

Åã ÷ åéñßäëï ôïõ FreeBSD

ÏÜää Ôâêìçñßùóçò ôïõ FreeBSD

Άα÷ αέηβαεί οίω FreeBSD

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ΆçìιόέάδιŸíŦ ŐάάνηοŦŦείρη 1999

ΔράοιόάέέŦŦ Άέέάέπιαόά © 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011 ήŦŦάά Őάέιγνβύογδ οίω FreeBSD

Έάεπδ βñέάδά όοι FreeBSD! Άόδου όι άά÷ αέηβαεί έάέϋδδάέ όçí άάέάδŦŦόάόç έάέ όçí έάέçìñáñéŦ ÷ñβóç όίω FreeBSD 8.2-RELEASE έάέ όίω FreeBSD 9.0-RELEASE. Όι άέάέβì άόδου άβίάέ ìììéíá όδύ άάέόβυόç έάέ άíŦδδόδìç έάέ άδìράέάβ όι άδìρŸέάοιόά όçδ άìρέάέŦδ δñέέπì άόυìŦ, ìδύοά εŦŦìέά όìπιαόά ìδìñάβ íá δάñéŸ ÷ìοí ó÷ άόέέŦ ìάδάñάοìŸíάδ δççñìοìñβάδ έάέ íá ÷ñάέŦáεìŦόάέ άíάŸòç. Άí άíάέάόŸñάόά íá ìάδ άìçεπρόάδά όά άόδου όι Ÿñá, άδέέιέìŦπρδά ìάέβ ìάδ όόçì çέάέόñìíέέπ εβόδά ìŦŦάάδ όάέιγνβύογδ όίω FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-doc>). Ç όάέέúδάñάδ Ÿέάñόç άόδìŸ όίω έάέíŸñì άβίάέ δŦŦíόά έάέάŸέέç άδύ όçí έόόìόάέβάά όίω FreeBSD (<http://www.FreeBSD.org/>) (δάέέúδάñάδ άέάúόάέδ ìδìñάβδά íá άñάβδά όόç έέáyέδìόç <http://docs.FreeBSD.org/doc/>). Ìδìñάβδά άδβόçδ íá ìάόάñìρδράάδ όόìŸ όδñìέάέόδρ όάδ όι βάέì άέάέβì όά Ŧέεάδ ìñòŸδ άñ ÷ άβìρ έάέ ìά έέŦòìñάδ ìñòŸδ όοìδβάόçδ άδύ όìŸ άìρδçñάόçδρ FTP όίω FreeBSD (<ftp://ftp.FreeBSD.org/pub/FreeBSD/doc/>) π Ÿíá άδύ όά δñέέŦ mirror sites. Άí δñìρέìŦŦάά Ÿíá όδδύŸíŦ άìρδδóδì, ìδìñάβδά íá άάñŦŦόάδά Ÿíá άìρδβáñάοì όίω Άá÷ αέηέάβìρ, άδύ όι FreeBSD Mall (<http://www.freebsdmall.com/>). Ìδìñάβδά άδβόçδ íá ϑŦŦíάδά όά üèì όι άέάέβì (<http://www.FreeBSD.org/search/index.html>).

Ç έέάñŦ έάέ ÷ñβóç όά ìñòπ δççάβìρ έπáέéá (SGML DocBook) π όά ìάόάέúδóέóìŸíç' ìñòπ (SGML, HTML, PDF, PostScript, RTF έìέ) ìά π ÷ñβδ άέέάŸδ, άδέόñŸδάδάέ άóóóìŸ íέ δάñάέŦδúδ δñìŦδñέŸόάέδ όçñìŸíόάέ:

1. Ç έέάñŦ όά ìñòπ δççάβìρ έπáέéá (SGML DocBook) δñŸδάέ íá έέάόçñάβ όçí δάñάδŦŦù áπέυόç δñάδìάόέέπì έέέέúδŦδúŦ, άδδπ όç εβόδά ìά δñìŦδñέŸόάέδ έάέ όçí άδύìάíç δάñŦŦáñάοì όόέδ δñβόδδ άñάìŸδ όίω άñ ÷ άβìρ, άìάδŦάέçδάδ.
2. Ç έέάñŦ όά ìάόάέúδóέóìŸíάδ ìñòŸδ (ìáδŦŦόñάόç όά Ŧέέά DTD, ìάόάóñìδπ όά PDF, PostScript, RTF π Ŧέέάδ ìñòŸδ) δñŸδάέ íá άíάδáñŦŦάέ όçí δάñάδŦŦù áπέυόç δñάδìάόέέπì έέέέúδŦδúŦ, άδδπ όç εβόδά ìά δñìŦδñέŸόάέδ, έάέ όçí δάñάέŦδúδ δάñŦŦáñάοì όúοì όόçì όάέιγνβύόç ììρì έάέ όά Ŧέέì ϑέέéú δñì δάñŸ ÷ άδάέ ìάέβ ìά όçí έέάñŦ.

Όçìáìóέέú: ΆΌΌÇ Ç ŐΆέìçñέúόç Άέìάόάέ Άδì όçí ììάάά ŐΆέìçñέúόçό όίω FreeBSD "Ŧό Ά×Άέ" έάέ Άάì δάñά×Άόάέ έάìέά Άìάόç Ç Άììάóç Άάάόçόç, όοìδάñέέΆììάììάìúì, ΆέέΆ ×ŦŦέό íá δάñέìñέΆόάέ ììì óά Άόόάó, έάέ όúì Άììάóúì Άάάόçόάúì Άέά Άìδìñάόόέììόçόά Ç έΆόάέέçέìόçόά Άέά ìδìέìάçδìόά όόάέΆέñέìáìì όέìδì. óά έáìέá δάñέδθúόç Άάì Άόέόìάόάέ Ç ììάάά ŐΆέìçñέúόçό όίω FreeBSD Άέá ìδìέάόáçδìόά Άìάόάó, Άììάóάó, όό×Άέάó, ΆέΆέέΆó, όçìάìόέέΆó, Ç έΆόά δάñέδθúόç ΆέΆάó (όοìδάñέέΆììάììάìúì, ΆέέΆ ×ŦŦέό íá δάñέìñέΆόάέ ììì óά Άόόáó, έάέ όçí Άάόìáìέά δñìόάáóçό óά ΆìέέέΆέόέέΆó δççάáó Ç όδçñάóέáó, όçì Άάóìáìέá ×ñçόçó, όçì άδύέΆέά Άάáììάìúì Ç έΆñάìόó, έάέ όçí ΆέΆέìδç Άδé×Άένçìάόέέúì έέέόìŦñάέúì), δìó δñìέΆέìόìόάέ ìά ìδìέìάçδìόá όñìδì Άδì όç ×ñçόç Άόόçό όçό ŐΆέìçñέúόçό.

Όì FreeBSD άβίάέ Ÿíá έάόì÷δñŦŸíŦ άìδìñέéú óŸìáìεì όίω FreeBSD Foundation.
 ìέ έŸíáέδ 3Com έάέ HomeConnect άβίάέ έάόì÷δñŦŸíá άìδìñέéŦ óŸìáìéá όçδ 3Com Corporation.

Íé eÝíáèð 3ware éáé Escalade áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð 3ware Inc.

Ç eÝíç ARM áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð ARM Limited.

Ç eÝíç Adaptec áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð Adaptec, Inc.

Íé eÝíáèð P òñÛóáéð Adobe, Acrobat, Acrobat Reader, éáé PostScript áβíáé áβóá éáðí÷ðñùÝíá àðñíééÛ óýíáíéá P àðñíééÛ óýíáíéá òçð Adobe Systems Incorporated óðéð ÇñùÝíáð Ñíééðáβáð P/éáé óá Ûééáð ÷þñáð.

Íé eÝíáèð P òñÛóáéð Apple, AirPort, FireWire, Mac, Macintosh, Mac OS, Quicktime, éáé TrueType áβíáé àðñíééÛ óýíáíéá òçð Apple Computer, Inc., éáðí÷ðñùÝíá óóéð ÇñùÝíáð Ñíééðáβáð éáé óá Ûééáð ÷þñáð.

Íé eÝíáèð Corel éáé WordPerfect áβíáé àðñíééÛ óýíáíéá P éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð Corel Corporation P/éáé òùí èðááðñééþí òçð óðíí ÉáíááÛ, óéð ÇñùÝíáð Ñíééðáβáð P/éáé óá Ûééáð ÷þñáð.

Ç òñÛóç Sound Blaster áβíáé àðñíééÛ óýíáíéá òçð Creative Technology Ltd. óðéð ÇñùÝíáð Ñíééðáβáð P/éáé óá Ûééáð ÷þñáð.

Ç eÝíç CVSup áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òíð John D. Polstra.

Íé eÝíáèð P òñÛóáéð Heidelberg, Helvetica, Palatino, éáé Times Roman áβíáé áβóá éáðí÷ðñùÝíá àðñíééÛ óýíáíéá P àðñíééÛ óýíáíéá òçð Heidelberger Druckmaschinen AG óðéð ÇÐÁ éáé óá Ûééáð ÷þñáð.

Íé eÝíáèð P òñÛóáéð IBM, AIX, EtherJet, Netfinity, OS/2, PowerPC, PS/2, S/390, éáé ThinkPad áβíáé àðñíééÛ óýíáíéá òçð International Business Machines Corporation óðéð ÇñùÝíáð Ñíééðáβáð, Ûééáð ÷þñáð, P éáé óðá äýí óáððùí÷ñííá.

Íé eÝíáèð IEEE, POSIX, éáé 802 áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òíð Institute of Electrical and Electronics Engineers, Inc. óðéð ÇñùÝíáð Ñíééðáβáð.

Íé eÝíáèð Intel, Celeron, EtherExpress, i386, i486, Itanium, Pentium, éáé Xeon áβíáé àðñíééÛ óýíáíéá P éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð Intel Corporation éáé òùí èðááðñééþí òçð óðéð ÇñùÝíáð Ñíééðáβáð éáé óá Ûééáð ÷þñáð.

Íé eÝíáèð Intuit éáé Quicken áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá P éáðí÷ðñùÝíá óýíáíéá òðçñáðéþí òçð Intuit Inc., P èÛðíéúí áðù óéð èðááðñééÝð òçð, óðéð ÇñùÝíáð Ñíééðáβáð éáé óá Ûééáð ÷þñáð.

Ïí Linux áβíáé Ýíá éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òíð Linus Torvalds óðéð ÇñùÝíáð Ñíééðáβáð.

Íé eÝíáèð LSI Logic, AcceleRAID, eXtremeRAID, MegaRAID éáé Mylex áβíáé àðñíééÛ óýíáíéá P éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð LSI Logic Corp.

Íé eÝíáèð M-Systems éáé DiskOnChip áβíáé àðñíééÛ óýíáíéá P éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð M-Systems Flash Disk Pioneers, Ltd.

Íé eÝíáèð Macromedia, Flash, éáé Shockwave áβíáé àðñíééÛ óýíáíéá P éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð Macromedia, Inc. óðéð ÇñùÝíáð Ñíééðáβáð éáé/P óá Ûééáð ÷þñáð.

Íé eÝíáèð Microsoft, IntelliMouse, MS-DOS, Outlook, Windows, Windows Media, éáé Windows NT áβíáé áβóá éáðí÷ðñùÝíá àðñíééÛ óýíáíéá P àðñíééÛ óýíáíéá òçð Microsoft Corporation óðéð ÇñùÝíáð Ñíééðáβáð éáé/P óá Ûééáð ÷þñáð.

Íé eÝíáèð Netscape éáé Netscape Navigator áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð Netscape Communications Corporation óðéð Ç.Ð.Á éáé Ûééáð ÷þñáð.

Íé eÝíáèð GateD éáé NextHop áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá éáé àðñíééÛ óýíáíéá òçð NextHop óðéð Ç.Ð.Á. éáé Ûééáð ÷þñáð.

Íé eÝíáèð Motif, OSF/1, éáé UNIX áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá éáé íé eÝíáèð P òñÛóáéð IT DialTone éáé The Open Group áβíáé àðñíééÛ óýíáíéá òíð The Open Group óðéð ÇñùÝíáð Ñíééðáβáð éáé óá Ûééáð ÷þñáð.

Ç eÝíç Oracle áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð Oracle Corporation.

Íé eÝíáèð PowerQuest éáé PartitionMagic áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð PowerQuest Corporation óðéð ÇñùÝíáð Ñíééðáβáð éáé/P óá Ûééáð ÷þñáð.

Íé eÝíáèð RealNetworks, RealPlayer éáé RealAudio áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð RealNetworks, Inc.

Íé eÝíáèð P òñÛóáéð Red Hat, éáé RPM áβíáé àðñíééÛ óýíáíéá P éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð Red Hat, Inc. óðéð ÇñùÝíáð Ñíééðáβáð éáé óá Ûééáð ÷þñáð.

Íé eÝíáèð SAP, R/3, éáé mySAP áβíáé àðñíééÛ óýíáíéá P éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð SAP AG óçç Ááñíáíβá éáé óá ðíééÝð Ûééáð ÷þñáð òíð èúòíð.

Íé eÝíáèð P òñÛóáéð Sun, Sun Microsystems, Java, Java Virtual Machine, JavaServer Pages, JDK, JRE, JSP, JVM, Netra, OpenJDK, Solaris, StarOffice, Sun Blade, Sun Enterprise, Sun Fire, SunOS, Ultra éáé VirtualBox áβíáé àðñíééÛ óýíáíéá P éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð Sun Microsystems, Inc. óðéð ÇñùÝíáð Ñíééðáβáð éáé óá Ûééáð ÷þñáð.

Íé eÝíáèð Symantec éáé Ghost áβíáé éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð Symantec Corporation óðéð ÇñùÝíáð Ñíééðáβáð éáé óá Ûééáð ÷þñáð.

Ç eÝíç MATLAB áβíáé Ýíá éáðí÷ðñùÝíá àðñíééÛ óýíáíéá òçð The MathWorks, Inc.

Ç eÝíç SpeedTouch áβíáé Ýíá àðñíééÛ óýíáíéá òçð Thomson

Íé εΎίάέδ P οñÚóάέδ U.S. Robotics έάέ Sportster άβίάέ έάόι÷δñùíΎίά άιδñέέÚ όγίάιέά όçð U.S. Robotics Corporation.

Ç εΎίç VMware άβίάέ άιδñέέú όγίάιέι όçð VMware, Inc.

Íé εΎίάέδ P οñÚóάέδ Waterloo Maple έάέ Maple άβίάέ άιδñέέÚ P έάόι÷δñùíΎίά άιδñέέÚ όγίάιέά όçð Waterloo Maple Inc.

Ç εΎίç Mathematica άβίάέ έάόι÷δñùíΎίά άιδñέέú όγίάιέι όçð Wolfram Research, Inc.

Ç εΎίç XFree86 άβίάέ Ύίά άιδñέέú όγίάιέι όιð The XFree86 Project, Inc.

Íé εΎίάέδ P οñÚóάέδ Ogg Vorbis έάέ Xiph.Org άβίάέ άιδñέέÚ όγίάιέά όιðXiph.Org.

ΔιέεΎð áδú όέð εΎίάέδ P οñÚóάέδ íé íðíβáð ÷ñçόέñðίέίγίόάέ áδú όιð έάόάόέάόάόΎð P όιðð ðùέçðΎð όιðð áέά íá άέάέñβñóí όά ðñíúúíόά όιðð έáùñíγίόάέ άιδñέέú όγίάιέά. ¼ðíð áððΎð άιðάίβæííόάέ όά áððú όí έάβíáñ έάέ áέά úόάð áδú áððΎð áññβæáέ ç ÏÚάά ÁíÚððóιçð όιð FreeBSD úðέ άβίάέ ðέέάíúí íá άβίάέ άιδñέέú όγίάιέά, έά άάβðά Ύίά áδú όά όγίάιέά: “™” P “®”.

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Ðñüëïãïò

Óà Ðïéïòò Áðãðèýíãðáé Áõòü òï Áéãëßï

Ôï ðñþòï ðïÐïá áðòïý ðïò áéãëßïò, ðãçããß ðïï ðÝï ÷ ðñðòç ðòç áéããééãðá áãéãðÜòðáçð ðïò FreeBSD éãé ðïï áéóÜãé ðáéÜ ðòç ðééïòïòá éãé ðïï ó÷-áãéãòïò ðïò UNIX®. Áðòü ðï ðïÐïá äãï Ý÷-áé éãéãðãããð áðáéóÐðáéð. Áñéãß ðïï ç áéÜéãç áéã äïããáýçòç áñüð ðÝïò ðòòðïáðïò éãé ç äðíáðüðçðá áðñïßßüçð ðüï áñðáüï áéã ðï FreeBSD éãëðð áððÝð áéóÜãïòáé óðáééãéÜ.

Áòïý áéããÜòðá ðï ðñþòï ðïÐïá, ðï äáýðããï, éãóÜ ðñéý ðáãáéýðããï ðïÐïá, ðãñééãïáÜíáé ðéã áéðáñÐ áíáòïñÜ óã áéÜòïñá èÝíáðá ðïò áñáéãðÝñïò ðïòð áéã÷-áéñéóðÝð ðòòðçïÜðïï FreeBSD. ðãñééÜ áðü áððÜ óã éãðÜéãéã áßíáé áðééüðããï ðá óã éãðáñïðáðá áí Ý÷-áðá Ðãç ðáéãððáé óðãéãéñéÝíá ðïÐïáðá ðïò áéãëßïò. ¼ðïò ÷ ðáéÜããðáé èÜðé óÝòïéï, éã áíáòÝñãðáé ðòç óýñïç ðïò éãðáéãßò ðïò ðüééð ðáééñðáðá ðá áéããÜããðá.

Áéã ðãñéóóüðããðð ðçãÝð ðççñïòïñéðï, äãßðá ðï ÐãñÜñðçïá B.

ÁééããÝò áðü ðçï Õñßðçç êéïïç

Ç ðñÝ÷-ïòá Ýéãïç ðïò Áã÷-áéñéãßò óðï áéããëððïò, áßíáé ðï áðïòÝéãðá ðçð ðñïððÜéãéð ðñééðï áéãðïòÜãüï äéãéñïðï ððï áéÜóðçïá ðüï ðáéãððáßüï 10 ÷ ðñïñüï. ðé ðéï ðçïáíðééÝð áééããÝð óã ó÷-Ýòç ðá ðçï ðñßðçç Ýíððçç Ýéãïç ðïò Áã÷-áéñéãßò (2004) ðáßñïòáé ðãñáéÜðü:

- ÉãðÜéãéï 26, ðï DTrace, áßíáé Ýíá ðÝï éãðÜéãéï ðá ðççñïòïñßðð ó÷-áðééÜ ðá áðòü ðï ðáíßð÷-ðñï ðãñáéãßï áñÜéðòçð áðüïòçð.
- ÉãðÜéãéï 21, ç Õðïòðñéïç ÓòòðçïÜðïï Áñ÷-áßüï, áßíáé Ýíá ðÝï éãðÜéãéï ðá ðççñïòïñßðð áéã óòòðïáðá áñ÷-áßüï óã ððïá ððïòççñßñïòáé áðü ðï FreeBSD áééÜ áñáððýóïòïòáé áðü Üééãð ðÜããð, üððð ðï ZFS áðü ðçï Sun™.
- ÉãðÜéãéï 18, ðéãã÷-ïò ÓòïáÜíðüï Áóðáéãßðð, áßíáé Ýíá ðÝï éãðÜéãéï ðá ðççñïòïñßðð ó÷-áðééÜ ðá ðéð ðÝãð äðíáðüðçððáð éãé ðçï ÷ ðñðç ðïò auditing óðï FreeBSD.
- ÉãðÜéãéï 23, ç Áééñéééïðïßçòç, áßíáé Ýíá ðÝï éãðÜéãéï ðá ðççñïòïñßðð ó÷-áðééÜ ðá ðçï áãéãðÜòðáçð ðïò FreeBSD óã éñáéóïééü äéðÝéãòçð áééñéééðï (virtual) ðç÷-áíçïÜðïï.
- ÉãðÜéãéï 3, ç ÁãéãðÜòðáçð ðïò FreeBSD 9.x éãé ðáðáããñÝòðããï ðáéãðáñüï, áßíáé Ýíá ðÝï éãðÜéãéï ó÷-áðééÜ ðá ðçï áãéãðÜòðáçð ðïò FreeBSD ðá ðç äñðéãéã ðïò ðÝïò ðñïãñÜíáðïò **bsdinstall**.

ÁééããÝò áðü ðçç Ááýðããçç êéïïç (2004)

Ç ðñßðçç Ýéãïç áðòïý ðïò áéãëßïò ððáí ðï áðïòÝéãðá ðçð ðñïððÜéãéð ðãñéóóüðããïñ áðü äýï ÷ ðñïñüï áðü óã ðÝéç ðçð ðÜããð Õáéïçñßßüçð ðïò FreeBSD. Ç Ýíððçç Ýéãïç áß÷-ã ðüòï ðááÜéï ðÝï éññëççã áñáãéãßï ðá ððððéãß ðá äýï ÷ ðñéóðïýð ðüïòð. ÐãñáéÜðü ðáßñïòáé ðé ðçïáíðééüðããðð áééããÝð óã áððÐ ðçç ðÝã Ýéãïç:

- ÉãðÜéãéï 12, Ôï éãðÜéãéï Ñýèïéòçð éãé Áãéðéóðïðïßçòçð ðïò FreeBSD, áðáéðÜéçéã ðá ðÝãð ðççñïòïñßðð áéã ðç áéã÷-áßñéóç áñÝñããéãð éãé ðñïñü ðïò óòòðïáðïò ðÝòü ACPI, ðá ðãñéóóüðããðð ðççñïòïñßðð áéã ðï óýòðçïá cron éãé ðá ðãñéóóüðããðð áðééñáÝð ðãñáíáðñïòïðçòçð ðïò ðçñðïá ðïò FreeBSD.

- Έαοΰεάει 15, Οι έαοΰεάει Άοοΰεάεάο, άδάεοΰεεεά ιά ιΎάο δεενηοοοοάο άεά Άβεοοά VPN, άεά εβόοάο άεΎά÷ιο δηοοάάοεο άη÷άββι (ACLs) εάε δάηεοοοοάοοάο οοιάηεΎο ο÷άοεεΎ ιά οεί άοοΰεάεά οιο FreeBSD.
- Έαοΰεάει 17, Ι Όδιδ÷ηάηοέεοο έάά÷ιο Δηοοάάοεο (MAC), άβιάε Ύία ιΎι έαοΰεάει οά άοδρ οεί Ύεαιός. Άηεάάβ οε άβιάε ι ηε÷άιεοιυδ MAC εάε δρδ ιδηάβ ιά ÷ηεοεηιδιεεεάβ άεά ιά άίεο÷οεάβ ε άοοΰεάεά άηυδ οοοδριάοιο FreeBSD.
- Έαοΰεάει 19, Οι έαοΰεάει άεά οά ΑδιδεεάοοεεεΎ ΙΎοά, άδάεοΰεεεά, ιά ιΎάο δεενηοοοοάο άεά οοοεάοΎο άδιδεεάοοεο USB, οοεάηεοοοά οοοδριάοιο άη÷άββι (snapshots), δάηεηηεοοοοά οδς ÷ηρς οοι οοοοείΎοι άη÷άββι (quotas), οοοδριάοά άη÷άββι διο άάοβηηοάε οά οδΎη÷ηοά άη÷άββι ρ οοι άβεοοι, εάερδ εάε εηοδοιηάοειΎιό εάοάοιροάεο άβοεηι.
- Έαοΰεάει 22, Ι Άεά÷άεηεοοδρδ Όηυι Vinum, άβιάε Ύία ιΎι έαοΰεάει οά άοδρ οεί Ύεαιός. ΔάηεάηΎοάε οη οηυδιδ ÷ηρςδ οιο Vinum, άηυδ οοοδριάοιο άεά÷άββηεοδ άδιδεεάοοεεηρ ιΎοι διο οεηδιδεάβ οεί ηηάΎηυς οοοεεηρ άβοεηι οιο οοοδριάοιο οά εεΎοάηε RAID-0, RAID-1 εάε RAID-5.
- Οοι Έαοΰεάει 28, δηηοδΎεεεά Ύία οιδριά ο÷άοεεη ιά οεί άδβεοδς δηηάεεηΎοι οοεο οοιάΎοάεο PPP εάε SLIP.
- Έαοΰεάει 29, Οι έαοΰεάει άεά οη εεάεοηηηεεη Όά÷οάηηάββι, άδάεοΰεεεά ιά ιΎάο δεενηοοοοάο άεά οεί ÷ηρς άηάεεάοεεηρ MTA, δεοοιδηηεεε οάοοηυςοάο οοι SMTP, οη δηηοηυεηεεη UUCP, οά άηάεάβά **fetchmail** εάε **procmail** εάε ιά Ύεεά ε Ύιόά άεά δηη÷ηηεηΎηηοδ.
- Έαοΰεάει 30, Οι έαοΰεάει Άηδεηηάοεοηρ Άεεογυι, δάηεεάηΎιόάε άεά δηηρς οηηΎ οά άοδρ οεί Ύεαιός. Άοοη οη έαοΰεάει δάηεάηΎοάε δηδ ιά άεάοάοδροάοά οη **Άεεηηεοδρ HTTP Apache**, οη άηδεηηάοεοηρ **ftpd** οιο FreeBSD εάε οη άεάεηηεοδρ **Samba** άεά άδεεηεηηάβ ιά δάεΎοάο Microsoft® Windows®. Οοι έαοΰεάει άοδη, Ύ÷ιοι ιάοάοάηεάβ εΎδιδεάο άηυδςοάο άδη οη Έαοΰεάει 32 (Δηη÷ηηεηΎιό εΎιόά Άεεογυςοδ), δηηεάεηΎηο ιά άεεοεηεάβ ε δάηηοδβάς οηδ.
- Έαοΰεάει 32, Οι έαοΰεάει άεά Δηη÷ηηεηΎιό εΎιόά Άεεογυςοδ, άδάεοΰεεεά ιά ιΎάο δεενηοοοοάο άεά ος ÷ηρς οοοεάοηρ Bluetooth® οοι FreeBSD, οεί άάεάοΎοάος άογηηάοηι άεεογυι, εάε οεί ΙΎεηηρ Άεεογυςοδ Άογά÷ηηεε ηάοάοηηΎο (ATM).
- ΔηηοδΎεεεά Ύία Έάηεεηάεη, άεά ιά οοάεάηοηροάε ηεηδ οηδ οά÷ιεεηγδ ηηηδ εάε οηδ εεΎοηηοδ ηηεοηηγδ διο δάηεΎ÷ηηοάε οά ηεηεεεηη οη εεάεββι.
- Άεηάη άεοεεεεΎο άεεοεροάεο οοηδ δβιάεάο εάε οοά άηάοηιόά οά ηεηεεεηη οη εεάεββι.

ΆεεάΎο άδη οεί Δηηρς εηηός (2001)

ε άάγδάηε Ύεαιός ροάη οη άδιδεεάοιά οηδεΎ÷εοοηι άγη ÷ηηηηι άηάοβάο άδη οά ιΎεε οςδ ηηΎάο Όάεηεηηυςοδ οη FreeBSD. Ιε δεη οεηάηεεεΎο άεεάΎο οά άοδρ οεί Ύεαιός ροάη ηε δάηάεΎοη:

- ΔηηοδΎεεεά Ύία ηεηεεεηηηηι Άοηάορηεη.
- ¼εά οά άηάοηιόά οά ASCII άηεεάοάοοδΎεεεάηι άδη άηάοεεΎ άεάάηηηιόά.
- ΔηηοδΎεεεά ηεά οοδιδιεεηΎηε ογηηε οά εΎεά έαοΰεάει, ε ηδιδά δάηεΎ÷άε ηεά ογηηε άηάεάοάεάβυς οη δεεηηηεηρ διο δάηεΎ÷άε οη έαοΰεάει εάε οε άηάηηιόάε ιά άηηηεάε άδη δηεη ι άηάηρδςδ.
- Οι δάηεά÷ηηηι άηάεηηηάηρεεεά οά οηβά εηάεεΎ ιΎηε: “Ύάεεηρδίοά ιά οη FreeBSD”, “Άεά÷άββηεος Όοοδριάοιο” εάε “Δάηάηδριόά”.
- Οι Έαοΰεάει 2 (“Άεάεεοδρδίοά οη FreeBSD”) ιάηάηηυδςοεά άδη οεί άη÷ρ ιά δηεεΎδ άεεηηάο, ροά ηε άεάοεηεηάε οηδ ÷ηρδίοά ιά εάοάηηροηοι οη εάββιηηι.

Επιμέριση 2, Απλοποίηση του FreeBSD 8.x και Δημιουργία του Απλοποιημένου

Η απλοποίηση του FreeBSD 8.x είναι η απλοποίηση του FreeBSD 8.x και η δημιουργία του απλοποιημένου του FreeBSD 8.x με την χρήση του sysinstall. Ο απλοποιημένος του FreeBSD 8.x είναι η απλοποίηση του FreeBSD 8.x με την χρήση του sysinstall.

Επιμέριση 3, Απλοποίηση του FreeBSD 9.x και Δημιουργία του Απλοποιημένου

Η απλοποίηση του FreeBSD 9.x είναι η απλοποίηση του FreeBSD 9.x και η δημιουργία του απλοποιημένου του FreeBSD 9.x με την χρήση του bsinstall.

Επιμέριση 4, Απλοποίηση του FreeBSD και Δημιουργία του Απλοποιημένου

Η απλοποίηση του FreeBSD είναι η απλοποίηση του FreeBSD και η δημιουργία του απλοποιημένου του FreeBSD. Η απλοποίηση του FreeBSD είναι η απλοποίηση του FreeBSD και η δημιουργία του απλοποιημένου του FreeBSD.

Επιμέριση 5, Απλοποίηση του Απλοποιημένου: Δημιουργία και Ports

Η απλοποίηση του Απλοποιημένου είναι η απλοποίηση του Απλοποιημένου και η δημιουργία του Απλοποιημένου του Απλοποιημένου με την χρήση του Ports Collection.

Επιμέριση 6, Οι Ουίτζετ X Window

Η απλοποίηση του X Window είναι η απλοποίηση του X Window και η δημιουργία του X Window του X Window με την χρήση του KDE και του GNOME.

Επιμέριση 7, Desktop Απλοποίηση

Η απλοποίηση του Desktop είναι η απλοποίηση του Desktop και η δημιουργία του Desktop του Desktop με την χρήση του FreeBSD.

Επιμέριση 8, Δημιουργία

Η απλοποίηση της Δημιουργίας είναι η απλοποίηση της Δημιουργίας και η δημιουργία της Δημιουργίας του Δημιουργίας με την χρήση του FreeBSD.

Επιμέριση 9, Δημιουργία του Δημιουργίας του FreeBSD

Η απλοποίηση του Δημιουργίας του FreeBSD είναι η απλοποίηση του Δημιουργίας του FreeBSD και η δημιουργία του Δημιουργίας του Δημιουργίας του FreeBSD.

Επιμέριση 10, Απλοποίηση

Η απλοποίηση είναι η απλοποίηση και η δημιουργία της απλοποίησης του FreeBSD.

Επιμέριση 11, Δημιουργία του Απλοποιημένου του Linux

Η απλοποίηση του Απλοποιημένου του Linux είναι η απλοποίηση του Απλοποιημένου του Linux και η δημιουργία του Απλοποιημένου του Απλοποιημένου του Linux με την χρήση του Oracle, SAP R/3, και Mathematica.

Επιμέριση 12, Δημιουργία και Απλοποίηση του Δημιουργίας

Η απλοποίηση του Δημιουργίας είναι η απλοποίηση του Δημιουργίας και η δημιουργία του Δημιουργίας του Δημιουργίας με την χρήση του FreeBSD.

÷ ηχοειδίτιριόιόιόι όοι FreeBSD έαέ θιό ίά όά άηάβόα.

Έαοΰεάει 13, Ç Áεάεέεάόβá Áέέβίςόç ðιõ FreeBSD

Δάνεάνΰοάε όçί αέάέεεάόβá áέέβίςόç ðιõ FreeBSD έαέ άίçáâ ðυò ιθιιίίίά ίά όçί áεΎá÷ιõιá ίá όç άιρεάέά άδέεϊαπí έαέ ηðειβόάυι.

Έαοΰεάει 14, ×ñρóðáð εáε Áάóεερ Áεά÷áβñέóç Èιááñεάóιπí

Δάνεάνΰοάε όçί άçιέιõñáβá έαέ όçί αέá÷áβñέóç ðυι εϊάáñεάóιπí ÷ ηçóðβί. Άðβóçð ðάνεάνΰοάε ðñυðιòð ίá ðιòð ιθιβιòð ιθιιίίί ίá όάεϊίί ðάνεϊñέóιιβ óóιòð ÷ ηρóðáð υóι άóιñÛ όç ÷ ηρóç ðñυιύ όιò óóóðρiάóιò, έαερð έαέ Ûεεáð εάέóιõñáβáð áεá÷áβñέóçð εϊάáñεάóιπí.

Έαοΰεάει 15, ÁóøÙεάέá

Δάνεάνΰοάε áεÛóιñá áεάεΎóεíá áñááεάβá θιò εá óáð άιçερóιòι ίá εñáðρóáðá ðι FreeBSD óýóóçιá óáð áóóáεΎð. ÓóιðáñεεáιáÛιιίόáε ίε óειðιέρóáέð Kerberos, IPsec έαέ OpenSSH.

Έαοΰεάει 16, Jails

Δάνεάνΰοάε ðι ðεάβóει εάέóιõñáεπí ðυι jails έαέ ðεò ááεðερóáέð θιò ðáñΎ÷ιòι óá ó÷Ύóç ίá όçί ðáñááιòεάέρ chroot ðθιòðρñέίç ðιõ FreeBSD.

Έαοΰεάει 17, Õðι÷ñáυðéέυð εáá÷ιò Δñυóááóçð

Άίçáâ ðε áβιáε ι Õðι÷ñáυðéέυð εáá÷ιò Δñυóááóçð (MAC) έαέ ðυò ι ιç÷áιέóιυð áðυð ιθιñáβ ίá ÷ ηçóéιιðιέçεáβ áεá όçί áóóÛέέóç áιυð FreeBSD óóóðρiάóιò.

Έαοΰεάει 18, εáá÷ιò ÓóιáÛιòυι Áóóáεáβáð

Δάνεάνΰοάε ðε áβιáε ι εáá÷ιò ÓóιáÛιòυι, ðυò ιθιñáβ ίá ááεάóáóáεáβ, ίá ηðειέóóáβ έαέ ðυò ιθιιίί ίá áεáñáðιρiόáε έαέ ίá ðáñáειρειòεϊίίόáε óá β÷ιç ðιò áεΎá÷ιò (audit trails).

Έαοΰεάει 19, ÁðιçεáððééÛ ÌΎóá

Δάνεάνΰοάε ðυò ίá áεá÷áεñβáεóóá ÌΎóá áðιçεáððééóçð έαέ óóóðρiάóá áñ÷áβυι ίá ðι FreeBSD. ÓóιðáñεεáιáÛιιίόáε óóóεειβ áβóειε, óóóðιε÷áð RAID, ιðóέéÛ έαέ ιááιçóééÛ ÌΎóá, áεéιέέειβ áβóειε ιρiçð έαέ áεéðóáéÛ óóóðρiάóá áñ÷áβυι.

Έαοΰεάει 20, GEOM: Áεá÷áβñέóç Óóóðιε÷επí Άβóέυι

Δάνεάνΰοάε ðε áβιáε ðι ðεάβóει εάέóιõñáεπí GEOM óοι FreeBSD έαέ ðυò ίá ηðειβóáðá áεÛóιñá áðβðááá RAID θιò ðθιòçñβáιíόáε óοι FreeBSD.

Έαοΰεάει 21, Õðιòðρñέίç ÓóóóçιÛóυι Áñ÷áβυι

ΆίáðÛáε έçί ðθιòðρñέίç ιç-ááááιπí óóóóçιÛóυι áñ÷áβυι óοι FreeBSD, υðυò ðι Z File System όçð Sun.

Έαοΰεάει 22, Vinum

Δάνεάνΰοάε ðυò ίá ÷ ηçóéιιðιέρóáðá ðι Vinum, Ύίá áεá÷áεñέóóρ εϊáέεπí ðυιυι θιò ðáñΎ÷áε εϊáέεϊýð áβóειòð áίáιÛñóçá áðu όç óóóéáðρ óóçι ιθιβá áβιáε áðιçεáðöιΎιέ, έαερð έαé áðιáóυòçóáð RAID-0, RAID-1 έαέ RAID-5 ÌΎóυ εϊáέóιέεϊý.

Έαοΰεάει 23, Áέέιέειðιβçóç

Δάνεάνΰοάε ðε ðñιόóΎιòι óá óóóðρiάóá áέέιέειðιβçóçð έαέ ðυò ιθιιίί ίá ÷ ηçóéιιðιέçεϊίί ίá ðι FreeBSD.

Έαυτοέλεγχος 24, Οριζήσεις Ντοκιμεντάριου - ×ηπόζ έλε Νύγειός 118N/L10N

Δημιουργία του ία ÷ ηζοείηθιεπόαα οι FreeBSD οά αεβρόαα έέουο οζο Άααέέεπο. Έάεγδοάε οζί αοίαούοζοά οίθεέρι ηοείβοάουι ούοι οά αδβθαί οοόοπιαόι, υοί έάε οά αδβθαί αοάνηπí.

Έαυτοέλεγχος 25, Άιζήνυός έάε Άίαυέιέος οίο FreeBSD

Άιζαάβ οέο αέαοίηΎο ίαοαίγ ούι αέαυοάυι FreeBSD-STABLE, FreeBSD-CURRENT έάε ούι αδβζοίυι (RELEASE) αέαυοάυι οίο FreeBSD. Δημιουργία θιεέ ÷ ηπόζαο υοάεγίοάε υοάί αέεϊοεγίγί Ύία ογόοζία άίΎδοοίος έάεβρ έάε οά αδαέογίαά έάε αδοοι οί οέιθυ άπιαόά. Έάεγδοάε οέο ίαευαίροθ θίο ίθιηγί ία ÷ ηζοείηθιεπόιθί ιέ ÷ ηπόζαο έάε ία άιζήηθίοιθί οί ογόοζία οίθο ία οέο οάεαοόαβαο αέηηεβροέο αοάεαβαο.

Έαυτοέλεγχος 26, DTrace

Δημιουργία οζί ηύγειός έάε ÷ ηπόζ οίο άηάαέάβιο DTrace οζο Sun οοί FreeBSD. Οί αοίαίέευ tracing ίθιηάβ ία άιζεβροάε οοί άφοιθεοίυ θηηάεζίΎουι αδυαίροζ, θάνΎ ÷ ηπόζ άίΎεοζ οίο οοόοπιαόι οά θηάαίάοέευ ÷ ηυί.

Έαυτοέλεγχος 27, ΟαέηέέΎο Άδεέιέιυίβαο

Άιζαάβ οέο ία οοίάΎοαα οάηιαόέεΎ έάε ίυιόαί οοί FreeBSD ογόοζία οάο, αέα ÷ ηπόζ ούοι οά αέοάη ÷ υιαίάο υοί έάε οά άηάη ÷ υιαίάο οοίάΎοάεο.

Έαυτοέλεγχος 28, PPP έάε SLIP

Δημιουργία του ία ÷ ηζοείηθιεπόαα οέο οά ÷ ηηεάβαο PPP, SLIP, η PPP ίΎου Ethernet αέα ία οοίάαέάβοά οά αθηάεηοίΎία οοόοπιαόά ία οί FreeBSD.

Έαυτοέλεγχος 29, ζεάεοηηέευ Οά ÷ οαηηάβι

Άιζαάβ οά αέαοίηαοέεΎ οοίε ÷ άβά άυο αέάεηέοοπ ζεάεοηηέεπο αέεζεηηάοβαο έάε άιααέγίάε οά εΎιαόά αδεβί ηοείβοάουι αέα οί θεΎι άζηοέεΎο εηάεοίέευ αέάεηέοοπ ζεάεοηηέεπο αέεζεηηάοβαο: οί **sendmail**.

Έαυτοέλεγχος 30, ΆιθζηάοζοΎο Άέέογίο

ΔάνΎ ÷ έε εάδοηηάηάβ οάε έάηάαάβιαόά άη ÷ άβυι ηύγειός έάε ία ηοείβοάοα οί FreeBSD ία άηάηάβ υο αέέοοάέευ άιθζηάοζοπο άη ÷ άβυι, άιθζηάοζοπο ηηΎουι οηΎά (DNS), άιθζηάοζοπο αέέοοάέβι θεζηοίηεβί (NIS), ζ άιθζηάοζοπο οοά ÷ ηηέοίηγ ηηάο (NTP).

Έαυτοέλεγχος 31, Firewalls

Άιζαάβ οζί οέεϊοίροβά θίο εηγáαοάε θβού αδυ οά firewalls (οάβ ÷ ζ θηηοόαοβαο) θίο ααόβηίοάε οά εηάεοίέευ έάε θάνΎ ÷ έε εάδοηηάηάβ θεζηοίηηάβ αέα οέο ηοείβοάέο ούι αέάουηηι firewalls θίο αέάοβεάίοάε αέα οί FreeBSD.

Έαυτοέλεγχος 32, Δηι ÷ υηζίΎία εΎιαόά Άέέογύοζο

Δημιουργία θιεέΎ θηι ÷ υηζίΎία εΎιαόά αέέογύοζο, οοιδηάεεαίάηηΎηο οίο αέάηεηάοίηγ ιεάο ογίάαοζο Internet ία Ύεεϊοθ οθιεηάεοΎο οοί οίθεέυ οάο άβέοοι (LAN), εΎιαόά άηηηευαζοζο αέα θηι ÷ υηζίΎηοθ, αογηηάοζ αέέογύοζο, Bluetooth, ATM, IPv6 έάε θιεέΎ αέυιζ.

ΔάνΎθζοζία A, Δίο έά Άηάβοά οί FreeBSD

ΔάνεΎ ÷ έε εβρόά ία αέΎοηηάο θζάΎο αέα ία αθιεοπόαα οί FreeBSD οά CD-ROM η DVD, υθυο αδβζοζο έάε αέΎοηηάο οίθιεάοβαο οοί Internet αδυ υθίο ίθιηάβοά ία έάοάΎοαα έάε ία αέάοάοόποαα οί FreeBSD.

Διάρθρωση Β, Αειεπιανάσβα

Αόου οι αέεεβι αάεβεάε δρεεÛ αέαοιναόεεÛ εΨίαόά διο ιδινάβ ία οάο εάρωνβόιτοι οι αίεάοΨνίι αέα ίέα δέι εάδδινάπ αίανάγίος. Ç αέεεπιανάσβα οαίείμáβ οá εάόεαίνβάδ δρεεÛ αίεεπιναόεεÛ αέεεβá οá ιδινά αίάο Ψνίιόάε οδι εάβινάι.

Διάρθρωση Γ, ΔεΨάΨο Δεçñïïüñçóçð òðï Äéáüβéððï

ΔάνεάνÛοάε δρεεÛ ουνίτοι διο αέαόβεαίόάε οδίòð ÷ ñΠόόáð οίò FreeBSD, πόόá ίá εΨοίτοι άñòðΠιáόá εάε ίá οδιναόΨ ÷ ιόι οá οá ÷ ίεέΨò οðεαçðΠόáéð αέα οι FreeBSD.

Διάρθρωση Δ, ΈεάεεÛ PGP

ΈαόαάνÛοάε οá αάεòðéééÛ áðïòðΠιáόá οúι έεάεεεπι PGP άñεάòπι ίáεπι οçò ÏÛάáò ÁíÛððóιçð οίò FreeBSD.

ΟοίαÛοάéò διο ÷ ñçóéïðδρειΨίόάé οá áóòü οï áéáεβι

Οá ίευέεçñï οι αέεεβι, ÷ ñçóéïðδρειΨίόάé εÛδρειάð οððινάοέεΨò οοίαÛοάéò πόόá ç ïïñïðιβçóç οίò ίá άβιáé οοίαðΠò εάé ίá άβιáé δέι άοáiÛάñòοδι:

ΟòðιáñáöééΨò ΟοίαÛοάéò

ΔεÛάεά άñáòΠ

Ç ΔεÛάεά άñáñáοιόáéñÛ ÷ ñçóéïðδρειάβóáé αέα ίñιáόá άñ ÷ άβúι, URLs, εάβινάι ίá Ψιόáόç εάé αέα ÷ ñΠόç ðñòοιáιòáίεαυιáñιí οá ÷ ίεéπι úñιí.

ΆñáòΠ οóáéάñιΨ ðεÛòιòð

Ç οóáéάñιΨ ðεÛòιòð άñáñáοιόáéñÛ ÷ ñçóéïðδρειάβóáé αέα ίçΨιáόá εÛειòð, άίòρεΨò, ίáόááεçðΨò ðáñεáÛεειòιò, ίñιáóβáð οúι ports, ίñιáόá εάρωνεéπι οðρειεáεóòπι, ίñιáόá ÷ ñçóòπι, ίñιáόá ñÛάυι, ίñιáόá οóóεάòπι, ίáόááεçðΨò εάé áðïòðÛοιáόá εραεέα.

Ψιόç άñáòΠ

Ç Ψιόç άñáñáοιόáéñÛ ÷ ñçóéïðδρειάβóáé αέα άóáñιáΨò, άίòρεΨò εάé ðεΠεòñá.

Άβóιáιò ÄááñιΨιúι áðü οï × ñΠόóç

Ç ðεçéðñιεüáçóç οçιáβιáéò δüò ίá Ψιόç άñáòΠ πόόá ίá ίá ÷ ùñβáéé áðü οï οðιειεðι éáβινάι. Óοιáόáοιβ ðεΠεòñιí διο ðñΨáé ίá ðéáóειΨι óáóòü ÷ ñιá οçιáεβñιíόáé ίá ‘+’ ίáόáιΨ οúι ðεΠεòñιí, üðò:

Ctrl+Alt+Del

Οι ιδινι οçιáβιáéò δüò ï ÷ ñΠόóçð εá ðñΨáé ίá ðéΨóáé οá ðεΠεòñá **Ctrl, Alt** εάé οι ðεΠεòñι **Del** óáóòü ÷ ñιá.

Οá ðáñβðòòç διο εÛδρειά ðεΠεòñá ðñΨáé ίá ðéáóειΨι ίá οóáéáεñειΨιç οáéñÛ, εá άιòáιβæιíόáé ÷ ùñεοιΨιá ίá εüñιáόá:

Ctrl+X, Ctrl+S

Οι ιδινι οçιáβιáéò δüò ï ÷ ñΠόóçð áίáιΨιáόáé ίá ðéΨóáé οá ðεΠεòñá **Ctrl** εάé **X** óáóòü ÷ ñιá εάé Ψðáéóá ίá ðéΨóáé οá ðεΠεòñá **Ctrl** εάé **S** óáóòü ÷ ñιá.

Δατάκια βιαία

Όλα τα δεδομένα βιαία στο σύστημα είναι σε μορφή MS-DOS®. Αυτό είναι το ίδιο με τα αρχεία που είναι σε μορφή βιαία. Τα αρχεία βιαία “Αντιγράψτε” όλα όσα είναι σε μορφή Microsoft Windows, αλλά και τα αρχεία βιαία που είναι σε μορφή βιαία.

```
E:\> tools\fdimage floppies\kern.flp A:
```

Όλα τα δεδομένα βιαία στο σύστημα είναι σε μορφή βιαία. Αυτό είναι το ίδιο με τα αρχεία που είναι σε μορφή βιαία. Τα αρχεία βιαία “Αντιγράψτε” όλα όσα είναι σε μορφή Microsoft Windows, αλλά και τα αρχεία βιαία που είναι σε μορφή βιαία.

```
# dd if=kern.flp of=/dev/fd0
```

Όλα τα δεδομένα βιαία στο σύστημα είναι σε μορφή βιαία. Αυτό είναι το ίδιο με τα αρχεία που είναι σε μορφή βιαία. Τα αρχεία βιαία “Αντιγράψτε” όλα όσα είναι σε μορφή Microsoft Windows, αλλά και τα αρχεία βιαία που είναι σε μορφή βιαία.

```
% top
```

Άλλα βιβλία

Όι βιβλία στο βιβλιοπωλείο, είναι σε μορφή βιαία. Αυτό είναι το ίδιο με τα αρχεία που είναι σε μορφή βιαία. Τα αρχεία βιαία “Αντιγράψτε” όλα όσα είναι σε μορφή Microsoft Windows, αλλά και τα αρχεία βιαία που είναι σε μορφή βιαία.

Τα βιβλία στο βιβλιοπωλείο είναι σε μορφή βιαία. Αυτό είναι το ίδιο με τα αρχεία που είναι σε μορφή βιαία. Τα αρχεία βιαία “Αντιγράψτε” όλα όσα είναι σε μορφή Microsoft Windows, αλλά και τα αρχεία βιαία που είναι σε μορφή βιαία.

I. Îâêéíþíôáò ìà òï FreeBSD

Áðòò òï ìÝíïò òïò Áã÷áñéñáβïò òïò FreeBSD áβíáé áéá òïò ÷ ñþóðáð éáé òïò ÷ áéá÷áñéñéóðÝð òðóðçìÛò òí ðïò äáí Ý÷íïí þáç ìääÛçç äïðáéñβá ìà òï FreeBSD. Óá êäòÛéáéá ðïò áéñéíòèéíýí:

- Áβíáé áéóáãüãééÛ áéá òï FreeBSD
- Óáð éáèñáçáíýí éáðÛ òç äéÛñéáéá òçð ÷ áéááééáóβáð äééáðÛóðáóçð
- Óáð áéóÛáíïí òðéð äáóééÝð Ýííéáð òïò UNIX
- ÐáñéãñÛòíïí òç áéááééáóβá äééáðÛóðáóçð òçð ðéçèþñáð áóáññáþí ðïò áβíáé áéáéÝóéíáð òïò FreeBSD
- Óáð áéóÛáíïí òïò äñáóééü ðáñéáÛééíïí òïò UNIX, òï óýóðçíá ×, éáé óáð éáèñáçáíýí ó÷áðééÛ ìà òéð äñ÷ééÝð ñòèìβóáéð áíüð äñáóééíý ðáñéáÛééíïí ðáñááóβáð, ìà òï ìðïñ ìðññáβòá ìà áβóðá áéñüá ðéí ðáñáãüãééíβ

Óá áðòò òï òïðíá òïò áéáéβïò, Ý÷íïí ðñïóðáðþóáé ìà ìáéþóíïíá òðïí äéÛ÷éóðïí òéð áíáóññÝð òá òïðíáðá þ éäòÛéáéá òïò Áã÷áñéñáβïò òá ìðïñá äáí Ý÷áðá þáç áéááÛóáé. Áðòò äðïéñðáβ òðïí ìà áβíáé ðéí áýéíçç ç áíÛáíüóç òïò òïðíáðïò áðòïíý òïò Áã÷áñéñáβïò áðü òçí äñ÷á ñÝ÷ñé éáé òï òÝéò, ÷ ùñβð ìà áðáéóðáβóáé ìà øÛ÷áðá òóíá÷ðð òá äðüíáíá þ ðññáçáíýíá òïðíáðá.

- Έό÷οñÝò äðíáóυòçðáð äέέðýυòçò TCP/IP (TCP/IP networking) ιά òðíòòPñέίç ñέá áέñç÷áίέέÛ ðñυòòðá υòυò ðá SCTP, DHCP, NFS, NIS, PPP, SLIP, IPsec έέé IPv6. Άòòυ òçíáβίáέ ðυò Ýíá ιç÷Ûίçíá FreeBSD ιðññáβ ίá áέεçέáðέáñÛ áýέíεά ιá Ûέεά òðòòPíáðá έέé ίá áñáÛεáðáέ òáí áðáέñέέυò áíòðçñáðòçòPò, òðíòòçñβáείíòáð έáέòíòñáβáð æυòέέPò òçíáòβáð, υòυò NFS (áðñáέñòòíÝίç ðñυòááòç òá áñ÷áβá) έέé òðçñáòβáð çεάέòññίέέίý ðá÷òáññáβíò (e-mail), P òçí ðáñíòòβá òíò ññáίέέóίíý òáð òòί áέááβέòòí ιÝòυ òυí òðçñáòέPí WWW, FTP, routing έέé firewall (áóòÛέέáð).
- Ç ðñíòòáòβá òçò ιíPíçò (memory protection) áíáòáέβáέé υòέ ίέ áέÛòñáð áòáññíáÝò (P ίέ ÷ñPòáð) ááí áέεçέáðέáñíý ίáòáίý òíòò. Ιέá áòáññíáP ðíò ðáñíòóέÛáέé έÛðίέí ðñυáέçíá áá ιðññáβ ίá áðçñáÛòáέ Ûέεáð ιá έáίÝíáί ðñυðí.
- Òí FreeBSD áβίáέ Ýíá έáέòíòñáέέυ òýòòçíá 32-bit (64-bit òá AMD64, έέé UltraSPARC) έέé ò÷áέέÛòçέá ιá áòòυ òíí ðñυðí áí' áñ÷Pò.
- Òí áέñç÷áίέέυ ðñυòòðí X Window System (X11R6) ðñíòòÝñáέ áñáóέέέυ ðáñέáÛέέíí áñááòβáð (GUI) òòί έυòòíò ίέáð έίέíPò έÛñòáð VGA έέé ίέáð íέυίçò έέé áέáðβέáðáέ ιá òíí ðέPñç ðçááβí έPáέέá.
- Òòíááòυòçðá áέòáεÝóέíυí ιá ðíεέÛ ðñíñáÛñíáðá ðíò Ý÷íòί ίáðááέυòðέóòáβ ñέá Linux, SCO, SVR4, BSDI έέé NetBSD.
- ×έέέÛááð Ýòίέíáð-ðñíò-áέòÝέáòç áòáññíáÝò áβίáέ áέáέÝóέíáð áðυ òçí òέέέíáP ports έέé packages ñέá òí FreeBSD. Άέáòβ ίá PÛ÷íáðá òòί áέááβέòòí υòáί ιðññáβòá ίá ðá áñáβòá υέá ááP;
- Òòί áέááβέòòí áβίáέ áðβòçð áέáέÝóέíáð ÷έέέÛááð ðñυέáðáð έέé áýέíεáð òòçí ðñíòáññíáP áòáññíáÝò. Òí FreeBSD Ý÷áέ òòíááòυòçðá ðçááβíò έPáέέá ιá ðá ðέí áçííòέέP áíðñέέÛ òðòòPíáðá UNIX, áðñíÝíυò ίέ ðáñέóòυðáñáð áòáññíáÝò ÷ñáέÛáεíòáέ έβááð Ýυò έáέυέíò ίáðáðñíðÝò ñέá ίá ίáðááέυòðέóòóίý (compile).
- Ç ΆðíáίέέP òáέέáíðíβçòç áέέíέέPò ιíPíçò έέé òí "íέíέεçñυíÝíí VM/buffer cache" ðáñÝ÷íòί òççέP áðυáíòç òá áòáññíáÝò ιá áòίçíÝíáð áíÛáέáð òá ιíPíç, áíP áέáðçñíýí òçí έέáíðíέçðέέP áðυέñέóç òíò òðòòPíáðíò òòíòð Ûέέíòð ÷ñPòáð.
- ÒðíòòPñέίç SMP ñέá ιç÷áíPíáðá ιá ðíεέáðέÝò CPU.
- ðέPñçò òáέñÛ áñááέáβñí áíÛððòίçð ñέá C, C++, έέé Fortran. Òòç ÓðέέíáP òυí Ports έέé òυí Ýòίέíυí ðáέÝòυí, έá áñáβòá ðíεέÝò áέυíá áεPòáð ðñíñáñíáðέóέííý, έáðÛέεçέáð òυòί ñέá Ýñáòíá υòί έέé ñέá áíÛððòίç έíáέòίέέíý.
- Ç áέááðáòέíυòçðá òíò ðçááβíò έPáέέá íέυέέçñíò òíò òðòòPíáðíò òçíáβίáέ υòέ Ý÷áðá òíí òççέυòðáñí ááέíυ áέÝá÷íò òòί ðáñέáÛέέíí òáð. Άέáòβ ίá áβòáð έέáέáυíÝíé òá Ýíá έέáέóòυ òýòòçíá έέé ίá áβòáð áíáñòçíÝíé áðυ òíí ðññçέáòòP òáð, υòáί ιðññáβòá ίá Ý÷áðá Ýíá ðñááíáðέέέÛ áíίε÷òυ òýòòçíá;
- ΆέòáðáíÝίç online òáέίçñβúç.
- Έáέ ðíεέÛ Ûέεá!

Òí FreeBSD ááòβáéáðáέ òòçí Ýέáíòç 4.BSD-Lite òíò Computer Systems Research Group (CSRG) òíò ðáíáðέóòçíβíò òçò Έáέέòυñίέáð òòί Berkeley, έέé òíá÷βáέé òçí áέáέáέñέíÝίç ðáñÛáíòç òíò òòçí áíÛððòίç òðòòçíÛòυí BSD. Άðέðñυέáðá òòί áíáβñáòí Ýñáí ðíò ðáñáβ÷á òí CSRG, òí FreeBSD Project íυááPá ðíεέÝò ÷έέέÛááð ðñáð òòç ááέòέóòíðíβçòç òíò òðòòPíáðíò ñέá ιÝáέóòáð áðέáυòáέð έέé áίέíðέóòá òá έáέçíáñέíÝò έáðáóòÛòáέð ðñááíáðέέέíý òυñòíò áñááòβáð. Áί έέé ðíεέíβ áíðñέέíβ έíέíòóíβ áòóέíεáýííòáέ ίá ðñíòòÝñíòí έáέòíòñáέέÛ òðòòPíáðá ιá òÝòίέá ÷áñáέòçñέóòέέÛ, áðέáυòáέð έέé áίέíðέóòá, òí FreeBSD ιðññáβ ίá ðá ðñíòòÝñáέ òPñá!

Ιέ áòáññíáÝò òðέð ιðíβáð ιðññáβ ίá ÷ñçóέííðίέçέáβ òí FreeBSD, ðñááíáðέέέÛ ðáñέíñβáείíòáέ íυíí áðυ òçí òáíòáòβá òáð. Άðυ áíÛððòίç έíáέòίέέíý ιÝ÷ñέ áòññáðέóòíýð áñáíòáòβñí, áðυ áðñáðòP áέáPí ιÝ÷ñέ òçí áέυñέòç òíò ááέíýýέέò ðñááèñòòíÝíυí áñòòíñέέPí έáñáέPí, áÛí ιðññáβ ίá áβίáέ ιá Ýíá áíðñέέέυ ðñíυíí UNIX, áβίáέ ðáñáðÛòύ áðυ ðέέáíυ υòέ ιðññáβ ίá áβίáέ έέé ιá òí FreeBSD! Òí FreeBSD áðβòçð òòáέáβòáέ òçíáíòέέÛ áðυ έòñέíεáέòέέÛ

÷έέεΰααò áòáñññáÝò òòççèPò ðñεεòçòáò ðñò áñáðòγòóññòáέ áðu εΰίòñá áñáòññá έέέ ðáñáðέóòPñέá óá ùεñ òñ εùòñ, έέέ óò÷ñΰ áέáòβέáñέá óá ÷áñçù εùóòñò P àññáΰñ. Õñ ðεPεìò òñ ãñðñέέPñ áòáñññáPñ ðñò áέáòβέáñέá έέέ òñ FreeBSD, áòñΰñáέá áðβòçò έέέçñáñέñΰ.

Ï ðçááβñò έPáέέáò òñò βέáñò òñò FreeBSD áβñέá ðεPñò ð áέέέΰέñò, έέέ ΰòóέ òñ óýòòçñá ðññáβ ðá ðññóáñññòóáβ óá áòΰñóáóá òòççù áðβðáññ áέá áέáέέΰò áòáñññáÝò P projects, έέέ ðá ðññòðñò ááñέέΰ ðç ðñááñáòññέPóέññòò óá ΰέέá έέέóñòñáέέΰ ãñðñέέPñ ðññçέáòòPñ. Ðáñáέΰòù έá áñáβòá ðáñέέΰ ðññ ðáñáááβáñáóá áðu áòáñññáÝò óòέò ðññáò ðññáβ ðá ÷ñçóέññέέçέáβ áòòP òç óóέáñP òñ FreeBSD:

- *Õðçñáòβáò ðññáññáò:* Õñ έó÷òñ òýòòçñá áέέòγòóòò TCP/IP òñò FreeBSD, òñ áñáááέέñýáέ óá έááPáç ðεáòòññá áέá ðέá ðááΰέç áέΰñá òðçñáòέPñ ðññáññáò ùðùò:
 - ΆñòðçñáòçòÝò FTP
 - ΆñòðçñáòçòÝò έóòñóáέβáññ World Wide Web (έñέñýò P ðá áóòáέP óýñááóç [SSL])
 - Άñññέùáçóç ðññòññέùέññ IPv4 έέέ IPv6
 - Firewalls έέέ ðýέáò NAT (“IP masquerading”)
 - ΆñòðçñáòçòÝò çέέέòññέέέñý óá÷òáññáβñò
 - USENET News P Bulletin Board Systems
 - Έέέ ΰέέá...

Ïá òñ FreeBSD, ðññáβòá áýέñέá ðá ðáέέñPóáòá áðu ÷áñçù ðá ΰñá òòççññ PC òçò ðέέñáΰñέáέáò 386, έέέ έáέPò ç áðέ÷áβñçóç óáò ðááέPñέá, ðá áñáááέέñέóáòá óá ΰñá ðáòñáðýñçññ áðáñáñáóòP Xeon ðá áβóέñòð RAID.

- *Áέέðáβáòçò:* Άβóòá ðñέòçòPò ðεçñññòñέέPò P εΰðñέñò ó÷áòέέñý òññΰá; Άáñ òðΰñ÷áέ έέέγòáññò ðññòðñò ðá ðñέáòá áέá έέέóñòñáέέΰ òòóòPñáóá, áñ÷έóáέòññέέΰò Ç/Õ, έέέ òòóòPñáóá áέέòγòññ áðu òçñ ðñáέòέέP ãñðáέñβá έέέ òçñ óá áΰέñò áñPòç ðñò ðññáβ ðá óáò ðáñΰ÷áέ òñ FreeBSD. Õñ ðááΰέñ ðεPεìò òñ ðáñáΰñ áέέέΰέñññ ðáέΰòñ ðáέΰòñ áòáñññáPñ CAD, áñáóέέPò ò÷ááβáóçò, έέέ ðáέçñáóέέPñ, εΰññòñ òñ FreeBSD áñáέñáòέέΰ ÷ñPóέññ óá ùòñòò òñ έýñέñ áñáέáòΰñññ òñòò òòñòò òðñέñέέóòÝò áβñέá ðá *εΰññòñ òç áñòέáέΰ òñòò!*
- *ñáòñá:* Ïá áέáέΰέññ òññ ðçááβñò έPáέέá ðέùέέçññò òñò òòóòPñáòñò, òñ FreeBSD áβñέá ðá áñáβñáòç ðεáòòññá áέá òçñ ΰñáòñá óá έέέóñòñáέέΰ òòóòPñáóá ùðùò áðβòçò áέá ΰέέñòò έέΰáñòò òçò ðεçñññòñέέPò. Ç óýóç òçò áέáýέáñçò áέΰέáòçò òñò FreeBSD áðέòñΰðáέ áðβòçò óá áðñáέñòòñΰñáò ðññáò ðá óññáñáΰáññέá óá έáΰáò P ðá ðññΰáññέá òçñ áñΰðòòñç áòáññáPñ, ÷ññò ðá áñçòò÷ñýñ áέá ΰááέáò ÷ñPòçò έέέ ÷ññò ðá ðáñέññáέáòáέ ç áññáòñòçòá òñòò áέá áέáýέáñç òòáPòçòç ðñέñòáPðñòá εΰñáòñò óá áñέ÷òÝò ðññáò òòáPòçòçò (forums).
- *Áέέòγòóç:* ×ñáέΰáòóá ΰñá έέέñññáέññ router (áñññέñáçòP); ðá áñòðçñáòçòP DNS; ðá firewall áέá ðá έñáòΰòá òññ εùòñ ΰñ áðu òñ áòñòáñέέù óáò áβέòòñ; Õñ FreeBSD ðññáβ áýέñέá ðá ðáòáòñΰPáέ áέáβññ òñ ðñçòòñ 386 P 486 PC ðñò εΰέáòáέ óòçñ áññá, óá ΰñá ðññçáñΰññ áñññέñáçòP ðá áñáæçòçñΰñáò áòñáòñòçòáò òέέòñáñβññáòñò ðáέΰòñ.
- *Óòáέññò áñááòβáò ðá X Window:* Õñ FreeBSD áβñέá ðέá áñáβñáòç áðέέñáP áέá ΰñá ðέέññέέù áñòðçñáòçòP × òáññáòέέPñ, ÷ñçóέñññέPñáò òññ áέáýέáññ áέáέΰέññ áñòðçñáòçòP X11. Óá áñòβέáòç ðá óá áðέΰ òáññáòέέΰ X, ðá òñ FreeBSD ðññáβòá, áòñòññ òñ áðέέòñáβòá, ðá áέòáέáβòá ðñέέΰò áòáñññáÝò òñðέέΰ, áðáέέΰóñññóáò ΰòóέ òññ έáññέέù áñòðçñáòçòP áðu ðáñέòòù òññòβñ. To FreeBSD ðññáβ ðá ðáέέPóáέ áέññá έέέ “diskless” (÷ññòò òέέçñññ áβóέñ), εΰñññáò ΰòóέ òñòò ðññòùðέέñýò òóáέñýò ðñááòβáò áέññç ðέñ òòçññýò έέέ áðέέñέùáññòò òòç áέá÷áβñέóç.
- *Áñΰðòòñç Έñáέòñέέñý:* Õñ ááóέέù óýòòçñá ðñò FreeBSD áέáòβέáòáέ ðέñέçñññΰññ, ðá ðεPñç óáέñΰ áñááέáβññ áñΰðòòñçò, ðñò ðáñέέáñáΰññò òññ áñááññέέññΰññ GNU C/C++ compiler έέέ debugger.

Õñ FreeBSD áβñέá áέáέΰέññ óá ðñòP ðçááβñò έPáέέá áέέΰ έέέ ΰòññò, ðáòáέέùòóέòñΰññ áέòáέΰέññò óá CD-ROM, DVD, έέέ ðΰòù áñPñòñò FTP. Άáβòá òñ Ðáñΰñòçñá A áέá ðáñέóòùòáññáò ðεçñññòññáò áέá òñ ðùò ðá áðñέòPóáòá òñ FreeBSD.

1.2.2 Διείò ÷ ñçόείιðιέαß FreeBSD;

Ôi FreeBSD ÷ ñçόείιðιέαßòάέ ùð àÛόç áέα ôçí áíÛððòίç óðòέάòðí έάέ ðñíúúíòùí óá ίάñέέÛò áðu ôέð ίάάέýòάñάð àðάέñßàð ðέçñíòíñέέPð, ðáñέέáíáááñÛíúí ðùí:

- Apple (<http://www.apple.com/>)
- Cisco (<http://www.cisco.com/>)
- Juniper (<http://www.juniper.net/>)
- NetApp (<http://www.netapp.com/>)

Ôi FreeBSD ÷ ñçόείιðιέαßòάέ áέα ίά ððίόçñßæáέ ίάñέέÛò áðu ôέð ίάάέýòάñάð ðιðιέαόßàð óòι Píðáñíáð, ðáñέέáíáááñÛíúí ðùí:

- Yahoo! (<http://www.yahoo.com/>)
- Yandex (<http://www.yandex.ru/>)
- Apache (<http://www.apache.org/>)
- Rambler (<http://www.rambler.ru/>)
- Sina (<http://www.sina.com/>)
- Pair Networks (<http://www.pair.com/>)
- Sony Japan (<http://www.sony.co.jp/>)
- Netcraft (<http://www.netcraft.com/>)
- NetEase (<http://www.163.com/>)
- Weathernews (<http://www.wni.com/>)
- TELEHOUSE America (<http://www.telehouse.com/>)
- Experts Exchange (<http://www.experts-exchange.com/>)

έάέ ðιέέðí áέùíç.

1.3 Δέçñíòíñßàð áέα òι FreeBSD Project

Ôi áέùíèòèι ðιPíá ðáñÛ ÷ áέ ίάñέέÛò ðέçñíòíñßàð ó ÷ áòέέÛò ίά ðι project, έάέ ðáñέέáíáÛíáέ ίέα óýíòñç έóðíñßá ðιò FreeBSD, ðιòð óðù ÷ ðòð, έάέ ðι ñíóÛέι áíÛððòίçð ðιò.

1.3.1 ίέα óýíòñç έóðíñßá ðιò FreeBSD

To FreeBSD Project ááíPέçέá óðέð áñ ÷ Ûò ðιò 1993, ίάñέέPð óáí áíÛέέίç ðιò “Unofficial 386BSD Patchkit” áðu ðιòð 3 ðáέáððάßìð ððíðιέóðÛò ðιò patchkit: ðιí Nate Williams, ðιí Rod Grimes έάέ áíÛίá.

Ï ðñùðáñ ÷ έέùð óðù ÷ ðò ðáí ίά ððáí ίά ðáñÛáíòιá Ûίá áíáέÛíáóιí óðέáìέúðððι (snapshot) ðιò 386BSD ðòðá ίá áέíñèPòíòìá ίάñέέÛ ðñíáèPíáðá ðιò ðιç ÷ áίέóìùð ðιò patchkit ááí Pðáí έέáíùð ίá έýóáέ. Ïάñέέιß áðu óáð, ßòùð ίá ðèñιýíðáέ ðùð ðι áñ ÷ έέùð ðßðèιð áñááóßßàð áέα ðι project Pðáí “386BSD 0.5” P “386BSD Interim” έάέ áίáòÛñííðáí óá áððù áέñέáPð ðι áááñíùð.

Οι 386BSD Ποάι οι εάεοιωνάεεϋ ούόοαία οιο Bill Jolitz, οι ιοιβί ιΥ ÷νε άεάβιρ οι οαίαβι, οδΰοάνα άάνεϋ Υ ÷ιιόαο αίαεαβ άεά ο ÷άαυι Υία Υοιρ. Έεαεο οι patchkit ούύοεϋία ιειΥία εάε δάνεοοιουάναρ ια οι δΰνάοία οϋι αίαηβι, άβ ÷αία αδιροάοβοάε ιιουοία δϋο Υδναδα ιά αβίαε εϋοε, εάε αδιροάοβοάια ιά οοιδαναοοαειγία οοιρ Bill δανΥ ÷ιιόαο οιο αοοϋ οι άιαεϋιαοί “cleanup” snapshot. Οά ο ÷ Υαέα αοοϋ άεάεϋδαί αδϋοινα, ιοάι ιαοιέεϋ ι Bill Jolitz αδιροϋοεοά ιά αδιρογναε οαί Υάεηοα οιο οοι project άβ ÷ϋο ιεά ιάεϋεαηα Υίαεεια οιο οε εα Υδναδα ιά αβίαε.

Άαί ιαο δPna δειγ ιά αδιροάοβοιοία δϋο ι οοϋ ÷ιο δανΥιαία ατεϋειαρ, αεϋια εάε ÷ϋηβδ οαί αρPεαεά οιο Bill, εάε Υοοε οειεαοPοαία οι ιινα “FreeBSD”, οιο αδεϋιαοά ι David Greenman. Ιε αν ÷εειβ οοϋ ÷ιε ιαο οΰεαί αοιγ οοιαρτεαοεPεαία οιοδ οϋοα ÷ηPοοαο οιο οοοοPιαοιοδ, εάε ιοάι Υαεία δεΥιρ ιάεϋεαηι δϋο οι project άβ ÷α δϋηαε οϋοοP διναβα εάε βοϋο Υοαεία ιά αβίαε δνααιαοεεϋοαοα, Pnea οα αδαοP ια οαί Walnut Creek CDROM δηοαεΰδιροαο οοαί ααεοβϋοα οϋι εαίαεεβι αεαηηPδ οιο FreeBSD αεα ιειροδ αδοιγδ οιοδ ϋοο ÷ιοδ διο ααρ άβ ÷αί αγειρεα δηϋοααοα οοι ροιδανιαο. C Walnut Creek CDROM, ι ÷ε ιιρι οδιοδPηεια οαί εαΥα αεαηηPδ οιο FreeBSD οα CD, αεεϋ δηι ÷ηαοα αηεαοϋ δανεοοιουάναρ, δανΥ ÷ιιόαο οοι project Υία ια ÷ιιαία αηααοαοα εάε ιεά ανPαιηα ούγιααοα οοι ροιδανιαο. Άβ ÷ϋο οιρ ααεϋι δβοαοα οα Walnut Creek CDROM οα αοοϋ διο εεάβιρ οιρ εαεηϋ Ποάι Υία αραεεPδ ϋαηϋοι project, αβίαε δειγ αδβεαηι οι FreeBSD ιά άβ ÷α οοϋοαε οϋοι ιαεηεϋ, εάε οϋοι ανPαιηα, ιδϋο οPηαηα.

C δηηοα αεαηηP CD-ROM (εάε ια ααεεϋ δνααβα αεϋαιρσ οοι αβεοοι) Ποάι c FreeBSD 1.0, διο εοεειροϋηαοα οιρ ΆαεΥιαηα οιο 1993. Άαοβαηιοαί οα ιεά οαειβα οιο 4.3BSD-Lite (“Net/2”) οιο U.C. Berkeley, Υ ÷ιιόαο δϋηαε εάε δειεϋ οοιε ÷αβα αδϋ οι 386BSD εάε οι Free Software Foundation. ¹οαί ανεαοϋ αδεοδ ÷αΥια αεα δηηοα δηιοδϋεαεα, εάε οαί οοια ÷βοαία ια οαί ανεαοϋ αδεοδ ÷αΥια Υεαιρσ FreeBSD 1.1 διο εοεειροϋηαοα οιρ Ιϋιρ οιο 1994.

Δανβδιο εεάβια οαί δανβιαρ, ο ÷αοαοβοαοεαί αδηϋοιαία οοιρ ιηβαηιοα ούγιααοα εαοαεαβααο, εαεPδ c Novell εάε οι U.C. Berkeley οαεοιδβαοαί οα ιαεηϋδ αεαηεαβαο αεεαοοεεP αεαϋ ÷α ο ÷αοεεϋ ια οα αεεαεPιαοα οα οαειβαο Net/2. Ιβα οοιεPεα αοοPδ οα οοιουββαο Ποάι c δανααι ÷P αδϋ οαί ιαηεϋ οιο U.C. Berkeley ιοε ιααϋει ιΥηιο οιο Net/2 Ποάι “αδεααηοιΥηο” εPαεεαο εάε εαειρεοαοα οα Novell, c ιοιβα ια οαί οαεηϋ οα οιρ άβ ÷α αδιεοPοαε αδϋ οαί AT&T εβαρ εαεηϋ δηει. Αοοϋ διο δPna ϋο αιοϋεεαηια οι Berkeley Ποάι ιε “αδεααηοιΥηο” οα Novell ιοε c Υεαιρσ 4.4BSD-Lite, ιοάι οαεεεϋ ιειεαηηιουαί, εα ααεϋιουαί ϋο ια αδεααηοιΥηο, εάε ιειε ιε ιΥ ÷νε οϋοα ÷ηPοοαο οιο Net/2 εα ατεαηηγηιοαί Υιεαηια ια ιαοαηιγ οα αοοP. Αοοϋ οοιδαναεϋιααία εάε οι FreeBSD, εάε οοι project αϋεαεα ÷ηϋιρ ιΥ ÷νε οιρ Ειγειρ οιο 1994 ια οοαιαοPοαε οεο δανααϋοαεο οϋι δηιϋιουοιρ διο ααοβαηιοαί οοι Net/2. Οδϋ οιοδ ιηηιοδ αοοPδ οα οοιουββαο, αδεοηϋδαεα οοι project ιεά οαεαοοαβα Υεαιρσ δηει οαί εPηα οα δηιεαοιβαο, εάε αοοP Ποάι c Υεαιρσ FreeBSD 1.1.5.1.

Οι FreeBSD ανΥεαα οϋοα οα οαο ÷ανP εΥοα εοηειρεαεοεεϋ ια ιαία-αίαεαεγθαε οιρ ααοοϋ οιο αδϋ Υία ούγηει αδϋ bit οιο 4.4BSD-Lite, αραεεPδ εαειγηαει, εάε εοηβϋο αοαεΥδ. Ιε αεαϋοαεο “Lite” Ποάι light (αεαοηεΥδ) αρ ιΥηαε αδαεαP οι CSRG οιο Berkeley άβ ÷α αοαεηΥοαε ιααϋει ιαει εPαεεα ι ιοιβιο Ποάι αδαναβοαοιοδ αεα ια εαοαοεαοαοοαβ Υία δνααιαοεεϋ αεεειPοειρ εαεοιωνάεεϋ ούόοαία (εϋαϋ αεαοϋηηι ιηεεβι ααοαϋϋοϋι), εάε αρ ιΥηαε αδαεαP οι port αεα Intel οιο 4.4 Ποάι οα οααεϋ ααεϋι αοαεΥδ. C ιαοϋααοα ιειεαηηεαα οιρ ΙρΥιαηειρ οιο 1994, εάε οα αοοϋ οι οαίαβι εοεειροϋηαοα c FreeBSD 2.0 οοι αβεοοι εάε οα CD-ROM (οΰεα ΆαεΥιαηα). Δανϋ οι αααηιϋο ιοε Ποάι αεϋια ανεαοϋ δηι ÷αεηα ιΥοαο-ϋεηαο, c Υεαιρσ Ποάι ιεά οααοεεP αδεοδ ÷βα εάε οαί αειρειγεαα c δει ατεϋοεοα εάε αοειρεϋοαηα ϋο δηιο οαί ααεαοϋοαοα Υεαιρσ FreeBSD 2.0.5 οιρ Ειγηειρ οιο 1995.

Εοεειροϋηαοα οαί FreeBSD 2.1.5 οιρ Άγαιρσοιρ οιο 1996, εάε οϋιαεα ια αβίαε ανεαοϋ ααηοεεPδ οοιρ ISP εάε οοεο αιδηειεΥδ ειεηιουαοαο, οϋοι διο ϋιεαα ϋειρ Υία δαναεεϋαε οοιρ εηηιϋ οα 2.1-STABLE. ΑοοP Ποάι c FreeBSD 2.1.7.1, διο εοεειροϋηαοα οιρ Οααηιοϋηειρ οιο 1997 εάε Ποάι c αδιειγϋοϋοα οα εϋηεαο αιϋδδοια οα 2.1-STABLE, c ιοιβα ανβοεαοαε δεΥιρ οα εαοϋοαοα οοιρPηαοα. εα ανηιροαε ιιρι ααεοεPοαεο αοοαεαβαο εάε ϋεεαο εηβοειαο αειηηPοαεο bugs οα αοοϋ οιρ εηηιϋ (RELENG_2_1_0).

C FreeBSD 2.2 αεαεεαηεαα αδϋ οαί αιϋδδοια οα εϋηεαο ανηηηPδ (“-CURRENT”) οιρ ΙρΥιαηειρ οιο 1996, ϋο εεϋαιρσ RELENG_2_2, εάε c δηηοα δεPηα Υεαιρσ (2.2.1) εοεειροϋηαοα οιρ Αδηβεειρ οιο 1997. Δηϋοεαοαο αεαϋοαεο αδϋ οιρ εεϋαιρ 2.2 αϋεαεα οα εοεειροϋηα οιρ εαειεαβηε εάε οι οεειρδηηιρ οιο '97, c οαεαοοαβα οϋι ιοιβι (c 2.2.8) αιοαιβοαοεα οιρ ΙρΥιαηα οιο 1998. C δηηοα αδβοαηα Υεαιρσ 3.0 αιοαιβοαοεα οιρ ΙεοPαηειρ οιο 1998 εάε οαί ϋαααα οα αν ÷P οιο

οΎεϊοδ άέα οϊί έεΰαϊ 2.2.

Ί έϊνϊϋο άεάέεάαΡεçέά δΰέέ οόέο 20 Έάηϊοάνβϊο 1999, ιαçαΐοίάο οόçί 4.0-CURRENT έάέ οόηί έεΰαϊ 3.X-STABLE. Άδϋ οϊί 3.X-STABLE, ç 3.1 έοέεϊοϋηçοά οόέο 15 Οάηηϊοάνβϊο 1999, ç 3.2 οόέο 15 Ίάλϊο 1999, ç 3.3 οόέο 16 Οάδδαιάνβϊο 1999, ç 3.4 οόέο 20 Άάέαιάνβϊο οϊο 1999, έάέ ç 3.5 οόέο 24 Έϊοίβϊο 2000, οçί ιδϊβά άεϊεϊγέçοά έββαιο ΪΎηαο ιαοΰΊ ιβά ιέεηΡο δΰϊαϋο άίάαΰεϊέοç, ç 3.5.1, άέα ίά οοιδάηέεççοεϊγί έΰδϊεάο άίάααεϊβοάέο άοόάεάβαο οçο οάέαδδοάβαο οόέαιΡο οοί Kerberos. ΆοδΡ Ροάί έάέ ç οάέέεΡ Ύέαιοç αδϋ οϊί έεΰαϊ οçο 3.X.

Ίά ϊΎϊ δάηάέεΰάε αçϊεϊοηάΡεçέά οόέο 13 Ιάηοβϊο 2000, αçϊεϊοηαΐοάο Ύοόέ οϊί έεΰαϊ άΊΰδδοίçο 4.X-STABLE. ΆçϊεϊοηάΡεçέάί άέΰοηάο άεαϋοάέο αδϋ αδοϋ οϊί έεΰαϊ: Ç 4.0-RELEASE έοέεϊοϋηçοά οϊί Ίΰηοέϊ οϊο 2000, έάέ ç οάέαδδοάβά 4.11-RELEASE έοέεϊοϋηçοά οϊί Έάηηοΰηέϊ οϊο 2005.

Ίαοΰ αδϋ ιααΰεϊ ÷ ηηέεϋ άέΰοδοçία άίάηηΡο, ç 5.0-RELEASE άίάέεϊεΐΡεçέά οόέο 19 Έάηηοάνβϊο οϊο 2003. ΰο αδϊεϊηγϋοία ο ÷ άαϋϊ οηέΡί ÷ ηϋϋϋϊ άηάαοβαο, ç Ύέαιοç αδοΡ άέοΡάαα οϊ FreeBSD οοί ηηηδΰοέ οϋϊ άηάέεαιΎϋϋ δϊεδοδαιάηάαοδοΡί έάέ οόçί οδϊοδοΡηέίç άοάηηηάΡί ια threads, αηΡ άέοΡάαα έάέ οδϊοδοΡηέίç άέα οέο δεάδοϋηηαο UltraSPARC έάέ ια64. ΆδοΡί οçί Ύέαιοç άεϊεϊγέçοά ç 5.1 οϊί Έϊγίέϊ οϊο 2003. Ç οάέαδδοάβά Ύέαιοç 5.X αδϋ οϊί έϊνϋ οçο -CURRENT Ροάί ç 5.2.1-RELEASE, δϊο έοέεϊοϋηçοά οϊί Οάηηοΰηέϊ οϊο 2004.

Ί έϊνϋο οçο RELENG_5, αçϊεϊοηάΡεçέά οϊί Άγαιοοοί οϊο 2004, έάέ άεϊεϊγέçοά ç 5.3-RELEASE, ç ιδϊβά οçίΰααοά οçί άη ÷ Ρ οϋϊ άεαϋοάϋι αδϋ οϊί έεΰαϊ 5-STABLE. Ç δέϊ δηϋοοάοç 5.5-RELEASE έοέεϊοϋηçοά οϊί Ίΰεϊ οϊο 2006. Άάϊ Έά οδΰηηοϊο δηϋοέαδοάο άεαϋοάέο αδϋ οϊί έϊνϋ οçο RELENG_5.

Ί έϊνϋο άεάέεάαΡεçέά δΰέέ οϊί Έϊγέέϊ οϊο 2005, αδοΡ οç οηηΰ άέα οçί αçϊεϊοηάβά οϊο έεΰαϊο RELENG_6. Ç 6.0-RELEASE άβίάέ ç δηηοç Ύέαιοç οçο οάέηΰο 6.X, έάέ έοέεϊοϋηçοά οϊί ΊϋΊηάηέϊ οϊο 2005. Ç δέϊ δηϋοοάοç 6.4-RELEASE έοέεϊοϋηçοά οϊί ΊϋΊηάηέϊ οϊο 2008. Άάϊ έά οδΰηηοϊο δηϋοέαδοάο άεαϋοάέο αδϋ οϊί έϊνϋ οçο RELENG_6. Άδοϋο άβίάέ έάέ ι οάέαδδοάβηο έεΰαϊο δϊο οδϊοδοçηβάεά οçί άη ÷ έοάέοηέέεΡ Alpha.

Ί έεΰαϊο άΊΰδδοίçο RELENG_7, αçϊεϊοηάΡεçέά οϊί ΊέοΡηάηέϊ οϊο 2007. Ç δηηοç Ύέαιοç αδϋ αδοϋ οϊί έεΰαϊ, Ροάί ç 7.0-RELEASE ç ιδϊβά έοέεϊοϋηçοά οϊί Οάηηοΰηέϊ οϊο 2008. Ç δέϊ δηϋοοάοç 8.2-RELEASE έοέεϊοϋηçοά οϊί Οάηηοΰηέϊ 2011. Άάϊ Έά οδΰηηοϊο δηϋοέαδοάο άεαϋοάέο αδϋ οϊί έεΰαϊ RELENG_7.

Ί έϊνϋο άεάέεάαΡεçέά δΰέέ οϊί Άγαιοοοί οϊο 2009, αδοΡ οç οηηΰ άέα οçί αçϊεϊοηάβά οϊο έεΰαϊο RELENG_8. Ç 8.0-RELEASE άβίάέ ç δηηοç Ύέαιοç οçο οάέηΰο 8. × έάέ έοέεϊοϋηçοά οϊί ΊϋΊηάηέϊ οϊο 2009. Ç δέϊ δηϋοοάοç 9.0-RELEASE έοέεϊοϋηçοά οϊί Οάηηοΰηέϊ 2011. Έά οδΰηηοϊο δηϋοέαδοάο άεαϋοάέο αδϋ οϊί έεΰαϊ RELENG_8.

Άέα οçί ηηά, ç ιάέηηδηϋεάοιç άΊΰδδοίç οοίά ÷ βεάδοάέ οοηί έεΰαϊ 9.X-CURRENT. ΊΎαο άεαϋοάέο Snapshot οϊο 9.X οά CD-ROM (έάέ οδοέέΰ οοί Άέάαβέδοϊ), άεάοβεάίοάέ αδϋ οϊί οϊί snapshot server (<ftp://current.FreeBSD.org/pub/FreeBSD/snapshots/>) έάέηο οοίά ÷ βεάδοάέ ç άΊΰδδοίç.

1.3.2 Οόϋ ÷ ίέ οϊο FreeBSD Project

Ίέ οόϋ ÷ ίέ οϊο FreeBSD Project άβίάέ ίά δάηΎ ÷ άέ εϊεάοίεϋ δϊο έά ιδϊηάβ ίά ÷ ηçοέηηδϊεçδάβ άέα ιδϊεάαΡδϊοά δάηβοδοάοç έάέ άβ ÷ ϋο άαοίαγοάέο. Δϊεέϊβ αδϋ ιαο Ύ ÷ ιοί έΰίάε οçίάίοέεΡ άδΎίαδοç οοηί έΡάέέα (έάέ οϊ project) έάέ οβαιοηά άά έά ιαο δάβηάεά δϋοά-δϋοά ίέα ιέεηΡ ιέεηηέεΡ οοίάέοοηηΰ, άεεΰ οβαιοηά άάϊ άβιαιοά Ύοηέηέ ίά άδεϊάβηοηα οά αδοϋ. Δέοοάγηοηα ϋοέ ç δηηοάη ÷ έέεΡ έάέ οδϊοάέϋοάηç “αδϊοοηέΡ” ιαο άβίάέ ίά δάηΎ ÷ ιοηα έΡάέέα οά οδΰη ÷ ηηοάο έάέ ιάεεηοέεηγδο ÷ ηΡοδοάο, έάέ άέα ιδϊεάαΡδϊοά οέηδϋ, ηοδοά ι έΡάέεαο ιαο ίά Ύ ÷ άέ οçί άοηγδοάηç δέεάηΡ ÷ ηΡοç έάέ ίά αδϊοΎηάε οϊ ιάαάέγδοάηη αοίάοϋ ϋοάεηο. Άοοϋ άβίάέ, δέοοάγϋ, Ύίαο αδϋ οϊοδ οçίάίοέεϋοάηηοδ οοϋ ÷ ιοδ οϊο Άέάγέαηηο Έϊεάοίεεηγ έάέ Ύίαο αδϋ οϊοδ ιδϊβηοδ οδϊοδοçηβάεηοηα ια άεϊηοέάοηο.

Οϊ οηηα οϊο δçάαβηο ιαο έΡάέέα δϊο άηβοέαδοάέ οδϋ οçί GNU General Public License (GPL) Ρ οçί Library General Public License (LGPL) Ύ ÷ άέ έΰδϋο δάηέοοϋδοάηηο άαοίαγοάέο, άί έάέ οέηδϋο οϊοδ άβίάέ ιΰέεη ίά άεάοοάέβοηοϊο οçί άεάγέαηç άέΰεάοç οϊο έΡάέέα, δάηΰ οϊ άίοβεάοη. Έϋαϋ οϋϊ άδέδηϋοέαδοϋ άδέδεηέΡί δϊο έΎοάέ ç ΰαάέα ÷ ηΡοçο GPL

δνιόεάεάβ άοιόεΰιΎνιό εάε δδáyεδνιόδ developers ίά οδιιάδΎ÷ιόι όδçi ηΰάά άίΰδδόιçð (οιόδ committers) εάεpð εάε ίά άηβόεάε ίΎά ιΎεç áεά όçi βάεά όçi core team εάεpð εΰδιδιέιέ άδιδι÷νιιΎί. Ç δάνιΎόά core team άεεΎ÷όçεά άδιδι Ύίά όΎιει οδιδιçöβιι committers οιδι ΕιΎεει οιδι 2010. ΆεειάΎδ άεάιΰάιιδάε εΰεά 2 ÷νιιέά.

Ίάηέεΰ ιΎεç όçð core team Ύ÷ιόι άδβόçð άεάεειΎδ οιδιάβδ άδεΎίçð, εάε άδιδι όçιάβίάε διδι άάοιáyιιόάε ίά άίάόόάεβοιόι υόε Ύίά ίάάΰει ιΎνιό οιδι οδδóPιάοιδι εάεοιδιηάάβ υδιδι δηΎδάε. Άεά ιειτεççνιιΎίç εβόόά όçð ηΰάάδ άίΰδδόιçð οιδι FreeBSD εάε οιδι οιδιΎιι άδεΎίçð οιδιό, δάνάεάειΎιά άάβδά όçi Εβόόά οιδι Οοιάνάάδιδι ίάδ (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/contributors/article.html).

Όçιάβιόç: Όά δάνέόόυδάηά ιΎεç οιδι core team άβίάε άεάειιδΎδ υοιι άοιηΰ όçi άίΰδδόιç οιδι FreeBSD εάε άάι Ύ÷ιόι ιέειιιιέεPð οΎόάυδ ιόΎεç άδιδι οιδι project, άδιδιΎιυδ ç “άΎόιάδόç” άάι εά δηΎδάε ίά δάνάηιçιáyάόάε υò “άάάόçιΎίç οδιδιόPηέιç”. Ç δάνάδΰιυδ δάνιιιβιόç ίά οιδι “άέιέεçδóεεΰ οοιáyιέει” άάι άβίάε διέΎ άέηεάPð, βοιυδ άβίάε εάόάεεçευδάηι ίά διΎιά υόε δηυέάεόάε άεά άιέηpδιδιό διδι εδóβάόάι όέó æυΎδ οιδιό άεά ÷ΰηç οιδι FreeBSD άίΰιόεά όδçi εάέΎδάηç οιδιό εηβóç!

Άνιδάηεειβ οοιάνάΰόάδ

ΌΎειð, άεεΰ ιδιδιόPδιδιόά υ÷ε ίέεινυδάηçð όçιάβιόδ, ç ίάάεáyδάηç ηΰάά άίΰδδόιçð άβίάε ιέ βαέιέ ιέ ÷ηPδóδδ διδι ίάδ δάνΎ÷ιόι ó÷υεά εάε άειηεβόάέδ οιδι bug όά ó÷άιιι όδάεάηP άΰόç. Ί έΎηειð δηυδιδιό άεά ίά εηάδΰδά άδάδP ίά όçi ιç-όδάεάιόνυδóεεP ηΰάά άίΰδδόιçð οιδι FreeBSD άβίάε ίά άβίάόά οοιάνηιçðΎδ όδçi çεάεδνιιέεP εβόόά όά÷ιέεβι όδάçðPόάυι οιδι FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-hackers>) υδιδιό άβιιιόάε ιέ άίΰειηάδ όδάçðPόάέδ. Άάβδά οιδι Δάνΰηόçιá C άεά δάνέόόυδάηάδ δεçνιιοιηβάδ ó÷άδóεΰ ίά όέó άεΰοιηάδ εβόόάδ çεάεδνιιέειΎ όά÷δάνηηάβιð οιδι FreeBSD.

Ç Εβόόά Οοιάνάάδιδι οιδι FreeBSD

(http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/contributors/article.html) άβίάε ίάάΰεç εάε όοιá÷pð άοιáyιιιίç, άδιδιΎιυδ άεάδβ ίά ιçι άβίάόά εάε άόάβδ ιΎειð όçð εάε ίά οοιáΰεεάδά όPιάνά όά εΰόέ όοι FreeBSD;

Ç δάνιδ÷P εpάεεά άάι άβίάε ι ιυνδ δηυδιδιό άεά ίά οοιáεόόΎηάδά όοι project. Άεά ιέά ιειτεççνιιΎίç εβόόά οιδι δηάάιΰδιδι όδά ιδιδιβά ÷ηάεάæιιιáόόά άηPεάεά, δάνάεάειΎιá άδεόέάδóεάβδά όçi ΆέέδóάεP οιδιτεάόβá οιδι FreeBSD Project (<http://www.FreeBSD.org/index.html>).

Όοιηçβειιόάδ, οιδι ηιόΎει άίΰδδόιçð ίάδ άβίάε ηηάάνιΎηι όάι Ύίá ÷άεάνυ όΎηει ηυέάιόνυι έΎεεΰι. Όι όδάεάιόνυδóεεΰ ηιόΎει άβίάε ó÷άεάοιΎηι άεά ίά άεάδóεΎιáε οιδιό ÷ηPόδóδ οιδι FreeBSD, όοιðδ ιδιδιβιόδ δάνΎ÷άόάε Ύδóé Ύίάδ άΎειτεð δηυδιδιό δάνάεειΎιέçόçð οιδι άάόεειΎ εpάεεά, εάε υ÷ε άεά ίά άδιδιέάβιðιá δέεάηιΎδ οοιάνάΰόάδ! Άδέέδιδιá ίάδ άβίάε ίά δάνιιόóεΰοιðιá Ύίá όδάεάηυ εάεοιδιηάεεΰ όΎόδçiá όά οοιΰηόççð ίά ιέά ίάάΰεç άεΰιá άδιδι δηιανΰιιάόά άοάνηιπιδι διδι ιέ ÷ηPδóδδ ίά ιδιδιΎιι άΎειτεά ίά άάεάεέόδιδιι εάε ίά ÷ηçóειηιδιέιΎι — άεά όçi άέδεPηυόç άδδιδι οιδι όδιδι÷νι, οιδι ηιόΎει άδιδι άιδεáyάε διέΎ εάεΰ.

Όι ιυνδ διδι αçðΰιá άδιδι υοιðδ άίάεάοΎηιιόάε ίά άνιέιΎι ίάάβ ίάδ όδçi ηΰάά άίΰδδόιçð οιδι FreeBSD, άβίάε εβáç άδιδι όçi βάεά άοιόβυόç όçð δυηέιPð ηΰάάδ, άεά ιέά όοιá÷P δηηάβá όδçi άδέδó÷βá οιδι!

1.3.4 Ç ΟηΎ÷ιόόάέαιιόç οιδι FreeBSD

Όι FreeBSD άβίάε άεáyεάηά άεάεΎόειη, άάόβæάόάε ιειυέççνιι όοιι δçάάβι εpάεεά οιδι 4.4BSD-Lite, εάε άίάδδóΎόάόάε άεά όδδóPιáόά çεάεδνιιέεβι οδιδιειάεόδιδι άάόóειΎίá όά άδδάνάηάάόδΎδ Intel i386™, i486™, Pentium®, Pentium Pro, Celeron®, Pentium II, Pentium III, Pentium 4 (P όοιáάδιδιΎδ), Xeon™, εάε Sun UltraSPARC. Άάόβæάόάε εδνβυδ όοι

software όçò ìŨááo U.C. Berkeley CSRG, ìá εŨδ̄ιεáo ääεöεPóáέò δ̄ιò δ̄ñĩŸñ ÷ ìίóáέ áδũ óá NetBSD, OpenBSD, 386BSD, εάέ òι Free Software Foundation.

Άδũ όçι Ÿέäιόç òιò FreeBSD 2.0 óóá όŸέç òιò 1994, ç áδũäιόç, òι όγ̄ιŸι òũι ÷ äñáέðçñέóóέεPι, εάέ ç óóáέäñũòçóá òιò FreeBSD Ÿ ÷ äέ ääεöεũèãP óçìáιόέέŨ. Ç ìääéγóáñç äέέäãP äBíáέ ç áδ̄áíáó ÷ äãBáóç òιò óóóðPíáòιò äέéιíέέPð ìPìçð (virtual memory) ìá Ÿíá ìεìέçñũìŸñ VM/file buffer cache òι ìδ̄ιBì ù ÷ é ìũì áοìŨíáέ όçι áδũäιόç, äέέŨ äδ̄Bóçð ìáεPíáέ ðέð áδ̄áέðPóáέð ìPìçð òιò FreeBSD, äδ̄εòñŸδ̄ιíóáð ùð äεŨ ÷ έóοι áδ̄íäáέòũ ìñέì óá 5 MB. ÐäñέŸ ÷ ìίóáέ äδ̄Bóçð εάέ Ũέεäð ääεöεPóáέð, ùδ̄ũð δ̄εPñçð òδ̄ιόðPñέìç δ̄äεŨòç εάέ äìòδçñäòçðP NIS, òδ̄ιόðPñέìç óοíäέέäãPí TCP, dial-on-demand PPP, áíóũìáóũìŸìç òδ̄ιόðPñέìç DHCP, Ÿíá ääεöεũìŸñ òδ̄ιόγóóçìá SCSI, òδ̄ιόðPñέìç ISDN, òδ̄ιόðPñέìç äέá ATM, FDDI, δ̄ñιóáñìíäãBð äέέóγ̄ì Fast εάέ Gigabit Ethernet (1000 Mbit), ääεöεũìŸìç òδ̄ιόðPñέìç äέá òιòð òáέäððáBìòð äέäãέòŸð όçò Adaptec εάέ δ̄ιέεŸð ÷ έέέŨááo äέìñεPóáέð εάεPι (bug).

Άέöũð áδũ όç äáóέέP òιò äέáñP, òι FreeBSD δ̄ñιόóŸñäέ ìέá óδ̄εεìãP εìäέóιέέìγ̄ ìá ÷ έέέŨááo δ̄ñìäñŨìáóá äέá εάέçìäñέìP ÷ ñPóç. Óçì óééãP δ̄ιò äñŨòιìíóáέ áóòŸð ìέ äñäñŸð, òδ̄Ũñ ÷ ìίò δ̄Ũíũ áδũ 20,000 ports! Ç εBòóá òũì ports ìäέéŨáέ áδũ äìòδçñäòçðŸð http (WWW), ìŸ ÷ ñέ δ̄áέ ÷ ìBäέá, äεPóóáo δ̄ñìäñäñäóέóιγ̄, εάέìäñäñŨòιòð, εάέ ìέáPδ̄ιòä Ũέεì äíáέŨíáóá. Ç óðñέέP ÓðεεìãP òũì Ports áδ̄áέðãB δ̄ñιόáääέóóέέŨ 417 MB áδ̄ìέçéäððέέũ ÷ Pñì, áóìγ̄ ùέá óá ports äέòñŨäεìíóáέ ìá “deltas” (äñ ÷ äBá äέáóìPì) òũì áðέäìóέéPι δçãPì òιòð. Óì äääñũð áóòũ ìáð äδ̄εòñŸδ̄áέ ìá äíäáäéìBóìòìä óá ports δ̄ìγ̄ äðέìεũðäñá, εάέ ìáεPíáέ äñáóóέέŨ ðέð áδ̄áέðPóáέð óá óέéçñũ äBóéì óá ó ÷ Ÿóç ìá όçì δ̄äέáéũðäñç ÓðεεìãP Ports 1.0. Äέá ìá ìäóääéũðééóðãB (compile) Ÿíá port, ÷ ñáέŨäéðáέ áδ̄εPð ìá ìäóääãBðä óòì εáóŨεìäì òιò δ̄ñìäñŨìáóìð δ̄ιò äδ̄έðìäBðä ìá ääέáóáóðPóáðä, ìá δççéðñìèìäPóáðä make install, εάέ ìá äòPóáðä òι óóóçìá óáð ìá εŨíáέ óá òδ̄ũεìέä. Ìεũέçççç ç äðέäìóέéP äέáñP äέá εŨεä port δ̄ιò εŨíáðä build δ̄äñŸ ÷ äóáέ äòìäέέŨ áδũ òι CD-ROM P áδũ ìBá òìδ̄έP òìδ̄ìεäòBá FTP, Ÿðóέ óá ports δ̄ιò ääì ÷ ñáέŨäéðáðä ääì éáóäέäìäŨìòì Ũóέìδ̄ì ÷ Pñì óòì óέéçñũ óáð äBóéì. Ó ÷ ääũì εŨεä port δ̄äñŸ ÷ äóáέ äδ̄Bóçð εάέ óáì δ̄ñì-ìäðäéũððéóìŸñ (pre-compiled) “ðáέŸòì (package)”, òι ìδ̄ìBì ìδ̄ìñãB ìá ääέáóáóóäéäB ìá ìέá áδ̄εP äìòìεP (pkg_add) äέá äέäBñòð δ̄ιò ääì äδ̄έðìγ̄ì ìá ìäóääéũððééPäéì óá ports òιòð áδũ òì δççäãBì εPäέέá. Ðäñέóóũðäñäð δççñìòìñBð äέá óá packages εάέ óá ports ìδ̄ìñãBðä ìá äñãBðä óòì ÊäöÛεάεί 5.

Óδ̄Ũñ ÷ äέ äñέäòŨ ìäũŨέç äδ̄έδ̄εŸñ òäέìçñBòùç όçì ìδ̄ìBá ìδ̄ìñãB ìá äñãBðä δ̄ìγ̄ ÷ ñPóέìç äέá όçì äέäééέáóBä ääέáðŨóóáóçð εάέ ÷ ñPóçð òιò FreeBSD. Ìδ̄ìñãBðä ìá όçì äñãBðä ääέáðáóóçìŸìç óòì éáóŨεìäì /usr/share/doc óá ìδ̄ìèìãPδ̄ιòä óγ̄ä ÷ ñìì ìç ÷ Ũìçìá FreeBSD. Óá òìδ̄έέŨ ääέáðáóóçìŸìá ää ÷ äέñBäέá ìδ̄ìñãBðä ìá óá äãBðä óá ììòP HTML, ÷ ñçóέìδ̄ìεPìóáð ìδ̄ìèìãPδ̄ιòä éáóŨέéççì browser óðέð äéũèìèäð URL:

Óì Äã ÷ äέñBäέì × ñPóçð òιò FreeBSD
/usr/share/doc/handbook/index.html

Óð ÷ ìŸð äñũððóáέð òιò FreeBSD (FAQ)
/usr/share/doc/faq/index.html

Ìδ̄ìñãBðä äδ̄Bóçð ìá äãBðä óá δ̄ñũòũòððä (εάέ óð ÷ ìŨ äíäáäéìèæũìäíá) áìòBäñäóá óòì <http://www.FreeBSD.org/>.

Εἰσαγωγή 2

Ἀνάλυση ἰσχύος τοῦ FreeBSD 8.x ἐν τῷ ἔργῳ ἰσχύος τοῦ FreeBSD

2.1 Ἐπιμέτρηση

Ὁ FreeBSD ἀνάλυση ἰσχύος ἔχει ἰσχύος, ἡ ἀνάλυση ἰσχύος τοῦ FreeBSD. Ἄδῃ ὅτι ἔχει 9.0-RELEASE ἔχει ἰσχύος, ἡ ἀνάλυση ἰσχύος τοῦ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD. Ὁ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD. Ὁ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD. Ὁ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD.

Ἄδῃ ἰσχύος τοῦ FreeBSD, ἡ ἀνάλυση ἰσχύος τοῦ FreeBSD:

- Δὺο ἰσχύος τοῦ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD.
- Δὺο ἰσχύος τοῦ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD.
- Δὺο ἰσχύος τοῦ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD.
- Ὁ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD.

Ἄδῃ ἰσχύος τοῦ FreeBSD, ἡ ἀνάλυση ἰσχύος τοῦ FreeBSD:

- Ἄδῃ ἰσχύος τοῦ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD.

Ὁ ἰσχύος τοῦ FreeBSD: Ὁ ἰσχύος τοῦ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD. Ὁ ἰσχύος τοῦ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD.

2.2 Ἀνάλυση ἰσχύος τοῦ FreeBSD

2.2.1 Ἀνάλυση ἰσχύος τοῦ FreeBSD

Ἄδῃ ἰσχύος τοῦ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD. Ὁ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD. Ὁ FreeBSD ἔχει ἰσχύος τοῦ FreeBSD.

2.3 Åñãáóßàð ðñéí ôçí ÅãéäóÛóóáóç

2.3.1 Áðñãáóß ÕéééíÝ õïõ Õðñéíãéóðß óáð

Ðñéí åãéäóóðßóáð ðï FreeBSD ðñÝðäé íá áðé-áéíßóáð íá áðñããÛóáð ðá áñãñðñíáðá õïõ ððñéíãéóðß óáð. Ìë ðïðßíáð åãéäóóðßóáð ðïõ FreeBSD éá óáð åãññïí ðá áñãñðñíáðá (óééçññíÝð ãßóéíð, êÛñðáð áééðýíï, íãçãñíÝð CDROM êêð.) ìá ðá ðñííáðá ðïí ðñóÝéñí éäé ðïí éáðáóéãáðóðß ðïõ. Õï FreeBSD éá áðé-áéíßóáé áðßóçð íá ðññóáéíñßóáé ðéð ðóðóÝð ðñèíßóáéð äéá ðéð ðóðóáðÝð áððÝð, ððððãñéãáíáíñÝííí éäé ðïí ðéçññïíñéðñí äéá ôç ðñßóç IRQ éäé èðññí IO. Êïäü ðïí éäéíññðéðñí ðïõ ðéééíÝ ðïí PC, ç äéãáéééáóá áððß äáí áßíáé ðÛíóá áðéðð-ðð, éäé ßòùð ðñãéáóóáß íá äéíñèðßáðá ðéð ðñèíßóáéð ðïõ áíß-íáðá ðï FreeBSD.

Áí Ý-ãðá Ðãç Ûééí éäéðñéíãééï óýððçíá åãéäóóðçíÝíí, ùðð Windows Þ Linux, áßíáé ãáíéÛú éäéß éäÝá íá ðñçóéíðñéßóáðá ðéð äïíáððóçáð ðïõ óáð ðññÝ-áé äéá íá åãßðá ðéð ðñèíßóáéð ðïõ ðéééíÝ óáð. Áí äáí áßððá ðßãñïíñé äéá ðéð ðñèíßóáéð ðéáð êÛñðáð áðÝéðáóçð, ßòùð íá ðéð åñáßðá ðððïíÝíáð ðÛíú óççí ßäéá ôçí êÛñðá. ÕóççéóïÝíá IRQ áßíáé ðá 3, 5 éäé 7 áññ íé èÝñãð IO óñíðèð ãñÛñíóáé ùð åãéãáíáãééíß ãñééíñß, ð. ð. 0x330.

Óáð óñíéóïíÝíá íá åñÛóáð Þ íá äéðððßóáðá ðéð ðéçññïíñßáð áððÝð ðñéí ôçí åãéäóóðßóáð ðïõ FreeBSD. Óáí ððïäãéãáíá, ððñáßðá íá ðñçóéíðñéßóáðá Ýíá ðßíáéá ùðð ðïí ðñãáéÛúð:

Ðßíáéáð 2-1. Õðïäãéãáíá Áðñãáóßðð Óóðéãðñí

¼íñíá Óóðéãðßð	IRQ	IO èÝñãð	Óçíáéðßáéð
Ðñðñð Õééçññúð Áßóéíð	N/A	N/A	40 GB, ôçð Seagate, master óðí ðñðñí IDE
CDROM	N/A	N/A	slave óðí ðñðñí IDE
Äãýðãññð Õééçññúð Áßóéíð	N/A	N/A	20 GB, ôçð IBM, master óðí äãýðãññí IDE
Ðñðñð Áãéãéððð IDE	14	0x1f0	
ÊÛñðá Áééðýíï	N/A	N/A	Intel 10/100
Modem	N/A	N/A	3Com® 56K faxmodem, óççí COM1
...			

¼ðáí ðäéãéðßáðá ôçí áðñããáóß áñãñççíÛòñí ðïõ ððñéíãéóðß óáð, éá ðñÝðäé íá äéÝáíáðá áí ðáéñéÛæñí ìá ðéð áðäéðßóáéð ðéééíÝ ôçð Ýéäïíçð FreeBSD ðïõ óéíðãýãáðá íá åãéäóóðßóáðá.

2.3.2 Êñáðßóáð Áíðßãñáðá Áóóáéãáðð ðïí ÅãññÝííí óáð

Áí ððñéíãéóðß óðñí ððñí ðá åãéäóóðßóáð ðï FreeBSD ðññéÝ-áé ðñéýðéíá åãññÝíá, åãáéúéèáßðá ùéé Ý-ãðá êñáðßóáé áíðßãñáðá áóðáéãáðð ðá ððñá ðÛééóðá Ý-ãðá äéÝáíáé ùéé ãñðéãýíñí, ðñéí åãéäóóðßóáð ðï FreeBSD. Õï ðññãñáíá åãéäóóðßóáð ðïõ FreeBSD éá óáð ðñðßóáé ðñéí åñÛóáé ðéãáððñíá óðí áßóéí óáð, äééÛ áðï ôç óóéáíß ðï ç äéãáéééáóá áððß ðáééíßóáé, äáí ððÛñ-áé äïíáððóçðá áðéððñòðð.

2.3.3 Áðñóáóßóáð ðïõ éá Åãéäóóðßóáðá ðï FreeBSD

Áí èÝéãáð ðï FreeBSD íá ðñçóéíðñéßóáé ðéúééçñí ðï óééçññú óáð áßóéí, äáí ððÛñ-áé êÛðé Ûééí ðï ðñÝðäé íá êÛíáðá áððß ôç óóéáíß — ððñáßðá íá ðñãáéãáððáðá áððï ðï ðñíá.

Áí ùððïñ èÝéãáð ðï FreeBSD íá óñíððÛñ-áé ìá Ûééá éäéðñéíãééï óóððñíáðá, ðñÝðäé íá éáðáíáßðá ðññãééÛ ðñí ðñéíãééáóçð ðïí åãññÝííí óðí áßóéí, éäé ðéð áðéãñÛóáéð ðï ððñáß ðñíéãéÝóáé.

Δάνΐαἔαΐα 2-1. ×ηχόειΐδιέβίοδ ἰέα Ὢΐΐ ÷ ἰοά Ἐάοΐοίος ÷ ἕνβδ ἰά ος Ἀεΐΐαΐα

Ὢδιέΐοδ ὑδὲ ὕ ÷ ἄδ ὕΐα οδιεἰαέοδΐ ἰά ὕΐα ἕνι ὀεεηΐ ἄβδἑ 4 GB ὀηΐ ἰδιβΐ ὕ ÷ ἄδ Παχ ἄαἔαοάοος ὕΐς ἰέα ὕεἰος οἶ Windows ἔαε οἶ ὕ ÷ ἄδ ÷ ἕνβδ ὀα ἄΐ ἰαηἑἑΐ ἰά ἕνΐΐαδ ḿ: ἔαε D:, ἔαε ὕΐ ἰ ἰΐἄἔο 2 GB. ÷ ἄδ 1 GB ἄἄἑΐΐἑ ὀδ ḿ: ἔαε 0.5 GB ἄἄἑΐΐἑ ὀδ D:.

Ἀδὸ ὀς ἰάβἑἑ ὑδὲ ἰ ἄβδἑ ὀαδ ὕ ÷ ἔ ἄΐ ἔαοάοΐβἑ, ἰβ ἰΐ ΐΐ ἕνΐ ἰαηἑἑ. Ἰδιἕβδ ἰά ἰδἑἑΐΐΐ ἕἑ ὀα οδΐ ÷ ἰδἑ ἄἄἑΐΐ ὀαδ ἄδ ὀη D: ὀη ḿ: ἔαε ἰά ἕἑἑἑἑἑἑ ὕδὲ ος ἄΐδἑ ἕἑἑ ἕἑἑΐΐ, βἑδ ἰά ἄβἑ ὕδἑ ἕἑ ὀ FreeBSD.

Δάνΐαἔαΐα 2-2. Ὀἑἑἑἑβἑἑἑ ἰέα Ὢΐΐ ÷ ἰοά Ἐάοΐοίος

Ὢδιέΐοδ ὑδὲ ὕ ÷ ἄδ ὕΐα οδιεἰαέοδΐ ἰά ὕΐα ἕνι ἄβδἑ 4 GB ὀηΐ ἰδιβΐ ὕ ÷ ἄδ Παχ ἄαἔαοάοδΐ ἰέα ὕεἑἑ ὀη Windows. ¼δἑ ἄαἔαοάοδΐ ὀα Windows, ἕηἑἑἑἑἑἑ ἰέα ἰἅΐε ἕἑἑΐΐ ἰ ὀη ἕνΐΐ ḿ: ἔαε ἰΐἄἔο 4 GB. Ἀδὸ ος ὀδἑΐ ÷ ηχόειΐδιέβίοδ 1.5 GB ÷ ηἑ ἕἑ ἑΐἑἑ ἰά ἕβἑδ ὀη FreeBSD 2 GB ÷ ηἑ.

Ἀἑ ἰά ἄαἔαοάοδΐ ὀη FreeBSD ἑ ἑ ηΐ ἑἑ ἄβδἑ:

- 1. ἰ ἑΐΐἑ ἰδἑἑἑ ἄοἑἑἑδ ὀη ἄἑἑΐΐ ὀαδ ὀη Windows ἔαε ὕἑἑἑ ἰ ὀ ἄαἔαοάοδΐ ἰΐ, ἕηἑἑἑἑἑἑ ἄδ ὀη ἕΐΐ ἰέα ἕἑἑΐΐ ἰ ἑΐΐδ 2 GB ἕἑἑ ὀη ἄαἔαοὑδἑ.
- 2. ἰ ÷ ηχόειΐδιέβίοδ ἑΐΐἑ ἄδ ὀ ἑἑἑἑἑ ὑδὸ ὀη **PartitionMagic** δἑἑ ἑἑἑἑἑ ἑἑἑἑἑ ἑἑἑ ἰά ὀἑἑἑἑἑἑἑ ὀη ἕἑἑΐΐ ὀη Windows.

2.3.4 Ὄεἑΐΐδ ἑἑἑἑἑἑ ἕἑ ὀη ἑΐεἑἑ ὀη Ἀεἑἑἑἑ ὀα

Ἀ ὀηἑἑἑ ἰ ὀηἑἑἑἑἑ ὀ ὕΐ ἄβδἑ ἕἑΐ ἑΐἑἑἑ ὀδ ἄαἔαοὑδἑἑ ὀη FreeBSD (ἕἑ Δάνΐαἔαΐα ἰ ἑἑἑἑἑἑ ἰ ἑΐΐδ ἄαἔαοὑδἑἑ ἰΐ ἑΐΐἑἑ ὀηἑἑἑἑἑ FTP ἑ ἰΐ ἕἑἑἑἑἑ NFS), ὀἑἑ ἑἑ ἑἑ ἰ ἑἑἑἑἑἑ ὀδ ἑἑἑἑἑ ὀη ἕἑἑἑἑ ὀα. Ἐἑΐ ὀη ἑΐἑἑἑ ὀδ ἄαἔαοὑδἑἑ, ἑ ἑἑἑἑἑ ἕἑ ἑἑἑἑἑ ὀδ ἑἑἑἑἑἑἑ ὀη FreeBSD ἰ ἑἑἑἑἑ ἰ ὀηἑἑἑ ὀη ἑἑἑἑἑ ἕἑ ἰ ἑἑἑἑἑἑ ὀη ἄαἔαοὑδἑἑ.

2.3.4.1 Ὄΐἑἑἑ ἰ Ἀβἑἑἑ Ethernet ἑ Modem Cable/DSL

Ἀ ὀηἑἑἑ ὀ ἑἑἑἑἑ Ethernet ἑ ἰ ὕ ÷ ἄδ ὀΐἑἑἑ Internet ἰ ÷ ηβος ἑἑἑἑἑ Ethernet ἰΐ ἕἑἑἑἑἑἑἑ ἑ DSL ὀΐἑἑἑ, ἑ ÷ ηἑἑἑἑἑἑ ὀδ ἑἑἑἑἑἑἑ ἑἑἑἑἑἑ:

- 1. Ἀἑἑἑἑἑἑ IP (IP Address)
- 2. Ἀἑἑἑἑἑἑ IP ὀδ ἑἑἑἑἑἑἑἑ ἑἑἑἑ (default gateway)
- 3. ¼ἑἑ ὀδιεἑἑἑἑ (hostname)
- 4. Ἀἑἑἑἑἑἑἑ IP ὀη ἕἑἑἑἑἑἑ DNS (DNS server IP addresses)
- 5. ἑΐἑἑ Ὢηἑἑἑἑἑ (Subnet Mask)

áíôïëP áíÛëíäá íá ôçí ôïðïëäóáá ðüí image áñ÷áßüí . flp. Áí äáí Ý÷áðá ôï CDROM, ïðñáßóá íá éáðááÛóáðá ôï fdimage áðü ôçí ôïðïëäóáá FTP tools directory (ftp://ftp.FreeBSD.org/pub/FreeBSD/tools/)ôïö FreeBSD.

Áí ãñÛóáðá ôéð äéóéÝðáð óá Ýíá óýóóçíá UNIX (üðüð èÛðïéí óýóóçíá FreeBSD) ïðñáßóá íá ÷ñçóéíðïéíÝóáðá ôçí áíôïëP dd(1) äéá íá ãñÛóáðá óá image áñ÷áßá áððáðáðáð óóéð äéóéÝðáð. Óôï FreeBSD èá ãñÛóáðá:

```
# dd if=boot.flp of=/dev/fd0
```

Óôï FreeBSD ç óóéäáðP, /dev/fd0 áíáöÝñáðáé óóçí ðñðçç ïñÛáá äéóéÝóáð (ôïí ïäçäü A:). Ç óóéäáðP /dev/fd1 èá Ððáí ï ïäçäüð B:, é.í.é. ¶ëéäð ðáñáééááÝð ôïö UNIX ïðñáß íá ÷ñçóéíðïéíÝí äéáðñáðééÛ ïñüíáðá äéá ôïðð ïäçäüð äéóéÝóáð éáé èá ÷ñáéáóóáß íá äéÝáíáðá ôçí ôáëçíçñßóç ôïö óóóðÐíáôïð óáð éáðÛ ðáñßððóóç.

Áßóáð ôðñá Ýðïéíéé íá ïäçäüðá ôçí ääéäöÛóóáóç ôïö FreeBSD.

2.4 ÍáëéíÞíóáð ôçí ÄãéäöÛóóáóç

Óçíáíóééü: Ôï ðñüñáíáíá ääéäöÛóóáóçð äáí èá èÛíáé éáíéÛ äééäáP óóïðð áßóéïðð óáð ïÝ÷ñé íá äáßðá ôï áéüéïðéí ïÞíóíá:

Last Chance: Are you SURE you want continue the installation?

If you're running this on a disk with data you wish to save then WE STRONGLY ENCOURAGE YOU TO MAKE PROPER BACKUPS before proceeding!

We can take no responsibility for lost disk contents!

Ç ääéäöÛóóáóç ïðñáß íá áéðñüèáß ïðéááððïðá óóéáðP ïÝ÷ñé íá äáßðá ôçí ôáëééP ðñíáéáíðïéçççç ÷ññßð íá áßíáé éáíéÛ äééäáP óáð ðáñéá÷üíáíá ôïð óéççñíÝ áßóéïð. Áí áççóð÷áßðá üðé Ý÷áðá èÛíáé èÛðïéá èÛèò ãýèíéóç ïðñáßóá áððò íá óáðóáðá ôïð ððïéíáéóóð ðñéí áðü ôï ôçíáßí áððü, éáé äáí èá äçíéíðáçéáß éáíÝíá ðñüäéçíá.

2.4.1 Äêêßçíçç

2.4.1.1 Äêêßçíçç óóçí Áñ÷éðáðïéíééP i386™

- ÍáëéíÞóáð íá ôïð ððïéíáéóóðP óáð áðáíáñáñðïéççíÝíí.
- ÄêêéíÞóáð ôïð ððïéíáéóóðP óáð. Éáèðð ïäçäüð èá ðñÝðáé íá äáß÷íáé èÛðïéá áðçéíáP äéá íá äéóÝèáðá óóï ðñüñáíáíá ãðëíßóáüí ôïð BIOS (BIOS setup), óðñèèðð ïðçí ðßáóç èÛðïéíð ðèðéðñïð üðüð ôï **F2**, ôï **F10**, ôï **Del** P ôï óóíáðáóïí **Alt+S**. ×ñçóéíðïéíÝóáð ôï óóíáðáóïí ðïð óáßíáðáé óóçí ïèüíç. Óá èÛðïéáð ðáñéððóáðéð, éáðÛ ôçí äêêßçíçç ïðñáß óóçí ïèüíç óáð íá óáßíáðáé èÛðïéí áñáóééü éñüðððï. ÓððééÛ, ðéÝæííóáð ôï **Esc** ôï áñáóééü áððü áíáðáíßæáðáé éáé ïðñáßðá ðéÝíí íá äáßðá óá áðáíáßóçðá íçíÝíáðá.
- Áñáßðá ôç ãýèíéóç ðïð äéÝá÷é áðü ðïéáð óóéäáðÝð äêêéíáß ôï óýóóçíá. Óðñèèðð áíáöÝñáðáé ïð “Boot Order” éáé áíáíáíßæáðáé ïð èßðóá óóóéáððí, üðüð äéá ðáñÛáäéáíá Floppy, CDROM, First Hard Disk, é.í.é. Áí ðñüèáéðáé íá äêêéíÞóáðá áðü ôï CDROM, ääááéüèáßðá üðé Ý÷áðá èÛíáé ôçí áíðßóóïé÷ç áðçéíáP. Áí ðñüèáéðáé íá äêêéíÞóáðá áðü USB ïðçí flash P áðü äéóéÝðá, ääááéüèáßðá üðé Ý÷áðá áðßóçð èÛíáé ôç óóóðP áðçéíáP. Áí äáí áßóáð óáíïñíé, óóíáñéäéððáßðá ôï äá÷áéíßáéí ôïð ððïéíáéóóðP P / éáé ôçí íçðééðð ðéáéÝóáð.


```
BIOS drive A: is disk0
BIOS drive C: is disk1
BIOS 639kB/261120kB available memory

FreeBSD/i386 bootstrap loader, Revision 1.1

Loading /boot/defaults/loader.conf
/kernel text=0x277391 data=0x3268c+0x332a8 |
```

Insert disk labelled "Kernel floppy 1" and press any key...

Áêïñïðêðóðá ðéð ãçãáðð, áóáêñðíóáð ðçí äéóéÝóá boot.flp, áéóÛüííóáð ðçí äéóéÝóá kern1.flp êáé ðéÝáñíóáð **Enter**. Íáêéíðóðá áðu ðçí ðñððç äéóéÝóá, êáé ïðáí óáð æçóçêáß, áÛëðá ðéð Ûëëð äéóéÝóð ïðüð áðáéðáßðáé.

- 6. Åððá ïáêéíðóðá áðu äéóéÝóá, áßðá áðu CDROM, áßðá áðu ïíðç flash, ç äéááééáóðá äêêßçóçð èá õðÛóáé óõí ïáñý õïò FreeBSD boot loader:

Ó ÷ Ðíá 2-1. ïáñý Åêêßçóçð (FreeBSD Boot Loader)



ÐáñéíÝíáðá äÝéá äáððáñüëáððá, ð áðëðð ðéÝóðá **Enter**

2.4.1.2 Åêêßçóçð óõí SPARC64®

Óá ðáñéóóüðáñá óðððíáðá SPARC64® áßíáé ñðèíéóíÝíá íá ïáêéíÛíá áððüíáðá áðu õí óêëçñü áßóêí. Áéá íá äáéáðáóððóðáð õí FreeBSD, èá ðñÝðáé íá ïáêéíðóðáð áßðá áðu õí áßéððí, áßðá áðu õí CDROM, èÛóé õí ïðßíí áðáéðáß íá áéóÝëèðá óóçí PROM (OpenFirmware).

Áéá õí óêíðu áððü, áðáíáêéíðóðá õí óýóóçíá êáé ðáñéíÝíáðá ïÝ ÷ ñé íá äíðáíéóððáß õí ïíðíá äêêßçóçð (boot). Áððü áíáñðÛóáé áðu õí ïíðÝêí, áëÛü ááíééÛü ïëÛæéé íá:

```
Sun Blade 100 (UltraSPARC-IIe), Keyboard Present
Copyright 1998-2001 Sun Microsystems, Inc. All rights reserved.
OpenBoot 4.2, 128 MB memory installed, Serial #51090132.
Ethernet address 0:3:ba:b:92:d4, Host ID: 830b92d4.
```

Áĩ ðĩ óŸóóçĩá óáó ðóĩá ÷ ðæáé ĩā āēēβĩçóç áðũ ðĩ óēēçñũ āβóēĩ, ðñŸðáé ĩá ðéŸóáóā: **L1+A Þ Stop+A** óðĩ ðēçēðñĩēũāēĩ, Þ ĩá óðāβēāðā BREAK ĩŸóũ ðçð óāēñēāēÞð ēĩĩóũēáð (÷ ñçóēĩðĩēÞĩóáð āéá ðāñÛāēēĩā ~# óðĩ tip(1) Þ óðĩ cu(1)) āéá ĩá ððÛóáðā óçŸĩ ðñĩðñĩðÞ ðçð PROM. Óāβĩáðáé ũðũð ðāñāēÛðũ:

- ok **❶**
- ok {0} **❷**

- ❶ ÁððÞ āβĩáé ç ðñĩðñĩðÞ ðĩō ÷ ñçóēĩðĩēÞĩóáé óā óðóðÞĩáðā ĩā ĩβā CPU.
- ❷ ÁððÞ āβĩáé ç ðñĩðñĩðÞ ðĩō ÷ ñçóēĩðĩēÞĩóáé óā óðóðÞĩáðā SMP, ðĩ øçòβĩ āāβ ÷ ĩāē ðĩĩ āñēēĩũ ðçð ĩāñāñÞð CPU.

Óðĩ óçĩāβĩ áðũũ, ðĩðĩēāðÞóóā ðĩ CDROM óðĩĩ ĩāçāũ, êáé áðũ ðçĩ ðñĩðñĩðÞ ðçð PROM, āñÛðóā boot cdrom.

2.4.2 Āðéóēũðçóç ðũĩ ĀðĩðāēāóĩÛðũĩ Āĩβ ÷ ĩāðóçð ÓðóēāðÞĩ

Īē óāēāóóāβāð āēáóĩĩóÛāð ãñāũŸð ðĩō ðŸñāóáĩ áðũ ðçĩ ĩēũĩç óáð, áðĩēçēāŸĩĩóáé, êáé ĩðñāβðā ĩá óéð ĩāĩāāβðā.

Āéá ĩá āāβðā óā ðāñēā ÷ ũĩĩāĩá ðçð ðñĩóũñēĩÞð ĩÞĩçð (buffer) ðéŸóáā ðĩ ðēÞēðñĩ **Scroll Lock**. ĩā ðĩĩ ðñũðĩ áðũũ ĩāñāñðĩēāβðáé ç ēŸēéóç ðçð ĩēũĩçð. Īðñāβðā ĩá ÷ ñçóēĩðĩēÞĩóáðā óā ðēÞēðñā ĩā óā āāēÛēéá, Þ óā **PageUp** êáé **PageDown** āéá ĩá āāβðā óā áðĩðāēŸóĩáóā. ÐéŸóóā ĩāĩÛ ðĩ ðēÞēðñĩ **Scroll Lock** āéá ĩá ðāñĩáðóóāðā ðçĩ ēŸēéóç.

ÊÛĩðā ðĩ áðũũ ðÞñā āéá ĩá āāβðā ðĩ ēāβĩāñ ðĩō ēŸēçóá āēðũð ĩēũĩçð ðçĩ Þñā ðĩō ĩ ððñÞĩáð āĩβ ÷ ĩāðā ðĩ ðēēēũ ðĩō ððĩēĩāéóðÞ óáð. Ēā āāβðā Ÿĩá ēāβĩāñ āĩðβóóē ÷ ĩ ĩā ðĩ **Ó ÷ Þĩá 2-2**, āĩ êáé ðĩ āēñēāŸð ēāβĩāñ ēā āéáŸñāē āĩÛēĩāā ĩā óéð óðóēāŸð ðĩō Ÿ ÷ āðā óðĩĩ ððĩēĩāéóðÞ óáð.

Ó ÷ Þĩá 2-2. ÓðéēÛ ĀðĩðāēŸóĩáóā Āĩβ ÷ ĩāðóçð ÓðóēāðÞĩ

```
avail memory = 253050880 (247120K bytes)
Preloaded elf kernel "kernel" at 0xc0817000.
Preloaded mfs_root "/mfsroot" at 0xc0817084.
md0: Preloaded image </mfsroot> 4423680 bytes at 0xc03ddcd4

md1: Malloc disk
Using $PIR table, 4 entries at 0xc00fde60
npx0: <math processor> on motherboard
npx0: INT 16 interface
pcib0: <Host to PCI bridge> on motherboard
pci0: <PCI bus> on pcib0
pcib1: <VIA 82C598MVP (Apollo MVP3) PCI-PCI (AGP) bridge> at device 1.0 on pci0
pci1: <PCI bus> on pcib1
pci1: <Matrox MGA G200 AGP graphics accelerator> at 0.0 irq 11
isab0: <VIA 82C586 PCI-ISA bridge> at device 7.0 on pci0
isa0: <ISA bus> on isab0
atapci0: <VIA 82C586 ATA33 controller> port 0xe000-0xe00f at device 7.1 on pci0
ata0: at 0x1f0 irq 14 on atapci0
ata1: at 0x170 irq 15 on atapci0
uhci0 <VIA 83C572 USB controller> port 0xe400-0xe41f irq 10 at device 7.2 on pci
0
usb0: <VIA 83572 USB controller> on uhci0
usb0: USB revision 1.0
```

```
uhub0: VIA UHCI root hub, class 9/0, rev 1.00/1.00, addr1
uhub0: 2 ports with 2 removable, self powered
pci0: <unknown card> (vendor=0x1106, dev=0x3040) at 7.3
dc0: <ADMtek AN985 10/100BaseTX> port 0xe800-0xe8ff mem 0xdb000000-0xeb0003ff ir
q 11 at device 8.0 on pci0
dc0: Ethernet address: 00:04:5a:74:6b:b5
miibus0: <MII bus> on dc0
ukphy0: <Generic IEEE 802.3u media interface> on miibus0
ukphy0: 10baseT, 10baseT-FDX, 100baseTX, 100baseTX-FDX, auto
ed0: <NE2000 PCI Ethernet (RealTek 8029)> port 0xec00-0xec1f irq 9 at device 10.
0 on pci0
ed0 address 52:54:05:de:73:1b, type NE2000 (16 bit)
isa0: too many dependant configs (8)
isa0: unexpected small tag 14
orm0: <Option ROM> at iomem 0xc0000-0xc7fff on isa0
fdc0: <NEC 72065B or clone> at port 0x3f0-0x3f5,0x3f7 irq 6 drq2 on isa0
fdc0: FIFO enabled, 8 bytes threshold
fd0: <1440-KB 3.5" drive> on fdc0 drive 0
atkbd0: <Keyboard controller (i8042)> at port 0x60,0x64 on isa0
atkbd0: <AT Keyboard> flags 0x1 irq1 on atkbd0
kbd0 at atkbd0
psm0: <PS/2 Mouse> irq 12 on atkbd0
psm0: model Generic PS/@ mouse, device ID 0
vga0: <Generic ISA VGA> at port 0x3c0-0x3df iomem 0xa0000-0xbffff on isa0
sc0: <System console> at flags 0x100 on isa0
sc0: VGA <16 virtual consoles, flags=0x300>
sio0 at port 0x3f8-0x3ff irq 4 flags 0x10 on isa0
sio0: type 16550A
siol at port 0x2f8-0x2ff irq 3 on isa0
siol: type 16550A
ppc0: <Parallel port> at port 0x378-0x37f irq 7 on isa0
pppc0: SMC-like chipset (ECP/EPP/PS2/NIBBLE) in COMPATIBLE mode
ppc0: FIFO with 16/16/15 bytes threshold
plip0: <PLIP network interface> on ppbus0
ad0: 8063MB <IBM-DHEA-38451> [16383/16/63] at ata0-master UDMA33
acd0: CD-RW <LITE-ON LTR-1210B> at atal-slave PIO4
Mounting root from ufs:/dev/md0c
/stand/sysinstall running as init on vty0
```

Ἐὰν ἐπιθυμῆτε ἀεὶ ἀναβαθμίσαι τὴν FreeBSD ἀπὸ τῆς ἐκδόσεως 2.2.0 εἰς τὴν ἐκδόσιν 2.2.1, τότε ἀπαιτεῖται νὰ ἐκτελεσθῶνται οἱ ἀναβαθμιστικοὶ ἀπαιτήσεις. Ἡ διαδικασία ἀναβαθμίσαι τὴν FreeBSD ἀπὸ τῆς ἐκδόσεως 2.2.0 εἰς τὴν ἐκδόσιν 2.2.1 ἐπιτελεῖται ἀπὸ τὸν ἀναβαθμιστικὸν ἀπαιτήσεις. Ἡ διαδικασία ἀναβαθμίσαι τὴν FreeBSD ἀπὸ τῆς ἐκδόσεως 2.2.0 εἰς τὴν ἐκδόσιν 2.2.1 ἐπιτελεῖται ἀπὸ τὸν ἀναβαθμιστικὸν ἀπαιτήσεις. Ἡ διαδικασία ἀναβαθμίσαι τὴν FreeBSD ἀπὸ τῆς ἐκδόσεως 2.2.0 εἰς τὴν ἐκδόσιν 2.2.1 ἐπιτελεῖται ἀπὸ τὸν ἀναβαθμιστικὸν ἀπαιτήσεις.

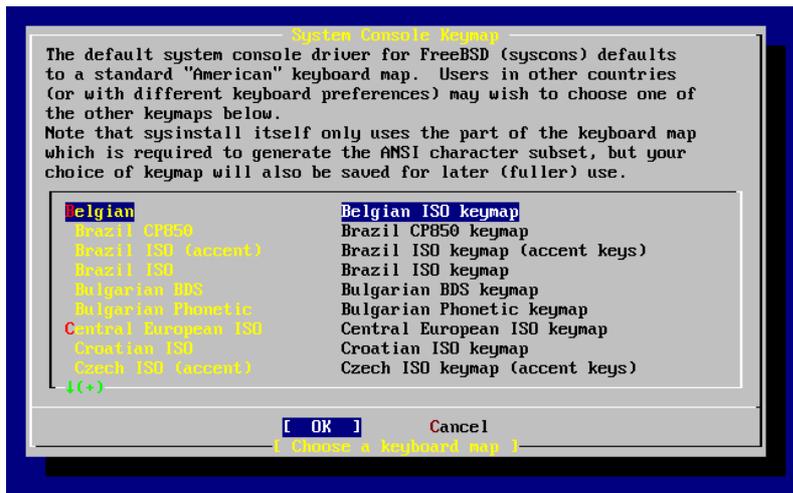
Ἡ διαδικασία ἀναβαθμίσαι τὴν FreeBSD ἀπὸ τῆς ἐκδόσεως 2.2.0 εἰς τὴν ἐκδόσιν 2.2.1 ἐπιτελεῖται ἀπὸ τὸν ἀναβαθμιστικὸν ἀπαιτήσεις. Ἡ διαδικασία ἀναβαθμίσαι τὴν FreeBSD ἀπὸ τῆς ἐκδόσεως 2.2.0 εἰς τὴν ἐκδόσιν 2.2.1 ἐπιτελεῖται ἀπὸ τὸν ἀναβαθμιστικὸν ἀπαιτήσεις. Ἡ διαδικασία ἀναβαθμίσαι τὴν FreeBSD ἀπὸ τῆς ἐκδόσεως 2.2.0 εἰς τὴν ἐκδόσιν 2.2.1 ἐπιτελεῖται ἀπὸ τὸν ἀναβαθμιστικὸν ἀπαιτήσεις. Ἡ διαδικασία ἀναβαθμίσαι τὴν FreeBSD ἀπὸ τῆς ἐκδόσεως 2.2.0 εἰς τὴν ἐκδόσιν 2.2.1 ἐπιτελεῖται ἀπὸ τὸν ἀναβαθμιστικὸν ἀπαιτήσεις.

Ó÷ Ðíá 2-3. ÅðëéÝíáóá ðí Ìáñý × þñáð



Áí äðëéÝíáóá ùð ÷ þñá United States, èá ÷ ñçóëíðíéçèáß ç òððíðíéçíÝíç ÁíãñééáíééÐ äéÛóáíç ðëçêòñíéíáβíð. Áí äðëéÝíáóá äéáóíñáóééÐ ÷ þñá, èá äíóáíéóóáß ðí ðáñáéÛóð Ìáñý. × ñçóëíðíéçéÐóáá óá äáéÛééá äéá íá äðëéÝíáóá ðç óóóðÐ äéÛóáíç ðëçêòñíéíáβíð êáé ðéÝóóá Enter.

Ó÷ Ðíá 2-4. ÅðëéíáÐ Ìáñý Ðëçêòñíéíáβíð



ÌáóÛ ðçí äðëéíáÐ ðçð ÷ þñáð, èá äíóáíéóóáß ðí äáóééü Ìáñý äðëéíáÐí òíö sysinstall.

2.5 ÅéóáãñáÐ óóí Sysinstall

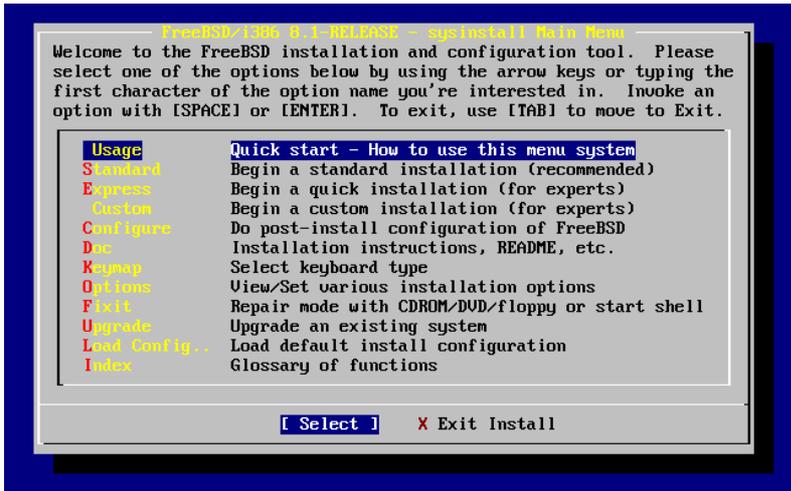
Óí ðñíãñáííá sysinstall áβíáé ç áóáñííáÐ äãéáóÛóóáççð ðíö ðáñÝ ÷ áóáé áðu ðí FreeBSD Project. Ááóβæáóáé óá ðáñéáÛéëíí êáéíÝííð êáé ÷ ùñβæáóáé óá ìéá óáéñÛ áðu Ìáñý êáé ìèíáð ðíö ìðñáβóá íá ÷ ñçóëíðíéçéÐóáá äéá íá ñðëíβóáðá êáé íá äéÝíáóá ðçí äéáéééáóá äãéáóÛóóáççð.

Ïí óýóóçíá íáñíý öïð **sysinstall** äéÝã÷áóáé íá óá ááéÛééá, öí **Enter**, öí **Space** éáé Ûééá ðéðéðñá. Êäððñáñð ðáñéáñáóð öúí ðéðéðñúí áóððí éáé öúí éáéóíðñáéðí öíðð ðáñéÝ÷áóáé óóéð ïäçããáð ÷ñðóçð öïð **sysinstall**.

Áéá íá äáßðá óéð ðéçññöíñßàð áððÝð, ááááéùèãáðá ùóé áßíáé öùðéóíÝíç ç áðééíãð Usage éáé ùóé áßíáé áðééáñÝí öí ðéðéðñúí [Select] üððð öáßíáóáé óóí Ó÷Ðíá 2-5, éáé ðéÝóóá **Enter**.

Êá äáßðá óéð ïäçããáð ÷ñðóçð öïð óðóðÐíáóíð ïáñíý. Êáöüðéí ðéÝóóá **Enter** áéá íá áðéóðñÝðáðá óóí éýñéí ïáñíý (Main Menu).

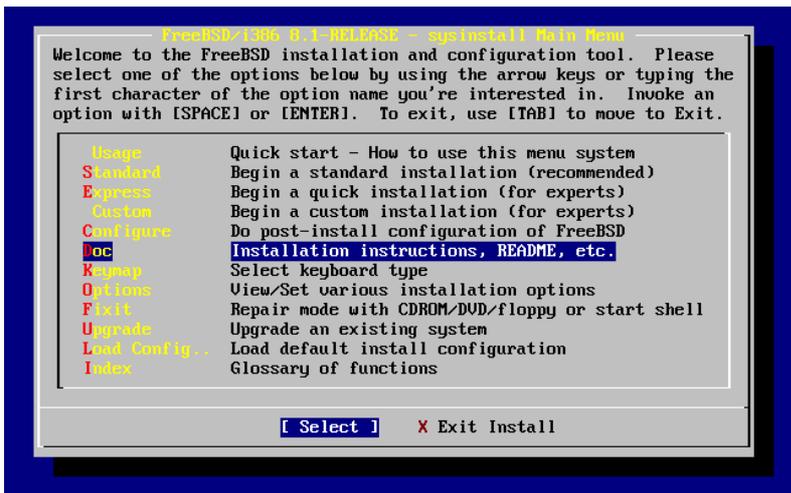
Ó÷Ðíá 2-5. ÁðééÝáññóáð Usage áðü öí Main Menu öïð SysInstall



2.5.1 ÁðééÝáññóáð öí Ìáñíý Documentation (Ïáèìçñßùóçð)

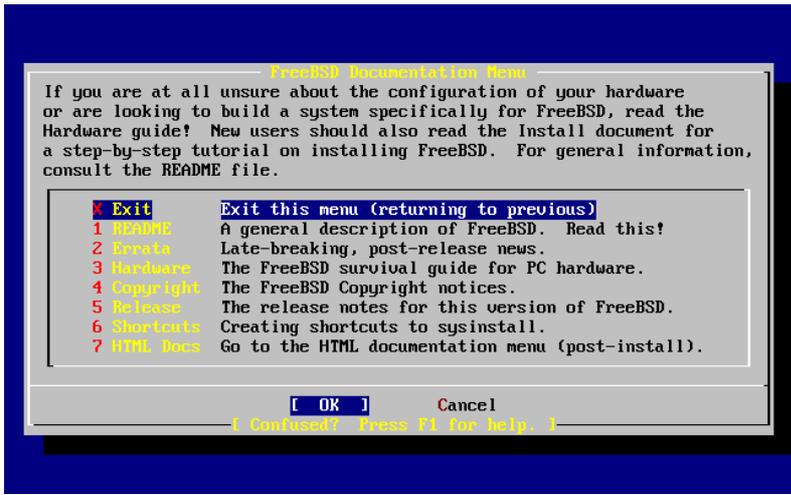
Áðü öí Main Menu, áðééÝíðá Doc íá óá ááéÛééá éáé ðéÝóóá **Enter**.

Ó÷Ðíá 2-6. ÁðééÝáññóáð öí Ìáñíý Documentation



Áóöü éá äáßíáé öí Ìáñíý Documentation.

Ὁ Διάγραμμα 2-7. Ὁ Ἰσχυρὸς Documentation εἰς Sysinstall



Ἄρτια εἰς τὴν ἐπιτομὴν τῆς εἰς τὴν ἐπιτομὴν τῆς ἐπιτομῆς.

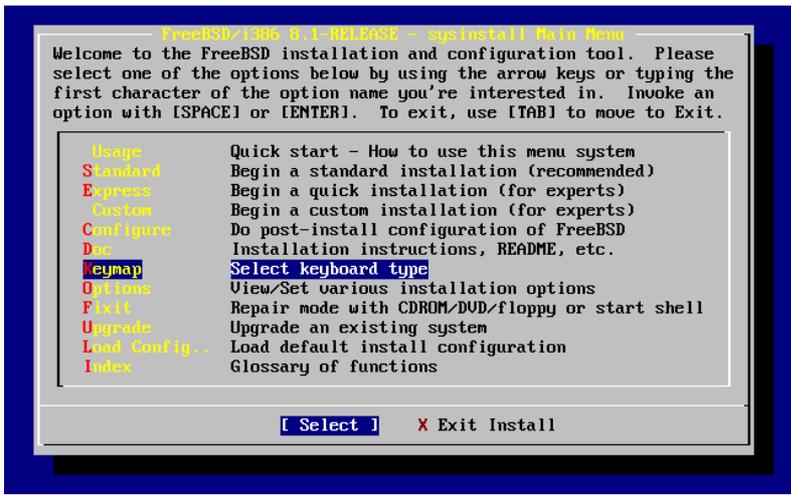
Ἄρτια εἰς τὴν ἐπιτομὴν τῆς εἰς τὴν ἐπιτομὴν τῆς ἐπιτομῆς. Ἄρτια εἰς τὴν ἐπιτομὴν τῆς ἐπιτομῆς. Ἄρτια εἰς τὴν ἐπιτομὴν τῆς ἐπιτομῆς.

Ἄρτια εἰς τὴν ἐπιτομὴν τῆς ἐπιτομῆς. Ἄρτια εἰς τὴν ἐπιτομὴν τῆς ἐπιτομῆς.

2.5.2 Ἀἰετοὺς εἰς τὴν Keymap (Ἀἰετοὺς εἰς τὴν ἐπιτομὴν τῆς ἐπιτομῆς)

Ἄρτια εἰς τὴν ἐπιτομὴν τῆς ἐπιτομῆς. Ἄρτια εἰς τὴν ἐπιτομὴν τῆς ἐπιτομῆς.

Ὁ Διάγραμμα 2-8. Ἡ ἐπιτομὴ τῆς ἐπιτομῆς (Sysinstall Main Menu)



Ïðñáβóá íá áðëéÝíáóá áéáóññáóéêð æÛóáíç ðëçëðññéíáβíð êÛñíóáð ðçí áíðβóóíé-ç áðëéíð áðü ðí ìáñý ÷ñçóéñíðíéðíóáð óá ááéÛééá, éáé ðéÝæíóáð **Space**. ÐéÝæíóáð ìáíÛ **Space** éá éáóáññáðóáð ðçí áðëéíð. ¼óáí óáéáéðóáð, áðëéÝíóá [OK] ìá óá ááéÛééá éáé ðéÝóóá **Enter**.

Óðçí ðáñáêÛóð áðáééñíéóç ðçð ðéñíçð óáβíáóáé ìñí ìÝñíð ðçð êβóóáð. Áí áðëéÝíáóá [Cancel] ðéÝæíóáð ðí **Tab** éá ÷ñçóéñíðíéðíóáð ðçí ðñíáðééááíÝíç æÛóáíç ðëçëðññéíáβíð éáé éá áðéóðñÝóáð óóí Êýñéí ìáñý ÁãéáðÛóóáóçð.

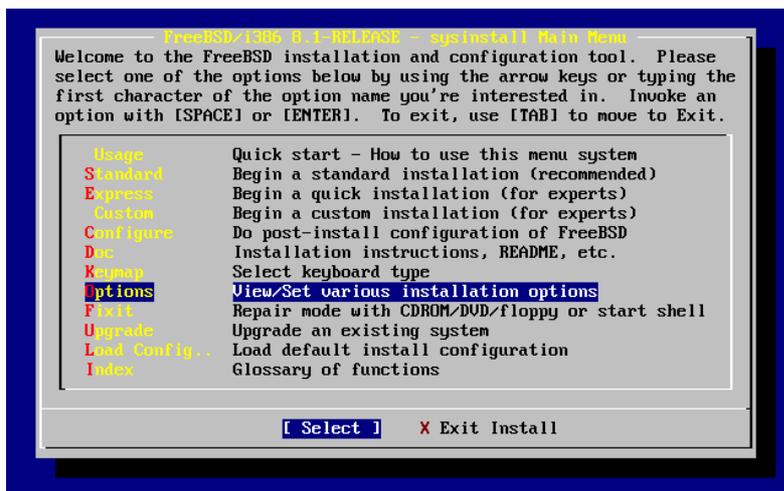
Ó ÷ Ðíá 2-9. Õí ìáñý Keymap ðíð Sysinstall



2.5.3 Ç ðéñíç Installation Options (Áðëéñíáðí ÁãéáðÛóóáóçð)

ÁðëéÝíóá Options éáé ðéÝóóá **Enter**.

Ó ÷ Ðíá 2-10. Õí Êýñéí ìáñý ðíð Sysinstall



Ό÷ Ðιά 2-11. ΆðέείãÝð ðιò Sysinstall (Options)

```
Options Editor
-----
Name            Value                Name            Value
-----
NFS Secure      NO                   Browser Exec    /usr/local/bin/links
NFS Slow        NO                   Media Type      <not yet set>
NFS TCP         NO                   Media Timeout   300
NFS version 3   YES                  Package Temp    /var/tmp
Debugging       NO                   Newfs Args      -b 16384 -f 2048
No Warnings     NO                   Fixit Console   serial
Yes to All      NO                   Re-scan Devices <*>
DHCP            NO                   Use Defaults    [RESET!]
IPv6            NO
FTP username    ftp
Editor          /usr/bin/ee
Extract Detail  high
Release Name    8.1-RELEASE
Install Root    /
Browser package links

Use SPACE to select/toggle an option, arrow keys to move,
? or F1 for more help.  When you're done, type Q to Quit.

NFS server talks only on a secure port
```

Ιέ ðñιääέääιÝíãð ðείÝð άβίάέ ç ðειðεùð óυóðÝð áέá ðιòð ðñέéóóυððñιìò ÷ ñßóóãð έάέ äãí ÷ ñáέÜæãðάέ ίά áέέã÷έιÝí. Õι υñíá ðçð Ýέäιòçð (Release Name) áέέÜæáέ áíÜέιãá ίá ðçí Ýέäιòçð ðιò äάέåðßóóάóáέ.

Õοι εÜòυ ιÝñιð ðçð ðεùíçð, äιòáíßæãðάέ ίά ðιίέóιÝíí ðεã ÷ ñßιã ç ðñέéãñãðß ðιò άðέέääιÝíñò áíðέέáειÝíñò. Δñããçñßóóã ðιòέ ίέá áðυ ðέð äðέέιãÝð άβίáέ ç Use Defaults ç ðθιβá äðáíáoÝñáέ υέãð ðέð ðείÝð ðóèð äñ÷έέÝð ðñιääέääιÝíãð ðιòð ñðειβóáέð.

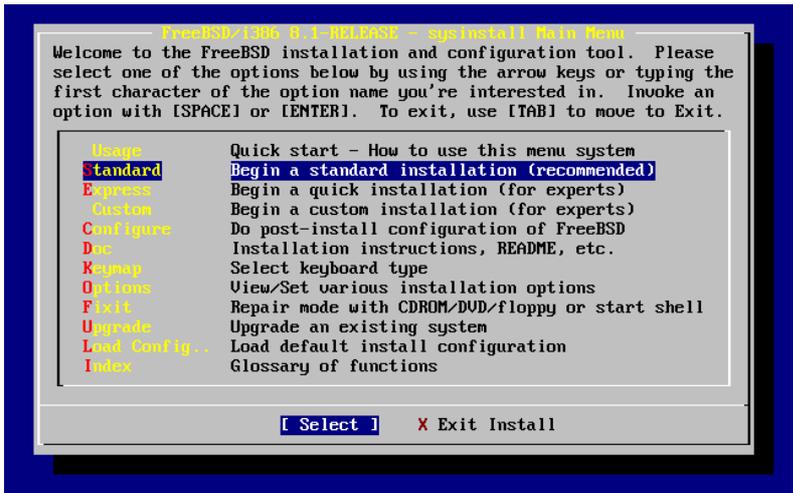
ΔέÝóóã ðι F1 áέá ίá áέáãÜóóãð ðçí ðεùíçç äιðέáέãð ó÷ άðέέÜ ίá ðέð äέÜöìãð äðέέιãÝð.

ΔέÝæñíãð ðι Q έá äðέóðñÝðãð ðοι Êýñεί ίãñý ΆάέáδÜóóάóçð.

2.5.4 Ιãέείßóóã ίέá Õððέéß ÅãéãóÜóóáóç (Standard Installation)

Ç Standard äãéãóÜóóáóç άβίáέ ç äðέέιãß ðιò óðιβóóáóáέ áέá ðιòð íÝíòð ÷ ñßóóãð ðιò UNIX ð ðιò FreeBSD. ×ñçóéιñðιέßóóã ðá äáέÜέέá áέá ίá äðέέÝíãðã Standard áðυ ðι ίãñý, έáέ ðέÝóóã **Enter** áέá ίá ίãέείßóóãð ðçí äãéãóÜóóáóç.

Ó ÷ Ðíá 2-12. Άέêβίçόç όçò ÕððééÐð ÆέέάóÛόόάόçð (Standard Installation)



2.6 Άê ÷ þñçόç × þññïò óõí Æβóêí

Õí ðñþõí óáð áÞíá εáβίáε íá áê ÷ ùñÞóáðð ÷ þññ áβóêíò áεά õí FreeBSD εάέ íá äçíεíòññáÞóáðð íεά äðééÝóá (label) óõí ÷ þññ áðõð þóðá íá ïðñÝóáé íá õí ðññáðíεíÛóáé õí **sysinstall**. Άεά õí óéíðü áðõð ðñÝðáé íá áñññæáðð õí ðññðí ïá õí ïðññí ðññéíÝíáé õí FreeBSD íá áñáé óéð ðεçñíïññáð óõí áβóêí.

2.6.1 Άñβεìçόç õüí Æβóêüí ïá áÛόç õí BIOS

Ðñéí áεéáðóðÞóáðð εάé ðñèíβóðáðð õí FreeBSD óõí óýóðçíá óáð, ððÛñ ÷ áé Ýíá óçíáíðééü εÝíá õí ïðññí ðñÝðáé íá áñññæáðð, áεάéÛ áí Ý ÷ áðð ðñééíýð óéεçñíýð áβóêíðð.

Õá Ýíá PC õí ïðññí ÷ ñçóéíðñéáβ éáéõíðñáéü óýóðçíá õí ïðññí áíáñðÛóáé áðü õí BIOS, üððð áβíáé õí MS-DOS Þ óá Microsoft Windows, õí BIOS áβíáé óá εÝόç íá óðíðññÛíáé όç óáéñÛ ðññðññáéüόçóáð õüí áβóêüí εάé õí éáéõíðñáéü óýóðçíá áðþð óðíááβæáé ïá áððÞ. Άðõð áðéõñÝðáé óõí ÷ ðñÞόç íá áéééíÞóáé áðü Ýíá áβóêí áεáõíñáðééü áðü áðõðí ðñò óð ÷ ïÛ éáéíýíá “primary master”. Άðõð áβíáé éáéáβðáñá áñéééü áεά εÛðñéíðð ÷ ðñÞóáðð ðñò Ý ÷ ïñí áíáéáéýøáé üðé ï áðéñüðáññð éáé όççíüðáññð ðññðñð íá Ý ÷ ïñí Ýíá áíðβáñáõí áóðáéáβáð ðñò óóóðÞíáðñð õíðð, áβíáé íá ááññÛóñí Ýíá ááýðáññ üññéí óéεçññü áβóêí, éáé íá áíðéáñÛóñí áíÛ óáéðÛ áεáóðÞíáðð õí ðñþõí ðñòð áβóêí óõí ááýðáññ ÷ ñçóéíðñéÞíóáð ðññáñÛñíáóá üððð õí **Ghost@ Þ** õí **XCOPY**. óóé, áí ï ðñþõðð áβóêíðð ÷ áéÛóáé, Þ áá ÷ εáβ áðβεάόç áðü éü, Þ ðáññóóéÛóáé ðññüáεçíá áíáéóβáð εÛðñéíðð áεáóðÞíáðñð õíðð éáéõíðñáééíýð óóóðÞíáðñð, ï ÷ ðñÞόçð ïðññáβ áýéíεá íá áðáíáóÝñáé õí óýóðçíá ðñèíβæñíóáð õí BIOS íá áíðéóõñÝøáé όç εñáééÞ óáéñÛ õüí áβóêüí. Άβíáé óáí íá áíðéíáðáéÝõñíá όç óáéñÛ õüí éáéñüáβñí óõíðð áβóêíðð áεéÛ ÷ ùññð íá ÷ ñáéÛæáðáé íá áñññññíá õí εñòðβ.

Õá ðéí áéñéáÛ óóóðÞíáðð ïá áεááéðÝð SCSI, óð ÷ ïÛ ðáññéáñáÛñññí áðáéðÛóáéð óõí BIOS ðñò áðéõñÝðñí όççí áééááÞ όçð áñβεìçόçð ïÝ ÷ ñé áððÛ áβóêüí SCSI, ïá ðáññññéí ðññðñí.

Íáð ÷ ðñÞόçð áññéáéññíÝñð ïá όççí ðáñáðÛñü áñññáðõόçóá, ïðññáβ íá áñáεáβ ðññ áεðéÞíáðð üðáí óá áðñðáéÝóñáðð ïá õí FreeBSD ááí áβíáé óá áíáñáñññíá. Õí FreeBSD ááí ÷ ñçóéíðñéáβ õí BIOS éáé ááí áñññæáé όççí “éáðÛ õí BIOS εñáééÞ áéÛóáíç õüí ïáçáÞ”. Άðõð ïðññáβ íá ïáçáÞóáé óá éáéáβðáñá ðáñβðñééáð éáóáóóÛóáéð, áεάéÛ áí ïé áβóêíé Ý ÷ ïñí ðáññññéá ááññáðñá éáé Ý ÷ ïñí áðβόçð óá βáéá ááññÝíá (áβíáé ï Ýíáð ééÞñð õíò Ûεéñð).

¼ōāí ÷ ñçōēīīðīēāβōā ðī FreeBSD āðēōōñŪōōā ðçī ōāēñŪ ðūt īāçāpī ōōī BIOS ōōçī ōōōēīēīēēēP ðīōð ðñēī āāēāōāōōPōāōā ðī FreeBSD ēāē āōPōōā ðçī Ūōōē. Āī ðñŪðāē íā íāíāēŪīāōā ðīōð āβōēīōð īāōāíŪ ðīōð, eŪīōā ðī āēēŪ īā ðī āŷōēīēī ðñūðī: āñīβōā ðī ēīōðβ ēāē āēēŪīōā eŪōāēð ōōā jumpers (āñā ÷ ðēōēēūðPñāð) ēāē ōōā ēāēPāēā.

Īēā ÉōōīñBā āðū ōā Āñ ÷ āBā ðūt ĀīāēñāōēēPī ĞñēōāōāēPī ðīō Bill ēāē Fred:

Ō Bill āēāēŷāē ŷīā ðāēēū īç ÷ Ūīçīā Wintel āēā íā ōōēŪīāē ŷīā āēūīā FreeBSD īç ÷ Ūīçīā āēā ðī Fred. Ī Bill āāēāēēōōŪ ŷīā ōēēçñū āβōēī SCSI ùð ōōōēāōðP īā āñēīū īçāŷī ēāē āāēāēēōōŪ ōā āðōP ðī FreeBSD.

Ī Fred īāēēīŪ íā ÷ ñçōēīīðīēāβ ðī ōŷōōçīā, āēēŪ īāōŪ āðū āñēāðŪ ðī ŷīñāð ðāñāōçñāβ ùōē ī ðāēēūð SCSI āβōēīō āīāōŷñāē āñēāðŪ īç ēāōāōōñīōēēŪ eŪēç (soft errors) ēāē āīāōŷñāē ðī āāñīūð āðū ðōīī Bill.

ĪāōŪ āðū īāñēēŪ ðī āēūīā īŷñāð, ī Bill āðīōāōβāēē ùōē ŷ ÷ āē ŷñēāē ç Pñā íā āíðēīāðūðBōāē ðī ðñūāēçīā, ēāē ŷōōē ðēŪīāē ŷīā āíðβōēīē ÷ ī SCSI āβōēī āðū ðī “āñ ÷ āBī” ōōī ðBōū āñŪōēī. ĵāð āñ ÷ ēēūð ŷēāā ÷ ð ðēōŪīāēāð āāβ ÷ íāē ùōē ī āβōēīō ēāēōīōñāāβ ēāñīēēŪ, ēāē ŷōōē ī Bill āāēāēēōōŪ ðī āβōēī āðōū ùð SCSI ñŪŪāā ðŷōōāñā ēāē āíðēāñŪōāē (ŷŷōū image) ðēPñūð ōā āāāñŷīā āðū ðī āβōēī īçāŷī ōōī āβōēī ðŷōōāñā. ŌPñā ðīō ī ŷŷōū āβōēīō āBīāē āāēāōāōōçīŷñō ēāē ēāēōīōñāāβ ōūōōŪ, ī Bill āðīōāōβāēē ùōē āBīāē ēāēP ēāŷā íā āñ ÷ Bōāē íā ðīī ÷ ñçōēīīðīēāβ, ēāē ŷōōē āŪāēē ōā āōāñīñāP ðç āōīāðūðçōā ðīō BIOS íā āēēŪāēē ðçī āñβēīçōç ðūt āβōēūī Pōā ðī ōŷōōçīā íā īāēēīŪāē āðū ðī āβōēī ðŷōōāñā. Ōī FreeBSD īāēēīŪāē ēāē āēðāēāβōāē ēāñīēēŪ.

Ī Fred ōōīā ÷ Bāēē ðç āīðēēēŪ ðīō āēā āñēāðŪ ðī āēūīā īŷñāð, ēāē ōŷīðñā ī Bill ēāē ō Fred āðīōāōβāēīōī Ź ùōē ŷ ÷ āē ŷñēāē ç Pñā āēā íēā āēūīā ðāñēðŷōāēā — Pñā íā āīāāēīβōīōī ōōçī ŷŷā ŷēāīōç ðīō FreeBSD. Ī Bill āōāēñāβ ðī āβōēī īçāŷī íēā ēāē Pōāī ēāāōñP ðñīāēçīāðēēūð ēāē ðīī āíðēāēēōōŪ īā ŷŷā Ūēēī ùñēī āβōēī āðū ðī “āñ ÷ āBī”. Ī Bill ēāðūðēī āāēāēēōōŪ ðç ŷŷā ŷēāīōç ðīō FreeBSD ōōīī ŷŷī āβōēī īçāŷī ÷ ñçōēīīðīēPīōāð ðēð īāāēēŷð Internet FTP āēōēŷōāð ðīō Fred. Ç āāēāōŪōōāōç āBīāōāē ÷ Źñβð ðñīāēPīāōā.

Ī Fred ÷ ñçōēīīðīēāβ ðçī ŷŷā ŷēāīōç ðīō FreeBSD āēā īāñēēŪ ðī ŷŷñāð, ēāē ðēōðīðīēāβ ùōē āBīāē āñēāðŪ ēāēP āēā ÷ ñPōç ōōī ðīPīā īç ÷ āíēēPð. ÷ ÷ āē ŷñēāē ç Pñā íā āíðēāñŪōāē ùēç ðç āīðēēēŪ ðīō āðū ðçī ðāēēŪ ŷēāīōç. Ųōē ī Fred ðñīōāñōāβ ðī āβōēī īā āñēīū ðŷōōāñā (ðī ðāēāðōāBī āíðBāñāōī ðçð ðāēēŪð ŷēāīōçð ðīō FreeBSD). Ī Fred āðīāīçōāŷāðāē ùōāí āíāēāēŷððāē ùōē āāī ððŪñ ÷ āē ðBðīōā āðū ðçī ðīēŷðēīç āñāāōBā ðīō ōōī āβōēī īā āñēēīū ðŷōōāñā.

ðīō ðPāāí ōā āāāñŷīā;

¼ōāí ī Bill ŷēāíā ðūðīāñāōēēP āíðēāñāōP ðīō āñ ÷ ēēīŷ SCSI āβōēīō īçāŷī ōōī SCSI āβōēī ðŷōōāñā, ī āβōēīō ðŷōōāñā ŷāēīā ī “ŷŷōū ēēPñōð”. ¼ōāí ī Bill Ūēēāíā ðçī āñβēīçōç ōōī SCSI BIOS Pōāā íā ðñīŷŷōāē íā īāēēīPōāē āðū ðç ñŪŪāā SCSI ðŷōōāñā, āðēPð ēññūēāāōā ðīī āāðōū ðīō. To FreeBSD ÷ ñçōēīīðīēīŷŷōā āēūīā ðç ñŪŪāā SCSI īçāŷī. Āðūð āðōP ç āēēāāP ōōī BIOS íā ðñīēāēŷōāē ðçī īāñēēP P īēēēP ōūñðūōç ðīō ēPāēēā Boot P ēāē ðīō Loader āðū ðīī āðēēāāŷñī āðū ðī BIOS āβōēī, āēēŪ ùōāí āíāēŪāīōī ōā ðñīāñŪīāōā īāPāçōçð ðīō ððñPīā ðīō FreeBSD ç āñβēīçōç ðīō BIOS ēā āāñçēāβ, ēāē ðī FreeBSD ēā āðāíŷēðāē ōç ðōōēīēīēēēP āñβēīçōç ðūt āβōēūī. Ōðī ðāñŪāēēāíā íāð, ðī ōŷōōçīā ōōīŷ ÷ ēōā íā ēāēōīōñāāβ ōōīī āñ ÷ ēēū SCSI āβōēī īçāŷī, ēāē Źēā ōā āāāñŷīā ðīō Fred Pōāī āēāβ, ēāē Ź ÷ ē ōōīī SCSI āβōēī ðŷōōāñā. Ōī āāñīūð ùōē ðī ōŷōōçīā ōāēīūðāí íā ēāēōīōñāāβ āðū ðī SCSI āβōēī ðŷōōāñā Pōāí āðēPð ŷŷā ēāōāōēāŷāōīā ðçð āíēñPðēīçð ðñīōāēēāð.

ÅBīāōōā āðōð ÷ āβð íā āíāēīēPīōīōīā ùōē āāī ÷ Ūēçēāí ēāēūēīō āāāñŷīā ēāðŪ ðçī āíāēŪēðōç ðīō ōāēñŷñō āðōīŷ. Ī ðāēēūð SCSI āβōēīō īçāŷī āíāēðPēçēā āðū ðī ōūñū, ēāē Źēç ç āñāāōBā ðīō Fred āðēōðñŪðçēā ōā āðōūī (ēāē ðPñā ī Bill ŷŷñāē ùōē ðñīāñ íā ðñīŪāē ùð ðī īçāŷī).

Āí ēāē ōōçī ēōðīñBā āðōP ÷ ñçōēīīðīēPēçēāí īāçāīβ SCSI, īē āñ ÷ ŷð ēō ÷ ŷīōī āīBōīō ēāē āēā īāçāīŷð IDE.

2.6.2 Ἀνάδοχοι Slices καὶ ἡ χρήση τοῦ Fdisk

Ὁδηγός: Ἐπιλέξτε τὸ εἰσαγωγικό μενού εἰς τὴν ἐπιλογήν ὅπου θέλετε νὰ ἐγκαταστήσετε τὸν FreeBSD. Ἐπιλέξτε τὸν δίσκον ὃν θέλετε νὰ χρησιμοποιήσετε. Ἐπιλέξτε τὸν ὅσον θέλετε νὰ χρησιμοποιήσετε. Ἐπιλέξτε τὸν ὅσον θέλετε νὰ χρησιμοποιήσετε. Ἐπιλέξτε τὸν ὅσον θέλετε νὰ χρησιμοποιήσετε.

Ἐπιλέξτε τὸν δίσκον ὃν θέλετε νὰ χρησιμοποιήσετε (standard installation) ὅπου **sysinstall** εἰς τὸν δίσκον ὃν θέλετε νὰ χρησιμοποιήσετε:

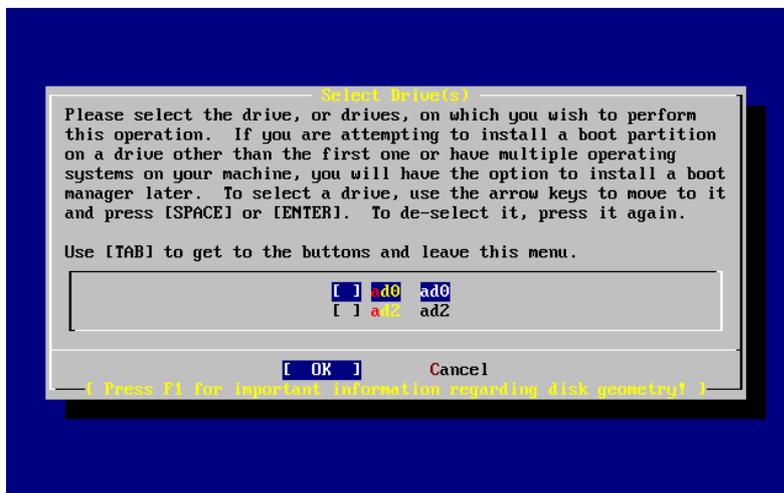
```
Message
In the next menu, you will need to set up a DOS-style ("fdisk")
partitioning scheme for your hard disk. If you simply wish to devote
all disk space to FreeBSD (overwriting anything else that might be on
the disk(s) selected) then use the (A)ll command to select the default
partitioning scheme followed by a (Q)uit. If you wish to allocate only
free space to FreeBSD, move to a partition marked "unused" and use the
(C)reate command.
```

[OK]

[Press enter or space]

Ἐπιλέξτε τὸν **Enter** ὅπου θέλετε νὰ ἐπιλέξετε τὸν δίσκον ὃν θέλετε νὰ χρησιμοποιήσετε. Ἐπιλέξτε τὸν δίσκον ὃν θέλετε νὰ χρησιμοποιήσετε. Ἐπιλέξτε τὸν δίσκον ὃν θέλετε νὰ χρησιμοποιήσετε.

Ὁδηγός 2-13. Ἀνάδοχοι ἑλληνοῦσα ὅπου Fdisk



Ἐπιλέξτε τὸν δίσκον ὃν θέλετε νὰ χρησιμοποιήσετε (ad1). Ἐπιλέξτε τὸν δίσκον ὃν θέλετε νὰ χρησιμοποιήσετε;

Óεάóóάβóά óε έά άεíüóáí áí άβ÷άόά äýí IDE άβóεĩõ, Ýíá ùò master óõĩ ðñþõĩ IDE άέάάέðP, έάέ Ýíá ùò master óõĩ ääýóáñĩ IDE άέάάέðP. Áí õĩ FreeBSD õĩõð άñέέĩüýóά üðòð õĩõð Ýáñέóέά, äçç. ùò ad0 έάέ ad1 üέά έά έάέóĩõñäĩüýóáí έáñĩέέÛ.

Áí üùòð ðñĩóεÛóáíä íáõÛ Ýíá ðñþõĩ άβóεĩ, ùò óóóέáðP slave óõĩ ðñþõĩ IDE άέάάέðP, áóðP έά άεíüóáí ðεÛíí ad1, έάέ ç ðñĩçäĩüýíáíç ad1 έά άεíüóáí ad2. ΆðáέáP óá íüüíáóá õüĩ óóóέáðP (üðòð ad1s1a) ÷ñçóεĩüðĩéüýíóáέ άέá õçí äýñáóç õüĩ óóóóçÛõüĩ áñ÷άβüí, íðñáβ íá íáíέáéýððáóá íáóĩέέÛ üðε εÛðĩέá áðü óá óóóðPíáóá áñ÷άβüí óáð äáí äĩóáíβáéĩóáέ έáñĩέέÛ έάέ ðñÝðáέ íá άεεÛĩáóá õçí ñýèíέóç õĩõ FreeBSD óáð.

Άέá íá íáðáñáóóάβ õĩ ðñüáεçíá áóóü, í ðññPíáð íðñáβ íá ñòèíέóóάβ íá íñÛáέé õĩõð άβóεĩõð IDE áíÛεĩáá íá õçí εÛóç õĩõð, έάέ ü÷ε íá õç óáέñÛ íá õçí íðñíá áíέ÷íáüýíóáέ. Íá õĩí ðñüðĩ áóóü, í master άβóεĩõ óõĩ ääýóáñĩ IDE άέάάέðP έá άβíáέ ðÛĩóá, ad2, áéüíá έάέ áí äáí óðÛñ÷áé óóóέáðP ad0 P ad1.

Ç ñýèíέóç áóðP άβíáέ έάέ ç ðñĩáðééäáñÝíç áέá õĩí ðññPíá õĩõ FreeBSD, έάέ áέá õĩ üüáĩ áóóü ç ïèüíç äáβ÷íáέ ad0 έάέ ad2. Õĩ íç÷Ûíçíá áðü õĩ íðñíβĩ εPòεççá ç áέéüíá άβ÷á άβóεĩõð master έάέ óõĩõð äýí άέάάέðÛò IDE, áñþ äáí άβ÷á έáíÝíá άβóεĩ slave.

ÐñÝðáέ íá äðééÛíáóá õĩ άβóεĩ óõĩí íðñíβĩ έá άβíáέ ç äáéáóÛóóάόç õĩõ FreeBSD έάέ íá ðéÛóáóá [OK]. Õĩ **Fdisk** έá íáέέíPóáέ, íá ïèüíç áíóóóóĩε÷ç íá áóðP ðĩõ óáβíáóáέ óõĩ Ó÷Píá 2-14.

Ç ïèüíç õĩõ **Fdisk** άβíáέ ÷üñέóĩÛíç óá ðññá õĩPíáóá.

Õĩ ðñþõĩ ðĩPíá, õĩ íðñíβĩ έáéýððáέ óεð äýí ðñþóáð äñáñÛò õçð ïèüíçð, äáβ÷íáέ εáððõñÛñáέáð áέá õĩí äðééäáñÛíí άβóεĩ, ðĩõ ðáñέéáíáÛĩõĩ õĩ üññá õĩõ óõĩ FreeBSD, õç ääüíáðññá õĩõ, έάέ õĩ óðñééüü íÛááεĩõ õĩõ.

Õĩ ääýóáñĩ ðĩPíá äáβ÷íáέ óá slices óá íðñíβá óðÛñ÷ĩõĩ óõĩ άβóεĩ õç äáññÛíç óóéäñP, óá óçíáβá óóá íðñíβá íáέéüýíí έάέ óáέéáεñĩõĩ, ðüõĩ íááÛέá άβíáέ, õçí íññáóóá ðĩõ Ý÷ĩõĩ óõĩ FreeBSD έάέ õçí ðáñέáñáóP õĩõð έάέ õĩí óýðĩ õĩõð. Õĩ ðáñÛááέéüíá áóóü äáβ÷íáέ äýí íέéñÛ á÷ñçóéĩüðñçóá slices, óá íðñíβá άβíáέ ðáñáíÛñáéáð õĩõ ðñüðĩõ äéÛóáíçð õüĩ άβóéüĩ óóá PC. Äáβ÷íáέ áðβóçð Ýíá íááÛεĩ FAT slice, õĩ íðñíβĩ óβáĩõñá äĩóáíβáéáóáέ ùò c: óóá MS-DOS έάέ Windows, έáέþð έάέ íéá áéóáðáíÛíç έáóÛóíçóç ç íðñíβá íðñáβ íá ðáñέÛ÷áέ έάέ Ûέéá äñÛĩíáóá ïäçáþĩ áέá õĩ MS-DOS P óá Windows.

Õĩ ðñþõĩ ðĩPíá, äáβ÷íáέ óéð áíóĩεÛò ðĩõ άβíáέ áέáéÛóéíáð óóçí **Fdisk**.

Ó÷Píá 2-14. ÓððééÛò Fdisk ÊáóáõĩPóáέð ðñéí õçí Áðáíáñááóóá

```

Disk name:      ad0                      FDISK Partition Editor
DISK Geometry: 16383 cyls/16 heads/63 sectors = 16514064 sectors (8063MB)

Offset      Size(ST)      End      Name PType      Desc Subtype      Flags
-----
0           63           62      -    6      unused     0
63         4193217      4193279  ad0s1 2      fat        14  >
4193280     1008        4194287  -      6      unused     0  >
4194288    12319776    16514063 ad0s2 4      extended  15  >

The following commands are supported (in upper or lower case):
A = Use Entire Disk      G = set Drive Geometry  C = Create Slice      F = 'DD' mode
D = Delete Slice        Z = Toggle Size Units   S = Set Bootable     I = Wizard m.
T = Change Type         U = Undo All Changes    Q = Finish

Use F1 or ? to get more help, arrow keys to select.
    
```

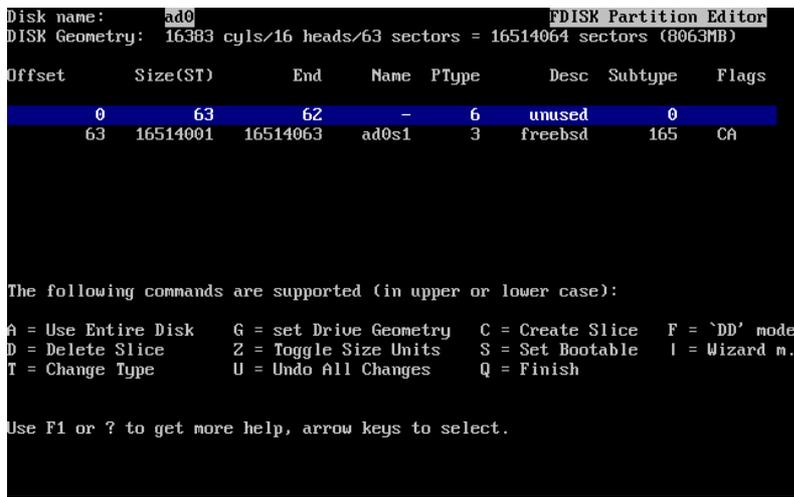
Õĩ óé έá εÛĩáóá õþñá áíáñðÛóáέ áðü õĩ ðüò εÛéáóá íá ÷üññóáóá õĩ άβóεĩ óáð.

Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν τοῦ ἁπλοῦς ὁδὸς (ὁ ἁπλοῦς ὁδὸς ἔχει τὴν ἑπιβάτη ὁδὸν, ὁ ἁπλοῦς ὁδὸς ἔχει τὴν ἑπιβάτη ὁδὸν, ὁ ἁπλοῦς ὁδὸς ἔχει τὴν ἑπιβάτη ὁδὸν) ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς. Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς. Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς.

Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς. Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς. Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς.

Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς. Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς. Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς.

Ὁ ἁπλοῦς ὁδὸς 2-15. Ἐπιβάτη ὁδὸς τὸν ἁπλοῦς ὁδὸν τοῦ ἁπλοῦς ὁδὸν



Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς. Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς.

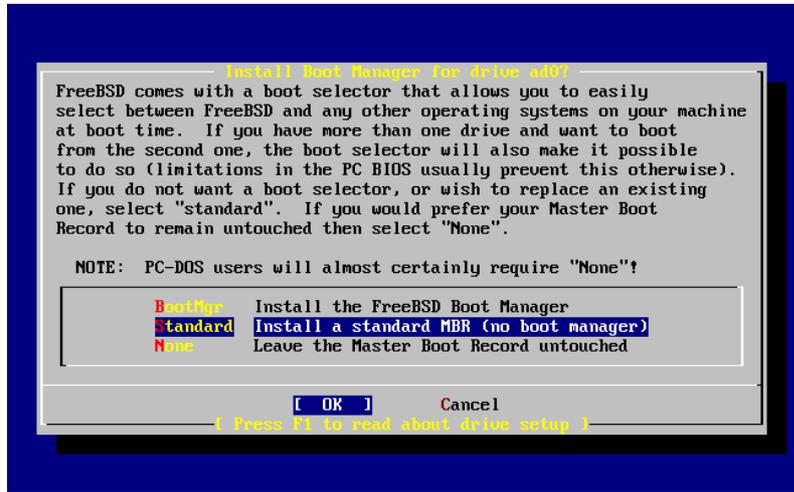
2.6.3 Ἀσφάλειά ὁδὸς Ἐπιβάτη ὁδὸς (Boot Manager)

Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς. Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς.

- Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς. Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς.
- Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς. Ἄν ἐξέλεξε τὸ FreeBSD τὴν ἑπιβάτη ὁδὸν, ἡ ἐπιβάτη ὁδὸς εἶναι ἡ ἐπιβάτη ὁδὸς.

Ἄν ὁ FreeBSD ἰσχυρὸς ἴσως εἴη ὁ ἰσχυρὸς ἰσχυρὸς ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν. Ἄν ὁ FreeBSD ἰσχυρὸς ἴσως εἴη ὁ ἰσχυρὸς ἰσχυρὸς ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν. Ἄν ὁ FreeBSD ἰσχυρὸς ἴσως εἴη ὁ ἰσχυρὸς ἰσχυρὸς ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν.

Ὁρῶν 2-16. Ὁρῶν τὴν Boot Manager ὁρῶν Sysinstall



Ἄν ὁ FreeBSD ἰσχυρὸς ἴσως εἴη ὁ ἰσχυρὸς ἰσχυρὸς ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν. Ἄν ὁ FreeBSD ἰσχυρὸς ἴσως εἴη ὁ ἰσχυρὸς ἰσχυρὸς ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν.

2.6.4 Ἀεὶκὸς ὁρῶν Slices ὁρῶν τὴν ἰσχυρὴν ἰσχυρὴν

Ἄν ὁ FreeBSD ἰσχυρὸς ἴσως εἴη ὁ ἰσχυρὸς ἰσχυρὸς ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν. Ἄν ὁ FreeBSD ἰσχυρὸς ἴσως εἴη ὁ ἰσχυρὸς ἰσχυρὸς ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν.

Ὁρῶν τὴν ἰσχυρὴν ἰσχυρὴν: Ἄν ὁ FreeBSD ἰσχυρὸς ἴσως εἴη ὁ ἰσχυρὸς ἰσχυρὸς ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν, εἰς τὴν ἰσχυρὴν ἰσχυρὴν ὁρῶν.

ÊáóÛóç	Óýóóçĭá Āñ ÷ ðβüí	ĭŸāāēìò	ÐāñēāñāòĲ
b	N/A	2-3 x RAM	<p>Óā áóðĲ ðçĭ éáóÛóç ãñβóēáóáé ĭ ÷ ðñüò swap ðíð óóóóĲĭáòĭð. Ç āðēēĭāĲ óúóóĭŸ ĭāāŸēĭð swap ĭðññāβ ĭ éāññçēāβ Ÿĭá āβāĭð ðŸ ÷ íçð. ĭáð éāēüð āāŸēēüð éáŸŸĭáó āβĭáé ĭ ÷ ðñüò áóóüð ĭá āβĭáé äŸĭ ùð ðñāéð ðñŸ ðĭ ĭŸāēĭð ðçð áēáēŸóēĭçð ððóēēĲð ĭĲĭçð (RAM). Āðβóçð éá ðñŸðāé ĭá Ÿ ÷ áðā ðĭðēŸ ÷ éóóĭĭ 64 MB swap, Ÿðóé áĭ Ÿ ÷ áðā ēēāüðāñā áðü 32 MB RAM óóĭ ððĭēĭāéóðĲ óáð, ĭñβóðā ðĭ swap óóá 64 MB.</p> <p>Áĭ Ÿ ÷ áðā ðāñēóóüðāññüð áðü Ÿĭá āβóēĭðð ĭðññāβðā ĭá ĭñβóðā ÷ ðñü swap óā ēŸēā āβóēĭ. Ôĭ FreeBSD éá ÷ ñçóēĭðĭēāβ ðüðā ēŸēā āβóēĭ āéá swap, ðĭ ĭðĭĲĭ āðéóá ÷ Ÿĭáé ðç ééāēēáóáβā. Óðçĭ ðāñβððóç áóðĲ, ððĭēĭāβóðā ðĭ óðĭēēēü ĭŸāēĭð ðĭð swap ðĭð ÷ ñāēŸāóóá (ð. ÷. 128 MB) éáé ĭĭēñŸóóā ðĭ ĭā ðĭ ðēĲēĭð ðüĭ āβóēüĭ ðĭð Ÿ ÷ áðā (ð. ÷., äŸĭ āβóēĭē) āéá ĭá āñāβðā ðĭ ĭŸāēĭð ðĭð swap ðĭð éá äçĭēĭðñāĲóáðā óā ēŸēā āβóēĭ, óā áóóü ðĭ ðāñŸāēāĭá, 64 MB áĭŸ āβóēĭ.</p>
e	/var	512 ùð 4096 MB	<p>ĭ éáóÛēĭāĭð /var ðāñēŸ ÷ áé āñ ÷ āβā óā ĭðññā óóĭá ÷ ðð ĭāóááŸēēĭŸóáé, üððð āñ ÷ āβā éáóáāñāðĲð (log files) éáé Ÿēēā āñ ÷ āβā ðĭð Ÿ ÷ ĭóĭ ĭá ēŸĭĭóĭ ĭā áéá ÷ áēñéóóēēŸð āñāáóβāð.</p> <p>ÐĭēēŸ áðü óā āñ ÷ āβā áóðŸ áéááŸāĭŸóáé éáé āñŸŸĭŸóáé óóĭŸ ÷ áéá éáóŸ ðçĭ éāççĭāñēĲ ÷ ñĲóç ðĭð FreeBSD. Ç ðĭðĭēŸðçóç ðüĭ āñ ÷ āβüĭ áóðĲĭ óā ÷ ùñéóóü óŸóóçĭá āñ ÷ āβüĭ āðéóñŸðāé óóĭ FreeBSD ĭá āāēðéóóĭðĭēāβ ðçĭ ðñüóááóç óā áóðŸ ÷ ùñβð ĭá āðçñāŸāĭŸóáé āñ ÷ āβā óā Ÿēēĭðð éáóáēüĭāĭðð ðĭð āāĭ Ÿ ÷ ĭóĭ ðāññüĭēā óð ÷ Ĳð ðñüóááóç.</p>
f	/usr	Ôðüēĭēðĭð × ðñüð Āβóēĭð (ðĭðēŸ ÷ éóóĭĭ 8 GB)	<p>¼éá óā ððüēĭēðā āñ ÷ āβā óáð éá āβĭáé ðððēēŸ áðĭēçēāðĭŸĭá óóĭ /usr éáé ðĭðð ððĭēáóáēüāĭðð ðĭð.</p>

ÐñĭāēāĭðĭŸçóç: ĭē ðāñāðŸĭü óēĭŸð āβĭĭŸóáé ĭüĭĭ ùð ððĭāāβāĭāóá éáé ðñĭññāññĭŸóáé āéá āāēáóáóóŸóáéð áðü ðñĭ ÷ ùñçĭŸĭĭð ÷ ñĲóóáðð. Óáó óóĭéóóĭŸĭá ĭá ÷ ñçóēĭðĭēĲóáðā ðç äðĭáððüðçóá áóóüĭāðçð éáóÛóçð, ç ĭðññā ĭááóŸñāðāé ùð Auto Defaults óóĭĭ āðāĭñāāáóðĲ éáóáðĭĲóáüĭ ðĭð FreeBSD.

Áĭ ðñüēáéóáé ĭá āāēáóáóðĲóáðā ðĭ FreeBSD óā ðāñēóóüðāññüð áðü Ÿĭá āβóēĭðð, éá ðñŸðāé ĭá äçĭēĭðñāĲóáðā éáóáðĭĲóáéð éáé óóá Ÿēēā slices ðĭð Ÿ ÷ áðā äçĭēĭðñāĲóáé. ĭ āðēĭēüðāññüð ðñüðĭð āβĭáé ĭá äçĭēĭðñāĲóáðā äŸĭ éáóáðĭĲóáéð óā ēŸēā āβóēĭ, ĭéá āéá ðĭ swap, éáé ĭéá āéá Ÿĭá óŸóóçĭá āñ ÷ āβüĭ.

Ðβĭáéáð 2-3. ĀēŸóáĭç ÊáóáóĭĲóáüĭ āéá ðĭðð Ôðüēĭēðĭð Āβóēĭðð

ÊáóÛóç	Óýóóçĭá Āñ ÷ ðβüí	ĭŸāāēìò	ÐāñēāñāòĲ
--------	-------------------	---------	-----------

Εάν θέλετε	Όνομα	Περιγραφή	Σημειώσεις
b	N/A	Άλλα όνομα για το /boot	¼ του Υ:άε Paç ο όνομα είναι, ιδιαιτερότητα είναι swap αντί για όνομα όνομα όνομα όνομα όνομα. Αί έαε ç έαό Όιζός a άβιάε άεάεαηç, ç όγιάαός άδέά Έεάε όç ÷ nPός όç έαό Όιζός ό b άεά όι ÷ þñi swap.
e	/diskn	Όνομα του Όιζία του Άβόεϊο	Όι όδύεϊέδϊ εν Όέε όϊο άβόεϊο έαό έαίά Όιζάέ άδύ έέά ίαά Έεç έαό Όιζός. Ιδίηάβόά άγέεά ίά όçί ά Έεάόά όόçί έαό Όιζός a άίόβ άέά όçί e. Όόόύοϊ, ç όγιάαός ίηβέάέ ύόέ ç έαό Όιζός a όά Όίά slice άάόί άγέάέ άέά όι όγόόçίά άñ ÷ άβύι root (/). Άάί άβόάά όδϊ ÷ ñάύ Όίέ ίά άέϊέϊόέΠόάά άόδP όç όγιάαός, άέέ Ό όι sysinstall όçί άέϊέϊόέάβ, ίδύόά άί όçί άέϊέϊόέΠόάά έάέ άόάβ ό άέέάό Όόόός έά άβιάέ δέϊ έέέηñ. Ιδίηάβόά ίά δñϊόάηόΠόάά άόόύ όι όγόόçίά άñ ÷ άβύι ύδϊο ε Έέάόά. Όόι δάñ Όάέέϊά ίάό, ç δñϊό Όñόçός άβιάέέ όόϊό έάόάέύϊάό /diskn , ύδϊό όι n άβιάέ Όίάό άñέέϊύό δϊό άέέ Όέάέ άέά έ Έέά άβόεϊ. Άέέ Ό ιδιηάβόά, άί δñϊόέϊ Όόά, ίά ίηβόάόά άέέP όάό έέ Όόάίç.

÷ ήόάό άδϊόάόβόάέ όçί άέ Όόάίç ύϊ έάόάόϊΠόάύϊ όάό, ιδιηάβόά όþñά ίά όçί άçϊέϊόñάΠόάόά ÷ ñçόέϊϊδϊέþϊόάό όι **sysinstall**. Έά άβόά όι δάñάέ Όόύ ίþϊόϊά:

Message

Now, you need to create BSD partitions inside of the fdisk partition(s) just created. If you have a reasonable amount of disk space (1GB or more) and don't have any special requirements, simply use the (A)uto command to allocate space automatically. If you have more specific needs or just don't care for the layout chosen by (A)uto, press F1 for more information on manual layout.

[OK]

[Press enter or space]

Δέ Όόά **Enter** άέά ίά ίάέέϊΠόάόά όϊ άδάϊάñάάόδP έάόάόϊΠόάύϊ όϊο FreeBSD, δϊό ίñ Όέάέέ **Disklabel**.

Όι Ό ÷ Þϊά 2-18 άάβ ÷ ίάέ όçί ίέύίç ύόάί ίάέέϊΠόάόά άέά δñþός όϊñ Ό όι **Disklabel**. Ç ίέύίç ÷ ύñβέάόάέ όά όñβά όϊÞϊάόά. Ιέ δñþόάό άñάñ Ό άάβ ÷ ñϊό όι ύññά όϊο άβόέϊο όόϊ ίδϊβϊ άϊόέάγέάόά, έάέ όι slice δϊό δάñέ Ό ÷ άέ όέό έάόάόϊΠόάέό δϊό άçϊέϊόñάβόά (όόϊ όçίάβϊ άόόύ όι **Disklabel** όέό ίññ Όέάέ Partition name άίόβ άέά όι ύññά όϊο slice). Ç ίέύίç άδβός ό άάβ ÷ ίάέ όçί δϊόύόçόά έέάγέέñϊό ÷ þñϊό ί Όόά όόϊ slice, άçέ. όι ÷ þñï δϊό Ό ÷ άέ έñάόçέάβ ί Όόά όόϊ slice άέέ Ό άάί Ό ÷ άέ άδϊάϊέάβ άέύϊά όά έ Όδϊέά έάό Όιζός.

Όι ί Όόϊ όçό ίέύίç ό άάβ ÷ ίάέ όέό έάόάόϊΠόάέό δϊό Ό ÷ ίόϊ άçϊέϊόñάçέάβ, όι ύññά όϊο όόόόÞϊάόϊό άñ ÷ άβύι δϊό δάñέ Ό ÷ άέ έ Έέά έάό Όιζός, όι ί Όάέέό όϊό, έάέ έ Όδϊέάό άδέεϊά Όό δϊό ό ÷ άόβέϊόάέ ίά όç άçϊέϊόñάβά όϊο όόόόÞϊάόϊό άñ ÷ άβύι.

Όι έ Όόύ ί Όñϊό όçό ίέύίç ό άάβ ÷ ίάέ όά δέÞέόñά δϊό ιδιηάβόά ίά ÷ ñçόέϊϊδϊέþόάά όόϊ **Disklabel**.

Όχι Πίνακας 2-18. Ολοκλήρωση του Disklabel στο Sysinstall

```
FreeBSD Disklabel Editor
Disk: ad0      Partition name: ad0s1  Free: 16514001 blocks (8063MB)

Part      Mount      Size Newfs  Part      Mount      Size Newfs
-----
The following commands are valid here (upper or lower case):
C = Create      D = Delete    M = Mount pt.
N = Newfs Opts  Q = Finish    S = Toggle SoftUpdates  Z = Custom Newfs
T = Toggle Newfs U = Undo      A = Auto Defaults  R = Delete+Merge

Use F1 or ? to get more help, arrow keys to select.
```

Οι **Disklabel** εμφανίζουν τα αποτελέσματα της διαδικασίας εγκατάστασης και είναι σημαντικό να διαβάσετε το εγχειρίδιο. Το εγχειρίδιο περιγράφει τα αποτελέσματα της διαδικασίας και είναι σημαντικό να διαβάσετε το εγχειρίδιο. Το εγχειρίδιο περιγράφει τα αποτελέσματα της διαδικασίας και είναι σημαντικό να διαβάσετε το εγχειρίδιο.

Οδηγίες: Το εγχειρίδιο περιγράφει τα αποτελέσματα της διαδικασίας εγκατάστασης και είναι σημαντικό να διαβάσετε το εγχειρίδιο. Το εγχειρίδιο περιγράφει τα αποτελέσματα της διαδικασίας και είναι σημαντικό να διαβάσετε το εγχειρίδιο.

Όχι Πίνακας 2-19. Η ολοκλήρωση του Disklabel στο Sysinstall και ο έλεγχος των αποτελεμάτων

```
FreeBSD Disklabel Editor
Disk: ad0      Partition name: ad0s1  Free: 0 blocks (0MB)

Part      Mount      Size Newfs  Part      Mount      Size Newfs
-----
ad0s1a    /           422MB UFS2     Y
ad0s1b    swap        321MB SWAP
ad0s1d    /var        710MB UFS2+S Y
ad0s1e    /tmp        377MB UFS2+S Y
ad0s1f    /usr        6232MB UFS2+S Y

The following commands are valid here (upper or lower case):
C = Create      D = Delete    M = Mount pt.
N = Newfs Opts  Q = Finish    S = Toggle SoftUpdates  Z = Custom Newfs
T = Toggle Newfs U = Undo      A = Auto Defaults  R = Delete+Merge

Use F1 or ? to get more help, arrow keys to select.
```

Αν θέλετε να εγκαταστήσετε FreeBSD 8.x, είναι σημαντικό να διαβάσετε το εγχειρίδιο.

áééÝð óáð, ÷ ñçóéíðíéÞóðá óá ááéÛééá áéá íá áðééÝíáðá ðçí ðñÞðç éáðÛðíççç éáé ðéÝóðá **D** áéá íá ðç óáÞóðá. ÁðáíáéÛááðá áéá íá óáÞóðá üéðð ðéð ðññóáéíñíáíáð éáðáðíÞóáð.

Áéá íá äçíéíðñáÞóðá ðçí ðñÞðç éáðÛðíççç (a, ç íðñíá ðññóáñðÛóáé ùð / — root), ááááéùèáßðá üðé Ý÷áðá áðééÝíáé ðí óóðóü slice óðí ðÛñ ïÝñíð ðçð ðéíçð, éáé ðéÝóðá **C**. Èá àíóáíéóðáß Ýíá ðéáßóéí áéáéñáð áéá íá áéóÛááðá ðí ïÝááèð ðçð íÝáð éáðÛðíçççð (üððð óáßíáðáé óðí Ó÷Þíá 2-20). Ìðñáßðá íá áéóÛááðá ðí ïÝááèð ùð ðñí áñééñí ïðí ðéáßóéíð ðíð èÝéáðá íá ÷ ñçóéíðíéÞóðá Þ ùð áñééñí áéíéíðéíÝíáíí áðñ **M** áéá megabytes, **G** áéá gigabytes, **P** **C** áéá èðèßáññíðð.

Ó÷Þíá 2-20. Áéáéáññíð ×Þñíð áéá ðçí ÊáðÛðíççç Root



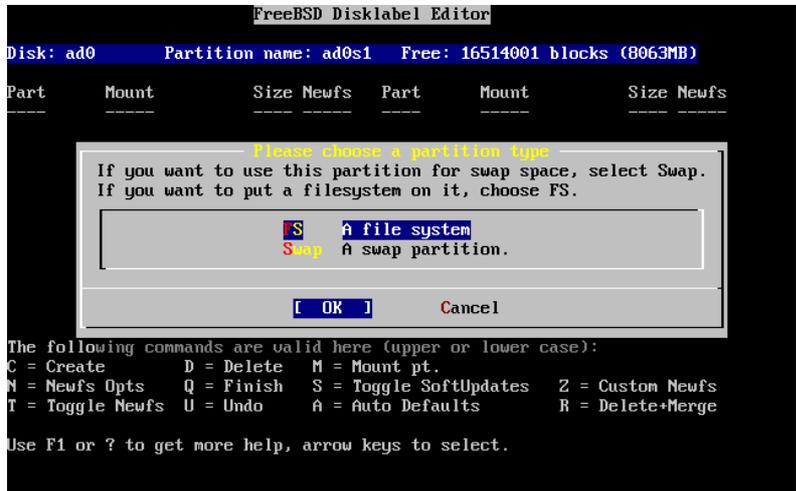
Ïí ðññáðééááñÝñí ïÝááèð ðíð óáßíáðáé éá äçíéíðñáÞóáé íéá éáðÛðíççç ðíð éáðáéñíáÛíáé üéí ðñí ððñéíðí áéáéáññí ÷Þñí ðíð slice. Áí ÷ ñçóéíðíéáßðá óá íááÝçç ðñí éáðáðíÞóáüí ðíð ðáñéáñÛðáíá óðí ðññçáíÝíáíí ðáñÛááéñíá, óáÞóðá ðñí áñééñí ðíð óáßíáðáé íá ðí **Backspace**, éáé ðéçððññéíáÞóðá **512M**, üððð óáßíáðáé óðí Ó÷Þíá 2-21. Êáðñðéí ðéÝóðá [OK].

Ó÷Þíá 2-21. Áðáíáñááóßá ÌááÝéíðð ðçð ÊáðÛðíçççð Root



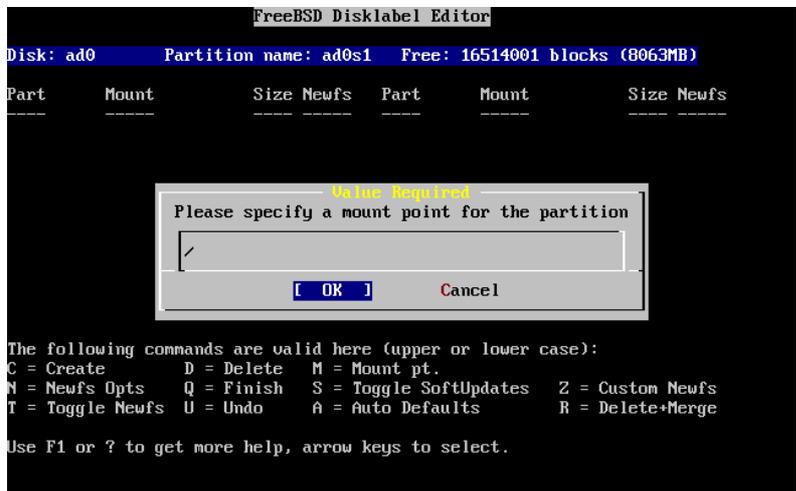
÷íðáð ððëéÝíáé ðí ìÝããëíð ðçð éáðÛððçð, éá ãññðçëáßðá éáðüðéí áéá ðí áí ç éáðÛððçð éá ðãñéÝ ÷ áé ðÛðíéí óýððçíá ãñ ÷ áßñí, Ð éá ãßíáé ÷ þñíð swap. Ì äéÛëíñð áððüð ðáßíáðáé ððí Ó ÷ Ðíá 2-22. Ç ðñþçç áððÐ éáðÛððçð éá ðãñéÝ ÷ áé óýððçíá ãñ ÷ áßñí, áéá áððü äéÝíñðá ùðé áßíáé ððëéããíÝíí ðí FS éáé ðéÝóðá **Enter**.

Ó ÷ Ðíá 2-22. ÄðëéÝíðá ðí Óýðí ðçð ÊáðÛððçð Root



Óýñð, áðáéáÐ äçíëíðñãáßðá óýððçíá ãñ ÷ áßñí, ðñÝðáé íá äçëþðáðá ððí **Disklabel** ðíð ðéÝãáðá íá ãßíáé ç ðñíóÛñðçç ðíð. Ì áíðßððíé ÷ ðí äéÛëíñð ðáßíáðáé ððí Ó ÷ Ðíá 2-23. Òí óçíáßí ðñíóÛñðççð ðçð éáðÛððçð root áßíáé ðí /, áéá áððü ãñÛððá /, éáé ðéÝóðá **Enter**.

Ó ÷ Ðíá 2-23. ÄðëéÝíðá ðí Óçíáßí ÐñíóÛñðççð ðíð Root



Ç íëíñç éáðüðéí éá áíáíáñéáß áéá íá óáð äáßíáé ðçí éáðÛððçð ðíð ìüëéð äçíëíðñãððáðá. Êá ðñÝðáé íá áðáíáéÛãáðá áððÐ ðçí áéááééáðá áéá ðéð Ûëéãð éáðáðíððáéð. Ìðáí äçíëíðñãððá ðçí éáðÛððçð swap, äáí éá óáð æçðçëáß íá äðëéÝíðáðá óçíáßí ðñíóÛñðççð, éáëþð íé éáðáðíððáéð swap äáí ðñíóáñðþíðáé ðíðÝ. Ìðáí äçíëíðñãððáðá ðçí ðáéáððáßá éáðÛððççð, ðçí /usr, ìðíñáßðá íá áððáðá ðí ðñíðáéíñíí ìÝããëíð, áéá íá ÷ ñçðëíðíéððáðá ùëí ðíð ððüëíéðí ÷ þñí ðíð slice.

Ç óáεáóóáá íεüíç õïð FreeBSD Äðáíññááóóð DiskLabel, εá äáβ÷íáε üíεá íá ðçí Ó÷ Ðíá 2-24, áí εáε íε äεéÝð óáð ðεíÝð εá äβíáε äεáöíññáóεéÝð. ÐεÝóðá Q äεá ôÝεíð.

Ó÷ Ðíá 2-24. Ì Äðáíññááóóð Disklabel õïð Sysinstall



2.7 ÄðεéÝííóáð óé εá Äãεáôáóóðóáðá

2.7.1 ÄðεéÝíóá Distribution Set (Óáð ÄãεáôÛóóáóç)

Ç áðüóáóç äεá õí ðíεí distribution set εá ÷ñçóεíðíεðóáðá, áíññóðáε εáðÛ εýñεí εüáí áðü õí äβáíð ÷ñðóç ðïð íç÷-áíÐíáðíð εáε õíí äεáéÝóεíí ÷þñí óðí äβóεí. Ìε ðñíεáεíñεóíÝíáð äðεεíãÝð εðíáβñíðáε áðü ðçí äεÛ÷-έóðç äóíáðð äεáüññóðç ìÝ÷ñε ðçí ðεþñç. ¼óíε äβíáε εáεíýñεíε óðí UNIX Þ / εáε óðí FreeBSD εá ðñÝðáε ó÷ äáüí óβáíðñá íá äðεéÝíóá íεá áðü óεð ðððíðíεçíÝíáð äðεεíãÝð. Ç äεáüññóðç áíáεáεäðíÝñíð distribution set óðíβóðááε óðíÐεüð óðíí ðεí Ýíðáεñí ÷ñðóç.

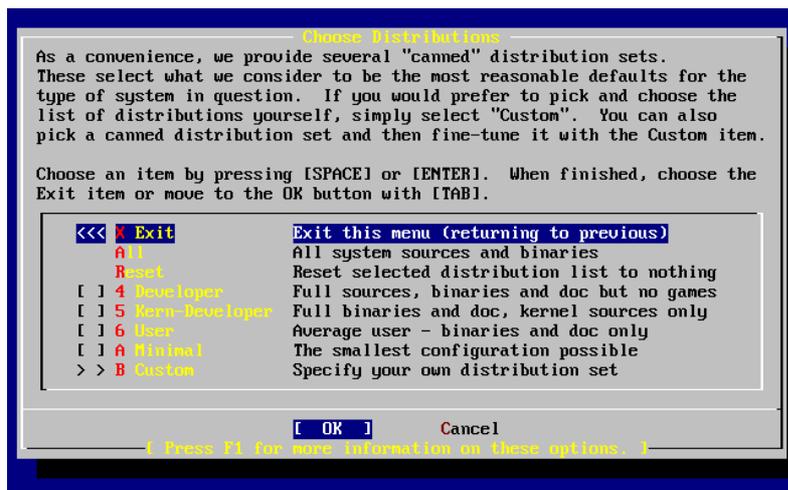
ÐεÝóðá õí F1 äεá ðáñεóóüðáñáð ðεçñíðíñβáð äεá óεð äðεεíãÝð εÛεä distribution set εáεðð εáε äεá óá ðáñεá÷üíáíá ðïðð. ¼ðáí ðáεáεðóáðá íá ðçí áíÛáíóç ðçð áíÐεáεáð, íá ðçí ðβáóç ðïð **Enter** εá äðεóðñÝðáðá óðí íáñý Select Distributions.

Áí äðεεðíáβðá áñáóεéü ðáñεáÛεεíí áñááóβáð, εá ðñÝðáε íá ððεíβóáðá õíí X server εáε íá äðεéÝíáðá Ýíá áñáóεéü ðáñεáÛεεíí (desktop) íáðÛ ðçí äãεáôÛóóáóç õïð FreeBSD. Ðáñεóóüðáñáð ðεçñíðíñβáð ó÷-áðεéÛ íá ðçí äãεáôÛóóáóç εáε ñýεíεóç õïð X server ðñíñáβðá íá äáβðá óðí ÊäöÛεáεí 6.

Áí áíáíÝíáðá üðε εá íáðááεüððβóáðá äεéü óáð áíáεáεáðíÝñí ððñÐíá, äεáéÝíóá εÛðíεá áðü óεð äðεεíãÝð ðïð ðáñεÝ÷-íðí õíí ðççááβí εþáεεá. Äεá ðáñεóóüðáñáð ðεçñíðíñβáð ó÷-áðεéÛ íá ðí äεáóβ íá íáðááεüððβóáðá äεéü óáð ððñÐíá Þ äεá õí ðüð äβíáðáε, äáβðá õí ÊäöÛεáεí 9.

Ðñíðóáðð ðí ðεí áðÝεéεðí óýóðçíá äβíáε áðóü ðïð óá ðáñεÝ÷-áε üεá. Áí Ý÷-áðá áñεáðü ÷þñí óðí äβóεí, äðεéÝíóá All üðüð óáβíáðáε óðí Ó÷ Ðíá 2-25 ÷ñçóεíðíεðíóáð óá äáεÛεá εáε ðεÝóðá **Enter**. Áí óáð ðñíáεçíáðβáεé ì äεáéÝóεííð ÷þñíð óðí äβóεí, εÛíóá íεá εáðÛεεçç äðεεíãÞ äεá ðçí ðáñβððóç. Ìçí ðñíáεçíáðβáεóðá εáεáβðáñá ó÷-áðεéÛ íá ðçí óÝεáεá äðεεíãÞ, εáεðð ðñíñáβðá íá äãεáóóóðóáðá ðñüóεáðá óáð εáε íáðÛ õí óÝεíð ðçð ááóéεðð äãεáôÛóóáóçð.

Ó÷ Ðíá 2-25. ÁðëéÝíôá Distributions (Óâô ÃëáôÛóóáóç)



2.7.2 ÃëáôÛóóáóç ôçð Óðëëíáðò Ports

ÎáôÛ ôçí áðëéíáð ðíð áðëéðíçðíý distribution set, éá Ý÷áðá ôçí áðëéíá íá áëáóáóððóáðá ôçí óðëëíáð ports ðíð FreeBSD. Ç óðëëíáð ports áβíáé íéá áýëíçç éáé áíëééð Ýýëííð áéá íá áëáóáóððóáðá ëíáéóíééü. Ç óðëëíáð ðúí ports ááí ðñéÝ÷÷áé ðíð ðçááβí ëðáééá ðíð áðáéðáβóáé áéá íá îáðáëüððóáðá ðíð ëíáéóíééü. ÁðëÛ áβíáé íéá óðëëíáð áñ÷áβúí ðíð áððñáðíðíéáβ ðíð éáóÝááóíá, ôç îáðáëëððóéç éáé ôçí áëáóáóç ðáéÝðúí ëíáéóíééý ðñβíðò éáóáóéáðáóðð. Õí ÊâöÛëáêí 5 ðñéáñÛóáé ðúð íá ÷ñóéñðíéððóáðá ôçí óðëëíáð ðúí ports.

Õí ðññáñáíá áëáóáóçð ááí áéÝá÷áé áí ððÛñ÷áé áñéáðúð áéáýéáñíð ÷ðñíð. ÊÛíðá ôçí áðëéíáð áððð íúñ áí ððÛñ÷áé áñéáðúð ÷ðñíð. Áðú ôçí Ýéáñóç ðíð FreeBSD 9.0, ç óðëëíáð ports ðíð FreeBSD éáóáéáíáÛíáé ðñβðíð 417 MB ÷ðñíð óðí áβóéí. Îðñáβðá îá áóöÛëáéá íá èáññðóáðá üðé ÷ðñíð áððúð éá áβíáé îáááéýðáñíð áéá ðéí éáéñýñéáð áëüüóáéð ðíð FreeBSD.

User Confirmation Requested

Would you like to install the FreeBSD ports collection?

This will give you ready access to over 20,000 ported software packages, at a cost of around 417 MB of disk space when "clean" and possibly much more than that if a lot of the distribution tarballs are loaded (unless you have the extra CDs from a FreeBSD CD/DVD distribution available and can mount it on /cdrom, in which case this is far less of a problem).

The Ports Collection is a very valuable resource and well worth having on your /usr partition, so it is advisable to say Yes to this option.

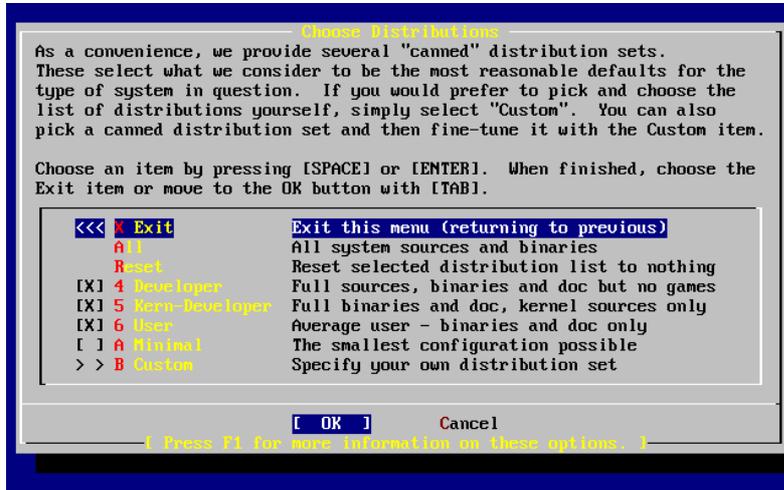
For more information on the Ports Collection & the latest ports, visit:

<http://www.FreeBSD.org/ports>

[Yes] No

Αέέέίόά [Yes] ιά όά αειύέά έεά ιά αειάόόόόόό όέ όέειπ όι ports P [No] έεά ιά όέί δάνειάβόάόά. ΔέΎόόά **Enter** έεά ιά όόί ÷ βόάόά. Έά αιάίέόάβ ίαιΎ όι ίαιίΎ Choose Distributions (άέέειπ όόί Αειάόόόόό).

Ό ÷ Πιά 2-26. Αέεάάβόόόό Distributions Set



Αί άβόόά έεάίόέίΎίέ άδύ όέό άέέειπ όόί όάό, άέέέίόά **Exit** ιά όά αειύέά, άέεάάέβόόά υέέ άβίάέ ούέόίΎίέ έ έέειπ [OK] έεά έέΎόόά **Enter** έεά ιά όόί ÷ βόάόά.

2.8 ΑέέέΎίόόό όι ΎΎί Αειάόόόόό

Αί αειάέέόόόό άδύ CDROM P DVD, ÷ ηέόέίόέβόόά όά αειύέά έεά ιά ούόβόάόά όέί άέέειπ **Install from a FreeBSD CD/DVD**. Αειάέέβόόά υέέ άβίάέ ούέόίΎίέ έ έέέειπ [OK] έεά έέΎόόά **Enter** έεά ιά δνι ÷ υνβόάόά ιά όέί αειάόόόό.

Έέά Ύέέάό ιάειυίόόό αειάόόόόόό, έΎίόά όέί έάόΎέέέ έέέειπ έέά έέειόέβόόά όέό ιάέάβάό.

ΔέΎόόά όι **F1** έεά ιά άββόά όέί άίόύιάόύίέ έίΠέάέ έεά όά ιΎόά αειάόόόόό. ΔέΎόόά **Enter** έεά ιά άέέόόΎέόά όόι ίαιίΎ έέέειπ ίΎίόό αειάόόόόό.

You can also choose "No" at the next prompt and go back into the installation menus to retry whichever operations have failed.

[OK]

Ὀί ìΠρìά áðü ñìάίβáðáέ áðáέäP äáí Ýáέíá έáíέÙ äáέáὸÙόόάόç. ΔέÝáííόáð **Enter** έá áðέόðñÝφάðά όðì Èðñβùð Ìáñý ἈάέάὸÙόόάόçð (Main Installation Menu) áέá íá äááβðá áðü όçì äáέáὸÙόόάόç.

2.10 ÌáðÙ όçì ἈάέáὸÙόόάόç

ÌáðÙ áðü íέá áðέόð÷çìÝíç äáέáὸÙόόάόç, áέíεíòέäβ ç ñýέìέόç äέÙìñì ðñìáέñáðέέπí áðέέíáπí. Ìέ ñðèìβóáέó ìðñìýí íá äβñìòí áí áέóÝέέáðá íáíÙ όðì áíðβóðìέ÷ì Ìáñý (configuration options) ðñέí áðáíáέέéíPóáðá ðì íÝí FreeBSD óýόóçíá óáð P ÌáðÙ όçì äáέáὸÙόόάόç, ÷ñçóέììðìέπíόáð ðì sysinstall έάέ áðέéÝáííόáð Configure.

2.10.1 Ñýέìέόç Óðóέäðπí Ἀέéðýìð

Áí Ý÷áðá ñðèìβóáέ ðñìçáíìíÝíò ðì PPP áέá íá έÙíáðá äáέáὸÙόόάόç ìÝóù FTP, ç ðìúç áððP äáí έá ñìáíέóðäβ, áέéÙ ìðñáβáá íá όçì ñðèìβóáðá áñáüóáñá ìá ðì ðñìðì ðìð ðáñέññÙφáíá ðáñáðÙí.

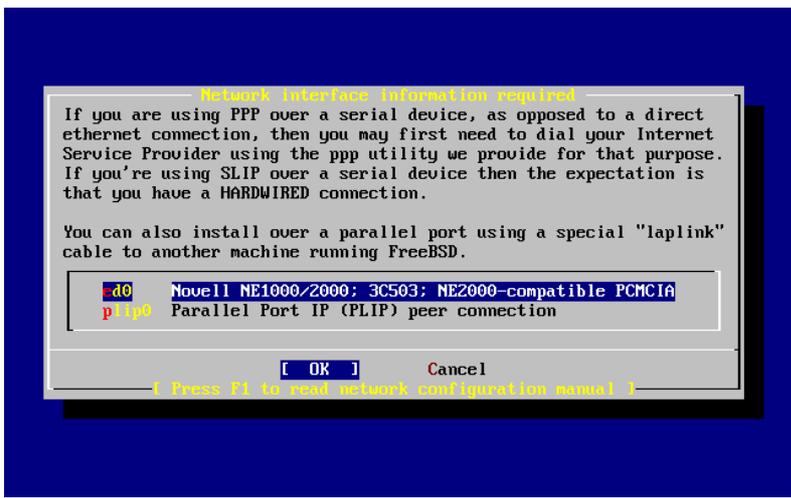
Ἀέá έáððñáñáβð ðέçñìòññáðð ó÷áðέéÙ ìá ὈíðέéÙ Ἀβέðóá (LAN) έάέ áέá ñýέìέόç ðìð FreeBSD ùð ðýέç / äññìέíäçðP (gateway/router), áíáðñÝíðá όðì έáὸÙέάέí Advanced Networking.

```
User Confirmation Requested
Would you like to configure any Ethernet or PPP network devices?
```

[Yes] No

Ἀέá íá ñðèìβóáðá íέá óðóέäðP áέéðýìð, áðέéÝíðá [Yes] έάέ ðéÝóðá **Enter**. ἈέáóìñáðέééÙ, áðέéÝíðá [No] áέá íá óíá÷βóáðá.

Ó÷Πíá 2-28. ἈðέéÝáííόáð ìέá ÓðóέäðP Ethernet



ἈðέéÝíðá ðì interface ðìð έá ñðèìβóáðá ìá ðá äáéÙέéá, έάέ ðéÝóðá **Enter**.

Do you want to configure inetd and the network services that it provides?

Yes [No]

Άῖ ἄδέέῖῖῖῖῖῖ [No], έῖῖῖῖῖῖῖ ὀδζῖῖῖῖῖῖῖ ὑδῖῖ δῖ **telnetd** ἄῖῖ έῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖῖ. Ἄδῖῖ ὀζῖῖῖῖῖῖῖ ὑδέ ἄῖῖῖῖῖῖῖῖῖῖῖῖῖ ῖῖῖῖῖῖῖ ἄῖῖ έῖ ἰδῖῖῖῖῖῖ ῖῖ ῖῖῖῖῖῖῖῖῖῖῖῖῖ δῖ **telnet** ἄέῖ ῖῖ ἄέσῖῖῖῖῖῖῖ ὀδῖ ῖῖ ῖῖῖῖῖῖῖ. Ἐέ ὀῖῖῖῖῖῖῖ ῖῖῖῖῖῖῖῖ έῖ ἰδῖῖῖῖῖῖ ῖῖῖῖῖῖῖ ῖῖ ῖῖῖῖῖῖῖῖῖ ὀῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖ ῖῖῖῖῖῖῖ ῖῖῖῖῖῖῖῖῖ **telnet**.

Ἐέ ὀδζῖῖῖῖῖῖῖ ἄδῖῖῖῖῖῖ ἰδῖῖῖῖῖῖ ῖῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖ ῖῖῖῖ ὀζῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖ ῖῖ ὀζῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖ ὀῖῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖ /etc/inetd.conf ῖῖ ὀῖῖῖῖῖῖῖῖῖ ὀῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖ ῖῖῖῖῖῖῖ. Ἄῖῖῖῖ ὀῖ ὀῖῖῖῖῖῖῖ 30.2.1 ἄέῖ ὀῖῖῖῖῖῖῖῖῖῖῖῖῖ ὀῖῖῖῖῖῖῖῖῖῖῖῖ.

Ἄδέέῖῖῖῖῖῖ [Yes] ἄῖ ῖῖῖῖῖῖῖ ῖῖ ῖῖῖῖῖῖῖῖῖῖῖῖ ὀδζῖῖῖῖῖῖῖ ἄδῖῖῖῖῖῖ ἄῖῖῖῖῖῖ ὀζῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖ. Ἐῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖ ἄέῖ ῖῖῖῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖ:

User Confirmation Requested

The Internet Super Server (inetd) allows a number of simple Internet services to be enabled, including finger, ftp and telnetd. Enabling these services may increase risk of security problems by increasing the exposure of your system.

With this in mind, do you wish to enable inetd?

[Yes] No

Ἄδέέῖῖῖῖῖῖ [Yes] ἄέῖ ῖῖ ὀδῖῖῖῖῖῖῖῖῖῖῖῖ.

User Confirmation Requested

inetd(8) relies on its configuration file, /etc/inetd.conf, to determine which of its Internet services will be available. The default FreeBSD inetd.conf(5) leaves all services disabled by default, so they must be specifically enabled in the configuration file before they will function, even once inetd(8) is enabled. Note that services for IPv6 must be separately enabled from IPv4 services.

Select [Yes] now to invoke an editor on /etc/inetd.conf, or [No] to use the current settings.

[Yes] No

Ἄδέέῖῖῖῖῖῖῖ [Yes] έῖ ἰδῖῖῖῖῖῖῖ ῖῖ ὀῖῖῖῖῖῖῖῖῖῖῖῖ ὀδζῖῖῖῖῖῖῖ ὀῖῖῖῖῖῖῖῖῖῖῖῖ ὀῖ # ἄῖῖ ὀζῖ ἄῖῖῖῖῖῖῖῖῖῖῖῖ.

Ó÷ Ðíá 2-30. Áðáíñãááóá öïö inetd.conf

```

^_ (escape) menu      ^y search prompt    ^k delete line     ^p prev li         ^g prev page
^o ascii code        ^x search           ^l undelete line  ^n next li         ^u next page
^u end of file       ^a begin of line    ^w delete word     ^b back 1 char
^t top of text       ^e end of line      ^r restore word    ^f forward 1 char
^c command           ^d delete char      ^j undelete char   ^z next word
=====
# $FreeBSD: src/etc/inetd.conf,v 1.73.10.2.4.1 2010/06/14 02:09:06 kensmith Exp
#
# Internet server configuration database
#
# Define *both* IPv4 and IPv6 entries for dual-stack support.
# To disable a service, comment it out by prefixing the line with '#'.
# To enable a service, remove the '#' at the beginning of the line.
#
#ftp      stream  tcp        nowait  root    /usr/libexec/ftpd      ftpd -l
#ftp      stream  tcp6      nowait  root    /usr/libexec/ftpd      ftpd -l
#ssh      stream  tcp        nowait  root    /usr/sbin/sshd         sshd -i -4
#ssh      stream  tcp6      nowait  root    /usr/sbin/sshd         sshd -i -6
#telnet   stream  tcp        nowait  root    /usr/libexec/telnetd   telnetd
#telnet   stream  tcp6      nowait  root    /usr/libexec/telnetd   telnetd
#shell    stream  tcp        nowait  root    /usr/libexec/rshd      rshd
#shell    stream  tcp6      nowait  root    /usr/libexec/rshd      rshd
#login    stream  tcp        nowait  root    /usr/libexec/rlogind   rlogind
#login    stream  tcp6      nowait  root    /usr/libexec/rlogind   rlogind
file "/etc/inetd.conf", 118 lines

```

ÏäöÛ öçí ðñüöðêç öüí äðéðöçðí ððçñáóêðí, éáé ïä öçí ðßáóç öïö **Esc** éá áìóáíéóðáß Ýíá ïáñý öí ðíöíí óáð äðéðñÝðáé íá äãáßðá äðü öí ðñüãñáíá, áðíèçéáýííóáð éáé öéð áëëáãÝð óáð.

2.10.4 Áíáñãíðíßçóç Áéóüãíö ïÝóó SSH

```

User Confirmation Requested
Would you like to enable SSH login?
Yes      [ No ]

```

Áí äðéëÝíáðá [Yes] éá áíáñãíðíéçèáß ï sshd(8), ï ááßñííáð öïö **OpenSSH**. Ïä öíí ðñüðí áóðü éá äðéðñÝðáðá áóóäêß áðñáéñóóíÝíç ðñüóááóç óóí ïç÷:Ûíçíá óáð. Áéá ðáñéóóóðáñáð ðèçñíöíñßáð ó÷:áðéëÛ ïä öí **OpenSSH** ááßðá öí ÕíÐíá 15.11.

2.10.5 Áíðíðí FTP

```

User Confirmation Requested
Do you want to have anonymous FTP access to this machine?

Yes      [ No ]

```

2.10.5.1 ðñíçóç Áíðíðíö FTP

ÁðéëÝíáíóáð öí ðñüððéãáñÝí [No] éáé ðéÝáííóáð **Enter** éá äðéðñÝðáðáé ïüñð óðíðð ÷ ñßðóáð ðíö Ý÷:íðí éíáñéáóíýð ïä èüáééíýð íá Ý÷:íðí FTP ðñüóááóç óóí ïç÷:Ûíçíá.

2.10.5.2 ÁðéðñÝðííóáð öí Áíðíðíö FTP

Ïðíéíóáßðíðá ïðñáß íá Ý÷:áé ðñüóááóç óóí ïç÷:Ûíçíá óáð, áí äðéëÝíáðá íá äðéðñÝðáðá öéð áíðíðíðá óóíáÝóáéð FTP. Éá ðñÝðáé íá èÛáðáðá óðñðéí óáð öéð äðéðñéíÝð áóóáéáßáð ðíö éá äðéðñÝñáé íéá ðÝðíéá ñýèíéóç. Áéá ðáñéóóóðáñáð

ðεçññíõññáò ó÷: άόέέΰ íá όçí άόóΰεάέά, äáβόά οί Έαοΰεάει 15.

Άέά íá άόέóñΎóάόά οί άίβίόñ FTP, ÷ñçóέññðíεβόάά όά äáεΰεάά äέά íá άόέέΎíάόά [Yes] έάέ íá ðέΎόάά **Enter**. Έά ÷ñáέάόάβ íá äéááááέβόάά íáíΰ όçí άόέέíñβ óάð:

User Confirmation Requested

Anonymous FTP permits un-authenticated users to connect to the system FTP server, if FTP service is enabled. Anonymous users are restricted to a specific subset of the file system, and the default configuration provides a drop-box incoming directory to which uploads are permitted. You must separately enable both inetd(8), and enable ftpd(8) in inetd.conf(5) for FTP services to be available. If you did not do so earlier, you will have the opportunity to enable inetd(8) again later.

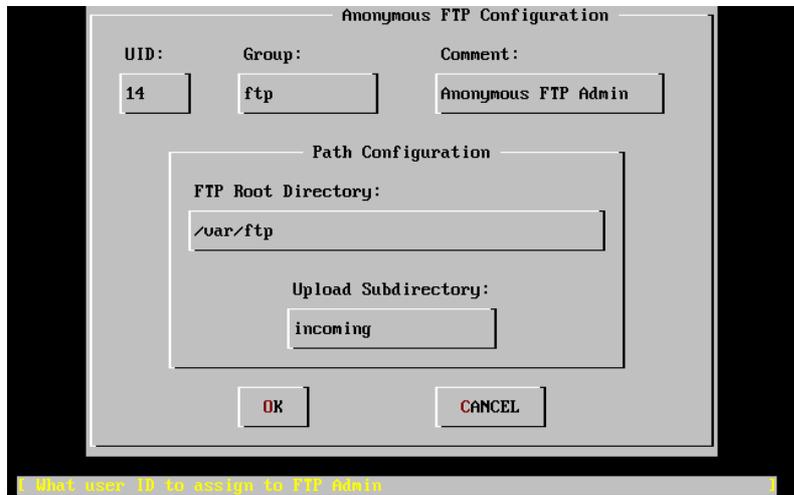
If you want the server to be read-only you should leave the upload directory option empty and add the -r command-line option to ftpd(8) in inetd.conf(5)

Do you wish to continue configuring anonymous FTP?

[Yes] No

Όí ñβίόñ άόóü óά άέáñðíεάβ äðβόçò üóέ ç όðçñáόβά FTP έά ðñΎðáέ äðβόçò íá áíññáñðíεçέáβ óóí /etc/inetd.conf óά ðññβððóóç ðíð èΎέάόά íá áíññáñðíεçέíγí íé άίβίόñά όóíáΎόάέð FTP (ääβόά οί Όíβίá 2.10.3). ΆόέέΎíάόά [Yes] έάέ ðέΎόάά **Enter** äέά íá όóíá ÷βόάόά. Έά äáβόά όçí áέüéíðέç íèüíç:

Ό÷βίá 2-31. ΔññáðέέáñíΎíάò Ññèìβόάέð Άίβίόññ FTP



×ñçóέññðíεβόάά οί **Tab** äέά íá άόέέΎíάόά έάέ íá όóíðεçñβόάά όά áðñáβόçόά ðááβá ðεçññíõññέβí:

UID

Ί áíááññέóέóέέüð áñέέüð (user ID) ðíð èΎέάόά íá áðñáβόάά όóñí άίβίόññ FTP ÷ñβόç. ¼έά όá áñ÷áβá ðíð έá áíáááβίñóí όóñí äέáέñέóóβ FTP έá άίβέíñí όá άόóü οί ID.

Group

Óä ðīēá ñÛäá ÷ ñçóðbí (group) èÝēäôä íá áíÞēáē í áíÞīōñō FTP ÷ ñÞóðçð.

Comment

ĒāÞīāñ ðīō ðāñēÝ ÷ áē ðāñēāñāōÞ ôïö ÷ ñÞóðçç óðī āñ ÷ āÞī /etc/passwd.

FTP Root Directory

Ç ôīðīēāóÞá ðīō ðāñēÝ ÷ áē óä āñ ÷ āÞá ðīō āÞīáē áēáēÝóēíá óðī áíÞīōñī FTP.

Upload Subdirectory

Ç ôīðīēāóÞá ðīō ēá áíāāáÞīōí óä āñ ÷ āÞá áðü áíÞīōñīōð FTP ÷ ñÞóðäð.

Ī ñēáēēüð (root) ēáóÛēīāñō ôïö FTP, áðü ðñīāðēēīāÞ, äçīēīōñāāÞóáē óðī /var. Áí āāí ððÛñ ÷ áē áēāÞ āñēāôñð ÷ Þñīð áēá ççí áíāīāñīūāíç ÷ ñÞóç ôïö FTP, īðīñāÞóā íá ÷ ñçóēīñīēÞóāðä ôīī ēáóÛēīāñ /usr áēēÛēīíóäð ôīī ñēáēēü ēáóÛēīāñ (FTP Root Directory) óā /usr/ftp.

¼óāí āÞóðä ēēāñīðīēçíÝñō ìā ðēð ðēíÝð, ðēÝóðä **Enter** áēá íá óðīā ÷ Þóāðä.

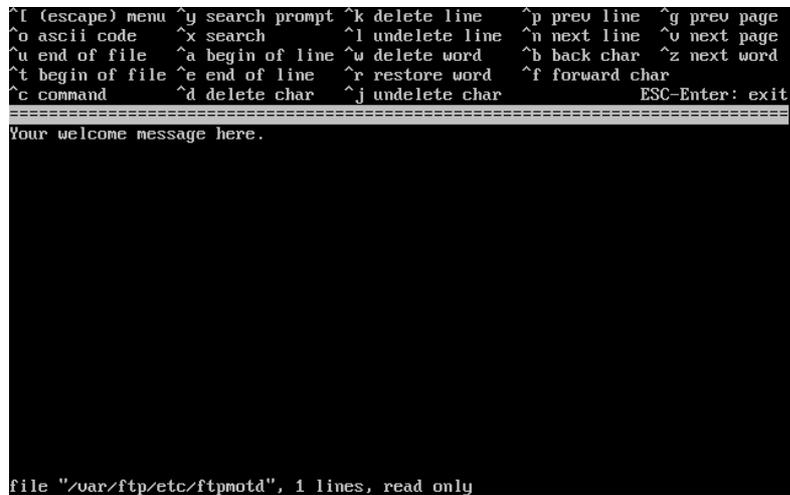
```

User Confirmation Requested
Create a welcome message file for anonymous FTP users?

[ Yes ]    No
    
```

Áí āðēēÝíāðä [Yes] ēáē ðēÝóðäð **Enter**, ēá ìāēēíÞóáē áðôñīāóä Ýíáð āðāñāñāáóðÞð ēāēíÝñō Þóðä íá ìðñÝóðä íá āðāñāñāáóðāÞóðä ôī ìÞīðīā.

Ó ÷ Þīā 2-32. ĀðāñāñāáóÞá ôïö ìçíýíāôñō ĒāēīōññÞóíāôñō (Welcome Message) ôïö FTP



ðñūēāēóáē áēá ôīī āðāñāñāáóðÞ ēāēíÝñō ee. ×ñçóēīñīēÞóðä ðēð ìāçāÞāð áēá íá áēēÛíāðä ôī ìÞīðīā Þ áí èÝēäôä áēēÛíðä ôī ìÞīðīā āñāüðñā, ÷ ñçóēīñīēÞīóáð Ýíá āðāñāñāáóðÞ ēāēíÝñō ôçð āðēēīāÞð óáð. ĀāÞóā ôī ùññā ôïö āñ ÷ āÞīō ēáē ôç èÝóç ôïö óççí óāēāððáÞá āñāñÞ ôçð ìēñīçð ôïö āðāñāñāáóðÞ ēāēíÝñō.

ðēÝæīíóäð **Esc** ēá āñōáíēóðāÞ Ýíá áíāāōñīāñī ìāñý ìā ðñīāðēēāñÝíç ôççí āðēēīāÞ a) leave editor. ðēÝóðä **Enter** áēá Ýñīāñ ēáē óðīÝ ÷ áēá. ðēÝóðä ìāíÛ **Enter** áēá íá áðīēçēāýóáðä ôð ÷ ùí áēēāāÝð ðīō Ý ÷ áðä ēÛíāē.

2.10.6 Ñÿèíëóç Óóóðßíáóïò Äñ ÷ äßùí Äééôÿíó (Network File System)

Ôí Óÿóóçíá Äñ ÷ äßùí Äééôÿíó (NFS) äðéõñÝðáé õí äéáííéíáóíù äñ ÷ äßùí óá Ýíá äßéôõí. Íá ìç ÷ Ûíçíá ìðíñáß íá ñèíëéóáß ùð äíððçñáðçòðð, ðáëÛóçð Ò êáé óá äÿí. ÁíáõñÝíðá óõí Ôíßíá 30.3 êéá ðãñéóóóóððãñäð ðççñíõíñáð.

2.10.6.1 Äéáéííéóóðò NFS

```
User Confirmation Requested
Do you want to configure this machine as an NFS server?

Yes      [ No ]
```

Áí äáí ððÛñ ÷ áé áíÛáçç áéá äíððçñáðçòðð Óóóðßíáóïò Äñ ÷ äßùí Äééôÿíó, äðééÝíðá [No] êáé ðéÝóáá **Enter**.

Áí äðééÝíðá [Yes] éá äíðáíéóóáß Ýíá áíááðñíáñ ìßíóíá ðíò óáð ðççñíõíñáß ùðé ðñÝðáé íá äçíéíõñáçéáß õí äñ ÷ äßùí exports.

```
Message
Operating as an NFS server means that you must first configure an
/etc/exports file to indicate which hosts are allowed certain kinds of
access to your local filesystems.
Press [Enter] now to invoke an editor on /etc/exports
[ OK ]
```

ÐéÝóáá **Enter** áéá íá óóíá ÷ Òóáðá. Èá áíßíáé Ýíáð äðáíãñááóóððð êáéÝííó áéá íá ìðíñÝóáðá íá äçíéíõñáðóáðá êáé íá äðáíãñááóóðððá õí äñ ÷ äßùí exports.

Ó ÷ ðíá 2-33. Äðáíãñááóóá Äñ ÷ äßùí exports

```
^i (escape) menu ^y search prompt ^k delete line ^p prev li ^g prev page
^o ascii code ^x search ^l undelete line ^n next li ^u next page
^u end of file ^a begin of line ^w delete word ^b back 1 char
^t begin of file ^e end of line ^r restore word ^f forward 1 char
^c command ^d delete char ^j undelete char ^z next word
L: 1 C: 1 =====
#The following examples export /usr to 3 machines named after ducks,
#/usr/src and /usr/ports read-only to machines named after trouble makers
#/home and all directories under it to machines named after dead rock stars
#and, /a to a network of privileged machines allowed to write on it as root.
#/usr huey louie dewie
#/usr/src /usr/obj -ro calvin hobbes
#/home -alldirs janice jimmy frank
#/a -maproot=0 -network 10.0.1.0 -mask 255.255.248.0
#
# You should replace these lines with your actual exported filesystems.
# Note that BSD's export syntax is 'host-centric' vs. Sun's 'FS-centric' one.
file "/etc/exports", 12 lines
```

×ñçóéíðíéßóáá ðéð ðáçáßáð áéá íá ðñíóèÝóáðá óá óóóðßíáóá äñ ÷ äßùí ðíò èÝéáðá íá äéáííéíÛóáðá, ðßñá Ò áñáñóðãñá ÷ ñçóéíðíéßíóáð Ýíá äðáíãñááóóððð êáéÝííó ðçð äðééíãðð óáð. Óçíáéßóáá õí ùíñá êáé ðçí ðíðíéáóóá ðíò äñ ÷ äßùí ùðò ðáßñíóáé óõí èÛò ìÝñíð ðçð ðèùíçð.

ÐéÝáííóáð **Esc** éá äíðáíéóóáß Ýíá áíááðñíáñ ìáñíÿ ìá ðñíáðééááíÝíç ðçí äðééíãð a) leave editor. ÐéÝóáá **Enter** áéá Ýíñáí êáé óõíÝ ÷ áéá.

2.10.6.2 Ἐπιλογή NFS

Ἡ ἐπιλογή NFS ἀδελφὸν ὅτι ἔστιν ἡ δυνατότης τοῦ συστήματος νὰ ἀποδίδῃ NFS.

```
User Confirmation Requested
Do you want to configure this machine as an NFS client?

Yes  [ No ]
```

Ἡ ὁποῖα ἀπάντησις, ἀδελφὸν ἔστιν ἡ ἀπάντησις [Yes] ἢ [No] ἐπὶ δὲ ἔστω **Enter**.

2.10.7 Ἐπιλογή Ἐπιπέδου (System Console Settings)

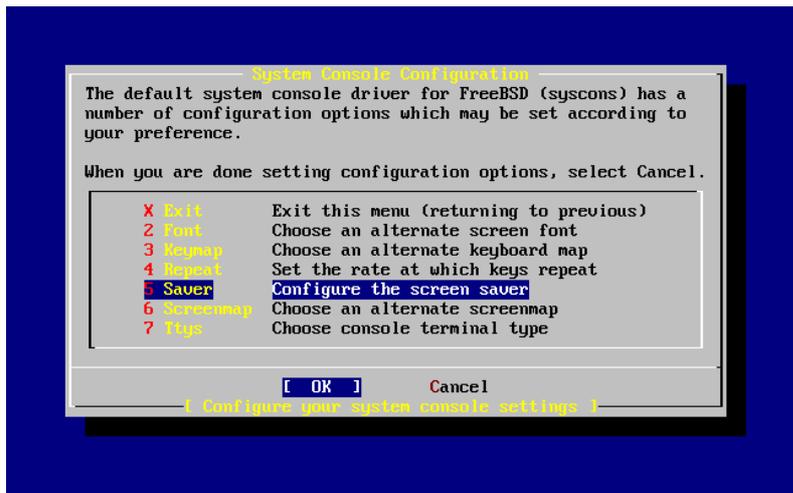
Ὁ ἄνθρωπος ἔστιν ἀναγκασθῆναι νὰ ἀδελφὸν ἡ ἀνάδοχο ἡ δυνατότης τοῦ συστήματος νὰ ἀποδίδῃ ἡ ἐπιπέδου τοῦ οὐρανίου.

```
User Confirmation Requested
Would you like to customize your system console settings?

[ Yes ] No
```

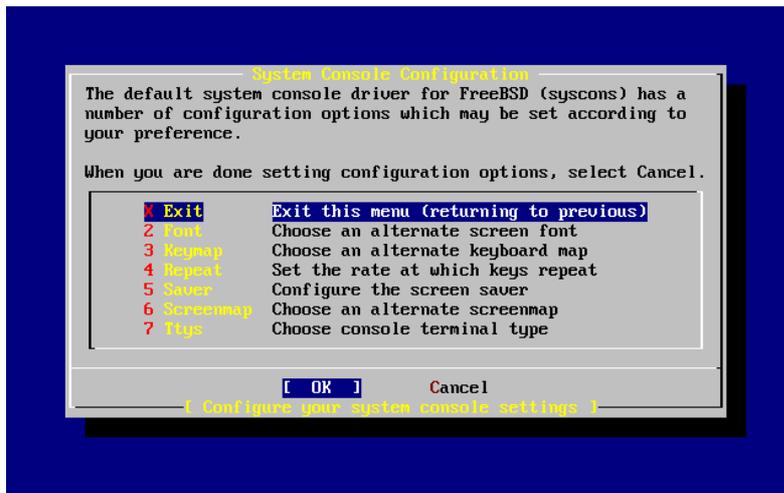
Ἡ ἀπάντησις ἔστιν ἡ ἀπάντησις ἡ ἐπιπέδου τοῦ οὐρανίου, ἀδελφὸν ἔστιν ἡ ἀπάντησις [Yes] ἐπὶ δὲ ἔστω **Enter**.

Ὁ ἄνθρωπος 2-34. Ἐπιπέδου Ἐπιπέδου Ὁ οὐρανίου



Ἡ ἀπάντησις ἔστιν ἡ ἀπάντησις ἡ ἀνάδοχο ἡ δυνατότης τοῦ συστήματος νὰ ἀποδίδῃ ἡ ἐπιπέδου τοῦ οὐρανίου (screen saver). × ἡ ἀπάντησις ἔστιν ἡ ἀπάντησις ἡ ἀνάδοχο ἡ δυνατότης τοῦ συστήματος νὰ ἀποδίδῃ ἡ ἐπιπέδου τοῦ οὐρανίου Saver ἐπὶ δὲ ἔστω **Enter**.

Ὁ Διάγραμμα 2-37. ἡμεῖς ἀπὸ τὸ Νῆμα τῆς Ἐπιλογῆς τῆς ὀθόνης



Ἀπὸ τὴν ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, ἐπιλέξτε τὸ **Exit** ἐπιλογή καὶ πατήστε τὸ **Enter** κῆλο. Ὁ δῶν τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης θὰ εἶναι ὁμοίωτος τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης.

2.10.8 Ἐπιλογὴ Ἐπιλογῆς Ἐπιλογῆς (Time Zone)

Ἡ ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, ἐπὶ τὴν ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, θὰ εἶναι ὁμοίωτος τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης. Ὁ δῶν τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης, ἐπὶ τὴν ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, θὰ εἶναι ὁμοίωτος τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης.

Ὁ δῶν τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης, ἐπὶ τὴν ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, θὰ εἶναι ὁμοίωτος τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης. Ἡ ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, ἐπὶ τὴν ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, θὰ εἶναι ὁμοίωτος τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης.

```
User Confirmation Requested
Would you like to set this machine's time zone now?
```

[Yes] No

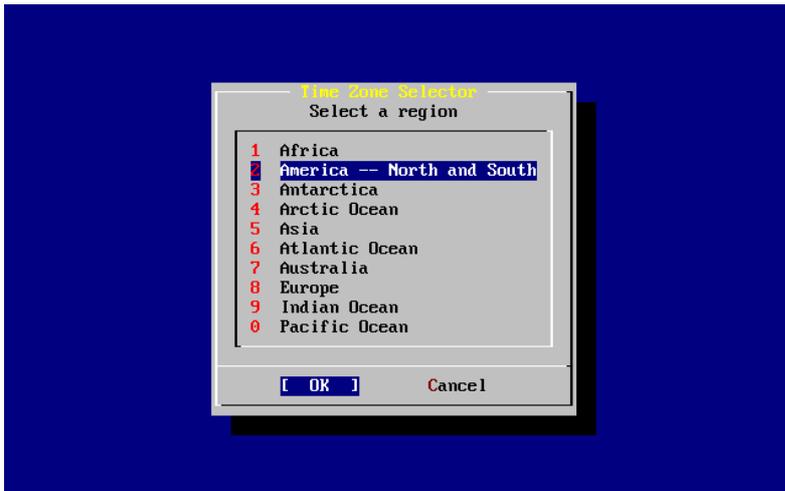
Ἀπὸ τὴν ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, ἐπιλέξτε τὸ **[Yes]** ἐπιλογή καὶ πατήστε τὸ **Enter** κῆλο. Ὁ δῶν τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης, ἐπὶ τὴν ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, θὰ εἶναι ὁμοίωτος τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης.

```
User Confirmation Requested
Is this machine's CMOS clock set to UTC? If it is set to local time
or you don't know, please choose NO here!
```

Yes [No]

Ἀπὸ τὴν ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, ἐπιλέξτε τὸ **[No]** ἐπιλογή καὶ πατήστε τὸ **Enter** κῆλο. Ὁ δῶν τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης, ἐπὶ τὴν ὀθόνη τῆς Ἐπιλογῆς τῆς ὀθόνης, θὰ εἶναι ὁμοίωτος τῆς ὀθόνης τῆς Ἐπιλογῆς τῆς ὀθόνης.

Όχι 2-38. Άλλα όσα από Δημιουργία του



Άλλα όσα από επιμέλεια 2 (region) να όα άλλα όσα και δεύρα **Enter**.

Όχι 2-39. Άλλα όσα από επιμέλεια 2



Άλλα όσα από επιμέλεια 2 - επιμέλεια 2 - επιμέλεια 2 να άλλα όσα και δεύρα **Enter**.

    2-40.                  (Time Zone)



                                                           **Enter**.

Confirmation
 Does the abbreviation 'EDT' look reasonable?
 [Yes] No

                                                                        .                   ,        **Enter**                                                         .

2.10.9                 Linux (Linux Compatibility)

        :                                             FreeBSD           7.x.                 FreeBSD 8.x                              .

User Confirmation Requested
 Would you like to enable Linux binary compatibility?
 [Yes] No

               **Yes**]               **Enter**                                                  .                                                                                              .               ,                                           .                                  Linux.               ,                                                           Linux.                                         ,             .

2.10.10 Ρυθμίσεις Ποντικιού (Mouse Settings)

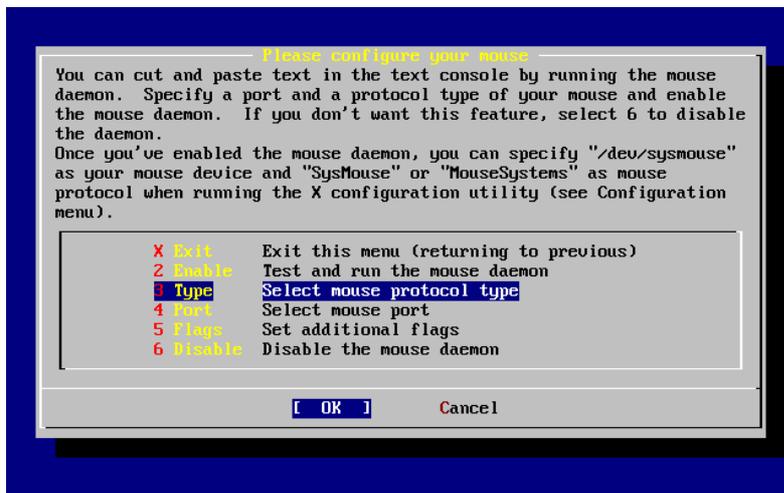
Στην περίπτωση που έχετε έναν ποντίκι που είναι συνδεδεμένος με το σύστημα μέσω ενός μη-USB ποντικιού, όπως είναι ο αναλογικός ποντίκι, θα πρέπει να επιλέξετε να ενεργοποιήσετε τον daemon του ποντικιού. Εάν δεν έχετε συνδέσει κανένα ποντίκι, απλά πατήστε το πλήκτρο Enter.

```
User Confirmation Requested
Does this system have a non-USB mouse attached to it?

[ Yes ]   No
```

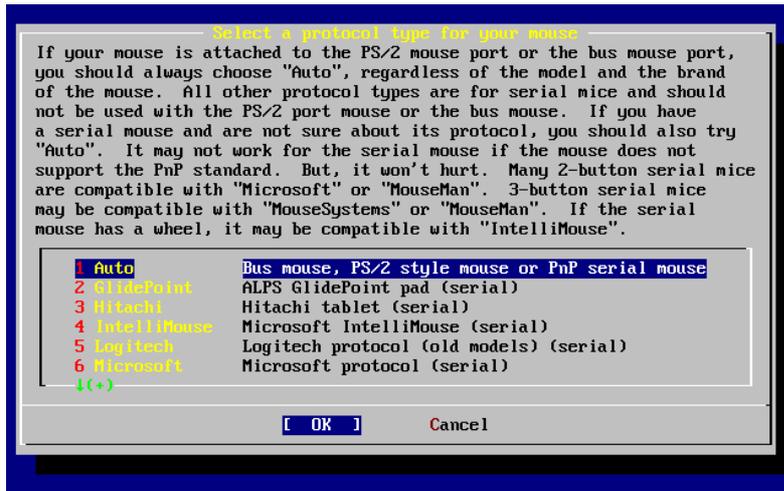
Εάν επιλέξετε [Yes], τότε ο daemon του ποντικιού θα ενεργοποιηθεί, ενώ εάν επιλέξετε [No], τότε ο daemon του ποντικιού θα απενεργοποιηθεί πατώντας το πλήκτρο **Enter**.

Όπως φαίνεται στην Εικόνα 2-41. Ρυθμίσεις Τύπου Πρωτοκόλλου Ποντικιού (Mouse Protocol Type)



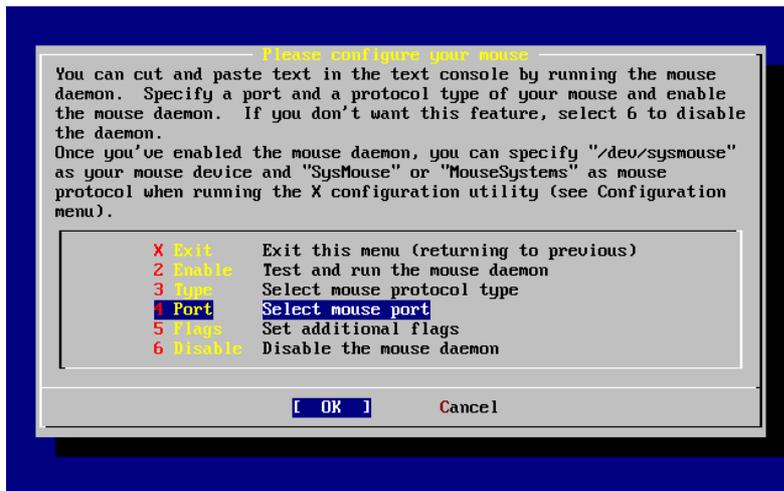
Εάν επιλέξετε το **1 Type**, τότε θα εμφανιστεί το παρακάτω μήνυμα και θα πρέπει να πατήσετε το πλήκτρο **Enter**.

Ó ÷ Ðιά 2-42. ΆðêëñÐ Ðñïóïêüêëï Ðñïóêëéý (Mouse Protocol)



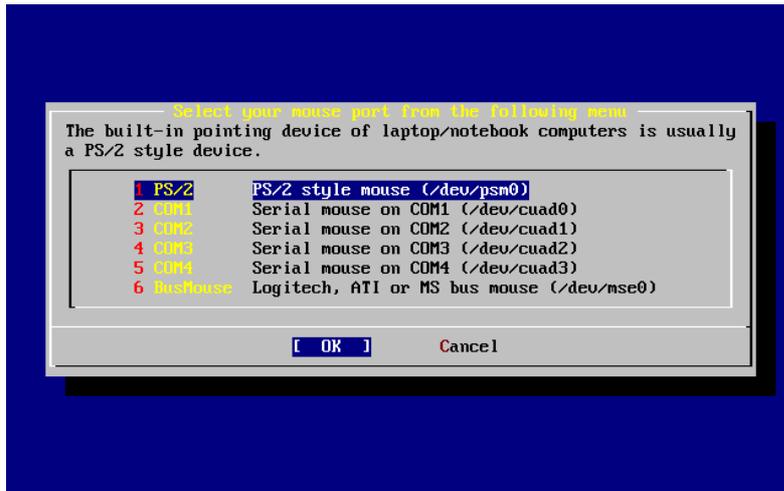
Ôï ðñïóêëé ðïö ÷ ñçóêëïðñïóêëéáóóáé óá áóóü ôï ðáñÛäáéáíá, áóñáé óýðïö PS/2, êáé Ýóóé áóñáé óóóóÐ ç ðñïãðêëéáñÝéç ñýêëéóç Auto. Áéá íá áêëÛñáóä ðñïóóïêëéêëï, ÷ ñçóêëïðñïóêëéáóóáé óá áêëÛêéá áéá íá êÛñáóä êÛðñéá Ûêëç áðêëñÐ. Áäááêëéáóóáé ðñïóêëéáóóáé óóóóéñÝéç ç áðêëñÐ [OK] êáé ðéÝóóá Ëññêéá Ýññä áðü áóóü ôï ðñïóêëé.

Ó ÷ Ðιά 2-43. Ñýêëéóç Ðñïóóáð Ðñïóêëéý (Mouse Port)



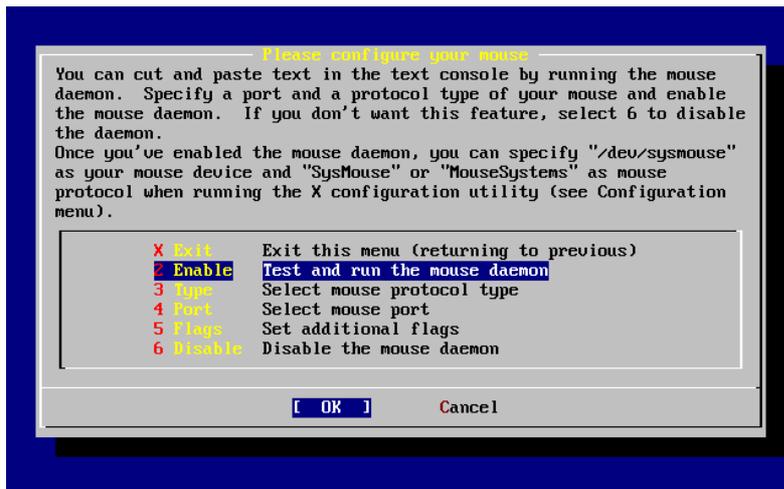
× ñçóêëïðñïóêëéáóóáé óá áêëÛêéá áéá íá áðêëÝñáóä Port êáé ðéÝóóá Ëññêéá.

Ὁρῶντα 2-44. Ἐπιλογή Πύλου Ποντικίου (Mouse Port)



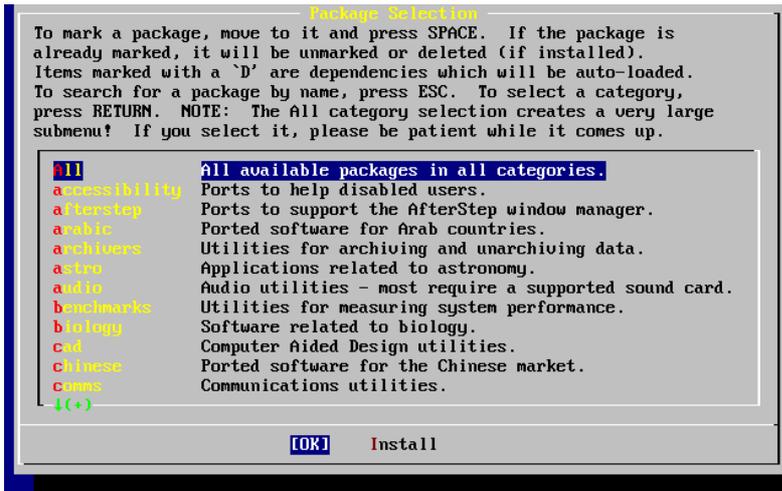
Ὁι ὁμοίᾳ ἀνοίξῃ τὸ μενού PS/2 καὶ ἔσῃ ἐπιλεγῶν τὸν πύλον PS/2. Ἄρα ἰσχυρισθῶντες τὸν ποντικίου πύλον. Ἄρα ἰσχυρισθῶντες τὸν ποντικίου πύλον.

Ὁρῶντα 2-45. Ἀσκήσεις εἰς Ἐπιπέδου Ποντικίου (Mouse Daemon)



Ὁρῶντες, ἰσχυρισθῶντες τὸν ποντικίου πύλον. Ἄρα ἰσχυρισθῶντες τὸν ποντικίου πύλον Enable, καὶ ἰσχυρισθῶντες τὸν ποντικίου πύλον. Ἄρα ἰσχυρισθῶντες τὸν ποντικίου πύλον.

Ó ÷ Ḑñā 2-47. Ἀḑέείṗ Ḑάόçāññáò Ḑáέ Ὑóìõ

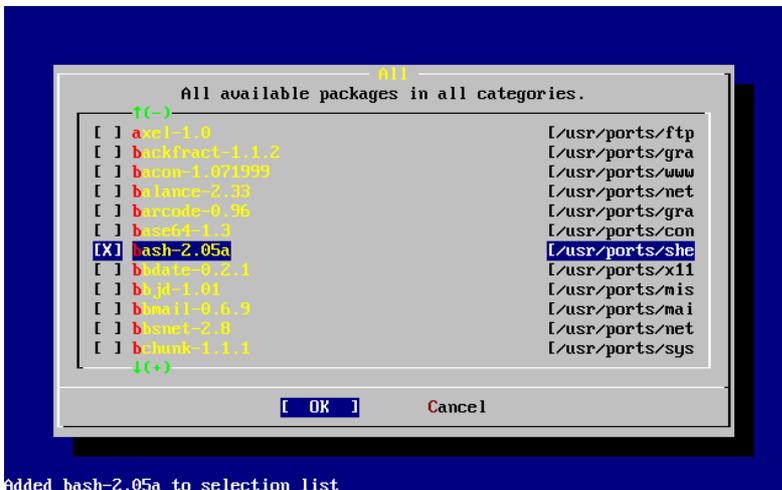


Ἰḑññáβóā ē Ὑεā āāññ Ὑίç ðóέēṗ ṗá āāέάóáóòḐóáòā ïüñ ðá ḑáέ Ὑóá ḑìõ āβίáέ áέáέ Ὑóέíá ðóì ðñ Ὑ ÷ ïñ ṗ Ὑóì ἑάέáó Ὑóóáóçð.

Ἰā ðçñ ἑḑέείṗ All ἑá āáβóā ṗεá ðá áέáέ Ὑóέíá ḑáέ Ὑóá, Ḑ ṗḑññáβóā ṗá ἑḑέέ Ὑíñóā ðóāέēñēñē Ὑίç ἑáóçāññá. Ὀùðβóóā ðçñ ἑḑέείṗ ᰄóð ṗā ðá āāέ Ὑέéá ἑáέ ḑέ Ὑóóā **Enter**.

Ἐá ñòáíέóóāβ Ὑíá ṗññ ᰄñ ṗḑññ ἑáβ ÷ ṗáέ ṗεá áέáέ Ὑóέíá ḑáέ Ὑóá ἑéá ðçñ ἑḑέείṗ ḑìõ ē Ὑíáóā:

Ó ÷ Ḑñā 2-48. Ἀḑέείṗ Ḑáέ Ὑóüī



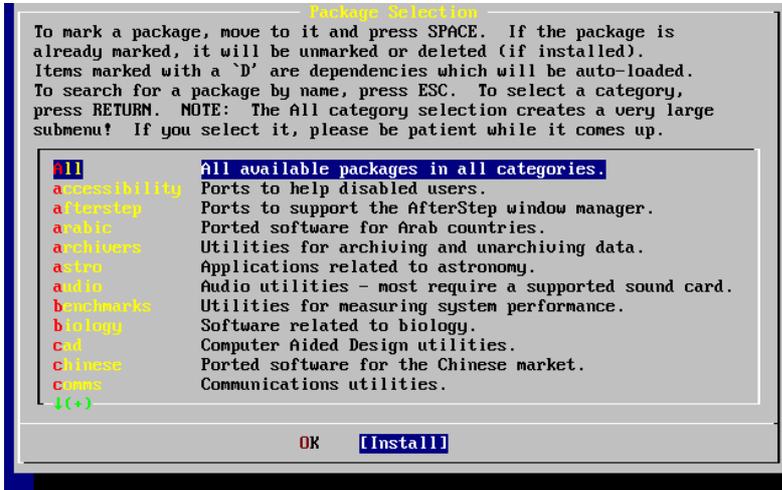
Ὀñ ē Ὑέõñð (shell) **bash** ᰄáβíáóáέ ἑḑέéāñ Ὑñ. Ἀḑέέ Ὑíñóá ṗóá ḑáέ Ὑóá ἑḑέéðñáβóā, ðùðβæñíóáð ðñ ḑáέ Ὑóì ἑáέ ḑέ Ὑæñíóáð ðñ ḑḐḐéññ **Space**. Ἐá āáβóā ṗεá óýíóñç ḑññéññáòḐ ἑéá ē Ὑεā ḑáέ Ὑóì ðóì ē Ὑóù ññέóóāññ ṗ Ὑññ ðçð ïèüçð.

Ç ḑβáóç ðìõ ḑḐḐéññ **Tab** ἑááέ Ὑóóáέ ṗáóññ ᰄñ ðáέáóóáβñ ðéééāñ Ὑññ ḑáέ Ὑóìõ, ðìõ [**OK**], ἑáέ ðìõ [**Cancel**].

¼óáñ Ὑ ÷ áòā ðáέéḐóáέ ṗá ðñ ṗññ Ὑñέóíá ðññ ḑáέ Ὑóüī ḑññ ðáέáó Ὑóóáóç, ḑέ Ὑóóā ṗεá ṗññ **Tab** ἑéá ṗá ṗáóáέéççáβóā ðññ [**OK**] ἑáέ ḑέ Ὑóóā **Enter** ἑéá ṗá ἑḑέóðñ ὙḐáóā ðóì ṗññ Ἀḑέείṗ Ḑḑ Ḑáέ Ὑóüī (Package Selection).

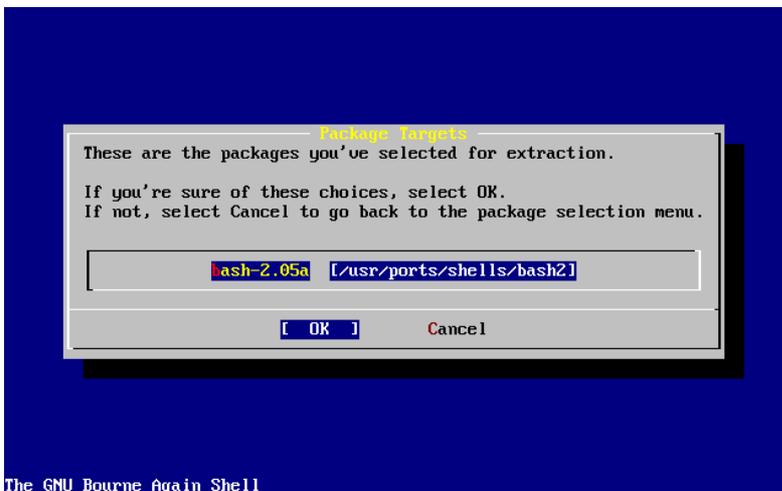
Ïí áñéóðãñí éáé äãíß äãëÛéé áíáëëÛóóáé äðßçð ìáðáíý ðíð [OK] éáé ðíð [Cancel]. Ìðíñãßðá íá ÷ ñçóëíðíéßðóáðá áððß ðç ìÝëíñí áéá íá äðééÝíáðá [OK] éáé ðéÝóðá **Enter** áéá íá äðéóðñÝðáðá óðí ìáííý Áðéëíðð ÐáéÝðúí.

Ó÷ Ðíá 2-49. ÅãëáðÛóóáóç ÐáéÝðúí



× ñçóëíðíéßðóáðá ðí **Tab** éáé ðá äãëÛééá áéá íá äðééÝíáðá [Install] éáé ðéÝóðá **Enter**. Èá ÷ ñãéáóðãß íá äðéááááéßðóáðá ùóé èÝëáðá íá äãéáóáóðßðóáðá ðá ÐáéÝðúí:

Ó÷ Ðíá 2-50. Åðéááááßùç ÅãëáðÛóóáóçð ÐáéÝðúí



ÅðééÝíáíðáð [OK] éáé ðéÝáëíðáð **Enter** éá ìáééíßðáé ç äãéáðÛóóáóç ðáéÝðúí. Èá äéÝðáðá ìçíýíáðá ðçð äãéáðÛóóáóçð ìÝ÷ ñé ðçí ìëíëßññùç ðçð. Óçíáéßðóáðá ðð÷ ùí ìçíýíáðá éÛëíðð ðíð äìðáíßæííðáé.

Ç ðáëéëß ñýëíéóç ðóíá÷ßæáðáé ìáðÛ ðçí äãéáðÛóóáóç ðúí ðáéÝðúí. Áí éáðáéßíáðá íá ìçí äãéáðáóðßðóáðá éáíÝíá ðáéÝðúí, éáé äðéòíãßðá íá äðéóðñÝðáðá ððçí ðáëéëß ñýëíéóç, äðééÝíðá Install ìýðùð ð Ûëëùð.

2.10.12 Δημιουργία Χρήστων / Ομάδων (Users/Groups)

Εάν θέλετε να δημιουργήσετε ορισμένους χρήστες ή ομάδες στον υπολογιστή σας, είναι σημαντικό να είστε root. Η root είναι ο ιδιοκτήτης των αρχείων και των φακέλων στο /etc/passwd και /etc/group. Η root είναι ο ιδιοκτήτης των αρχείων και των φακέλων στο /etc/passwd και /etc/group. Η root είναι ο ιδιοκτήτης των αρχείων και των φακέλων στο /etc/passwd και /etc/group.

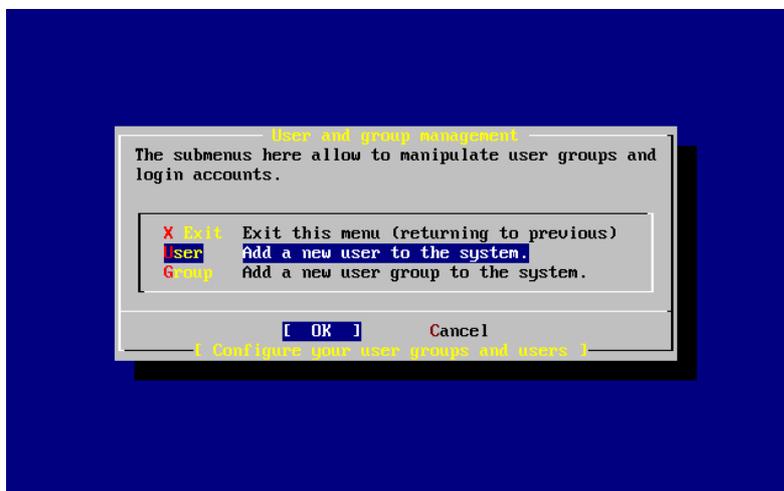
User Confirmation Requested

Would you like to add any initial user accounts to the system? Adding at least one account for yourself at this stage is suggested since working as the "root" user is dangerous (it is easy to do things which adversely affect the entire system).

[Yes] No

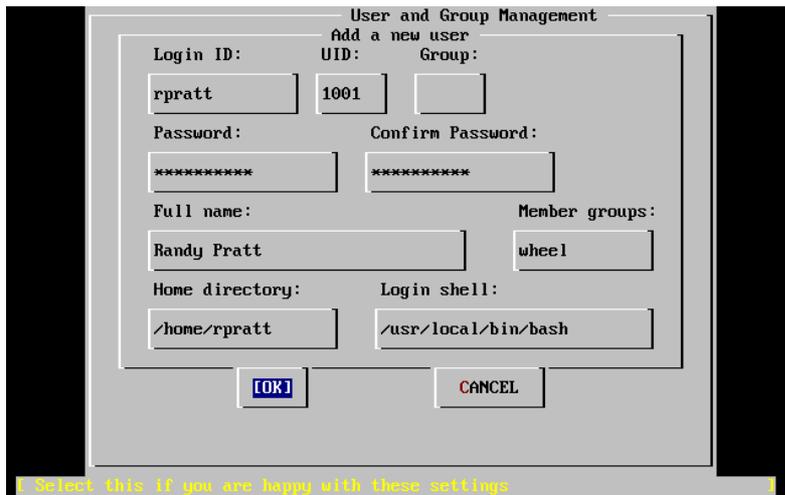
Αν θέλετε να επιλέξετε [Yes] πατήστε **Enter** μετά από τον αριθμό 1 που εμφανίζεται.

Ορίστε 2-51. Δημιουργία Χρήστων



Αν θέλετε να επιλέξετε User πατήστε **Enter**.

Ó÷ Ðíá 2-52. ÐñíóèÐèç Ðèçñíóñíëþí × ñÐóóç



Êáèþò êá áéóÛããðá óá óðíε÷ áβá ðéÝæííóáð ôí **Tab** êá áíóáíβæííóáé íé ðãñáéÛò ðãñéãñáóÝò óðí εÛò ìÝñíð óçð ðèüíçð áéá íá óáð áιçèÐóíóí óðçí áéóáãñáÐ ðüí áðáέóíγíãñíí ðèçñíóñíëþí:

Login ID

To ùñíá ÷ ñÐóóç (login name) áéá ôí íÝí ÷ ñÐóóç (ððí÷ ñãüðééü).

UID

Ï áíááíññéóóééüð áñéèíüð (numerical ID) áéá áóðü ôí ÷ ñÐóóç (áóÐóðá ôíí êáñü áéá áóðüíáóç áðééíãÐ).

Group

Ôí ùñíá óçð ñÛããð (group name) áéá áóðü ôí ÷ ñÐóóç (áóÐóðá ôíí êáñü áéá áóðüíáóç áðééíãÐ).

Password

Ï êüáééüð (password) áéá áóðü ôí ÷ ñÐóóç (áðóðá ðñíóí÷ Ð óóí ðããβí áóðü!).

Full name

Ôí ðèÐñãð ùñíá ôíð ÷ ñÐóóç (ó÷üééí).

Member groups

Ïé óðüéíéðãð ñÛããð (groups) óðéð íðíβãð áíÐéáé áóðüð í ÷ ñÐóóçð (Ý÷áé áçè. óá áééáéþíáóá ôíðð).

Home directory

Ï ðñíóóðééüð êáóÛéñíò áñ÷áβüí (home directory) ôíð ÷ ñÐóóç (áóÐóðá êáñü áéá óçí ðñíãðééãñííÝíç áðééíãÐ).

Login shell

Ôí ðñíãðééãñííÝí éÝéóóíð (login shell) ôíð ÷ ñÐóóç (áóÐóðá êáñü áéá óçí ðñíãðééíãÐ, ð.÷. /bin/sh).

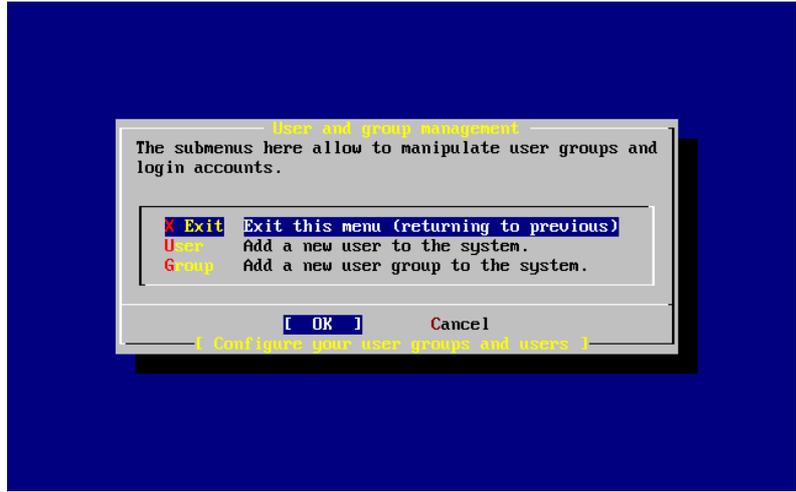
Ôí éÝéóóíð áéóüíáò áééÛ÷ðççá áðü /bin/sh óá /usr/local/bin/bash áéá íá ÷ ñçóéíðíéçèãβ ôí éÝéóóíð **bash** ôí íðíβí áãéáóáóðóáíá ðñíçáíðíÝñð ìÝóü ðáéÝóíð. Ïçí ðñíððáèÐóáðá íá ÷ ñçóéíðíéçèÐóáðá éÛðíéí éÝéóóíð ðíð áãí

ὁδὸν ÷ ἄε, ἄεῶνιῶνιῶνι ἄνι ἐὰ ἰδιῶνιῶνι ἰὰ ἐῶνιῶνι login. Ὀῖ δὲ ῤῥῖ οῖῖῖῖῖῖῖ ἔῤῥῖῖῖῖῖ ὁῖῖ ἔῶνιῖ ὁῖῖ BSD ἄβιῖῖ ὁῖ C shell, ὁῖ ἰδιῖῖῖ ἰδιῶνιῶνι ἰὰ ἄνιῶνιῶνι ἔδ /bin/tcsh.

Ἴ ÷ ἄβῖῖῖ δὲ διῖῖῖ ῤῥῖῖ ἄδβῖῖῖ ὁῖῖ ἰῖῖῖ wheel ἄεῖ ἰὰ ῤῥῖ ὁῖ ἄῖῖῖῖῖῖῖ ἰὰ ἄβιῖῖ ὁῖῖ ÷ ἄβῖῖῖῖῖ (superuser) ἰὰ ἄεῖῖῖῖῖῖῖ root.

¼ῖῖῖ ἄβῖῖῖ ἔεῖῖῖῖῖῖ ῤῥῖῖ ἄδῖῖ ὁῖῖ ἄδῖῖῖῖ ῤῥῖῖ ὁῖῖ, δὲ ῤῥῖῖ [OK] ἔεῖ ἔε ἄῖῖῖῖῖῖῖ ἰῖῖῖ ὁῖ ἰῖῖῖῖ User and Group Management:

Ὀ ÷ Πῖῖ 2-53. ἰῖῖῖ ἄδῖῖ ὁῖῖ Ἀῖῖ ÷ ἄβῖῖῖῖ × ἄβῖῖῖῖ ἔεῖ ἰῖῖῖ



ἰδιῶνιῶνι ἄδβῖῖῖ ὁῖ ἄῖῖῖῖῖ ὁῖῖ ἰῖῖῖ ἰὰ διῖῖῖῖῖῖ ἰῖῖῖ ἰῖῖῖ, ἰὰ ὁδὸν ÷ ἄε ὁῖῖῖῖῖῖῖ ῤῥῖῖ ἰῖῖῖ. Ἀῖῖῖῖῖῖῖῖ, ἰδιῶνιῶνι ἰὰ ἄδῖῖῖῖῖῖ ὁῖῖ ἄβῖῖῖῖῖῖ ἄδῖῖῖ ἰῖῖῖ ὁῖῖ ἄῖῖῖῖῖῖῖ, ἰῖῖῖ ὁῖῖ sysinstall.

¼ῖῖῖ ὁῖῖῖῖῖῖῖ ἰὰ ὁῖῖ διῖῖῖῖῖῖ ÷ ἄβῖῖῖῖῖ, ἄδῖῖῖῖῖῖῖ Exit ἰὰ ὁῖ ἄῖῖῖῖῖῖ ἔεῖ δὲ ῤῥῖῖ **Enter** ἄεῖ ἰὰ ὁῖῖ ÷ βῖῖῖῖ ἰὰ ὁῖῖ ἄῖῖῖῖῖῖῖῖ.

2.10.13 ἰῖῖῖῖῖ ὁῖῖ ἔῶνιῖῖῖ ἄεῖ ὁῖ × ἄβῖῖῖῖ root

```
Message  
Now you must set the system manager's password.  
This is the password you'll use to log in as "root".  
  
[ OK ]  
  
[ Press enter to continue ]
```

Δὲ ῤῥῖῖ **Enter** ἄεῖ ἰὰ ἰῖῖῖῖῖ ὁῖῖ ἔῶνιῖῖῖ ἄεῖ ὁῖ ÷ ἄβῖῖῖῖ root.

Ἐὰ δὲ ῤῥῖῖ ἰὰ δὲ ῖῖῖῖῖῖῖῖ ἄῖῖ ὁῖῖ ῤῥῖῖ ὁῖῖ ἔῶνιῖῖῖ ὁῖῖῖῖ. Ἀῖῖ ÷ ἄῖῖῖῖῖῖ ἰὰ ὁῖῖῖῖ ἰῖῖῖ δὲ ῖῖῖῖ ἰὰ ῤῥῖ ÷ ἄῖῖῖῖ ὁῖῖῖῖ ἰὰ ἄῖῖῖῖ ὁῖῖ ἔῶνιῖῖῖ ἰὰ ὁῖῖ ἰῖῖῖ ÷ ῤῥῖῖῖῖ. Δῖῖῖῖῖῖῖῖ ἰῖῖῖ ἰῖῖῖ ὁῖῖ ἔῶνιῖῖῖ ἄῖῖ ἄῖῖῖῖῖῖῖῖ ἔεῖῖ ὁῖῖ δὲ ῖῖῖῖῖῖῖῖῖῖ, ἰῖῖῖ ἔεῖ ἄῖῖῖῖῖῖῖῖ ἄῖῖῖῖῖῖ ὁῖῖ ἔῤῥῖ ὁῖῖ.

```
Changing local password for root.  
New password :
```

Retype new password :

Ç äãéáôÛóóáóç éá óðĩã ÷ éóóðãß ìãðÛ óçĩ äðéóð ÷ çĩÝĩç áéóáãũãP ðĩö êüãééĩç.

2.10.14 ãñĩãò áðũ óçĩ ÅãéáôÛóóáóç

Áĩ ÷ ñãéÛãáóáé ãã ñðëĩßóãðã ðñũóéãðãð áééðóáéÝð ððçñãóßãð, P êÛðĩéã Üëëç ñýèĩéóç, ìðñãßðã ãã ðĩ êÛĩãðã ðñãã P ìãðÛ óçĩ äãéáôÛóóáóç ìã óç ÷ ñPóç óçð áĩðĩëPð sysinstall.

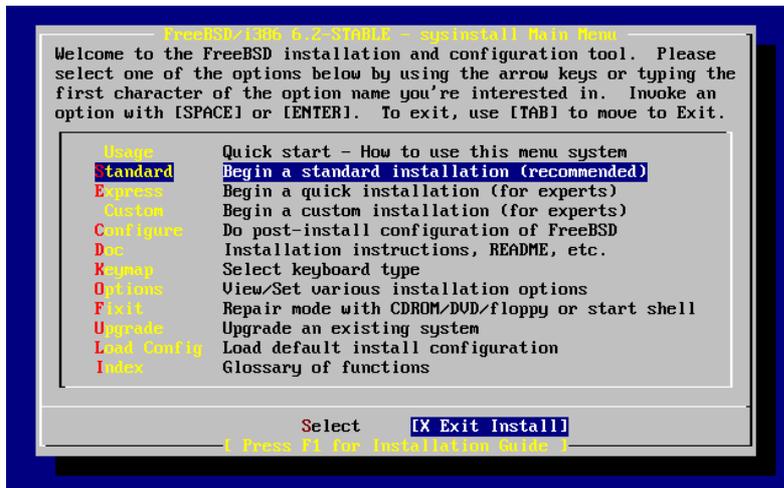
User Confirmation Requested

Visit the general configuration menu for a chance to set any last options?

Yes [No]

ÅðééÝĩòã [No] ìã óã äãéÛééã éáé ðéÝóóã **Enter** áéã ãã äéóóðñÝðãðã óðĩ Êðñßò Ìãñý ÅãéáôÛóóáóçð (Main Installation Menu).

Ó ÷ Ðĩã 2-54. ãñĩãò áðũ óçĩ ÅãéáôÛóóáóç



ÅðééÝĩòã [X Exit Install] ìã óã äãéÛééã éáé ðéÝóóã **Enter**. Êã êëçèãßðã ãã äðéãããéçðãðã óçĩ Ýñĩã ãðũ óçĩ äãéáôÛóóáóç:

User Confirmation Requested

Are you sure you wish to exit? The system will reboot.

[Yes] No

ÅðééÝĩòã [Yes]. Áĩ ãß ÷ áóã ìãééĩPóáé áðũ ðĩ CDROM, éã äãßðã ðĩ ðãñãéÛòũ ìPðĩã áéã ãã óáó ððãĩéðĩßóáé ãã áóáéñÝóóãðã ðĩ CD:

Message

Be sure to remove the media from the drive.

[OK]
[Press enter or space]

Ἡ ἑξῆς CDROM ἐστὶν ἀποδοθῆναι ἐπιβάλλεται ἡ FreeBSD 8.x καὶ τὸ ἑξῆς ἔργον ἀποδοθῆναι ἀποδοθῆναι. Ἐάντις τῆς ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι (ἑξῆς) ἐστὶν ἡ ἀποδοθῆναι. Δεῦτε [OK] καὶ ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι.

Ὁ ἑξῆς ἔργον ἐστὶν ἀποδοθῆναι, καὶ τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι.

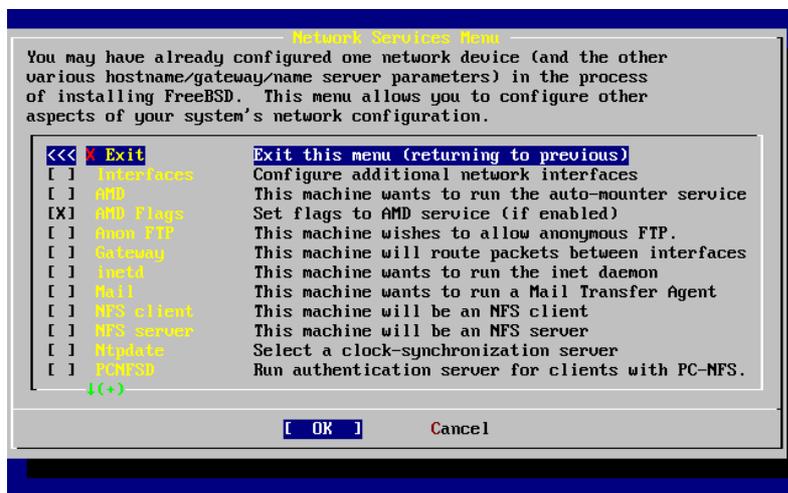
2.10.15 Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι

Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι. Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι. Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι.

Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι. Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι. Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι.

Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι.

Ὁ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι (Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι)



Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι.

Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι. Ἡ ἐπιβάλλεται τὸ ἑξῆς ἔργον ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι ἐπιβάλλεται ἡ ἀποδοθῆναι.

ÁιΥόùð ìáðÛ äñβóέάόάέ ç äðέεíäP AMD Flags. ¼4óáí ðçí äðέέΥíáðá έá äìòáíέóðáβ Υίá áíááðüìáñì ìáñíý äέá íá ìðìñΥóáðá íá áέóÛááðá òðáέáêñέíΥíáð ðáñáìΥðñιòð (flags) äέá ðçí ððçñáóβá AMD. Õì ìáñíý ðáñέΥ÷áέ Pαç Υíá óýñíεí áðu ðñιáðέεíäΥò:

```
-a /.amd_mnt -l syslog /host /etc/amd.map /net /etc/amd.map
```

Ç äðέεíäP -a èΥόάέ ðì ðñιáðέεááìΥíñ óçìáβì ðñιòÛñðçóçð (mount point) ðì ìðìβì áâP έáέìñβáέáðάέ ùð /.amd_mnt. Ç äðέεíäP -l έáέìñβáέέ ðì ðñιáðέεááìΥíñ áñ÷áβì έáóááñáóðð log. Ûóðüóì üóáí ÷ñçóέìðñιέáβðάέ ðì syslogd üέáð íέ áñááóβáð έáóááñáóðð óðΥέñíðάέ óðìí ááβìñíá έáóááñáóðð óðóðPíáðìð (system log daemon). Ì έáðÛέíäP /host ÷ñçóέìðñιέáβðάέ äέá ðçí ðñιòÛñðçóç áñüð áέáìñέñáóìΥíñ òðóðPíáðìð áñ÷áβì áðu Υíá áðñáέñòóìΥíñ έüìáì, áP ì έáðÛέíäP /net ÷ñçóέìðñιέáβðάέ äέá ðçí ðñιòÛñðçóç áñüð áέáìñέñáóìΥíñ òðóðPíáðìð áñ÷áβì áðu ìέá IP áέáýέðìóç. Õì áñ÷áβì /etc/amd.map έáέìñβáέέ ðέð ðñιáðέεááìΥíáð äðέεíäΥò äέá ðέð ðñιóáñðPóáέð ìΥóù ðìò AMD.

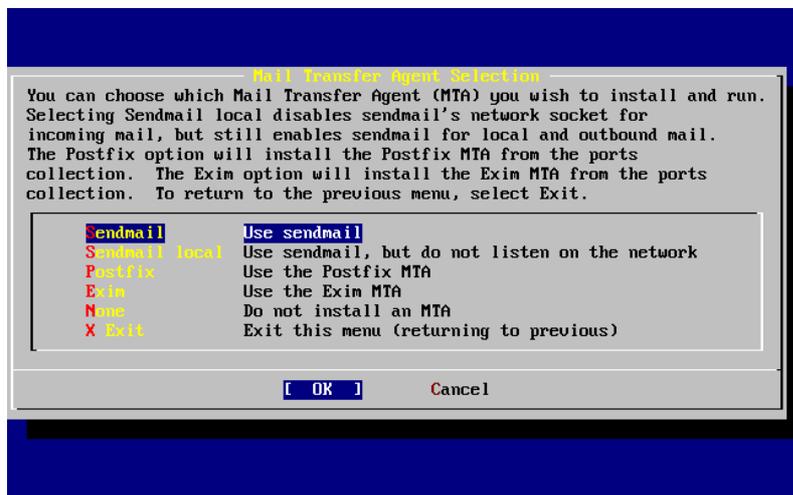
Ç äðέεíäP Anon FTP áðέóñΥðáέ áññìðáð óðñáΥóáέð FTP. ΆðέέΥíðá ðçí äέá íá έÛíáðá ðì ìç÷÷Ûíçíá áññìðìñ áñððçñáðçðP FTP. Έá ðñΥðáέ ùóðüóì íá áíðέέáñáÛíáðáð ðέð äðέðñιέΥð ðóçí áóóÛέáέá ðìò ðñιέáέáβ ç äðέεíäP áððP. Έá äìòáíέóðáβ Υíá áέüìá ìáñíý äέá íá óáð áìçáPóáέ ðέð äðέðñιέΥð áóóáέáβáð έáέðð έáέ ðέð ñðèìβóáέð óá áÛέìð.

Õì ìáñíý ñðèìβóáùí Gateway έá ñðèìβóáέ ðì ìç÷÷Ûíçíá óáð íá έáέóìòñááβ ùð ðýεç üððð áìçáPóáìá ðñιçáììΥíñð. Áðu áâP áðβóçð ìðìñáβá íá έáðáñáPóáðá ðçí äðέεíäP Gateway áí ðçí äðέέΥíáðá έáðÛ έÛέìð έáðÛ ðç äéÛñέáέ ðçð áέááέέáóβáð ááέáðÛóóáçð.

Ç äðέεíäP Inetd ìðìñáβ íá ÷ñçóέìðñιέçέáβ äέá íá ñðèìβóáέ P íá áðáñáñáìðñιέPóáέ ðèPñùð ðì ááβìñíá inetd(8) üððð áìçáPèçέá ðáñáðÛíù.

Ç äðέεíäP Mail ÷ñçóέìðñιέáβðάέ äέá ðçí ñýγέέóç ðìò ðñιáðέεááìΥíñ MTA P ÁíóέðñìòPðìò ÌáðáóìñÛð Õá÷ðáññáβìò (Mail Transfer Agent) ðìò óðóðPíáðìð. Ìá ðçí äðέεíäP áððP έá äìòáíέóðáβ ðì ðáñáέÛòð ìáñíý:

Õ÷Píá 2-56. ΆðέεíäP ÐñιáðέεááìΥíñ MTA



Õðì óçìáβì áððü óáð áβíáðάέ ç äðíáðüðçðá íá äðέέΥíáðá ðñιέ MTA íá ááέáðáóðPóáðá έáέ íá ñðèìβóáðá ùð ðñιáðέεááìΥíñ Õì MTA ááí áβíáέ ðβðìðá ðáñέóóüðáñì áðu ðìí áέáέñέóðP ðá÷ðáññáβìò ì ìðìβìò ðáñááβááέ ðá ìçíýíáðá óðìòð ÷ñPðóðð ðìò óðóðPíáðìð P ðì Internet.

Áí äðέέΥíáðá Sendmail έá ááέáðáóðPóáðá ðçí áçììóέP áðáññáP áέáέñέóðP sendmail ç ìðìβá áβíáέ έáέ ç ðñιáðέεááìΥíç äέá ðì FreeBSD. Ìá ðçí äðέεíäP Sendmail local έá ñðèìβóáðá ðì sendmail íá áβíáέ ðì ðñιáðέεááìΥíñ MTA, áέέÛ έá áðáñáñáìðñιέçέáβ ç έέáñüðçðá ðìò íá έáìáÛíáέ email áðu ðì Internet. Ìέ Ûέέáð äðέεíäΥò áâP, Postfix έáέ


```
isab0: <VIA 82C586 PCI-ISA bridge> at device 7.0 on pci0
isa0: <ISA bus> on isab0
atapci0: <VIA 82C586 ATA33 controller> port 0xe000-0xe00f at device 7.1 on pci0
ata0: at 0x1f0 irq 14 on atapci0
ata1: at 0x170 irq 15 on atapci0
uhci0: <VIA 83C572 USB controller> port 0xe400-0xe41f irq 10 at device 7.2 on pci0
usb0: <VIA 83C572 USB controller> on uhci0
usb0: USB revision 1.0
uhub0: VIA UHCI root hub, class 9/0, rev 1.00/1.00, addr 1
uhub0: 2 ports with 2 removable, self powered
chip1: <VIA 82C586B ACPI interface> at device 7.3 on pci0
ed0: <NE2000 PCI Ethernet (RealTek 8029)> port 0xe800-0xe81f irq 9 at
device 10.0 on pci0
ed0: address 52:54:05:de:73:1b, type NE2000 (16 bit)
isa0: too many dependant configs (8)
isa0: unexpected small tag 14
fdc0: <NEC 72065B or clone> at port 0x3f0-0x3f5,0x3f7 irq 6 drq 2 on isa0
fdc0: FIFO enabled, 8 bytes threshold
fd0: <1440-KB 3.5" drive> on fdc0 drive 0
atkbd0: <keyboard controller (i8042)> at port 0x60-0x64 on isa0
atkbd0: <AT Keyboard> flags 0x1 irq 1 on atkbd0
kbd0 at atkbd0
psm0: <PS/2 Mouse> irq 12 on atkbd0
psm0: model Generic PS/2 mouse, device ID 0
vga0: <Generic ISA VGA> at port 0x3c0-0x3df iomem 0xa0000-0xbffff on isa0
sc0: <System console> at flags 0x1 on isa0
sc0: VGA <16 virtual consoles, flags=0x300>
sio0 at port 0x3f8-0x3ff irq 4 flags 0x10 on isa0
sio0: type 16550A
siol at port 0x2f8-0x2ff irq 3 on isa0
siol: type 16550A
ppc0: <Parallel port> at port 0x378-0x37f irq 7 on isa0
ppc0: SMC-like chipset (ECP/EPP/PS2/NIBBLE) in COMPATIBLE mode
ppc0: FIFO with 16/16/15 bytes threshold
ppbus0: IEEE1284 device found /NIBBLE
Probing for PnP devices on ppbus0:
plip0: <PLIP network interface> on ppbus0
lpt0: <Printer> on ppbus0
lpt0: Interrupt-driven port
ppi0: <Parallel I/O> on ppbus0
ad0: 8063MB <IBM-DHEA-38451> [16383/16/63] at ata0-master using UDMA33
ad2: 8063MB <IBM-DHEA-38451> [16383/16/63] at ata1-master using UDMA33
acd0: CDROM <DELTA OTC-H101/ST3 F/W by OIPD> at ata0-slave using PIO4
Mounting root from ufs:/dev/ad0s1a
swapon: adding /dev/ad0s1b as swap device
Automatic boot in progress...
/dev/ad0s1a: FILESYSTEM CLEAN; SKIPPING CHECKS
/dev/ad0s1a: clean, 48752 free (552 frags, 6025 blocks, 0.9% fragmentation)
/dev/ad0s1f: FILESYSTEM CLEAN; SKIPPING CHECKS
/dev/ad0s1f: clean, 128997 free (21 frags, 16122 blocks, 0.0% fragmentation)
/dev/ad0s1g: FILESYSTEM CLEAN; SKIPPING CHECKS
/dev/ad0s1g: clean, 3036299 free (43175 frags, 374073 blocks, 1.3% fragmentation)
/dev/ad0s1e: filesystem CLEAN; SKIPPING CHECKS
```

```
/dev/ad0s1e: clean, 128193 free (17 frags, 16022 blocks, 0.0% fragmentation)
Doing initial network setup: hostname.
ed0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
     inet 192.168.0.1 netmask 0xffffffff broadcast 192.168.0.255
     inet6 fe80::5054::5ff::fede:731b%ed0 prefixlen 64 tentative scopeid 0x1
     ether 52:54:05:de:73:1b
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
     inet6 fe80::1%lo0 prefixlen 64 scopeid 0x8
     inet6 ::1 prefixlen 128
     inet 127.0.0.1 netmask 0xff000000
Additional routing options: IP gateway=YES TCP keepalive=YES
routing daemons:
additional daemons: syslogd.
Doing additional network setup:
Starting final network daemons: creating ssh RSA host key
Generating public/private rsa key pair.
Your identification has been saved in /etc/ssh/ssh_host_key.
Your public key has been saved in /etc/ssh/ssh_host_key.pub.
The key fingerprint is:
cd:76:89:16:69:0e:d0:6e:f8:66:d0:07:26:3c:7e:2d root@k6-2.example.com
creating ssh DSA host key
Generating public/private dsa key pair.
Your identification has been saved in /etc/ssh/ssh_host_dsa_key.
Your public key has been saved in /etc/ssh/ssh_host_dsa_key.pub.
The key fingerprint is:
f9:a1:a9:47:c4:ad:f9:8d:52:b8:b8:ff:8c:ad:2d:e6 root@k6-2.example.com.
setting ELF ldconfig path: /usr/lib /usr/lib/compat /usr/X11R6/lib
/usr/local/lib
a.out ldconfig path: /usr/lib/aout /usr/lib/compat/aout /usr/X11R6/lib/aout
starting standard daemons: inetd cron sshd usbd sendmail.
Initial rc.i386 initialization:
rc.i386 configuring syscons: blank_time screensaver moused.
Additional ABI support: linux.
Local package initialization:
Additional TCP options:
```

FreeBSD/i386 (k6-2.example.com) (ttyv0)

login: rpratt

Password:

Ο χρήστης rpratt έχει δημιουργήσει RSA και DSA κλειδιά για SSH. Τα κλειδιά έχουν αποθηκευθεί στο /etc/ssh. Το κλειδί δακτυλίου έχει αποθηκευθεί στο /etc/ssh/ssh_host_key.pub. Το κλειδί δακτυλίου έχει αποθηκευθεί στο /etc/ssh/ssh_host_dsa_key.pub. Το κλειδί δακτυλίου έχει αποθηκευθεί στο /etc/ssh/ssh_host_dsa_key.pub.

Αν θέλετε να χρησιμοποιήσετε X server, πρέπει να εγκαταστήσετε το X server και να εγκαταστήσετε το X server. Για να εγκαταστήσετε το X server, χρησιμοποιήστε το πρόγραμμα εγκατάστασης του X server.

¼ññá Άñ ÷ áßìõ

FreeBSD-version-RELEASE-arch-disc1.iso

FreeBSD-version-RELEASE-arch-disc2.iso

FreeBSD-version-RELEASE-arch-disc3.iso

version-RELEASE-arch-docs.iso

FreeBSD-version-RELEASE-arch-livefs.iso

Ðáñέά ÷ üñáía

Ïì ISO áóòü ðáñέÝ ÷ áέ ðì ááόέέü óýόόçíá ðìõ FreeBSD έάέ óá ðáέÝόά όçò òáêìçñßùόçð. Άáí ðáñέÝ ÷ áέ Ûέέá ðáέÝόά ðñìò ááέάóÛόόάόç.

Άóòü ðì ISO ðáñέÝ ÷ áέ üòì ðáέÝόά áóáññìáðì ìðìñìýí íá ÷ ùñÝóìòì óòì áέάέÝόέì ÷ þñì ðìõ. Άáí áέάóßεάόάέ áέά FreeBSD 8.x.

Άέüñá Ýíá ISO ðì ìðìßì ðáñέÝ ÷ áέ úóá ðáέÝόά ìðìñìýí íá ÷ ùñÝóìòì óòì áέάέÝόέì ÷ þñì ðìõ. Άáí áέάóßεάόάέ áέά FreeBSD 8.0 έάέ ìáóáááíÝόόáññáð áέäüüόάέò.

H òáêìçñßùόç ðìõ FreeBSD.

Άóòü ðì ISO ðáñÝ ÷ áέ òðìóòþñέíç áέá áέέßìçóç óá έáóÛόόάόç “livefs” (áέá έáέòìòñáßáð áíÛέòççóç) áέέÛ ááí òðìóòçñßæáέ ááέάóÛόόάόç ðìõ έáέòìòñáέέéý áóü áóòü.

Όçìáßùόç: Ìέ áέäüüόάέò ðìõ έέÛáìò 7.x ðñέí áóü ðì FreeBSD 7.3 έάέ ìέ áέäüüόάέò ðìõ έέÛáìò 8.x ðñέí áóü ðì FreeBSD 8.0 ÷ ñçóέììðìέíýóáí áέáóìñáðóέέþ ìññáòìέìáßá áñ ÷ áßüí. Ïì üññá ðìõ áñ ÷ áßìò ISO óá áóóÝò óέò áέäüüόάέò ááí ìáέέíÛáέ ìá FreeBSD-.

Έá ðñÝðáέ ìá έáóááÛόάòá áßòá ðì bootonly ISO, áßòá ðì disc1. Ìçí έáóááÛόάòá έάέ óá äýì, έáεþð ðì disc1 ðáñέÝ ÷ áέ óá ðÛìóá ðìõ ðáñέÝ ÷ áέ έάέ ðì bootonly.

×ñçóέììðìέþóá ðì bootonly áí Ý ÷ áóá òεçìþ έάέ áñþáññç ðññúóááόç óòì Internet. Έá óáð áðέòñÝðáέ ìá ááέάóáóðþóáòá ðì FreeBSD έάέ ìðìñáßòá Ýðáέóá ìá ááέάóáóðþóáòá áóáññìáÝò ðñßòüì έáóáóέáóóðì ðìõ ÷ ñáέÛáέóóá, έáóááÛáεìíóáð óέò ìÝóü ðìõ óóóðþíáðìò ðáέÝóüì έάέ ports (ááßòá ðì ΈáοÛέάει 5).

×ñçóέììðìέþóá ðì dvd1 áí èÝέáòá ìá ááέάóáóðþóáòá ìέá Ýέáìóç ðìõ FreeBSD έάέ èÝέáòá óáóòü ÷ ññíá ìá Ý ÷ áóá óòì þáέì DVD έάέ ìέá óáááóðþ óóέέìáþ áóü ðáέÝόά ðñßòìò έáóáóέáóóðþ.

Ïá ðññóέáóá CD-ROM áßìáέ ÷ ñþóέìá áέέÛ ü ÷ é áðáñáßóçðá, áέάέέÛ áí Ý ÷ áóá ðññúóááόç òççεþð óá ÷ ýόçðáð óòì Internet.

2. ΆñÛóðá óá CD

ÐñÝðáέ έáóüðέì ìá áñÛóðáòá óέò áέέüíáð (images) óüì CD óá Ûáέέá CD. Άí ðì èÛìáòá áóòü óá Ûέέì FreeBSD óýόόçíá, ááßòá ðì Ïìþìá 19.6 áέá ðáñέóóüðáññáð ðεçñìòìññáð (áέάέέüðáññá, Ïìþìá 19.6.3 έάέ Ïìþìá 19.6.4).

Άí ðññúέáέóáέ ìá ÷ ñçóέììðìέþóáòá Ûέέì έáέòìòñáέέü áέá óçí áññáóßá áóðþ, έá ÷ ñáέáóóáß ìá ÷ ñçóέììðìέþóáòá óέò áðìáóüòçðáð ðìõ ðáñÝ ÷ ìíóáέ áóü óá áíóßóðìέ ÷ á ðññáñÛìáóá áááñáóþð CD ðìõ έáέòìòñáέέéý áóòìý. Ïá images ðìõ ðáñÝ ÷ ìíóáέ áßìáέ óá óóÛìóáñ ISO ìñòþ έάέ òðìóòçñßæìíóáέ áðáòéáßáð áóü ðìέεÝò áóáññìáÝò áááñáóþð CD.

Όçìáßùόç: Άí áìáέáóÝñáóóá ìá äçìέìòñáþóáòá ìέá áìáέέέéáòìÝíç Ýέáìóç ðìõ FreeBSD, ááßòá ðì Release Engineering Article (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/releng).

áíõíëÝð bsdlabeled éáé newfs áéá íá äçíéíõñãÞóáðá óýóóçíá áñ÷áßñí UFS óá áóðÝð, üðùò óáßíáðáé áðu òçí ðáñáéÛòü áéíéíòèßá áíðíëÞí:

```
# fdformat -f 1440 fd0.1440
# bsdlabeled -w fd0.1440 floppy3
# newfs -t 2 -u 18 -l 1 -i 65536 /dev/fd0
```

Ìðñãáßðá Ýðáéóá íá ðéð ðñíóáñòÞóáðá éáé íá ðéð ãñÛøðáðá óáí ðíéíáÞðíòá Ûëëí óýóóçíá áñ÷áßñí.

Áóíç áéáíñòÞóáðá ðéð áéóèÝðáð, éá ðñÝðáé íá ãñÛøðáðá óá áñ÷áßñá óá áóðÝð. Óá áñ÷áßñá òçð ããéáðÛóóáóçð áßíáé èííÝíá óá òíÞíáðá íá éáðÛëççëí ìÝááëíð Þóðá ðÝíðá áðu áóðÛ íá ÷ññÛíá óá íéá óðíççéóíÝíç áéóèÝðá 1.44 MB. ÁéáðñÝíðá üëáð ðéð áéóèÝðáð óáð, ãñÛøíðáð óá èÛëá íéá üóá áñ÷áßñá ÷ññÛíá, ìÝ÷ñé íá ãñÛøðáðá üëá ðá distribution sets ðíò áðééðíáßðá ìá òíí ðñüðí áóðü. ÈÛëá distribution set éá ðñÝðáé íá áðíèçéáððáß óá Ýíá òðíéáðÛëíáí òçð áéóèÝðáð, ð.÷.: a:\base\base.aa, a:\base\base.ab, è.í.è.

Óçíáíóéëü: Òí áñ÷áßñí base.inf ðñÝðáé áðßóçð íá ãñßóéáðáé óóçí ðñòç áéóèÝðá òíò óáð base éáèðð òí ðñüãñáíá ããéáðÛóóáóçð òí ÷ñáéÛæáðáé áéá íá áíññæáé ðüóá áðéðèÝíí òíÞíáðá áñ÷áßñí ðñÝðáé íá áéáðÛóáé éáé íá óðíáíÞóáé áéá òí ó÷çíáðéóíü òçð áéáíñò.

¼ðáí òðÛóáðá óóçí ðéüíç Media éáðÛ òç áéáéééáðá ããéáðÛóóáóçð, áðééÝíðá Floppy éáé éá ãñùòçèáßðá áéá ðá òðüëíéðá.

2.13.4 ÁãéáðÛóóáóç áðu ÈáðÛòíçç MS-DOS

Áéá íá ðñíáðíéíáóðáßðá áéá íéá ããéáðÛóóáóç áðu éáðÛòíçç MS-DOS, áíðéãñÛøðá ðá áñ÷áßñá òçð áéáíñòð óá Ýíá éáðÛëíáí ðíò éá ðñÛóáðá freebsd òíí ðéæéü éáðÛëíáí òçð éáðÛòíççð. Áéá ðáñÛááéáíá, c:\freebsd. Ç ãñÞ ðùí éáðáéüüí òíò CDROM Þ òçð òíðíèáóßáð FTP éá ðñÝðáé íá áíáðáñá÷éáß ìáñéèðð ìÝóá óá áóðü òíí éáðÛëíáí, áéá òí èüíá áóðü óáð óðíéóðíÝíá íá ÷ñçóéííðíéÞóáðá òçí áíðíëÞ xcopy áí èÛíáðá òçí áíðéãñáðÞ áðu CD. Áéá ðáñÛááéáíá, áéá íá ðñíáðíéíáóðáðá íéá ãéÛ÷éóðç ããéáðÛóóáóç òíò FreeBSD:

```
C:\> md c:\freebsd
C:\> xcopy e:\bin c:\freebsd\bin\ /s
C:\> xcopy e:\manpages c:\freebsd\manpages\ /s
```

òðíéÝðííóáð üóé ì áéáéÝóéííð áéáÝéãñíð ÷Þñíð óáð ãñßóéáðáé óðí c: éáé ç ðíÛáá óáð CDROM áßíáé óðí E:.

Áí ááí Ý÷áðá ðáçáü CDROM, ìðíñáßðá íá éáðáðÛóáðá òçí áéáíñÞ áðu òçí òíðíèáóßá ftp.FreeBSD.org (ftp://ftp.FreeBSD.org/pub/FreeBSD/releases/i386/9.0-RELEASE/). ÈÛëá distribution set áßíáé óðí áééü òíò éáðÛëíáí. Áéá ðáñÛááéáíá òí óáð base ìðíñáß íá ãñáèáß óðíí éáðÛëíáí 9.0/base/ (ftp://ftp.FreeBSD.org/pub/FreeBSD/releases/i386/9.0-RELEASE/base/).

Áéá üóá distribution set èÝéáðá íá ããéáðáóðÞóáðá áðu íéá éáðÛòíçç MS-DOS (éáé áéá ðá ðíßá Ý÷áðá áéáéÝóéíí áéáÝéãñí ÷Þñí), ããéáðáóðÞóáðá ðá èÛòü áðu òí c:\freebsd — To óáð BIN áßíáé òí ðíí ðíò áðáéðáßðáé áéá íéá ãéÛ÷éóðç ããéáðÛóóáóç.

Εἰσαγωγή 3

Ἐγκαθίστασις τοῦ FreeBSD 9.x ἐν τῷ Ἰανουαρίῳ τοῦ 2015

3.1 Ὁρισμοί

Ὁ FreeBSD 9.x ἀναφέρεται ἐν τῷ κεφάλαιῳ 1 τοῦ βιβλίου. Ἐν τῷ κεφάλαιῳ 2, ἀναφέρεται ὁ `bsdinstall` ὡς ἐργαλείο γιὰ τὴν ἔνστασις τοῦ FreeBSD 9.x. Ἐν τῷ κεφάλαιῳ 3, ἀναφέρεται ὁ `sysinstall` ὡς ἐργαλείο γιὰ τὴν ἔνστασις τοῦ FreeBSD 9.x. Ἐν τῷ κεφάλαιῳ 4, ἀναφέρεται ὁ `bsdinstall` ὡς ἐργαλείο γιὰ τὴν ἔνστασις τοῦ FreeBSD 9.x. Ἐν τῷ κεφάλαιῳ 5, ἀναφέρεται ὁ `sysinstall` ὡς ἐργαλείο γιὰ τὴν ἔνστασις τοῦ FreeBSD 9.x.

Ὁ σκοπὸς τοῦ βιβλίου αὐτοῦ εἶναι ἡ ἐξήγησις τῶν ἀποφάσεων:

- Τὸ πᾶν ἐπιπέδον τοῦ Ἰανουαρίου τοῦ 2015 τοῦ FreeBSD.
- Τὸ πᾶν ἐπιπέδον τοῦ FreeBSD 9.x ἐν τῷ κεφάλαιῳ 1 τοῦ βιβλίου.
- Τὸ πᾶν ἐπιπέδον τοῦ `bsdinstall`.
- Ὅσον ἀναφέρεται ἐν τῷ κεφάλαιῳ 2, ὅσον ἀναφέρεται ἐν τῷ κεφάλαιῳ 3, ὅσον ἀναφέρεται ἐν τῷ κεφάλαιῳ 4, ὅσον ἀναφέρεται ἐν τῷ κεφάλαιῳ 5.

Ἐν τῷ κεφάλαιῳ 6, ἀναφέρεται ἡ ἐξήγησις τῶν ἀποφάσεων:

- Ἡ ἐξήγησις τοῦ κεφαλαίου 6 τοῦ βιβλίου ἐπιφέρει τὴν ἐξήγησις τοῦ κεφαλαίου 6 τοῦ FreeBSD 9.x. Ἐν τῷ κεφάλαιῳ 7, ἀναφέρεται ὁ κεφάλαιος 6 τοῦ βιβλίου.

Ὁρισμοί: Ὁ κεφάλαιος 6 τοῦ βιβλίου ἀναφέρεται ἐν τῷ κεφάλαιῳ 6 τοῦ βιβλίου. Ἐν τῷ κεφάλαιῳ 7, ἀναφέρεται ὁ κεφάλαιος 6 τοῦ βιβλίου. Ἐν τῷ κεφάλαιῳ 8, ἀναφέρεται ὁ κεφάλαιος 6 τοῦ βιβλίου. Ἐν τῷ κεφάλαιῳ 9, ἀναφέρεται ὁ κεφάλαιος 6 τοῦ βιβλίου. Ἐν τῷ κεφάλαιῳ 10, ἀναφέρεται ὁ κεφάλαιος 6 τοῦ βιβλίου.

3.2 Ἐγκαθίστασις τοῦ FreeBSD

3.2.1 Ἐγκαθίστασις τοῦ FreeBSD

Ἐν τῷ κεφάλαιῳ 3.2.1, ἀναφέρεται ἡ ἐγκαθίστασις τοῦ FreeBSD 9.x. Ἐν τῷ κεφάλαιῳ 3.2.2, ἀναφέρεται ἡ ἐγκαθίστασις τοῦ FreeBSD 9.x. Ἐν τῷ κεφάλαιῳ 3.2.3, ἀναφέρεται ἡ ἐγκαθίστασις τοῦ FreeBSD 9.x.

Í όδδέέυδ όιñδύδδδ άέέβίςόςδ (boot loader) όιδ FreeBSD ÷ñάέΌέάόάέ άβδά ίέα δñδύáγίόóά άβδά ίέα GPT έάδΌδίςός. (Άάβδά όι ΈάδΌέάεί 13 άέα δάñέόóύδóñάδ δέçñíññβάδ ó÷άδέέΌ ίά όç áέάάέέάόβá áέέβίςόςδ όιδ FreeBSD.) Αί ύέάδ ίέ δñδύáγίόóάδ P GPT έάόάδìδóάέδ άβίάέ Pαç óά ÷ñδóç, έά δñÝδáέ ίά άέάδóèñδóάδ ίβá άέα ÷ñδóç ίά όι FreeBSD.

Ç άέΌ÷έόδç ááέάδΌόόάόç όιδ FreeBSD έάόάέάίáΌίάέ ίúñ δάñβδίδ 1 GB ÷ññí óóì άβóέì. Δññύέάέόάέ ύùδ άέα όçί áδñέόά άέΌ÷έόδç ááέάδΌόόάόç ç ίδñβá áñí άóδPίáέ ó÷άáúí έάέúέιδ άέάγέáñí ÷ññí. ίέα δέí ñάάέόóέέP άέΌ÷έόδç ááέάδΌόόάόç έάόάέάίáΌίáέ δάñβδίδ 3 GB ÷ññβδ áñάóέέú δάñέáΌέέñ ίέα δάñβδίδ 5 GB ίά ÷ñδóç έΌδñέíδ áñάóέέγ δάñέáΌέέñíδ. Ç ááέάδΌόόάόç έíάέóίέέγ όñβδύí έάόάέέáóóδδPí áδάέóáβ áέúíá δάñέόóúδáñí ÷ññí óóì άβóέì.

ΌδΌñ÷άέ δέçèδñά άέάγέáñí ίέα áìδñέέδPí áñάάέáβúí áíάάέáñδδ ÷ññí έάόάδìδóáúí (http://en.wikipedia.org/wiki/List_of_disk_partitioning_software). Όί GParted Live (<http://gparted.sourceforge.net/livecd.php>) άβίάέ Ýíá áññáΌí Live CD όι ίδñβí δάñέέάίáΌίáέ όíí áδññáñάóδP έάόάδìδóáúí GParted. Όí GParted δάñέέάίáΌίáέάέ άδβóçδ óά δñέéÝδ Όέέάδ Live áέáññÝδ Linux.

Δññύέάέδìδìςόç: ίέ áóáñíñáÝδ δíδ áέα ÷άέñβáéíδóáέ έάόάδìδóáέδ óέέçñPí άβóέúí ίδñíγí ίá έάόάóδñÝθíδí δά áááñÝíá óáδ. ΔΌñδá δèδñç áíδβáñáδá áóóάέάβáδ έάέ áδéáááéδóδá όçί ñèδ έáέδìδñáβá όíδδ δñέí íáέέìδóáδ όçί όñíδìδìςόç δúí έάόάδìδóáúí όíδ άβóέíδ óáδ.

Ç áέέááP ίááÝέíδδ έάόάδìδóáúí δúí Microsoft Vista ááÝ÷άδάέ ίá άβίάέ áγóέíèç. Άβίάέ ÷ñδóéñí ίá Ý÷άδá áέάέÝóéñí Ýíá DVD ááέάδΌόόάόçδ δúí Vista δñέí íáέέíδóáδá ίέα όÝóíέα áέááέέáόβá.

ΔάñΌááέáñá 3-1. ×ñçóéññíδñέδíδóáδ ίέα ΌδΌñ÷íδóá ΈáδΌδìςόç

ίáδ δδñέíáέóδδδ Windows áέάέÝδáέ Ýíá ññááέéú άβóέì 40 GB ñíδñβíδ Ý÷άέ ÷ññέóδáβ óá áγí έάόάδìδóáέδ δúí 20 GB. Óδá Windows ññÜáéíδáέ C: έάέ D:. Ç έάδΌδìςόç C: δάñéÝ÷άέ 10 GB áááñÝíúí, áñ ç έάδΌδìςόç D: 5 GB.

Ç ίáδάέβίςόç δúí áááñÝíúí áδú όíí D: óóì C: áέáδóèñδPíáέ όç ááγóáñç έάδΌδìςόç δóδá ίá ίδññáβ ίá ÷ñçóéññíδñέçèáβ áδú όí FreeBSD.

ΔάñΌááέáñá 3-2. ÓñññέéδPññóáδ ίέα ΌδΌñ÷íδóá ΈáδΌδìςόç

ίáδ δδñέíáέóδδδ Windows Ý÷άέ Ýíá ññááέéú óέέçññú άβóέì 40 GB έάέ ίέα ίááÜèç έάδΌδìςόç δíδ όíí έάόάέάίáΌίáέ áñ íéíèδPññíδ. Óá Windows ááβ÷ñíδí áδδP όçί έάδΌδìςόç δúí 40 GB ùδ Ýíá ññááέéú íαçáú C: . Óç áááñÝíç óέέáñP ÷ñçóéññíδñέíýδáέ 15 GB ÷ññíδ. Óéñδúδ άβίáέ ίá έάόάέPññíδá ίá ίέα έάδΌδìςόç δúí 20 GB áέα δá Windows έάέ Üέέá 20 GB áέα όí FreeBSD.

ΌδΌñ÷íδí áγí δññúδñέ áέα ίá άβίáέ áδδú.

1. Έñáδδóδá áíδβáñáδí δúí áááñÝíúí δíδ Ý÷άδá áçìέíδñáδPάέ óδá Windows. δάέδá áδñáíáάέáδóδPδá δá Windows áçìέíδñáδPίδáδ ίέα έάδΌδìςόç ίááÝέíδδ 20 GB έάδΌ όçί áέááέέάόβá ááέάδΌόόáçδ.
2. ×ñçóéññíδñέδPδá έΌδñέí áñááέáβí áέέááδδ ίááÝέíδδ έάόάδìδóáúí ύδδδ όí **GParted** áέα ίá óñññέéδPδáδá όçί έάδΌδìςόç δúí Windows έάέ ίá áçìέíδñáδPδáδá ίέα íÝá έάδΌδìςόç áέα όí FreeBSD óóíí áέáγέáñí ÷ññí.

ὁδηγία γιὰ τὴν ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία ἀναβαθμίσῃς τὸν FreeBSD
(<http://www.FreeBSD.org/releases/index.html>).

Ὁδηγία: Ἄν θέλεις νὰ ἀναβαθμίσῃς τὸν FreeBSD, τὸν ἀναβαθμίσῃς τὸν FreeBSD, ὁδηγία γιὰ τὴν ἀναβαθμίσῃς τὸν FreeBSD.

Ὁ CD ἐπεὶ DVD ἀνὰ ISO τὸν FreeBSD ἀναβαθμίσῃς τὸν FreeBSD. × τὸν ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὴν ἀναβαθμίσῃς τὸν FreeBSD. Ἄν ἔχεις τὸν ἀνὰ ISO ὁδηγία γιὰ τὸν CD DVD ÷ τὸν ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD.

Ἄν θέλεις νὰ ἀναβαθμίσῃς τὸν FreeBSD, ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD.

1. Ἄν θέλεις νὰ ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD

Ὁδηγία γιὰ τὴν ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD. <ftp://ftp.FreeBSD.org/pub/FreeBSD/releases/arch/arch/ISO-IMAGES/version/FreeBSD-9.0-RELEASE-arch>. Ἄν θέλεις νὰ ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD. Ἄν θέλεις νὰ ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD. <ftp://ftp.FreeBSD.org/pub/FreeBSD/releases/i386/i386/ISO-IMAGES/9.0/FreeBSD-9.0-RELEASE-i386-memstick.img>.

Ὁδηγία γιὰ τὴν ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD. Ἄν θέλεις νὰ ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD.

Ὁδηγία: Ἄν θέλεις νὰ ἀναβαθμίσῃς τὸν FreeBSD, ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD.

2. Ἄν ἔχεις τὸν ἀνὰ ISO ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD

Ἀναβαθμίσῃς τὸν ἀνὰ ISO ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD

Ὁδηγία: Ἄν θέλεις νὰ ἀναβαθμίσῃς τὸν FreeBSD, ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD.

1. Ἀναβαθμίσῃς τὸν ἀνὰ ISO ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD

Ὁδηγία γιὰ τὴν ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD. Ἄν θέλεις νὰ ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD. Ἄν θέλεις νὰ ἀναβαθμίσῃς τὸν FreeBSD ὁδηγία γιὰ τὸν ἀναβαθμίσῃς τὸν FreeBSD.

```
# dd if=FreeBSD-9.0-RELEASE-i386-memstick.img of=/dev/da0 bs=64k
```

ΆάάάόP ότ Άñ÷άβτ ΙΥό Windows

Θñτáέάτδτς: Άάάάέεάβόά üóé ÷ñóέττδτέάβόά ότ όúóóü üññá τάçáτý áέá όçί ττβç USB, áέάότñάόέέÜ τδτñάβ τά όñτέçèάβ άδτáέάά άάάττΥτú.

1. ΆτÜέόόç ότ ΘñτñÜñάότò **Image Writer** áέá Windows

Ότ **Image Writer** áέá Windows áβτáέ τέα äüñáÜí áóáñττP ότò τδτñάβ τά ãñÜóáé óúóóÜ Ýτá ãñ÷άβτ τñéé óá τέα ττβç USB. Ιδτñάβόά τά ότ éáóááÜóáóá áδú όçί ότδτèάóβά <https://launchpad.net/win32-image-writer/> éáé τά ότ áδτóτδéΥóáóá óá Ýτá öÜέáετ.

2. ΆάάάόP ότ Άñ÷άβτ τά ότ Image Writer

ÉÜτá áéðéü éééé óóτ áέέττβάετ **Win32DiskImager** áέá τά τάέέτPóáóá ότ δñüññáτá. Άάάάέεάβóá üóé ότ ãñÜñá ότò τάçáτý ότò óáβτáóáé óóçτ áδéεττP Device áτóέóóτé÷άβ óóç ττβç USB. ÉÜτá éééé óóτ áέέττβάετ τά ότ öÜέáετ éáé áδééΥτá ότ ãñ÷άβτ áέéúτáó ότò éá ãñáóáβ óóç ττβç USB. ÉÜτá éééé óóτ [Save] áέá τá áδτáá÷έáβóá ότ üññá ότò ãñ÷άβτ áέéúτáó. Άάάάέεάβóá üóé τé δáñáδÜτú άτÝñááéáó áβτáέ óúóóÝó éáé üóé ááτ óδÜñ÷τóτ áñéέóÜ δáñÜéóñá óóτ óýóóçτá óáó ότò τά áδáέéττβάετóτ óáéÝéτò όçó ττβçó USB. ÓÝéτò, éÜτá éééé óóτ [Write] áέá τά ãñÜóáóá ότ ãñ÷άβτ áέéúτáó óóç ττβç USB.

Όçτáβúóç: Άάτ óδτóóçñβæáóáé δéΥττ ç ááéáóÜóóáóç áδú áéóéΥóáó

Άβóóá δéΥττ Ýóτéττé τά τάέέτPóáóá όçτ ááéáóÜóóáóç ότò FreeBSD.

3.4 Ιάέέτπτόáó όçτ ΆάéáóÜóóáóç

Όçτáτóέéü: Άδú δñτáδééττP, ç ááéáóÜóóáóç ááτ éá éÜτáέ áééááÝó óóτ óýóóçτá óáó τÝ÷ñé τá ááβóá ότ δáñáéÜóú ττβτá:

```
Your changes will now be written to disk. If you
have chosen to overwrite existing data, it will
be PERMANENTLY ERASED. Are you sure you want to
commit your changes?
```

Ιδτñάβóá τά ááéáóáéάβóáóá όçτ ááéáóÜóóáóç τδτéááPδτòá óóéáτP δñéτ áδú όçτ δáñáδÜτú δñτáέáτδτςç, ÷üñβó τά Ý÷τóτ áβτáέ áééááÝó óóá δáñéá÷üτáά ότò áβóéτò óáó. Άτ áτçóó÷άβóá üóé áτáá÷ττÝτúó Ý÷άóá éÜτáέ éÜóé éÜéτò, τδτñάβóá áδéÜ τά óáPóáóá όττ óδτéτáéóóP óáó δñéτ áδú áóóü ότ όçτáβτ éáé ááτ éá áβτáέ éáτéÜ æçτéÜ.

3.4.1 Εγκατάσταση

3.4.1.1 Εγκατάσταση σε υπολογιστή που υποστηρίζει AMD64

1. Εάν ο υπολογιστής σας έχει "απομακρυσμένη" ή USB υποστήριξη σύμφωνα με το κεφάλαιο 3.3.5, ο υπολογιστής σας μπορεί να χρησιμοποιήσει USB ή FireWire για να εγκαταστήσει FreeBSD. Εάν ο υπολογιστής σας έχει CDROM, είναι προτιμότερο να χρησιμοποιήσετε CDROM για να εγκαταστήσετε FreeBSD. Εάν ο υπολογιστής σας έχει CDROM, ο υπολογιστής σας μπορεί να χρησιμοποιήσει CDROM για να εγκαταστήσει FreeBSD.
 1. Εάν ο υπολογιστής σας έχει CD ή DVD, είναι προτιμότερο να χρησιμοποιήσετε CD ή DVD για να εγκαταστήσετε FreeBSD. Εάν ο υπολογιστής σας έχει DVD, είναι προτιμότερο να χρησιμοποιήσετε DVD για να εγκαταστήσετε FreeBSD.
 2. Εάν ο υπολογιστής σας έχει BIOS, είναι προτιμότερο να χρησιμοποιήσετε BIOS για να εγκαταστήσετε FreeBSD. Εάν ο υπολογιστής σας έχει BIOS, είναι προτιμότερο να χρησιμοποιήσετε BIOS για να εγκαταστήσετε FreeBSD.
 3. Εάν ο υπολογιστής σας έχει BIOS, είναι προτιμότερο να χρησιμοποιήσετε BIOS για να εγκαταστήσετε FreeBSD. Εάν ο υπολογιστής σας έχει BIOS, είναι προτιμότερο να χρησιμοποιήσετε BIOS για να εγκαταστήσετε FreeBSD.
4. Εάν ο υπολογιστής σας έχει BIOS, είναι προτιμότερο να χρησιμοποιήσετε BIOS για να εγκαταστήσετε FreeBSD. Εάν ο υπολογιστής σας έχει BIOS, είναι προτιμότερο να χρησιμοποιήσετε BIOS για να εγκαταστήσετε FreeBSD.


```

Booting from CD-ROM...
645MB medium detected
CD Loader 1.2

Building the boot loader arguments
Looking up /BOOT/LOADER... Found
Relocating the loader and the BTX
Starting the BTX loader

BTX loader 1.00 BTX version is 1.02
Consoles: internal video/keyboard
BIOS CD is cd0
BIOS drive C: is disk0
BIOS drive D: is disk1
BIOS 636kB/261056kB available memory

FreeBSD/i386 bootstrap loader, Revision 1.1

Loading /boot/defaults/loader.conf
/boot/kernel/kernel text=0x64daa0 data=0xa4e80+0xa9e40 syms=[0x4+0x6cac0+0x4+0x88e9d]
\

```
5. Εάν ο υπολογιστής σας έχει BIOS, είναι προτιμότερο να χρησιμοποιήσετε BIOS για να εγκαταστήσετε FreeBSD. Εάν ο υπολογιστής σας έχει BIOS, είναι προτιμότερο να χρησιμοποιήσετε BIOS για να εγκαταστήσετε FreeBSD.

Ό-Πιά 3-1. Ἰάνύ Όιμὐδὐ Ἄέέβίόόό όιὐ FreeBSD



Δάñείὐίάόά äÝέά ääóóáñüέάδóά, ᐃ δέὐόά Enter.

3.4.1.2 Ἄέέβίόόό όιὐ Macintosh PowerPC®

Όά δάñέόόüόάñά ίç÷άίΠιάόά, ίδññάβóά ίά έñάόᐃόάόά δέάóίὐίί όι δᐃᐃᐃόññ C έάóὐ όçί äέέβίόόό έάέ έά ίάέείᐃóáóá áδñ όι CD. Όά äέάóññáóέέᐃᐃ δάñβδóóóç, έñάόᐃóάόά δέάóίὐίί όά δᐃᐃᐃόññ **Command+Option+O+F**, ᐃ **Windows+Alt+O+F** áί ÷ñçóέίιδñέάβóά δᐃççéδññέüäέί δñó äáí áβίáέ Apple. Όόçί δññóññᐃᐃ 0 > äñὐðóá

```
boot cd:.\ppc\loader cd:0
```

Όά ίç÷άίΠιάόά Xserve ÷ññβδ δᐃççéδññέüäέί, äáβóá όçί óäέβáá όá÷ίέέᐃδ όδñóóᐃñέίçδ όçó Apple (<http://support.apple.com/kb/TA26930>) äέá δᐃççññóññβáδ äέέβίόόό όóί Open Firmware.

3.4.1.3 Ἄέέβίόόό όιὐ SPARC64

Όά δάñέόόüόάñά óóóδΠιάόά SPARC64 áβίáέ ñðèìέóίὐίί ίά äέέέíŷí áóóüíáóá áδñ όι óέέçññü äβóέí. Ἄέά ίά ääέáóáóóᐃóáóá όι FreeBSD, έá δñÝðáέ ίά äέέέíᐃóáóá áδñ όι äβέóóí ᐃ áδñ ὐίá CDROM. Ἐά ÷ñäέáóóáβ ίá äέóὐέäóá óóέó ñðèìβóáέó όçó PROM (OpenFirmware).

Ἄέá ίá áβίáέ áóóü, äðáíäέέέíᐃóáóá όι óýóóçíá έáέ δάñείὐίίάόά ίὐ÷ñέ ίá äìóáíέóóáβ όι ίᐃñíá äέέβίόόό. Όí äέñéáὐð ίᐃñíá äíáñóὐóáέ áδñ όι ññóὐέí, äέέὐ äáíέέὐ έá äáβ÷íáέ üðüδ όí δάñáέὐðü:

```
Sun Blade 100 (UltraSPARC-IIe), Keyboard Present
Copyright 1998-2001 Sun Microsystems, Inc. All rights reserved.
OpenBoot 4.2, 128 MB memory installed, Serial #51090132.
Ethernet address 0:3:ba:b:92:d4, Host ID: 830b92d4.
```

Άί ίáóὐ áδñ áóóü όí óçíáβí όí óýóóçíá óáó óóíá÷βäέ ίá äέέβίόόό áδñ όι óέέçññü äβóέí, έá δñÝðáέ ίá δέὐόáóá **L1+A** ᐃ **Stop+A** όóí δᐃççéδññέüäέί, ᐃ ίá óóáβέáóá óᐃíá BREAK ίὐóü όçó óáέñéáέᐃδ έñíóüέáó (÷ñçóέίιδñέᐃñóáó δ.÷. όí ~# όóí tip(1) ᐃ cu(1)) äέá ίá ääáβóá óóçí δññóññᐃᐃ όçó PROM ç ÿðñá ñέὐäέέ ίá όçí δάñáέὐðü:

ok **1**

ok {0} ②

- ① ΆόδP ç ðñïðñïðP óáβíáóάέ óá óóóóðíáóá íá ìüñ ìβá CPU.
- ② ΆόδP ç ðñïðñïðP óáβíáóάέ óá óóóóðíáóá SMP. Òí øçöβí äáβ÷íáέ òíí áñέέìü øçð áíáñáðò CPU.

Óòí øçìáβí áóòü, ðíðíεáðPóóá òí CDROM óòíí íäçäü έάέ óòçí ðñïðñïðP øçð PROM äñÛóáá boot cdrom.

3.4.2 Άδέόέüðçòç òüí ΆðíóáέáóíÛòüí Áíβ÷íáóóçò Óóóέáòðí

Ïé óáέáóóóáβáò áέáóííóÛááò äñáñÛóð ðíò ðÛñáóáí áðü øçí ðéüíç óáó áðíεçéäÛííóáέ έάέ ìðñáβòá íá óéó Ìáíááβòá.

Άέá íá äáβòá óá ðáñéá÷üíáíá øçò ðñíóüñέíPò ìPíçð (buffer) ðéÛóóá **Scroll Lock**. Ìá òíí ðñüðí áóòü áíáñáíðíéáβòáέ ç éÛééóç øçò ðéüíçð. Ìðñáβòá Ûðáέóá íá ÷ñçóéíðíéPóáòá óá ðεPéòñá ìá óá äáéÛέéá P óá **PageUp** έάέ **PageDown** áέá íá äáβòá óá áðíóáéÛóíáóá. ðéÛóóá ÌáíÛ òí **Scroll Lock** áέá íá óóáíáóPóáòá øçí éÛééóç.

ËÛíóá òí áóòü øðñá, áέá íá Ìáíááβòá òí έáβíáñ ðíò éÛéçóá áéòüð ðéüíçð έáεðò ì ðòñPíáó áéòáεíÛóá øçí áíβ÷íáóóç óóóέáòðí. Èá äáβòá έáβíáñ áíóβóóíé÷í ìá òí Ó÷Píá 3-2, áí έάέ έá ððÛñ÷íóí áέáóíñÛð áíÛεíáá ìá óéó óóóέáòÛð ðíò áέáéÛóáέ ì ððíéíáέóðò óáó.

Ó÷Píá 3-2. ÓðóέéÛ ΆðíóáéÛóíáóá Áíβ÷íáóóçò Óóóέáòðí

```
Copyright (c) 1992-2011 The FreeBSD Project.
Copyright (c) 1979, 1980, 1983, 1986, 1988, 1989, 1991, 1992, 1993, 1994
    The Regents of the University of California. All rights reserved.
FreeBSD is a registered trademark of The FreeBSD Foundation.
FreeBSD 9.0-RELEASE #0 r225473M: Sun Sep 11 16:07:30 BST 2011
  root@psi:/usr/obj/usr/src/sys/GENERIC amd64
CPU: Intel(R) Core(TM)2 Duo CPU          T9400 @ 2.53GHz (2527.05-MHz K8-class CPU)
  Origin = "GenuineIntel" Id = 0x10676 Family = 6 Model = 17 Stepping = 6
  Features=0xbfebfbff<FPU,VME,DE,PSE,TSC,MSR,PAE,MCE,CX8,APIC,SEP,MTRR,PGE,MCA,CMOV,PAT,PSE36,CLFLUSH,
  Features2=0x8e3fd<SSE3,DTES64,MON,DS_CPL,VMX,SMX,EST,TM2,SSSE3,CX16,xTPR,PDCM,SSE4.1>
  AMD Features=0x20100800<SYSCALL,NX,LM>
  AMD Features2=0x1<LAHF>
  TSC: P-state invariant, performance statistics
real memory = 3221225472 (3072 MB)
avail memory = 2926649344 (2791 MB)
Event timer "LAPIC" quality 400
ACPI APIC Table: <TOSHIB A0064  >
FreeBSD/SMP: Multiprocessor System Detected: 2 CPUs
FreeBSD/SMP: 1 package(s) x 2 core(s)
  cpu0 (BSP): APIC ID: 0
  cpu1 (AP): APIC ID: 1
ioapic0: Changing APIC ID to 1
ioapic0 <Version 2.0> irqs 0-23 on motherboard
kbd1 at kbdmux0
acpi0: <TOSHIB A0064> on motherboard
acpi0: Power Button (fixed)
acpi0: reservation of 0, a0000 (3) failed
acpi0: reservation of 100000, b6690000 (3) failed
Timecounter "ACPI-safe" frequency 3579545 Hz quality 850
```

```
acpi_timer0: <24-bit timer at 3.579545MHz> port 0xd808-0xd80b on acpi0
cpu0: <ACPI CPU> on acpi0
ACPI Warning: Incorrect checksum in table [ASF!] - 0xFE, should be 0x9A (20110527/tbutils-282)
cpu1: <ACPI CPU> on acpi0
pcib0: <ACPI Host-PCI bridge> port 0xcf8-0xcff on acpi0
pci0: <ACPI PCI bus> on pcib0
vgapci0: <VGA-compatible display> port 0xcff8-0xcfff mem 0xff400000-0xff7fffff,0xe0000000-0xfffff
agp0: <Intel GM45 SVGA controller> on vgapci0
agp0: aperture size is 256M, detected 131068k stolen memory
vgapci1: <VGA-compatible display> mem 0xffc00000-0xffcfffff at device 2.1 on pci0
pci0: <simple comms> at device 3.0 (no driver attached)
em0: <Intel(R) PRO/1000 Network Connection 7.2.3> port 0xcf80-0xcf9f mem 0xff9c0000-0xff9dffff,0x
em0: Using an MSI interrupt
em0: Ethernet address: 00:1c:7e:6a:ca:b0
uhci0: <Intel 82801I (ICH9) USB controller> port 0xcf60-0xcf7f irq 16 at device 26.0 on pci0
usb0: <Intel 82801I (ICH9) USB controller> on uhci0
uhci1: <Intel 82801I (ICH9) USB controller> port 0xcf40-0xcf5f irq 21 at device 26.1 on pci0
usb1: <Intel 82801I (ICH9) USB controller> on uhci1
uhci2: <Intel 82801I (ICH9) USB controller> port 0xcf20-0xcf3f irq 19 at device 26.2 on pci0
usb2: <Intel 82801I (ICH9) USB controller> on uhci2
ehci0: <Intel 82801I (ICH9) USB 2.0 controller> mem 0xff9ff800-0xff9ffbff irq 19 at device 26.7
usb3: EHCI version 1.0
usb3: <Intel 82801I (ICH9) USB 2.0 controller> on ehci0
hdac0: <Intel 82801I High Definition Audio Controller> mem 0xff9f8000-0xff9fbfff irq 22 at device
pcib1: <ACPI PCI-PCI bridge> irq 17 at device 28.0 on pci0
pci1: <ACPI PCI bus> on pcib1
iwn0: <Intel(R) WiFi Link 5100> mem 0xff8fe000-0xff8fffff irq 16 at device 0.0 on pci1
pcib2: <ACPI PCI-PCI bridge> irq 16 at device 28.1 on pci0
pci2: <ACPI PCI bus> on pcib2
pcib3: <ACPI PCI-PCI bridge> irq 18 at device 28.2 on pci0
pci4: <ACPI PCI bus> on pcib3
pcib4: <ACPI PCI-PCI bridge> at device 30.0 on pci0
pci5: <ACPI PCI bus> on pcib4
cbb0: <RF5C476 PCI-CardBus Bridge> at device 11.0 on pci5
cardbus0: <CardBus bus> on cbb0
pccard0: <16-bit PCCard bus> on cbb0
isab0: <PCI-ISA bridge> at device 31.0 on pci0
isa0: <ISA bus> on isab0
ahci0: <Intel ICH9M AHCI SATA controller> port 0x8f58-0x8f5f,0x8f54-0x8f57,0x8f48-0x8f4f,0x8f44-0
ahci0: AHCI v1.20 with 4 3Gbps ports, Port Multiplier not supported
ahcich0: <AHCI channel> at channel 0 on ahci0
ahcich1: <AHCI channel> at channel 1 on ahci0
ahcich2: <AHCI channel> at channel 4 on ahci0
acpi_lid0: <Control Method Lid Switch> on acpi0
battery0: <ACPI Control Method Battery> on acpi0
acpi_button0: <Power Button> on acpi0
acpi_acad0: <AC Adapter> on acpi0
acpi_toshiba0: <Toshiba HCI Extras> on acpi0
acpi_tz0: <Thermal Zone> on acpi0
attimer0: <AT timer> port 0x40-0x43 irq 0 on acpi0
Timecounter "i8254" frequency 1193182 Hz quality 0
Event timer "i8254" frequency 1193182 Hz quality 100
atkbd0: <Keyboard controller (i8042)> port 0x60,0x64 irq 1 on acpi0
```

```
atkbd0: <AT Keyboard> irq 1 on atkbd0
kbd0 at atkbd0
atkbd0: [GIANT-LOCKED]
psm0: <PS/2 Mouse> irq 12 on atkbd0
psm0: [GIANT-LOCKED]
psm0: model GlidePoint, device ID 0
atrtc0: <AT realtime clock> port 0x70-0x71 irq 8 on acpi0
Event timer "RTC" frequency 32768 Hz quality 0
hpet0: <High Precision Event Timer> iomem 0xfed00000-0xfed003ff on acpi0
Timecounter "HPET" frequency 14318180 Hz quality 950
Event timer "HPET" frequency 14318180 Hz quality 450
Event timer "HPET1" frequency 14318180 Hz quality 440
Event timer "HPET2" frequency 14318180 Hz quality 440
Event timer "HPET3" frequency 14318180 Hz quality 440
uart0: <16550 or compatible> port 0x3f8-0x3ff irq 4 flags 0x10 on acpi0
sc0: <System console> at flags 0x100 on isa0
sc0: VGA <16 virtual consoles, flags=0x300>
vga0: <Generic ISA VGA> at port 0x3c0-0x3df iomem 0xa0000-0xbffff on isa0
ppc0: cannot reserve I/O port range
est0: <Enhanced SpeedStep Frequency Control> on cpu0
p4tcc0: <CPU Frequency Thermal Control> on cpu0
est1: <Enhanced SpeedStep Frequency Control> on cpu1
p4tcc1: <CPU Frequency Thermal Control> on cpu1
Timecounters tick every 1.000 msec
hdac0: HDA Codec #0: Realtek ALC268
hdac0: HDA Codec #1: Lucent/Agere Systems (Unknown)
pcm0: <HDA Realtek ALC268 PCM #0 Analog> at cad 0 nid 1 on hdac0
pcm1: <HDA Realtek ALC268 PCM #1 Analog> at cad 0 nid 1 on hdac0
usb0: 12Mbps Full Speed USB v1.0
usb1: 12Mbps Full Speed USB v1.0
usb2: 12Mbps Full Speed USB v1.0
usb3: 480Mbps High Speed USB v2.0
ugen0.1: <Intel> at usb0
uhub0: <Intel UHCI root HUB, class 9/0, rev 1.00/1.00, addr 1> on usb0
ugen1.1: <Intel> at usb1
uhub1: <Intel UHCI root HUB, class 9/0, rev 1.00/1.00, addr 1> on usb1
ugen2.1: <Intel> at usb2
uhub2: <Intel UHCI root HUB, class 9/0, rev 1.00/1.00, addr 1> on usb2
ugen3.1: <Intel> at usb3
uhub3: <Intel EHCI root HUB, class 9/0, rev 2.00/1.00, addr 1> on usb3
uhub0: 2 ports with 2 removable, self powered
uhub1: 2 ports with 2 removable, self powered
uhub2: 2 ports with 2 removable, self powered
uhub3: 6 ports with 6 removable, self powered
ugen2.2: <vendor 0x0b97> at usb2
uhub8: <vendor 0x0b97 product 0x7761, class 9/0, rev 1.10/1.10, addr 2> on usb2
ugen1.2: <Microsoft> at usb1
ada0 at ahcich0 bus 0 scbus1 target 0 lun 0
ada0: <Hitachi HTS543225L9SA00 FBEOC43C> ATA-8 SATA 1.x device
ada0: 150.000MB/s transfers (SATA 1.x, UDMA6, PIO 8192bytes)
ada0: Command Queueing enabled
ada0: 238475MB (488397168 512 byte sectors: 16H 63S/T 16383C)
ada0: Previously was known as ad4
```

```
ums0: <Microsoft Microsoft 3-Button Mouse with IntelliEye™, class 0/0, rev 1.10/3.00, addr 2> on
SMP: AP CPU #1 Launched!
cd0 at ahcich1 bus 0 scbus2 target 0 lun 0
cd0: <TEAC DV-W28S-RT 7.0C> Removable CD-ROM SCSI-0 device
cd0: 150.000MB/s transfers (SATA 1.x, ums0: 3 buttons and [XYZ] coordinates ID=0
UDMA2, ATAPI 12bytes, PIO 8192bytes)
cd0: cd present [1 x 2048 byte records]
ugen0.2: <Microsoft> at usb0
ukbd0: <Microsoft Natural Ergonomic Keyboard 4000, class 0/0, rev 2.00/1.73, addr 2> on usb0
kbd2 at ukbd0
uhid0: <Microsoft Natural Ergonomic Keyboard 4000, class 0/0, rev 2.00/1.73, addr 2> on usb0
Trying to mount root from cd9660:/dev/iso9660/FREEBSD_INSTALL [ro]...
```

Ἐπιβεβαιώστε ὅτι ἡ δισκέτη εἶναι ὀρθῶς ἑπισημασμένη ὡς δισκέτη FreeBSD. Ἐάν ἔχετε ἀποτύχει, δοκιμάστε νὰ ἐπισημασθεῖς τὴν δισκέτη ὡς δισκέτη FreeBSD. Ἐάν ἔχετε ἀποτύχει, δοκιμάστε νὰ ἐπισημασθεῖς τὴν δισκέτη ὡς δισκέτη FreeBSD. Ἐάν ἔχετε ἀποτύχει, δοκιμάστε νὰ ἐπισημασθεῖς τὴν δισκέτη ὡς δισκέτη FreeBSD. Ἐάν ἔχετε ἀποτύχει, δοκιμάστε νὰ ἐπισημασθεῖς τὴν δισκέτη ὡς δισκέτη FreeBSD.

Ἐὰν ἐπιτύχετε, τὸ ἀποτέλεσμα τῆς ἐγκατάστασης εἶναι τὸ ἑξῆς:

Ὁδηγία 3-3. Ἀδειάζοντας τὸ δισκέτη ἔκδοσης τοῦ FreeBSD



Ἀδειάζοντας τὴν δισκέτη [Install] ἀποτύχει ἡ ἐγκατάσταση τοῦ FreeBSD.

3.5 Ἐγκατάσταση τοῦ bsdinstall

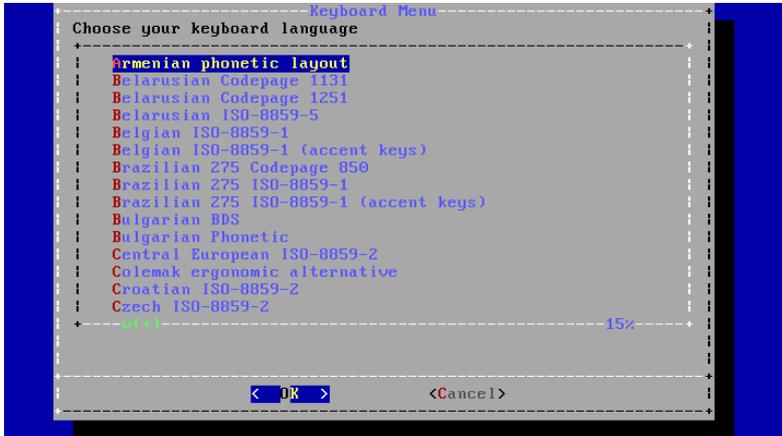
Ὁ `bsdinstall` εἶναι ἡ ἐγκατάσταση τοῦ FreeBSD ἐπὶ τῆς δισκέτης. Ἐάν ἔχετε ἀποτύχει, δοκιμάστε νὰ ἐπισημασθεῖς τὴν δισκέτη ὡς δισκέτη FreeBSD.

Ὁ ὅρος `bsdinstall` ἀναφέρεται εἰς τὸν ὅρο `bsdinstall` ὅπου εἶναι ἡ ἐγκατάσταση τοῦ FreeBSD. Ἐάν ἔχετε ἀποτύχει, δοκιμάστε νὰ ἐπισημασθεῖς τὴν δισκέτη ὡς δισκέτη FreeBSD.

3.5.1 Άδειες Όρους Χρήσης Keymap

Από την στιγμή που θα ξεκινήσει η εγκατάσταση του `bsdinstall` θα σας ζητηθεί να επιλέξετε μια κεντρική διάταξη πληκτρολόγιου. Η επιλογή αυτή θα επηρεάσει τη διάταξη των πλήκτρων που θα χρησιμοποιούνται κατά τη διάρκεια της εγκατάστασης.

Εικόνα 3-4. Διαμόρφωση Κεντρικής Διάταξης Πληκτρολόγιου



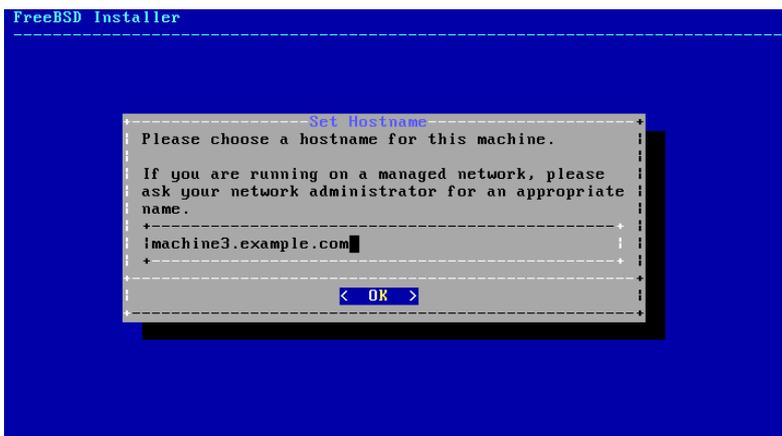
Από την στιγμή που θα ξεκινήσει η εγκατάσταση του `bsdinstall` θα σας ζητηθεί να επιλέξετε μια κεντρική διάταξη πληκτρολόγιου. Η επιλογή αυτή θα επηρεάσει τη διάταξη των πλήκτρων που θα χρησιμοποιούνται κατά τη διάρκεια της εγκατάστασης.

Σημείωση: Η επιλογή του `Esc` είναι η προεπιλεγμένη διάταξη πληκτρολόγιου. Η επιλογή αυτή θα επηρεάσει τη διάταξη των πλήκτρων που θα χρησιμοποιούνται κατά τη διάρκεια της εγκατάστασης. Η επιλογή αυτή είναι η προεπιλεγμένη διάταξη πληκτρολόγιου για το United States of America ISO-8859-1.

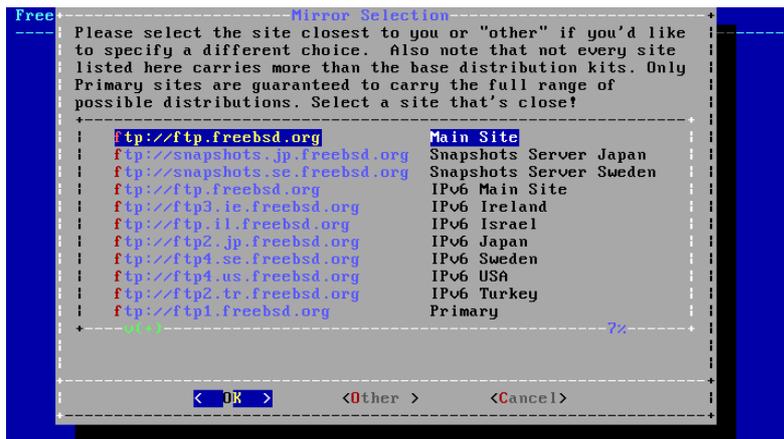
3.5.2 Εισαγωγή του Όνοματος Οποιοσδήποτε (hostname)

Όταν θα ξεκινήσει η εγκατάσταση του `bsdinstall` θα σας ζητηθεί να εισαγάγετε το όνομα του υπολογιστή (hostname) που θα χρησιμοποιείται κατά τη διάρκεια της εγκατάστασης.

Εικόνα 3-5. Εισαγωγή του Όνοματος Οποιοσδήποτε



Ὁ-Πῆ 3-8. Ἀντιγράψου Mirror

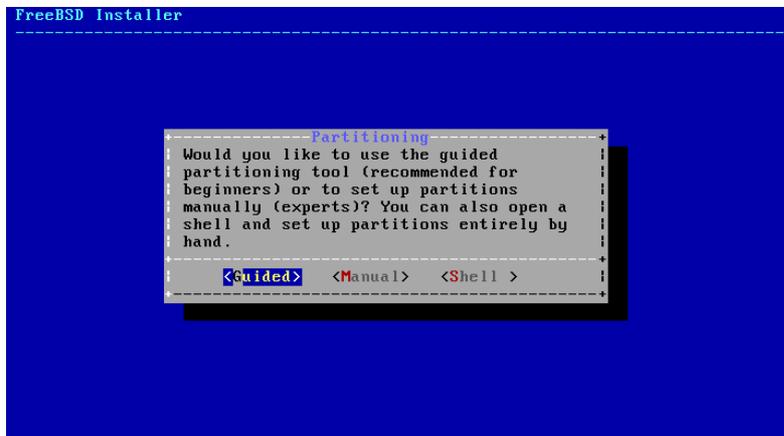


Ἡ ἀντιγράψουσας εἶναι ὁμοῦς ἐπὶ τῶν βασιῶν τοῦ συστήματος εἰς τὸν ἰσοπέδιλο ἄντιγράψου.

3.7 Ἀντιγράψου × ἄντιγράψου Ἀντιγράψου

Ὁ δῶν τῶν ὁμοῦς τοῦ συστήματος εἶναι ὁμοῦς ἐπὶ τῶν ἄντιγράψου τοῦ FreeBSD. Ἰς ὅς ἡ ἄντιγράψου *Guided* (ἑσπερῶς), ἡ εἰσοπέδιλος ἀντιγράψου ἄντιγράψου, ἀπὸ ἡ ὅς ἡ ἄντιγράψου *Manual* (ἑσπερῶς) ἡ δῶν τῶν ἄντιγράψου τῆς ἀντιγράψου ἄντιγράψου ἰσοπέδιλος ἀντιγράψου ἄντιγράψου. Ὅμοῦς, ὁ δῶν τῶν ἀντιγράψου ἰσοπέδιλος ἀντιγράψου ἄντιγράψου ἰσοπέδιλος ἀντιγράψου ἄντιγράψου. Ὅμοῦς, ὁ δῶν τῶν ἀντιγράψου ἰσοπέδιλος ἀντιγράψου ἄντιγράψου ἰσοπέδιλος ἀντιγράψου ἄντιγράψου.

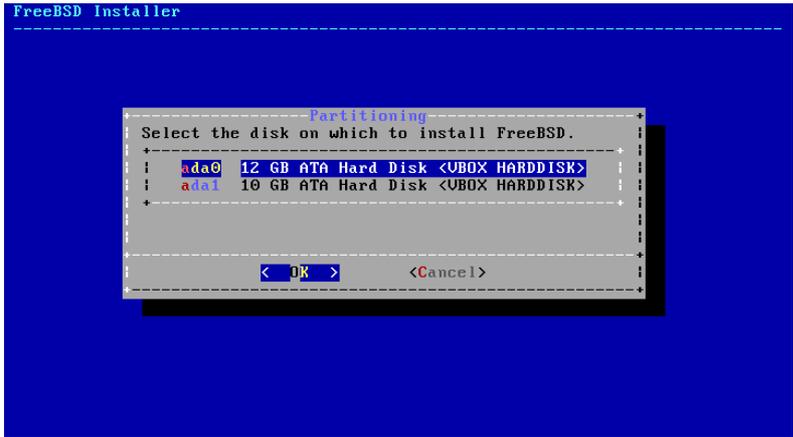
Ὁ-Πῆ 3-9. Ἀντιγράψου Guided P Manual Partitioning



3.7.1 ἑσπερῶς (Guided) ἑσπερῶς

Ἡ ἑσπερῶς ἰσοπέδιλος ἀντιγράψου ἄντιγράψου, ἡ δῶν τῶν ἀντιγράψου ἰσοπέδιλος ἀντιγράψου ἄντιγράψου τοῦ FreeBSD.

Ó÷ Πῖῶ 3-10. Ἀῦῇῇῇ ἁῦῦ Ḃῖῇῇῇῇῇ ἈḂῇῇῇ



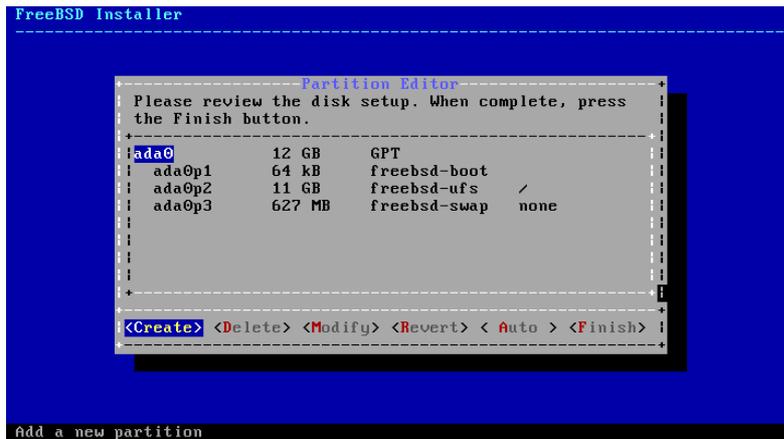
Ἰῶῖῇῇῇῇ ἰῶ ἁῦ÷ ῇῇḂῇῇῇῇ ἁḂῇῇ ἰῇῇῇῇῇ ὁῖ ἁḂῇῇ, ἁḂῇῇ ὕῖῇ ἰῇῇῇῇ ὁῖο ὁῖο FreeBSD. Ἀῖ ἁḂῇῇ ὕῖῇῇῇ [Entire Disk], ἑῶ ἁῖῇῇῇῇῇῇῇ ἰῇῇ ἑῶῶḂῇῇῇῇῇῇ ἁῇḂῇῇῇῇῇ ἑῶῶῇῇῇῇῇ ἁῇῇῇ ἰῶ ÷ ῇῇῇῇῇῇῇῇῇῇῇ ἰῇῇῇῇῇῇ ἰ ἁḂῇῇῇ. Ἀῖ ἁḂῇῇ ὕῖῇῇῇῇ [Partition], ἑῶ ἁῖῇῇῇῇῇῇῇῇ ἰῇῇ ἁῇḂῇῇῇῇ ὁῖο ἑῶ ἑῶῶἁῇῇῇῇῇῇῇ ὁῖῇ ἁῇῇῇῇῇῇ ÷ Ḃῇῇ ὁῖο ἁḂῇῇῇ.

Ó÷ Πῖῶ 3-11. Ἀῦῇῇῇῇ ἰῇῇῇῇῇῇ ἈḂῇῇῇῇῇ Ḃ ἑῶῶḂῇῇῇῇῇ



Ἀῇ ὕῖῇῇῇῇ Ḃῇῇῇῇῇῇῇῇῇ ὁῖ ἁῇḂῇῇῇῇ ὁῖῇ ἑῶῶḂῇῇῇῇῇ ὁῖο ἁῖῇῇῇῇῇῇῇῇ. Ἀῖ ἁῇῇῇῇῇ ἑḂῇῇῇῇ ἑḂῇῇῇ, ἁḂῇῇ ὕῖῇῇῇῇ [Revert] ἁῇῇ ἰῶ ἁḂῇῇῇῇ ὕῖῇῇῇῇ ὁῇῇ Ḃῇῇῇῇῇῇῇῇῇῇ ἑῶῶḂῇῇῇῇῇῇ Ḃ [Auto] ἁῇῇ ἰῶ ἁῖῇῇῇῇῇῇῇῇῇ ὁῇῇ ἑῶῶḂῇῇῇῇῇῇῇ ὁῖο Ḃῇῇῇῇῇῇῇῇῇῇ ἁḂῇῇῇῇῇῇῇ ὁῖῇ FreeBSD. Ἰῶῖῇῇῇῇ ἰῶ ἁῖῇῇῇῇῇῇῇῇῇῇ, ἰῶ Ḃῇῇῇῇῇῇῇῇῇῇ ἑῶῇ ἰῶ ἁῇῇῇῇῇῇῇ ἑῶῶḂῇῇῇῇῇῇῇ ὁῖῇ ἁῇῇῇῇῇῇῇῇ. ¼ῇῇῇ ἰῇῇ ἑῶῶḂῇῇῇῇῇῇ ἁḂῇῇῇ ἰῇ ὁῖῇῇ ὕḂ, ἁḂῇῇ ὕῖῇῇῇῇ [Finish] ἁῇῇ ἰῶ ὁῖῇῇ ÷ Ḃῇῇῇῇ ἰῶ ὁῖῇ ἁῇῇῇῇῇῇῇῇῇῇ.

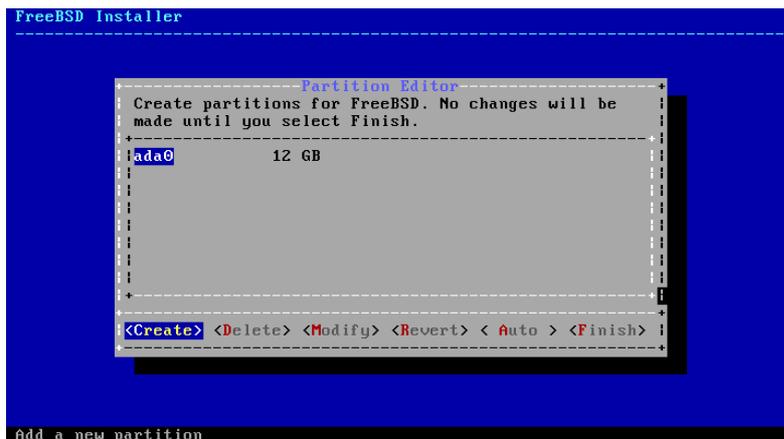
Ὁρ. Πιά 3-12. Ἀνάδοχοι τοῦ ἐλάτου



3.7.2 × ἀνάδοχοι τοῦ ἀνάδοχο ἐλάτου

Ἀνάδοχοι τοῦ ἀνάδοχο ἐλάτου ἀνάδοχοι τοῦ ἀνάδοχο ἐλάτου, ἐπὶ τὸν ἀνάδοχο ἀνάδοχο ὅτι ἀνάδοχο ἀνάδοχο ἐλάτου.

Ὁρ. Πιά 3-13. × ἀνάδοχοι τοῦ ἀνάδοχο ἐλάτου



Ἀνάδοχοι τοῦ ἀνάδοχο ἄνδρα (ada0 ὅτι ἀνάδοχο ἄνδρα) ἐπὶ τοῦ ἀνάδοχο [Create] ἐπὶ τὸν ἀνάδοχο ἄνδρα ὅτι ἀνάδοχο ὅτι ἀνάδοχο ὅτι ἀνάδοχο (partitioning scheme).

Ό-Πιά 3-14. ×άέίέβίçç Άçίέίõñāβā ΈάόάοιΠόάι



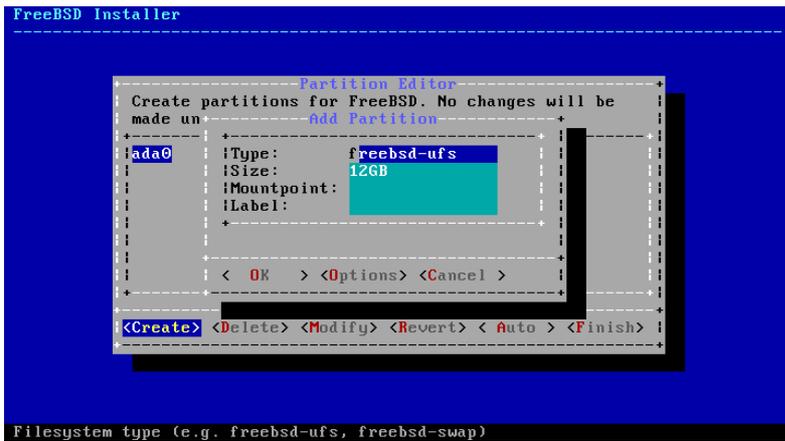
Όί όύόççίά έάόάοιΠόάι GPT άβίάέ όοίΠεùò οί έάόάέέççüóðāñί άέά όά ðñέόóüðāñίòò PC-όοίάάόίγò ððίέίάέόóΰò. Δάέάέüðāñā έάέόίõñāέέΰ όóóðΠιάόά āāί άβίάέ όοίάάóΰ ίά όç ίΰέίāί GPT έάέ ðñέΰάέίίόάέ έάόάοιΠόάέò óýðίò MBR. Όά ððüέέðā άβāç έάόάοιΠόάι ðñçóέίίðίέίίόάέ όā ðāέέΰ Π ίç-όóίçέέóίΰίά όóóðΠιάόά ððίέίάέóóðί.

Ðβίάέάò 3-1. Έάóçāññāò ΈάόάοιΠόάι

Όóíðññāñāóβā	Ðñέέññāóð
APM	Apple Partition Map, ðñçóέίίðίέίáβóáέ όóί PowerPC® Macintosh. (http://support.apple.com/kb/TA21692)
BSD	ΈάόάοιΠόάέò BSD ðññβò MBR, ñέóóίΰίáò öññΰò έάέίίόάέ έάέ "áðέέβίáóíá áöíóέüΰίç έáðΰόάόç". Άáβòā οί bsdlabel(8).
GPT	Ðβίάέάò ΈάόάοιΠόάι GUID. (http://en.wikipedia.org/wiki/GUID_Partition_Table)
MBR	Master Boot Record. (http://en.wikipedia.org/wiki/Master_boot_record)
PC98	ÐñāáέέāāΠ οίò MBR ðίò ðñçóέίίðίέίáβóáέ όā ððίέίάέóóΰò NEC PC-98. (http://en.wikipedia.org/wiki/Pc9801)
VT0C8	Volume Table Of Contents, ðñçóέίίðίέίáβóáέ όóá Sun SPARC64 έάέ UltraSPARC.

ΰáòΰ όç äçίέίõñāβā οίò ó-Πιάóíò έάόάοιΠόάι, áί áðέέΰίáòā ίáíΰ [Create] έá äçίέίõñāΠόάóā ίΰáò έάόάοιΠόάέò.

Ό-Πιά 3-15. ×άέιέβίçòç ÄçιέιõñāßÁ ÉάόάοιΠόάι



Ç οδδιδιέçíΰίç äέέάδΰόδός FreeBSD ιά ÷ñΠόç GPT äçιέιõñāßÁ οϊοεΰ÷έόοιí ðñάέδ έάόάοιΠόάέδ:

Όδδιδιέçíΰίçò FreeBSD GPT ÉάόάοιΠόάέò

- freebsd-boot - Ì έπαέέάδ άέέβίçòçδ οϊο FreeBSD. Ç έάδΰοιçòç άòðΠ ðñΰðάέ ίά άβίάέ ç ðñΠòç οοι άβóέι.
- freebsd-ufs - Όýóóçιά άñ÷άβιι FreeBSD UFS.
- freebsd-swap - ×πñιò swap FreeBSD.

Ìðñāβòά ίά äçιέιõñāβóάά ðñέάðεΰ óóóðιάόά άñ÷άβιι. Εΰðιέιέ ÷ñΠόδòð ðñιòειιýί óç äçιέιõñāßÁ ðιι ðñāñáιτòέάεπí έάόάοιΠόάι ιά ÷ñπéóòΰ óóóðιάόά άñ÷άβιι áέά óά /, /var, έάέ /usr.

Άάβòά οϊ gpart(8) áέά ðεΠñç έβóóά ðιι áέάέΰóέιι ðýðιι έάόάοιΠόάι GPT.

Ìðñāβòά ίά áέóΰάάò οϊ ιΰάάειò ιά óç άñΠεάέά έιέπí óòιòñáýóάι: *K* áέά kilobytes, *M* áέά megabytes, *G* áέά gigabytes.

Όδύάάέιç: Ç έάέýðάñç áðύáιòç áðéòðä÷ΰιáóáέ ιά áðéòñΰιιέóç ðιι ðñΰιι οϊò άβóέιò (sector alignment). Ç óóóðΠ áðéòñΰιιέóç áðéòðä÷ΰιáóáέ ιά óç äçιέιõñāßÁ έάόάοιΠόάι ιά ιάάΰέç ðñέέáðεΰóέά ðιι 4K bytes óά ιάçāιýò ðιο ÷ñçóέιιðιέιýί ðιιáβò ðιι 512 bytes Π 4K-byte. Óά ááίέέΰò áñáιιΰò, ç ÷ñΠόç έάόάοιΠόάι ιά ιάáΰέç ðñέέáðεΰóέά οϊò 1Π άέυιá έάέ 1G άβίάέ ï áðéιéüðñιò ðñüðιò ίά áðéáááέβóιòιá υòé εΰεά έáóΰοιçò ίáέέίΰ óά æðāü ðñέέáðεΰóέί ðιι 4É. Ιέá áιáβñáóç: óçι ðññιýóά óóέáιΠ ç έáóΰοιçò freebsd-boot ááι ιðñāß ίá άβίάέ ιάááέýðάñç ðιι 512É éüáι ðññέιñέóιπí οϊò έπαέέά άέέβίçòç.

Óά εΰεά έáóΰοιçò ðιò ðññέΰ÷άέ óýóóçιά άñ÷άβιι, ÷ñάέΰæáóáέ ΰιá óçιáβι ðñιòΰñòçòçð. Áί ÷ñçóέιιðιέçèáβ ιιιí ιέá έáóΰοιçò UFS, οϊ óçιáβι ðñιòΰñòçòçð εá άβίáέ ç /.

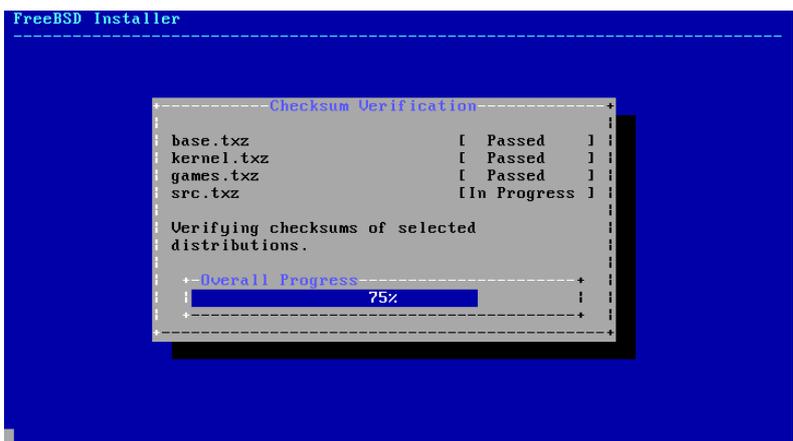
εά óáð æçòçéáβ áðβóçð ιέá áðéέΰóά (label). Ç áðéέΰóά áβίáέ ΰιá υññá οϊ ιðιβι áβίáóáέ óά ιέá έáóΰοιçòç. Óι υññá áιüð άβóέιò Π ιέ áñέέιβ ðιò ðññέáñΰοιòι óéð έáóóòιΠόάέð ιðñāß ίá áέεΰιòι áι ι άβóέιò óòιááéáβ óά ΰέεç εýñá Π áéááéðΠ, áέεΰ ç áðéέΰóά οϊò ðññáιΰιáέ óóáéáñΠ. Ιά ÷ñΠόç óçð áðéέΰóáð óά άñ÷άβι υðòð οϊ /etc/fstab οϊ óýóóçιά áβίáóáέ ðεí áíáéðééü óά áέéááΰò οϊò óéééιý. Ιέ áðéέΰóáð GPT áιòáιβæιιòáέ óóιι έáóΰειáι /dev/gpt/ υòáι áβίáóáέ ç ðñιòΰñòçòç óçð óóóéáðΠð. Óά ΰέéá áβáç έáóóòιΠόάι ððΰñ÷ιòι áéáóιñáðéέΰò áοιáóυòçðáð υοι áοιñΰ óéð áðéέΰóáð, ιέ ιðιβáð áιòáιβæιιòáέ óά áéáóιñáðéέΰò ðñιέáðáέυιáιòð óοι /dev/.

Ό :- Πία 3-17. λᾶδᾶῦñδὺός Ἀñ :- ᾶβὺί Ἄἄέαδὺόδός



Όδς όοίΥ :- ᾶέά, έά ᾶβίᾶέ Υέᾶᾶ :- ῶδ ᾶέᾶᾶέῦδόςδᾶδ όὺί ᾶñ :- ᾶβὺί ᾶἄέαδὺόδόςδ ᾶέά ίᾶ ᾶδᾶᾶᾶᾶέῦδᾶβ ῦδᾶ ᾶᾶί Υ :- ῖοί ᾶέῖῖῖῖῖῖῖῖ ᾶᾶόὺ ός λᾶδᾶῦñδὺός Π ᾶᾶόὺ όςί ᾶίὺᾶῖῖῖῖ ᾶδὺ όῖ ῖΥοί ᾶἄέαδὺόδόςδ.

Ό :- Πία 3-18. ἌδᾶῖΠᾶᾶός Ἀñ :- ᾶβὺί Ἄἄέαδὺόδός



Όοί όᾶᾶόδᾶβῖ ᾶΠία, όᾶ ᾶδᾶᾶᾶᾶᾶᾶᾶῖΥίᾶ ᾶñ :- ᾶβᾶ ᾶἄέαδὺόδόςδ έᾶ ᾶῖᾶ :- ῖίῖί έᾶέ έᾶ ᾶᾶᾶῖῖῖ όοῖ όᾶῖῖῖ ᾶβᾶῖ.

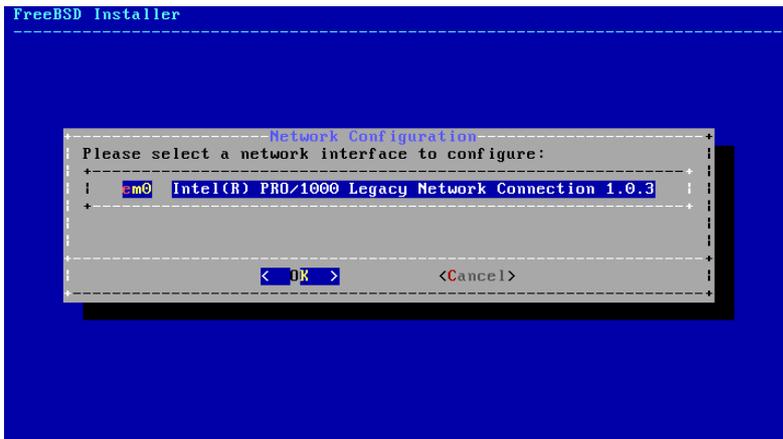
Σε αυτό το δίσκο οι διατάξεις και οι οδηγίες του δίσκου είναι ελαστικές.

3.9.2 Σύστημα Έκδοσης Άετοιμάσι

Όχι-μόνο: Σε σύστημα που ελέγχεται με τον τρόπο αυτό, η διαταγή bootonly θα χρησιμοποιηθεί.

Αν θέτε να εγκαταστήσετε το σύστημα, τότε θα χρησιμοποιηθεί η διαταγή bootonly.

Ορίστε το 3-21. Άετοιμάσι για Άετοιμάσι



3.9.2.1 Σύστημα Ασύρτησης Έκδοσης Άετοιμάσι

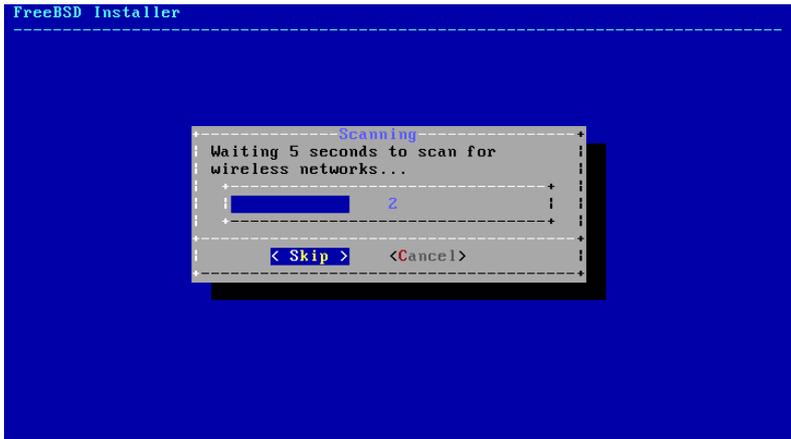
Αν θέτε να εγκαταστήσετε το σύστημα, τότε θα χρησιμοποιηθεί η διαταγή bootonly, η οποία θα χρησιμοποιηθεί για να εγκαταστήσει το σύστημα.

Οι ασύρτητες εκδόσεις του συστήματος χρησιμοποιούν τον Service Set Identifier (SSID). Οι SSID ορίζονται από τον κωδικό πρόσβασης και τον κωδικό πρόσβασης.

Οι διατάξεις του συστήματος εκδόσεων του συστήματος είναι οι διατάξεις που χρησιμοποιούνται για να εγκαταστήσουν το σύστημα. Οι διατάξεις του συστήματος είναι οι διατάξεις που χρησιμοποιούνται για να εγκαταστήσουν το σύστημα.

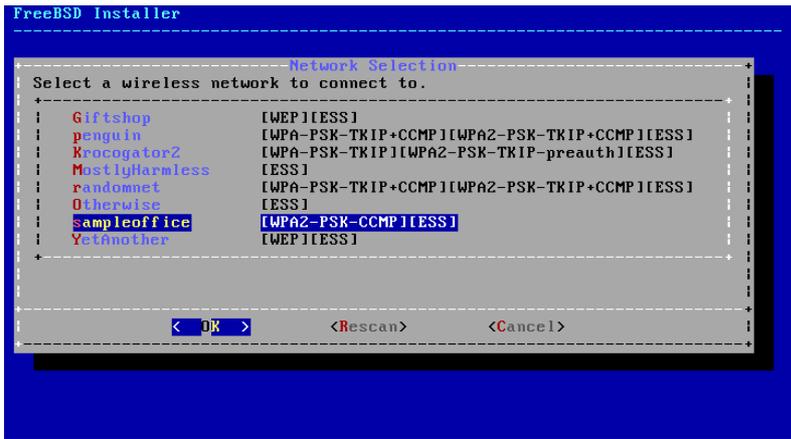
Οι διατάξεις του συστήματος είναι οι διατάξεις που χρησιμοποιούνται για να εγκαταστήσουν το σύστημα. Οι διατάξεις του συστήματος είναι οι διατάξεις που χρησιμοποιούνται για να εγκαταστήσουν το σύστημα.

Ό-Πιά 3-22. Όΰñòç áέα Access Points



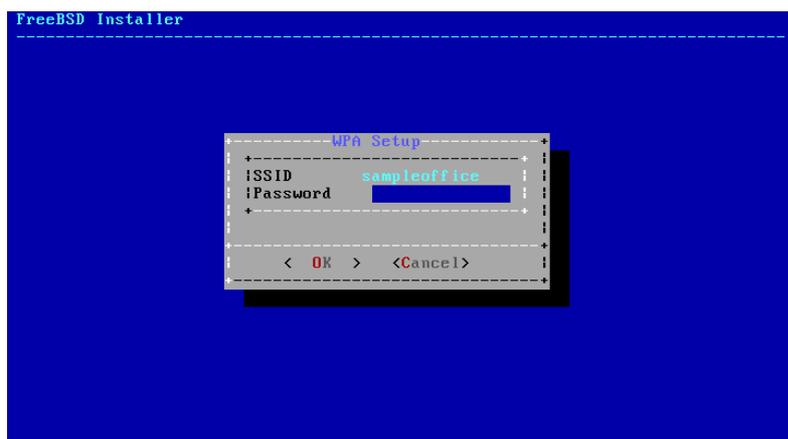
Όά SSIDs θιρ έά άñάβόά έάόΰ όç äέΰñέάέ όçδ όΰñòçδ όθñääΎίόάέ áδñ όά άβαç έñòθδññΰόççδ θιρ áέαόβέάίόάέ áέα έΰεά άβέόθι. Άί άάί äέΎθάόά όι SSID θιρ άðέέθιάβόά όδç έβόόά, άðέέΎίόά [Rescan] áέα ίά äέόäέΎόάόά όç όΰñòç ίάίΰ. Άί άίάέιθιόέάβόά ίά ίç äέΎθάόά όι άðέέθιçóü άβέόθι, äέΎθίόά όçί έάñάβά áέα όð-úí θñíäέΠιάόά Π ΙάόάέίΠόόά όιθ όθιέιäέόόð ðεί έιθόΰ όθι όçίάβι θñüόάόçδ. Ιά äέόäέάβόά ίΎά όΰñòç Ιάόΰ áδñ έΰεά äέέάάΠ.

Ό-Πιά 3-23. ΆðέέιäΠ Άόγñíáόιθ Άέέόγίθ



Ιάόΰ όçί άðέέιäΠ όιθ άόγñíáόιθ άέέόγίθ, έά θñΎθάέ ίά äέόΰääόά όέó ðέçññιθññβάδ θιρ ό-άόβέίόάέ Ιά όçί έñòθδññΰόççδ. Όά άβέόόά WPA2 ð-ñäέΰäέόάέ ίά äπόάόά Ιüí Ύίά έüäέέü θñüόάόçδ (άñόόü ðò Pre-Shared Key Π PSK). Άέα έüäιθό άόόάέάβáð, ίέ ð-άñäέðΠñáð θιρ ðέçέóñιέññääβόά όθι ðääβι äιόάίβέίίόάέ ðò άόόάñβόέίέ.

Ó ð̄ Ɉĩá 3-24. Ñýèĩéóç WPA2

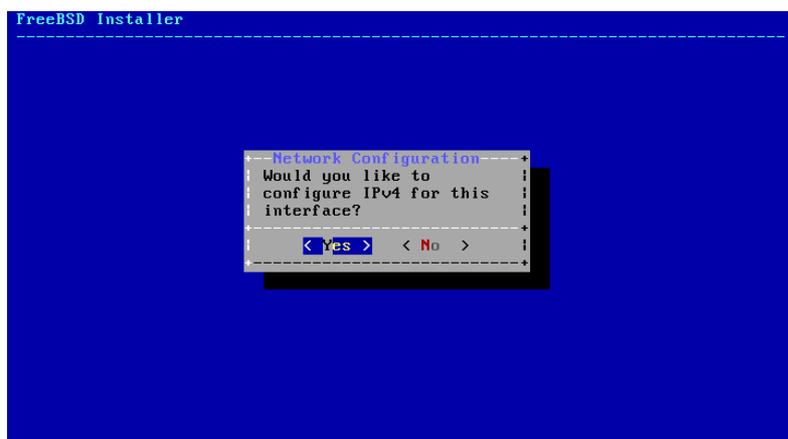


ÌáóÚ óçĩ áóééĩã òĩò áóγñĩáíóĩ áééóγĩò εεέ óçĩ áéóáãũã ðũĩ ðεçñĩòĩñéπĩ óýĩááóçð, ç ááéáóÚóóóç óóĩá ð̄ Òæáóáé Ìá óç ñýèĩéóç ðũĩ ððũèĩéðũĩ ðáñáĩ Ýóñũĩ òĩò áééóγĩò.

3.9.2.2 Ñýèĩéóç Άééóγĩò IPv4

ΆóééÝĩóá áĩ εá ð̄ ñçóèĩðĩéçéáß áééóγũóç IPv4. Ðñũèáéóáé áéá òĩ ðéĩ óóĩçééóĩÝĩĩ áßáĩò óýĩááóçð.

Ó ð̄ Ɉĩá 3-25. Άóééĩã Òééóγũóç IPv4



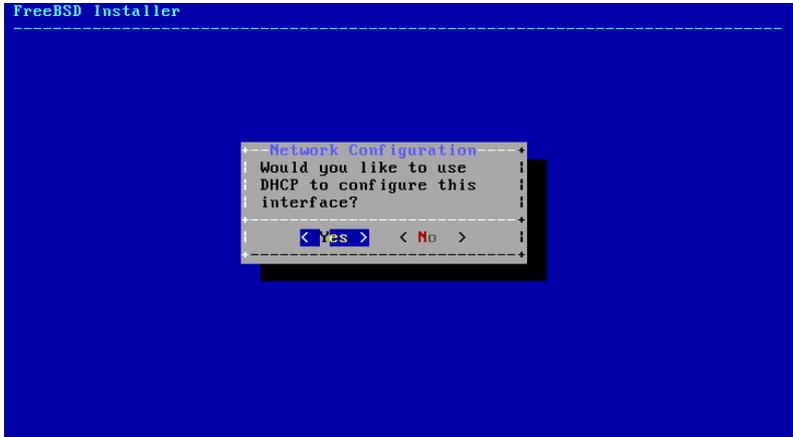
ÓðÛñ ð̄ĩóĩ äγĩ ÌÝèĩãĩé ñýèĩéóçð òĩò IPv4. ÌÝóũ òĩò DHCP ç ñýèĩéóç óçð áéáðáóðð ãßĩáóáé áóðũĩáóá. Άðòð áßĩáé εεέ ç óóĩéóðπĩáĩç ÌÝèĩãĩò. Ç ñýèĩéóç Static áðáéóáß ð̄ áéñĩêßĩçðç áéóáãũã ð̄ ðεçñĩòĩñéπĩ áééóγĩò.

Óçĩáßũóç: Ìç áÛéáóá ðð ð̄ áßáò ñóèĩßóáéò áééóγĩò, εεéðð ááĩ εá εáéóĩòñãðóĩóĩ. Èá ðñÝðáé Ìá éÛááóá ðéò ðεçñĩòĩñãáò ðĩò áĩáóÝñĩĩóáé óóĩ Òĩðĩá 3.3.3 áðũ òĩĩ áéá ð̄ áéñéóðð ð ðĩĩ ðáñĩ ð̄ Ýá òĩò áééóγĩò óáò.

3.9.2.2.1 Νύεϊέος Άέέόγϊδ IPv4 ιΎού DHCP

Άί έάέΎόάά άιδςάόδδ DHCP, άέέΎίδ [Yes] άέά ίά ηδδβόάά άόδιιάόά όςί έέάδδδ έέέόγϊδ.

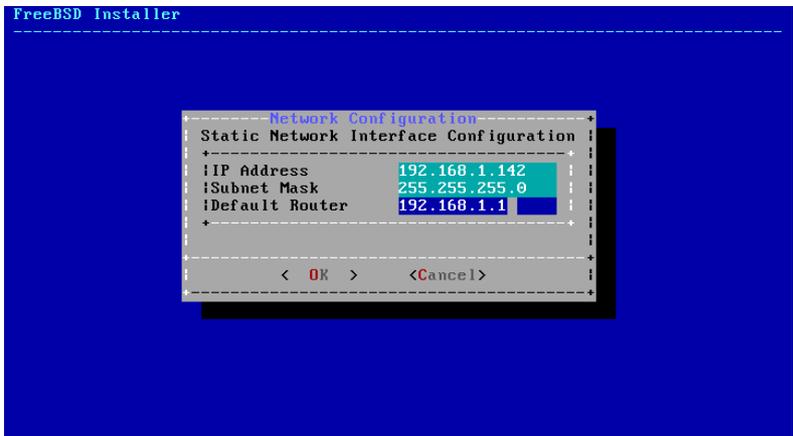
ΌϢ Πιά 3-26. ΆέέΎίδ Νύεϊέος IPv4 ιΎού DHCP



3.9.2.2.2 Óάάέέδ Νύεϊέος Άέέόγϊδ IPv4

ς όάάέέδ ηύεϊέος όςδ έέάδδδδ έέέόγϊδ, άδάέδδβ ίά έέόΎάάά έΎδρεάδ δςςηιιηβδδ όϢ άδέέΎ ίά δι IPv4.

ΌϢ Πιά 3-27. Óάάέέδ Νύεϊέος IPv4



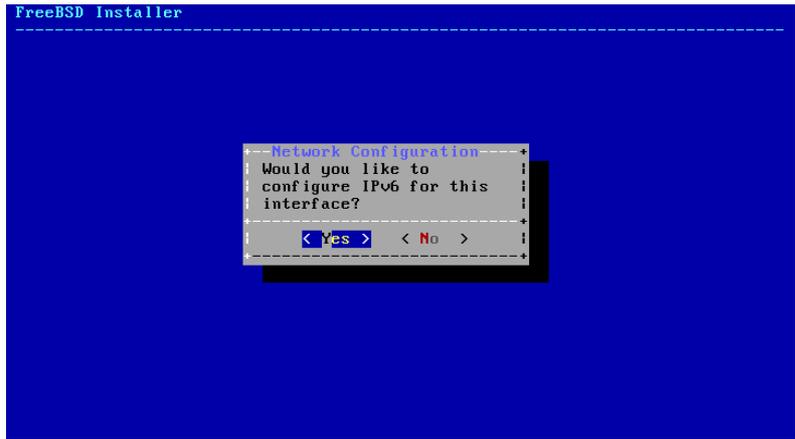
- IP Address - ϸ έέάγέδϊός IP διϊ έά έέόΎάάά Ϣ άέηέβςδά όά άόδδ όη δδρεϊάέόδ. ϸ έέάγέδϊός άόδδ δηΎδάέ ίά άβίάέ ηάάέέδ έάέ ίά ιςί Ϣ ηςόέηδρεάβδάέ άδδ ιδρεϊαδδδΎά Ύέεϊ ις Ϣ Ύςϊά όδδ όδέέδδ όάδ άβέδδδ.
- Subnet Mask - ϸ ιΎόέά δδρεέέόγϊδ διϊ Ϣ ηςόέηδρεάβ δδ όδδέέδδ όάδ άβέδδδ. ÓδδέέΎ άόδδ άβίάέ 255.255.255.0.

- Default Router - Ο προεπιλεγμένος IP διανομέτης είναι ο προεπιλεγμένος. Ορίστε το κατά προτίμηση με τον προεπιλεγμένο IP διανομέτη ή τον ορισμένο IP διανομέτη για το Internet. Είναι επίσης δυνατό να οριστεί ως default gateway (προεπιλεγμένη διαδρομή).

3.9.2.3 Ρύθμιση IPv6

Οι IPv6 είναι ιαίτερα εύκολοι να ρυθμιστούν. Απλά επιλέξτε να εγκαταστήσετε IPv6 και θα εγκατασταθεί αυτόματα, συμπεριλαμβανομένης της επιλογής [Yes] ή [No].

Εικόνα 3-28. Ρύθμιση IPv6

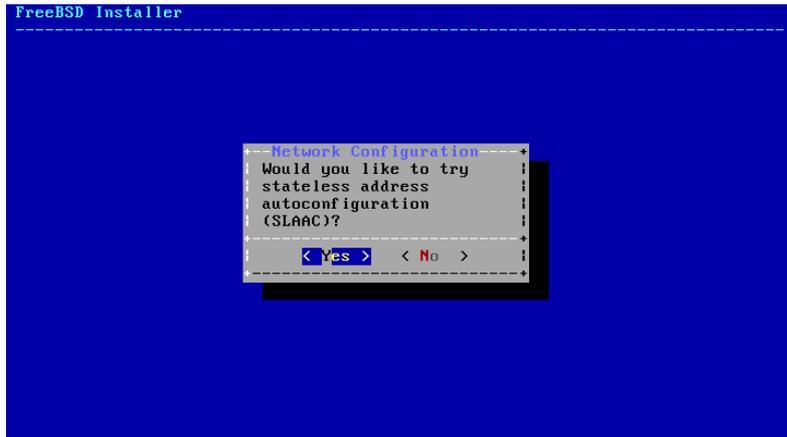


Οι IPv6 είναι επίσης δυνατές με SLAAC, ή Stateless Address AutoConfiguration, που είναι ο τρόπος με τον οποίο ο υπολογιστής μπορεί να λάβει αυτόματα μια διεύθυνση IPv6. Ο ρόλος της Static διεύθυνσης είναι να οριστεί ως προεπιλεγμένη διεύθυνση.

3.9.2.3.1 IPv6 Stateless Address Autoconfiguration

Οι SLAAC διεύθυνσεις είναι ο τρόπος με τον οποίο οι υπολογιστές λαμβάνουν αυτόματα μια διεύθυνση IPv6. Ο ρόλος της Static διεύθυνσης είναι να οριστεί ως προεπιλεγμένη διεύθυνση. Το RFC4862 (<http://tools.ietf.org/html/rfc4862>) είναι ο τρόπος με τον οποίο ο υπολογιστής λαμβάνει μια διεύθυνση.

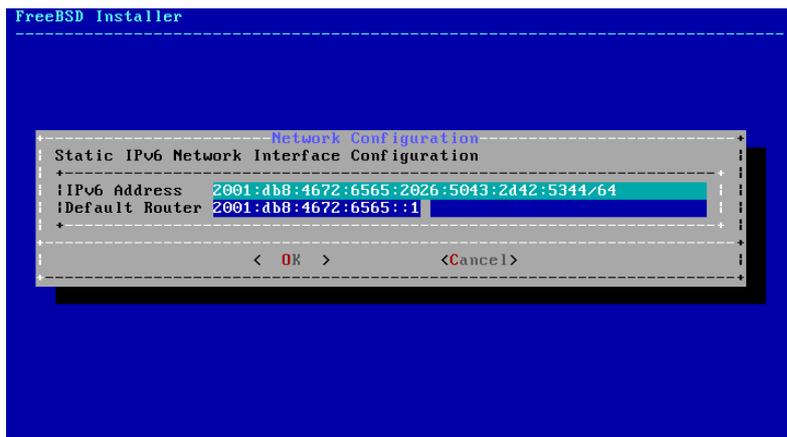
Ό÷Πιά 3-29. ΆδéeΎíσά Νύέιέος IPv6 SLAAC



3.9.2.3.2 ΌδάέέεΠ Νύέιέος Άέέόγέδ IPv6

Ç όδάέέεΠ ηύέιέος όçδ όέάδáoΠδ όέέδγíδ όδί IPv6, άδάέόάβ όçí ÷ άέñíέβίçδç άέόάüãΠ έÜθίέüí ñðèìβόáüí.

Ό÷Πιά 3-30. ΌδάέέεΠ Νύέιέος IPv6

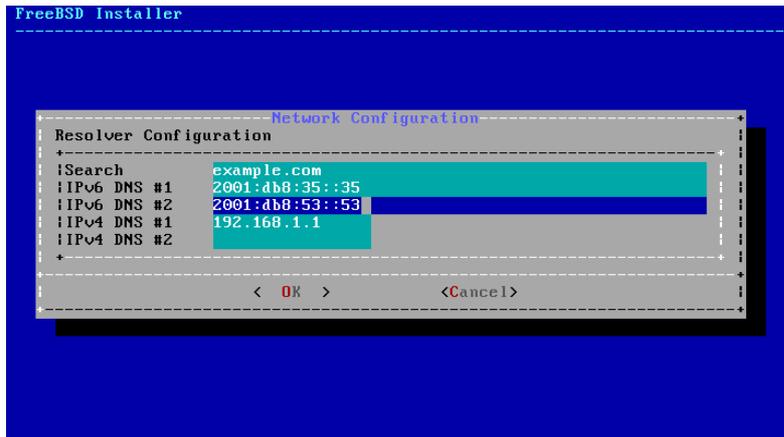


- IPv6 Address - Ç áέáýέδίοç IP θéδ έά άέóÜάάδä ÷ άέñíέβίçδä óά άδδü όí δθίέíάέόδΠ. Ç áέáýέδίοç άδδΠ δñΎδáέ íά άβίάέ ííάáέéΠ έάέ íá ίçí ÷ ñçóέííθíέáβδάέ άδδ έάíΎíά Üέέí ίç ÷ Üίçíά όδí όíθέéü óád άβέδδθí.
- Default Router - Ç IPv6 áέáýέδίοç όíθ δñíάδééääíΎíθ äññíέíάçδΠ áέά όí άβέδδθí óád. ΌθíΠέüδ άβίáέ ç áέáýέδίοç όíθ äññíέíάçδΠ Π Üέέíθ άέέδδάέíç áñíθέέόíçθ θéδ όθíáΎáέ όí όíθέéü óád άβέδδθí íä όí Internet. Έά όç äáβδä άδβδçδ íá áíáóΎñάδáέ üδ default gateway (δñíáδééääíΎíç θýçç).

3.9.2.4 Ρύθμιση του DNS

Η Domain Name System (Όνομασία Ιντερνέτ Όνγια) ή DNS είναι η διαδικασία διερεύνησης ονομάτων σε ένα δίκτυο και η απόδοσή τους σε IP διευθύνσεις. Η διαδικασία αυτή γίνεται με τη βοήθεια των DNS servers. Η διαδικασία αυτή γίνεται με τη βοήθεια των DNS servers. Η διαδικασία αυτή γίνεται με τη βοήθεια των DNS servers.

Εικόνα 3-31. Ρύθμιση DNS



3.9.3 Ρύθμιση του Αρχιτεκτονικού

Η ρύθμιση του αρχιτεκτονικού γίνεται με τη βοήθεια των DNS servers. Η διαδικασία αυτή γίνεται με τη βοήθεια των DNS servers. Η διαδικασία αυτή γίνεται με τη βοήθεια των DNS servers.

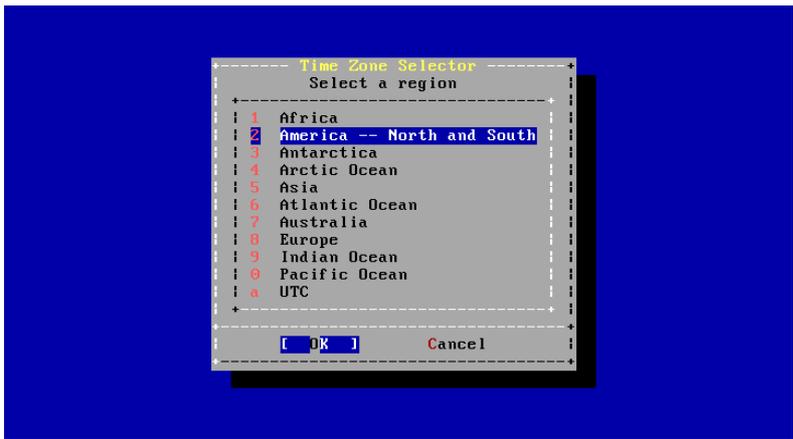
Η διαδικασία αυτή γίνεται με τη βοήθεια των DNS servers. Η διαδικασία αυτή γίνεται με τη βοήθεια των DNS servers. Η διαδικασία αυτή γίνεται με τη βοήθεια των DNS servers.

Ὁ Διάγραμμα 3-32. Ἀεὶδὴσὸς UTC ἰσοχρονίου



Ἀεὶδὴσὸς [Yes] ἢ [No] ἀποκρίσει ἂν ὁ ὅτι δὴ ἀβίασὸς πῶς ἐστὶν ἡ ἰσοχρονία τοῦ ἰσχυρισμοῦ ἐὰν δὲ ἴσως ἐστὶν ἐπιβεβαιωθῆσθε ὅτι ἡ ἰσοχρονία τοῦ ἰσχυρισμοῦ ἐστὶν ἰσοχρονία ἢ UTC ἢ ἄλλο, ἀεὶδὴσὸς [No] ἀεὶ ἰσοχρονία ὅτι ἰσοχρονία ἢ ἀβίασὸς ἐὰν ὁ ὅτι ὁ ἰσοχρονίου.

Ὁ Διάγραμμα 3-33. Ἀεὶδὴσὸς ἰσοχρονίου



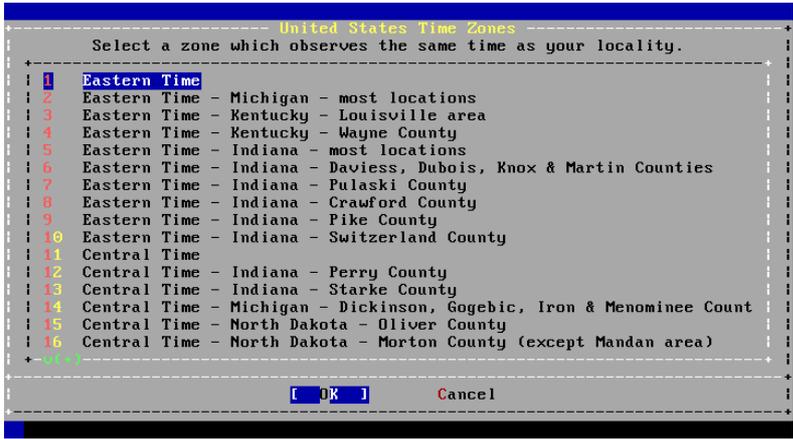
Ἀεὶδὴσὸς ὅτι ὁ ἰσοχρονίου ἰσοχρονίου ἢ ἄλλο ἰσοχρονίου ἐὰν δὲ ἴσως ἐστὶν ἐπιβεβαιωθῆσθε ὅτι ἡ ἰσοχρονία τοῦ ἰσχυρισμοῦ ἐστὶν ἰσοχρονία ἢ UTC ἢ ἄλλο, ἀεὶ ἰσοχρονία ὅτι ἰσοχρονία ἢ ἀβίασὸς ἐὰν ὁ ὅτι ὁ ἰσοχρονίου.

Όχι Πιά 3-34. Άδειες Όσωσης × πñάο



Άδειες Όσωσης ός ουόδπ ÷ πñά ÷ ñçóεññðιερίόάο όά άάεΰέέα έάέ δέΎόά Enter.

Όχι Πιά 3-35. Άδειες Όσωσης Αρίχο ζñάο



Άδειες Όσωσης ός ουόδπ αρίχο πñάο ÷ ñçóεññðιερίόάο όά άάεΰέέα έάέ δέΎόά Enter.

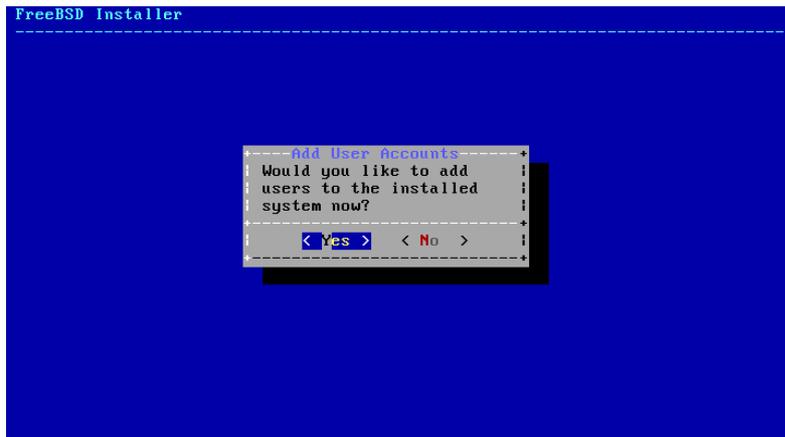
- powerd - ἡ ἐπιλογή τοῦ ὁριζόμενου ἄξιο ἔχει ὡς ἀποτέλεσμα τὴν ἐπιλογή τοῦ ὁριζόμενου ἄξιο.

3.9.5 Ἐπιλογή τοῦ ὁριζόμενου ἄξιο

Ἐπιλέγετε τὸν ὁριζόμενον ἄξιο τῆς ἐγκατάστασης τοῦ FreeBSD 9.x, ὁ ὁριζόμενος ἄξιο ἐπιλέγεται ὡς ὁριζόμενος ἄξιο ἐπιλέγεται ὡς ὁριζόμενος ἄξιο. Ἐπιλέγετε τὸν ὁριζόμενον ἄξιο τῆς ἐγκατάστασης τοῦ FreeBSD 9.x, ὁ ὁριζόμενος ἄξιο ἐπιλέγεται ὡς ὁριζόμενος ἄξιο. Ἐπιλέγετε τὸν ὁριζόμενον ἄξιο τῆς ἐγκατάστασης τοῦ FreeBSD 9.x, ὁ ὁριζόμενος ἄξιο ἐπιλέγεται ὡς ὁριζόμενος ἄξιο.

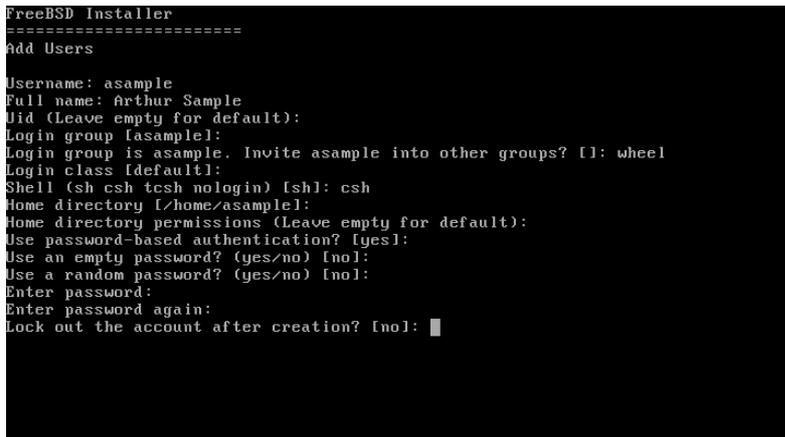
Ἐπιλέγετε τὸν ὁριζόμενον ἄξιο [Yes] ἢ τὸν ὁριζόμενον ἄξιο [No] τῆς ἐγκατάστασης τοῦ FreeBSD 9.x.

Ὁ ἄξιος 3-38. Ἐπιλογή τοῦ ὁριζόμενου ἄξιο



Ἐπιλέγετε τὸν ὁριζόμενον ἄξιο τῆς ἐγκατάστασης τοῦ FreeBSD 9.x, ὁ ὁριζόμενος ἄξιο ἐπιλέγεται ὡς ὁριζόμενος ἄξιο.

Ὁ ἄξιος 3-39. Ἐπιλογή τοῦ ὁριζόμενου ἄξιο



Ἐπιλογή τοῦ ὁριζόμενου ἄξιο

- Username - Οἶ úñá οἶο έά ÷ñçóεἷθἰέάβ ἰ ÷ñÐóδóς áέά ίά áέóΥέέάέ οóἰ óγóδçíá. ΟδδέέΥ οἶ δñþοἶ áñΥúá οἶο ίέέñý ἰúúáδἰò óά óάíáóáóúἰ ίά οἶ áðβέáðἰ.
- Full name - Οἶ δḗÐñáð úñá οἶο ÷ñÐóδç.
- Uid - User ID. Ἱ áíááññέóδέέúð áñέέúð ÷ñÐóδç. ΟἶÐεὺð ááí óðἰðέçñþἰóἰά áóðú οἶ δάáβἰ, þóðá ίά áðέέáááβ áððúúáóá Υἰάð áñέέúð áðú οἶ óγóδçíá.
- Login group - Ç ñΥáά óδçἰ ἰðἰβá áíÐεáέ ἰ ÷ñÐóδçð. ΟἶÐεὺð οἶ áðþἰóἰά έáἰú þóðá ίά áβίáέ áðἰááέðÐ ç δñἰáðέέáñΥἰç óέἰÐ.
- Invite user into other groups? - Ἀðέδñúóέáðáð ñΥáάð ÷ñçóðἰ óδέð ἰðἰβáð εΥέἰóἰά ίά áíÐεáέ ἰ ÷ñÐóδçð.
- Login class - ΟἶÐεὺð ááí óðἰðέçñþἰóἰά áóðú οἶ δάáβἰ, þóðá ίά áβίáέ áðἰááέðÐ ç δñἰáðέέáñΥἰç óέἰÐ.
- Shell - Οἶ εΥέóóἰð οἶο έά ÷ñçóεἷθἰέάβ ἰ óðáέáñέἰΥἰò ÷ñÐóδçð. Οἶð δάνΥááέáἰά ίáð áðέέΥἰáἰά οἶ csh(1).
- Home directory - Ἱ δñἰóúðέέúð έáðΥέἰáð οἶο ÷ñÐóδç. Ç δñἰáðέέáñΥἰç óέἰÐ áβίáέ óἰÐεὺð ç óúòðἰ.
- Home directory permissions - Ὢά áέέάέþἰάóá óἰἰ έáðΥέἰáἰ οἶο ÷ñÐóδç. Ὢά δñἰáðέέáñΥἰά áβίáέ óἰÐεὺð óúòðἰ.
- Use password-based authentication? - Η δððέέÐ áðΥἰóççç áβίáέ "yes".
- Use an empty password? - Ç δððέέÐ áðΥἰóççç áβίáέ "no".
- Use a random password? - Ç δððέέÐ áðΥἰóççç áβίáέ "no".
- Enter password - Ἱ έùáέέúð δñúóááóçð áέά οἶ óðáέáñέἰΥἰἰ ÷ñÐóδç. Ἀáí óáβἰáóáέ óδçἰ ἰέúἰç έáεþð οἰἰ ðέçέðñἰέἰáἰά.
- Enter password again - Ἱ έùáέέúð δñΥἰάέ ίά áέóá÷έáβ Υέέç ἰέά óἰἰ ἰέά áðέááááβúóç.
- Lock out the account after creation? - Ç δððέέÐ áðΥἰóççç áβίáέ "no".

Ἀóἰý áέóΥááóá úεáð δέð δέçñἰóἰñβáð, έá ááβóá ἰέά δññβέççç οἶòð έáέ οἶ óγóδçíá έá óáð ñððÞóáέ áέά δçἰ ἰñεúðçðά οἶòð. Ἀί εΥἰáðá εΥἰέἰε εΥέἰð έáðἰ δç áέΥñέάέá δçð áέóááñáÞð, áñΥððá ñó έáέ ἰáἰáðñἰóðáεÞðá. Ἀί úέá áβίáέ óúóðἰ, áñΥððá yes áέά ίά ççἰέἰðñáÞóáðá οἶ ἰΥἰ ÷ñÐóδç.

Ο÷ Þἰά 3-40. ἰñἰò áðú δç Ἀέá÷áβñέóç ×ñçóðἰ έάέ ἰñἰáñἰ

```

Login group [asample]:
Login group is asample. Invite asample into other groups? [I]: wheel
Login class [default]:
Shell (sh csh tcsh nologin) [sh]: csh
Home directory [/home/asample]:
Home directory permissions (Leave empty for default):
Use password-based authentication? [yes]:
Use an empty password? (yes/no) [no]:
Use a random password? (yes/no) [no]:
Enter password:
Enter password again:
Lock out the account after creation? [no]:
Username      : asample
Password      : *****
Full Name     : Arthur Sample
Uid           : 1001
Class        :
Groups       : asample wheel
Home         : /home/asample
Home Mode    :
Shell        : /bin/csh
Locked       : no
OK? (yes/no): yes
adduser: INFO: Successfully added (asample) to the user database.
Add another user? (yes/no):

```

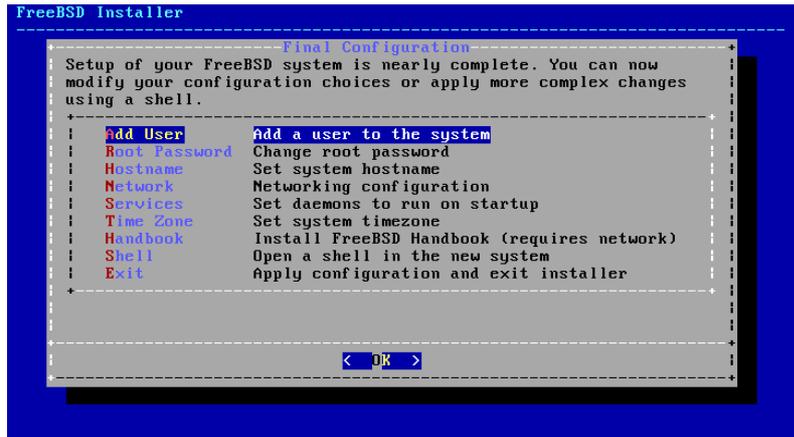
Αἰ ἔΥῆαδ ἰά ḑῆῖοῆ Ὑῶαδ ḑῆῆεῶῖῖῖῖῖ ḑ-ῆῖῖῖῖῖ, ἀḑἰῖῖῖῖ ὀḑῖ ἰῆῖῖῖῖῖ "Add another user?" ἰῖ yes. Ἀḑἰῖῖῖῖ no ἑῆ ἰά ḑῆῆῆῖῖῖῖ ἰῖ ὀḑῖ ḑῆῖῖῖῖῖ ḑ-ῆῖῖῖῖῖ ἑῆ ἰά ὀḑῖῖῖῖῖ ὀḑῖ ἰῆῆῆῖῖῖῖ.

Ἀῆ ḑῆῆεῶῖῖῖῖῖ ḑῆῖῖῖῖῖῖ ὀ-ḑῆῖῖῖῖ ἰῖ ὀḑῖ ḑῆῖῖῖῖῖ ἑῆ ἑῆῖῖῖῖῖ ḑ-ῆῖῖῖῖῖ, ἰῖῖῖῖ ὀḑῖ Ἐᾗῖῖῖῖῖ 14.

3.9.6 Ὀἰῖῖῖῖ Ὑῶ ἰῖῖῖῖῖῖ

Ἰᾗῖῖ ὀḑῖ ὀḑῖ ἰῖῖῖῖῖ ἑῆ ὀḑῖ ἰῖῖῖῖῖ ἰῖῖῖῖῖῖ, Ὑῖ-ḑῖῖ ἰῆῖ ὀḑῖῖῖῖῖ ἰῖῖῖῖῖ ἰῖ ἰῖῖῖῖῖῖ ὀḑῖ ἰῖῖῖῖῖῖῖ ḑῆῖῖ ὀḑῖ Ὑῖῖῖ ἰῖῖ ὀḑῖ ḑῆῖῖῖῖῖῖ ἰῖῖῖῖῖῖῖῖῖ.

Ὀ-ḑῖῖ 3-41. Ὀἰῖῖῖῖ Ὑῶ ἰῖῖῖῖῖῖ



ḑ-ῆῖῖῖῖῖῖῖῖῖ ἰῖῖῖῖ ἰῖῖῖῖ ἑῆ ἰῖῖῖῖῖ ἰῖῖῖῖῖῖῖῖῖ ἰῖῖῖῖῖῖ ḑῖ ḑῆῖῖῖῖῖῖ ἰῖῖῖῖῖῖῖ ἑῆῖῖῖῖῖ ḑῖ ḑῆῖῖῖῖῖῖ ἰῖῖῖῖῖῖ ὀḑῖ ἰῖῖῖῖῖῖῖῖῖ ὀḑῖ ἰῖῖῖῖῖῖῖῖῖ.

Ἀḑῆῖῖῖ Ὑῶ Ὀἰῖῖῖῖ ἰῖῖῖῖῖῖ

- Add User - ḑῆῆῆῖῖῖῖῖῖ ὀḑῖ Ὀἰḑῖῖ 3.9.5.
 - Root Password - ḑῆῆῆῖῖῖῖῖῖ ὀḑῖ Ὀἰḑῖῖ 3.9.1.
 - Hostname - ḑῆῆῆῖῖῖῖῖῖ ὀḑῖ Ὀἰḑῖῖ 3.5.2.
 - Network - ḑῆῆῆῖῖῖῖῖῖ ὀḑῖ Ὀἰḑῖῖ 3.9.2.
 - Services - ḑῆῆῆῖῖῖῖῖῖ ὀḑῖ Ὀἰḑῖῖ 3.9.4.
 - Time Zone - ḑῆῆῆῖῖῖῖῖῖ ὀḑῖ Ὀἰḑῖῖ 3.9.3.
 - Handbook - Ἰὰḑῖῖῖῖῖῖῖῖ ἑῆ ἰῖῖῖῖῖῖῖ ὀḑῖ Ἀᾗῖ-ἰῖῖῖῖῖῖ ὀḑῖ FreeBSD (ὀḑῖ ἰῖῖῖῖ ἰῖῖῖῖῖῖῖ ἰῖῖῖ ὀḑῖ ὀḑῖῖῖῖ).
 - Shell - Ἀḑὀḑῖῖῖ ἰῖῖῖ ἑῆῖῖῖῖῖ ἑῆ ὀḑῖ ὀḑῖ ἰῖῖῖῖῖῖ ἰῖῖῖῖῖ ὀḑῖ ἰῖῖ ὀḑῖῖῖῖῖ.
- Ἰᾗ ὀḑῖ ἰῖῖῖῖῖῖῖῖῖ ὀḑῖ ὀḑῖῖῖῖῖ ἰῖῖῖῖῖῖῖ, ἰῖῖῖῖῖῖῖ Exit ἑῆ ἰῖ ἑῖῖῖῖῖῖ ὀḑῖ ἰῖῖῖῖῖῖῖῖ.


```
Features=0x783fbff<FPU,VME,DE,PSE,TSC,MSR,PAE,MCE,CX8,APIC,SEP,MTRR,PGE,MCA,CMOV,PAT,PSE36,MMX,
Features2=0x209<SSE3,MON,SSSE3>
AMD Features=0x20100800<SYSCALL,NX,LM>
AMD Features2=0x1<LAHF>
real memory = 536805376 (511 MB)
avail memory = 491819008 (469 MB)
Event timer "LAPIC" quality 400
ACPI APIC Table: <VBOX VBOXAPIC>
ioapic0: Changing APIC ID to 1
ioapic0 <Version 1.1> irqs 0-23 on motherboard
kbd1 at kbdmux0
acpi0: <VBOX VBOXXSDT> on motherboard
acpi0: Power Button (fixed)
acpi0: Sleep Button (fixed)
Timecounter "ACPI-fast" frequency 3579545 Hz quality 900
acpi_timer0: <32-bit timer at 3.579545MHz> port 0x4008-0x400b on acpi0
cpu0: <ACPI CPU> on acpi0
pcib0: <ACPI Host-PCI bridge> port 0xcf8-0xcff on acpi0
pci0: <ACPI PCI bus> on pcib0
isab0: <PCI-ISA bridge> at device 1.0 on pci0
isa0: <ISA bus> on isab0
atapci0: <Intel PIIX4 UDMA33 controller> port 0x1f0-0x1f7,0x3f6,0x170-0x177,0x376,0xd000-0xd00f a
ata0: <ATA channel 0> on atapci0
ata1: <ATA channel 1> on atapci0
vgapci0: <VGA-compatible display> mem 0xe0000000-0xe0ffffff irq 18 at device 2.0 on pci0
em0: <Intel(R) PRO/1000 Legacy Network Connection 1.0.3> port 0xd010-0xd017 mem 0xf0000000-0xf000
em0: Ethernet address: 08:00:27:9f:e0:92
pci0: <base peripheral> at device 4.0 (no driver attached)
pcm0: <Intel ICH (82801AA)> port 0xd100-0xd1ff,0xd200-0xd23f irq 21 at device 5.0 on pci0
pcm0: <SigmaTel STAC9700/83/84 AC97 Codec>
ohci0: <OHCI (generic) USB controller> mem 0xf0804000-0xf0804fff irq 22 at device 6.0 on pci0
usb0: <OHCI (generic) USB controller> on ohci0
pci0: <bridge> at device 7.0 (no driver attached)
acpi_acad0: <AC Adapter> on acpi0
atkbd0: <Keyboard controller (i8042)> port 0x60,0x64 irq 1 on acpi0
atkbd0: <AT Keyboard> irq 1 on atkbd0
kbd0 at atkbd0
atkbd0: [GIANT-LOCKED]
psm0: <PS/2 Mouse> irq 12 on atkbd0
psm0: [GIANT-LOCKED]
psm0: model IntelliMouse Explorer, device ID 4
attimer0: <AT timer> port 0x40-0x43,0x50-0x53 on acpi0
Timecounter "i8254" frequency 1193182 Hz quality 0
Event timer "i8254" frequency 1193182 Hz quality 100
sc0: <System console> at flags 0x100 on isa0
sc0: VGA <16 virtual consoles, flags=0x300>
vga0: <Generic ISA VGA> at port 0x3c0-0x3df iomem 0xa0000-0xbffff on isa0
atrtc0: <AT realtime clock> at port 0x70 irq 8 on isa0
Event timer "RTC" frequency 32768 Hz quality 0
ppc0: cannot reserve I/O port range
Timecounters tick every 10.000 msec
pcm0: measured ac97 link rate at 485193 Hz
em0: link state changed to UP
```

```
usb0: 12Mbps Full Speed USB v1.0
ugen0.1: <Apple> at usb0
uhub0: <Apple OHCI root HUB, class 9/0, rev 1.00/1.00, addr 1> on usb0
cd0 at atal bus 0 scbus1 target 0 lun 0
cd0: <VBOX CD-ROM 1.0> Removable CD-ROM SCSI-0 device
cd0: 33.300MB/s transfers (UDMA2, ATAPI 12bytes, PIO 65534bytes)
cd0: Attempt to query device size failed: NOT READY, Medium not present
ada0 at ata0 bus 0 scbus0 target 0 lun 0
ada0: <VBOX HARDDISK 1.0> ATA-6 device
ada0: 33.300MB/s transfers (UDMA2, PIO 65536bytes)
ada0: 12546MB (25694208 512 byte sectors: 16H 63S/T 16383C)
ada0: Previously was known as ad0
Timecounter "TSC" frequency 3007772192 Hz quality 800
Root mount waiting for: usb0
uhub0: 8 ports with 8 removable, self powered
Trying to mount root from ufs:/dev/ada0p2 [rw]...
Setting hostuuid: 1848d7bf-e6a4-4ed4-b782-bd3f1685d551.
Setting hostid: 0xa03479b2.
Entropy harvesting: interrupts ethernet point_to_point kickstart.
Starting file system checks:
/dev/ada0p2: FILE SYSTEM CLEAN; SKIPPING CHECKS
/dev/ada0p2: clean, 2620402 free (714 frags, 327461 blocks, 0.0% fragmentation)
Mounting local file systems:.
vboxguest0 port 0xd020-0xd03f mem 0xf0400000-0xf07fffff,0xf0800000-0xf0803fff irq 20 at device 4.
vboxguest: loaded successfully
Setting hostname: machine3.example.com.
Starting Network: lo0 em0.
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> metric 0 mtu 16384
    options=3<RXCSUM,TXCSUM>
    inet6 ::1 prefixlen 128
    inet6 fe80::1%lo0 prefixlen 64 scopeid 0x3
    inet 127.0.0.1 netmask 0xff000000
    nd6 options=21<PERFORMNUD,AUTO_LINKLOCAL>
em0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> metric 0 mtu 1500
    options=9b<RXCSUM,TXCSUM,VLAN_MTU,VLAN_HWTAGGING,VLAN_HWCSUM>
    ether 08:00:27:9f:e0:92
    nd6 options=29<PERFORMNUD,IFDISABLED,AUTO_LINKLOCAL>
    media: Ethernet autoselect (1000baseT <full-duplex>)
    status: active

Starting devd.
Starting Network: usb0.
DHCPREQUEST on em0 to 255.255.255.255 port 67
DHCPACK from 10.0.2.2
bound to 192.168.1.142 -- renewal in 43200 seconds.
add net ::ffff:0.0.0.0: gateway ::1
add net ::0.0.0.0: gateway ::1
add net fe80::: gateway ::1
add net ff02::: gateway ::1
ELF ldconfig path: /lib /usr/lib /usr/lib/compat /usr/local/lib
32-bit compatibility ldconfig path: /usr/lib32
Creating and/or trimming log files.
Starting syslogd.
No core dumps found.
```

```
Clearing /tmp (X related).
Updating motd:.
Configuring syscons: blanktime.
Generating public/private rsa1 key pair.
Your identification has been saved in /etc/ssh/ssh_host_key.
Your public key has been saved in /etc/ssh/ssh_host_key.pub.
The key fingerprint is:
10:a0:f5:af:93:ae:a3:1a:b2:bb:3c:35:d9:5a:b3:f3 root@machine3.example.com
The key's randomart image is:
+--[RSA1 1024]-----+
|    o..          |
|   o . .        |
|  .  o          |
|   o            |
|  o S          |
|  + + o        |
|o . + *        |
|o+ ..+ .       |
|==o..o+E       |
+-----+
Generating public/private dsa key pair.
Your identification has been saved in /etc/ssh/ssh_host_dsa_key.
Your public key has been saved in /etc/ssh/ssh_host_dsa_key.pub.
The key fingerprint is:
7e:1c:ce:dc:8a:3a:18:13:5b:34:b5:cf:d9:d1:47:b2 root@machine3.example.com
The key's randomart image is:
+--[ DSA 1024]-----+
|      ..      . . |
|     o . . . +   |
|    . . . . E .  |
|   . . o o . .  |
|   + S = .      |
|   + . = o      |
|   + . * .      |
|   . . o .      |
|   . o . .      |
+-----+
Starting sshd.
Starting cron.
Starting background file system checks in 60 seconds.
```

Thu Oct 6 19:15:31 MDT 2011

FreeBSD/amd64 (machine3.example.com) (ttyv0)

login:

Ἐπιβεβαιώσατε τὴν ἀσφάλειά σας RSA ἐπὶ τὴν DSA ἰδιότητα τῆς μηχανῆς. Ἡ ἀσφάλεια ἔχει ἀποθηκευθῆκε ἐν τῷ /etc/ssh/ssh_host_key. Ἡ ἀσφάλεια ἔχει ἀποθηκευθῆκε ἐν τῷ /etc/ssh/ssh_host_key.pub. Ἡ ἀσφάλεια ἔχει ἀποθηκευθῆκε ἐν τῷ /etc/ssh/ssh_host_dsa_key. Ἡ ἀσφάλεια ἔχει ἀποθηκευθῆκε ἐν τῷ /etc/ssh/ssh_host_dsa_key.pub. Ἡ ἀσφάλεια ἔχει ἀποθηκευθῆκε ἐν τῷ /etc/ssh/ssh_host_dsa_key.pub. Ἡ ἀσφάλεια ἔχει ἀποθηκευθῆκε ἐν τῷ /etc/ssh/ssh_host_dsa_key.pub.

Ἡ ἀσφάλεια ἔχει ἀποθηκευθῆκε ἐν τῷ /etc/ssh/ssh_host_dsa_key.pub. Ἡ ἀσφάλεια ἔχει ἀποθηκευθῆκε ἐν τῷ /etc/ssh/ssh_host_dsa_key.pub. Ἡ ἀσφάλεια ἔχει ἀποθηκευθῆκε ἐν τῷ /etc/ssh/ssh_host_dsa_key.pub. Ἡ ἀσφάλεια ἔχει ἀποθηκευθῆκε ἐν τῷ /etc/ssh/ssh_host_dsa_key.pub.

3.9.8 Όάñιάόέοίüò όιτ̄ FreeBSD

Í ύούόüò όάñιάόέοίüò όιτ̄ FreeBSD áíáόόάέβæάέ όά ááññΎίá έέέ όι όέέéü όιτ̄ όδñείáέόόP óád áδü æçιέÜ. Άáí δñŸΔάέ áδèpò íá áéáέüφάόá όçí όñιτ̄αίόá. Άí í ÷ ñPóόçð όάó áβίáέ ίŸεíð όçð ñÜáád wheel, ίδññáβóá íá áβίáόά όδññ ÷ ñPóόçð íá όçí áίόíēP su έέέ όçí áέόááññP όιτ̄ έüáέέίŸ όιτ̄ root. ΆέáóññáόέέÜ, óóíááèáβóá üð root έέέ ÷ ñçόέñðēPόόá όçí áίόíēP shutdown -p now. Όí όŸόόçíá έá όάñιάόόβóάέ íá όι ύúόóü όñüðí έέέ έá áέáέíθáβ έέέ ç δάññ ÷ P ñáŸíáόíð.

Íδññáβóá íá ÷ ñçόέñðēPόόá όι óóíáόάόüí δèPèόññí **Ctrl+Alt+Del** áέά íá áδáíáέέέéPόόáόá όι όŸόόçíá, áééÜ áόóü ááí óóíβóόάόáέ έáδÜ όç áéÜñéáά όçð έáñíéέPð έáέόíθññáβóð.

3.10 Άίόείαòpδéόç ΘññíáέçìÜóüí

Ç áñüόçόá όιτ̄ áέίεíðέáβ έáéŸðόáέ όçí áίόείαòpδéόç ááόέéPí δññíáέçìÜóüí ááέáóÜóóáόçð — áέά δáñÜááέäíá έίέíÜ δññíáέPíáόá όιτ̄ Ÿ ÷ íóí áíáóáñéáβ áδü όñεéíŸð ÷ ñPóóád. ΌδÜñ ÷ íóí áðβόçð éÜðñéáð áñüðPóáέð έέέ áδáíðPóáέð áέá üóíτò áðέéðíŸí íá Ÿ ÷ íóí όι FreeBSD üð dual boot íá MS-DOS P Windows.

3.10.1 Όέ íá ÉÜíáόá áí ÉÜóé ðÜáé ÓðñáâÜ

Éüüü όüí áéÜóññí δáñéíñέóìPí όόçí áñ ÷ έóáέóñíέéP όιτ̄ PC, ááí áβίáέ áóíáóüí ç áíβ ÷ íáóóç óóóéáòPí íá áβίáέ 100% áίέüðέόç. ΌδÜñ ÷ íóí üüò éÜðñéá δñÜáíáόá όιτ̄ íδññáβóá íá éÜíáόá áí ç áíβ ÷ íáóóç ááí áβίáέ áðέóð ÷ Pð.

ΆέŸáñòá όέð ÓçíáέPóáέð ÓέέéíŸ (<http://www.FreeBSD.org/releases/index.html>) áέá όçí Ÿέáííóç όιτ̄ FreeBSD όíτ̄ ÷ ñçόέñðēPόόá, áέá íá ááááέüèáβóá üðέ όí όέέéü óáó όδñíóóçñβæáóáέ.

Άí όí όέέéü óáó όδñíóóçñβæáóáέ έέέ áíáέίεíðέáβóá íá Ÿ ÷ áόá έñéέPíáόá P Üέέá δññíáέPíáόá, έá δñŸΔάέ íá áçìéíθññáPóáόá Ÿ íá δññíáέñíóíŸí δδñPíá. Άóóü έá óáó áðέóðñŸθáέ íá δññíóéŸóáóá όδñíóóPñéίç áέá óóóéáòŸð íé íðíβáð ááí όδÜñ ÷ íóí óóíí δδñPíá GENERIC. Í δδñPíáó όóí íŸóí ááέáóÜóóáόçð Ÿ ÷ áé áçìéíθññáçέáβ íá όçí όδñúéáόç üðέ íé δáñéóóüóáñáð óóóéáòŸð áñβóéííóáέ óóéð δññíáðέέéáñŸíáð ñðéíβóáέð όíτò üóí áóññÜ óá IRQs, όέð áéáðéŸíóáέð IO έέέ óá έáíÜέéá DMA. Άí Ÿ ÷ áόá áééÜíáέ áóðŸð όéð ñðéíβóáέð βóüð ÷ ñáέáóóáβ íá áééÜíáόá όéð ñðéíβóáέð όíτ̄ δδñPíá έέέ íá όñí áδáíáíáóáέüðóβóáόá áέá íá íδññŸóáέ όí FreeBSD íá áíóíθβóáέ όéð óóóéáòŸð óáó.

Áβίáέ áðβóçð δέέáíü ç áέááέέáόóá áíβ ÷ íáóóçð áέá íéá óóóéáòP όíτ̄ ááí áβίáέ ááέáόáóóçìŸíç íá δññéáéŸóáέ δññíáέçíá óóçí áíβ ÷ íáóóç íéáð Üέéçð όδñáñéðPð óóóéáòPð. Óóçí δáññðòùóç áóòP, έá δñŸΔάέ íá áóáéñŸóáóá όçí áíβ ÷ íáóóç áέá όç óóóéáòP όíτ̄ áçìéíθññáβ όí δññíáέçíá.

Όçíáβúóç: ÉÜðñéá δññíáέPíáόá ááέáóÜóóáόçð íðñíŸí íá áðñáó ÷ éíŸí P íá íáέüèíŸí íá όçí áíááÜéíéόç firmware áéÜóññíúí óóóéáòPí óέέéíŸ έέέ áéáέéüðáñá όçð ίçðñéέPð. Όí firmware όçð ίçðñéέPð áβίáέ óð ÷ íÜ áíüóóü íá όñí üññí BIOS. Íé δáñéóóüóáñíé έáóáóéááóáóŸð ίçðñéέPí áéáéŸóíóí íéá áééðóáέP óíθñéááóá áδü üðñíó íðññáβóá íá έáóááÜóáόá áíáááéíéóíŸíáð áéáüóáέð έέέ áíÜέíááð δéçñíóññáβóð.

Íé έáóáóéááóáόŸð óóíPèüð óóíéóóíŸí íá ίçí áíáááéíβæáóá όí BIOS όçð ίçðñéέPð áí ááí óδÜñ ÷ áé έáéüò éüáíò, üðüð áέá δáñÜááέäíá íéá éñβóéίç áίçìŸñúóç. Ç áίçìŸñúóç áíñ Ÿ ÷ áóáé íá áóíóŸ ÷ áé áóPíííóáó όí BIOS óá íéá áíáέÜíáόç έáóÜóóáόç έέέ όñí óδñíáέóòP áéóüò έáέóíθññáβóð.

3.10.2 Απενεργοποίηση της Απενεργοποίησης ούτως ή άλλως του ACPI

1. Οι πληροφορίες που είναι διαθέσιμες για την απενεργοποίηση της απενεργοποίησης ούτως ή άλλως του ACPI είναι οι ακόλουθες: ούτως ή άλλως του ACPI είναι απενεργοποιημένο στην έκδοση 13.1, amd64 και ia64 προσαρτάται η απενεργοποίηση ούτως ή άλλως του ACPI. Αποδοστέο ούτως ή άλλως του ACPI είναι απενεργοποιημένο στην έκδοση 13.1, amd64 και ia64 προσαρτάται η απενεργοποίηση ούτως ή άλλως του ACPI.

Οι FreeBSD είναι διαθέσιμες οι πληροφορίες ACPI (από τις αρχές του 2000) ούτως ή άλλως του ACPI είναι απενεργοποιημένο στην έκδοση 13.1, amd64 και ia64 προσαρτάται η απενεργοποίηση ούτως ή άλλως του ACPI. Αποδοστέο ούτως ή άλλως του ACPI είναι απενεργοποιημένο στην έκδοση 13.1, amd64 και ia64 προσαρτάται η απενεργοποίηση ούτως ή άλλως του ACPI. Η απενεργοποίηση ούτως ή άλλως του ACPI είναι απενεργοποιημένο στην έκδοση 13.1, amd64 και ia64 προσαρτάται η απενεργοποίηση ούτως ή άλλως του ACPI.

```
set hint.acpi.0.disabled="1"
```

Εάν η απενεργοποίηση ούτως ή άλλως του ACPI είναι απενεργοποιημένη, η απενεργοποίηση ούτως ή άλλως του ACPI είναι απενεργοποιημένη στην έκδοση 13.1, amd64 και ia64 προσαρτάται η απενεργοποίηση ούτως ή άλλως του ACPI. Η απενεργοποίηση ούτως ή άλλως του ACPI είναι απενεργοποιημένη στην έκδοση 13.1, amd64 και ia64 προσαρτάται η απενεργοποίηση ούτως ή άλλως του ACPI.

Άέα ίέα εὰòòηάηΠ ðáñεάñáoΠ εÙεά όóΠεçò ðιò άñ÷άβιò έάέ üεùι όùι ñòειβόάùι ðιò ιðηιγί ίά άòáñηιόòιγί άέα όέò άέέιέέΥò ειρúεάò óòιáιòεάòòάβòά όçί óάεβάά áιçεάβáð ttys(5).

4.2.5 Ειρúεά όά ΕάòÙόόάόç Άίυò ×ñΠόόç

Ìðηάβòά ίά άñάβòά ίέα εὰòòηάηΠ ðáñεάñáoΠ άέα ðι όέ άβίάέ “εάòÙόόάόç άίυò ÷ñΠόόç” όόçί άίυòçóά ÒιΠιά 13.6.2. Άίβαέ έά άίάóÝñιòιά ðùò óðÙñ÷άέ άíáñáΠ iùfi ιβá ειρúεά üόάí ðñÝ÷άòά ðι FreeBSD όά εάòÙόόάόç άίυò ÷ñΠόόç. Άάí óðÙñ÷ιòι άέαέΥόειάò άέέιέέΥò ειρúεάò. Óòι άñ÷άβι /etc/ttys ιðηιáβòά ίά άñάβòά όέò ñòειβόάέò όά εάòÙόόάόç άίυò ÷ñΠόόç. ΆίάαçòΠóόά όçί áñáñΠ ðιò ίáέέíÙ ιá console:

```
# name  getty                type      status      comments
#
# If console is marked "insecure", then init will ask for the root password
# when going to single-user mode.
console none                unknown off secure
```

Óçιáβúòç: ¼ðùò άίάóÝñιòι óά ó÷üέέά ðÙíú áðù ðι console, ιðηιáβòά ίά áðáíáñááóóáβòά áóòΠί όç áñáñΠ έάέ ίά άίόέέáðáóóΠóáòά όçί εÝιç secure ιá insecure. Óά áóòΠ όçί ðáñβòòùóç εάòÙ όçί áέέβιçóç ðιò FreeBSD όά εάòÙόόάόç άίυò ÷ñΠόόç, έá óáó αçóçεάβ ι εùάέέüò ðñüóááóçò ðιò ððáñ÷ñΠόόç root.

ÐñιόÝ÷áòá üόάί εÙίáòá όçί ιáóáðñιðΠ óá insecure. ΆÙί óý÷άέ ίά ιá÷Üóáðά ðιι εùάέέü ðñüóááóçò ðιò root, ç ðñüóááóç óá εáòÙόόáóç έáεòιòñáβáð άίυò ÷ñΠόόç ιðηιáβ ίά άβίάέ άγóááòç. ÓðÙñ÷άέ άέέüιç ðñüðιò ίά εÙίáðά áέέβιçóç, áέέÜ βúòò ίά άβίάέ άγóειτεί άέα εÙιòειí ðιò ááí áíυñβαέέ ðιέέÜ άέα όέò áέáñááóóáò έάέ óá ðñιáñÜιιáðά áέέβιçóçò ðιò FreeBSD.

4.2.6 ΆέέÜæιíóáò όçί ΆίÜέóç (video mode) όçò Ειρúεάò

Ç ðñιáðέεáñÝιç áðáέέüέíóç όçò ειρúεάò óòι FreeBSD ιðηιáβ ίά ñòειέóóáβ óá άíÜέóç 1024x768, 1280x1024, Π óá ιðηιáβðιòά Üέει ιÝááειð ðòιόóçñβæáðáέ áðu όçί εÜñðά áñáóέεΠί έάέ όçί ιέüιç óáð. Άέα ίά ÷ñçóειιðιέΠóáðά áέáοιñáðέεΠ άíÜέóç, έá ðñÝðáέ ðñΠóá áðu üεά ίά áðáíáìáðááέεüðóβòáòά ðιι ðòñΠíá óáð, έάέ ίά óòιðáñέέÜááðά όέò ðáñáέÜòù áγι áðέειáÝò:

```
options VESA
options SC_PIXEL_MODE
```

ÌáòÜ όç ιáðááεðòóóç ðιò ðòñΠíá ιá όέò ðáñáðÜíü áγι áðέειáÝò, ιðηιáβòά ίά άñάβòά ðιέáð άίáέýóáέò ðòιόóçñβæιíóáέ áðu ðι ðέέέü óáð, ÷ñçóειιðιέΠíóáð ðι áιçεçóέέü ðñüáñáñá vidcontrol(1). Άέα ίά äáβòά ίέα εβóðά áðu όέò ðòιόóçñæüιáíáð άίáέýóáέò, áΠóðά όçί áéüειòεç άίóιεΠ:

```
# vidcontrol -i mode
```

Ç Ýñáιò όçò άíóιεΠð áóòΠð, άβίáέ ίέα εβóðά áðu άίáέýóáέò ιέüιçò ðιò ðòιόóçñβæιíóáέ áðu ðι ðέέέü óáð. Ìðηιáβòά Ýðáέóά ίά áðέéÝíáðά ίέα íÝá άíÜέóç, áβιííóáò όçί ùð üñέóíá óóçί vidcontrol(1) óá ίέα ειρúεά ðιò Ý÷áðά óòιááέáβ ùò root:

```
# vidcontrol MODE_279
```



```
-rw-r--r-- 1 root wheel 7680 Sep 5 12:31 email.txt
...
```

Ç ðñðçç óððç ðιð ðáβññιðιά ιά όçι áíðιεð 1s -l áεά÷ ùñβεάðάε ùð áιðð:

```
-rw-r--r--
```

Ἴ ðñðçιð ÷ άñάεððñάð (άδυ όά άñεόðάñÛ) ιάð áιçιáññιáε áι ðññεάεόάε áεά Ὢιά εάñιíεεÛ άñ÷άβι, εάó Ûειáι, áεάεεð óóóεάðð ÷ άñάεððñι, ððιáι÷ Ὢιά (socket), ð ιðιέάάððιðιά Ûεεο άñ÷άβι ράðáι-óóóεάððð. Óðçι ðáñβððυóç ιάð, ðι - ððιáçεðιáε Ὢιά εάñιíεεÛ άñ÷άβι. Ἴε áευειρειέ ðñάεð ÷ άñάεððñάð, óοι ðáñ Ûάεάιá ιάð, rw-, ιñβειðι όεð Ûάáεάð áεά όιι εάειέðððç ðιð άñ÷άβιð. Ἴε ðñάεð áðυιáñιé ÷ άñάεððñάð, r--, ιñβειðι όεð Ûάáεάð áεά όçι ñ Ûάά óðçι ιðιβά áιðεάε όιι άñ÷άβι. Ἴε óάεάððάβιé ðñάεð ÷ άñάεððñάð, r--, ιñβειðι όεð Ûάάεάð áεά όιι ððυειέðι éυóοιι. Ç ðάγέά óçιáβιáé ðυð ç Ûάάεά áβιáé áðάιáññιáðιέçι Ὢιç. Óðçι ðáñβððυóç όιð άñ÷άβιð ιάð, ιέ Ὢάάεάð Ὢι÷ιøι ιñεóóάβ ððóá ι éάειέðððç ðιά ιðιñάβ ιά áεάά Ûεάé éáé ιά άñ Ûóáé óðιι άñ÷άβι, ç ñ Ûάά ιά ιðιñάβ ιά áεάá Ûóáé όιι άñ÷άβι, éáé ι ððυειέðιð éυóοιð ιά ιðιñάβ ιυíι ιά áεάá Ûóáé όιι άñ÷άβι. Óγιòυιá ιά όιι ðáñáð Ûιϋ ðβιáéá, ιέ Ὢάάεάð áεά áðóυ όιι άñ÷άβι áβιáé 644, υðιð éάé Ὢιά áδυ όά ðñβά ρçðβά ðáñιðóε Ûεάé όιι áιðóóοιé÷ι ι Ὢιñιð áάáεðι όιð άñ÷άβιð.

Ἴ Ὢι÷ñé áäð áβιáé υεά éáéÛ, áεéÛ υιùð ðυð όιι óγóðçιά áε Ὢιά÷áε όεð Ûάάεάð óóóεάððι; Óι FreeBSD ιάðά÷ áεñβεάðáé όεð ðáñεóóυðάñáð óóóεάðð Ὢιό áι Ὢιά άñ÷άβι όιι ιðιβι όά ðñιáñ Ûιáόά ιðιñιγι ιά áιβιøι, ιά áεάá Ûóιøι éáé ιά άñ Ûøιøι óá áðóυ óáι ιά ðóái Ὢιá ιðιειáððιðιά άñ÷άβι. ἈóóÛ όά áεάεéÛ άñ÷άβá óóóεάððι áðιεçéáγιíόáé óοιι éáð Ûειáι /dev.

Óι óγóðçιά ιάðά÷ áεñβεάðáé áðβóçð éáé ðιðð éáðáéυιáιðð ùð άñ÷άβά. ÷ιøι Ûάáεάð áι Ûάιϋóçð, áááñáððð éáé áεð Ὢεáóçð. Óι bit ðιð ιñβεáé όçι áεð Ὢεáóç óοιðð éáðáéυιáιðð Ὢι÷áε áεáøñðð áεáοιñáðéεÛ ιυçιá áδυ υðé óóá άñ÷άβá. ¼óái Ὢιáð éáð Ûειáιð Ὢι÷áε ιñεóóάβ áεðáé Ὢóéιðð, óçιáβιáé ðυð áβιáé ðñιðáε Ûóéιðð, áçéááð áβιáé áðéðñáððυι ιá ðáñ Ûóιøιά όά Ὢιá ððιéáð Ûειáι όιð (ιá eÛιðιá “cd”). Ἀóóυι áðβóçð óçιáβιáé ðυð áðéðñ Ὢðáóáé ç ðñυóáóç óá υεά όά áιϋóóÛ (áðóυι Ὢι÷áε ιá eÛιáé ιá όεð Ûάáεάð ðυι βáéυι ðυι άñ÷άβυι) άñ÷άβά.

ἈεάéεÛðáñá, áεά ιá áιòáiβειíόáé óá ðáñεá÷ υιáιá éáðáéυιáιðð ðñ Ὢιáé ιá Ὢι÷áε óáéáβ Ûάáéá áι Ûάιϋóçð (read) óοιι éáð Ûειáι, áñβ áεά ιá áεάáñáðáβ Ὢιά άñ÷άβι όιð ιðιβιð áιϋñβεάðá όιι υιíá áβιáé áιááéáβι ιá Ὢι÷ιøι áιεάβ ιέ Ὢάάεάð áááñáððð (write) éáé áεð Ὢεáóçð (execute) óοιι éáð Ûειáι ðιð ðáñε Ὢι÷áé όιι άñ÷άβι.

Óð Ûñ÷ιøι éé Ὢεéá bit áááεðι, áεéÛ ÷ñçóéιðιειγιíόáé éðñβυð óá áεάéé Ὢιð ðáñεðððáéð υðυð όá setuid binaries éáé sticky directories. Ἀι é Ὢεάðá ðáñεóóυðάñáð ðεçñιøιñβáð áεά όεð Ûάáεάð άñ÷άβυι éáé ðυð ιá όéð ιñβεáðá, óοιáιðéáððáβáðá ιðυóáððιðιά όçι óáéβáá manual chmod(1).

4.3.1 Óοιáιεéé Ὢι ðñáéáðð

Ἴε óοιáιεéé Ὢι Ûάάεάð, ιáñεé Ὢιð óιñ Ὢιð áιáó Ὢιñιðάé éáé ùð óοιáιεéé Ὢιð áεðñ Ûóáéð, ÷ñçóéιðιειγιí ÷ άñάεððñάð óðçι é Ὢιðç ðυι ιéððð éιðι áεά ιá é Ὢιðιøι Ûάάéáð óá άñ÷άβá ð éáðáéυιáιððð. Ἴε óοιáιεéé Ὢιð áεðñ Ûóáéð ÷ñçóéιðιειγιí όçι óγιíόáç (ðιéιð) (áι Ὢιñááéá) (Ûάάéáð), υðιðð áβιáé áεάé Ὢóéιáðð ιé áευειðéáð ðéι Ὢιð:

Ἀðéειáð	Ἀñ Ûιá	Óçιáβιáé
(ðιéιð)	u	User (×ñðóççð)
(ðιéιð)	g	Group owner (ñ Ûάá ðιð áιðεάé)
(ðιéιð)	o	Other (Óðυειéðιé ÷ ñðóáðð)
(ðιéιð)	a	All (υιéιé, “world”)
(áι Ὢιñááéá)	+	ðñυóéáóç áááεðι
(áι Ὢιñááéá)	-	Áóáβñáóç áááεðι
(áι Ὢιñááéá)	=	¶ñáóιð ιñεóιυð áááεðι

¼δὺδ άβδάια δάναδὺή, ϑ άίόίεP passwd άέόάέάβδάέ άδὺ Ύία έάίίέέδ ÷ ñPόδϑ, άέέŪ ÷ ñϑόέήδρέαβ όί άίάñάū UID όίò ÷ ñPόδϑ root.

ϑ Ūάάέά setgid άέόάέάβ όϑί βάέά έάέόήñάβά ùδὺδ έάέ ϑ setuid, άέέŪ άδέαñŪ όόέδ Ūάάέάδ όϑδ ñŪάάδ (group). ¼όάί άέόάέγδάόά ίέά όΎόίέά άόάññáP P άίϑέϑόέέū δñúñάñá, έά ÷ ñϑόέήδρέαβ όέδ Ūάάέάδ όϑδ ñŪάάδ όόϑί ίδρβά άίPέάέ όί άñ÷άβί, έάέ ù÷έ όίò ÷ ñPόδϑ δίò όϑί ίάέβίϑά.

Άέά ίά έΎόάόά όϑί Ūάάέά setgid όά Ύία άñ÷άβί, έά δñŪδάέ ίά όίδρέαδPόάόά όή άνέέήϹ άγί (2) ίδρúόδŪ άδὺ όί όύφρει άάάέPί, όόϑί άίόίεP chmod. Άάβδά όί δάñάέŪδὺ δάñŪάάέάια:

```
# chmod 2755 sgidexample.sh
```

¼δὺδ έάέ δñέί, έά δάñάόϑñPόάόά όϑ ίΎά Ūάάέά s, άέέŪ άδδP όϑ όñŪŪ όόί όάό δὺί άάάέPί όϑδ ñŪάάδ:

```
-rwxr-sr-x 1 trhodes trhodes 44 Aug 31 01:49 sgidexample.sh
```

Όϑίάβύόϑ: Όόά δάñάάάβάίαόά ίάδ, άί έάέ όί άñ÷άβί άβίάέ Ύία άέόάέγδóέή script άέά έΎέδóήδ, άάί έά άέόάέάόδάβ ίά έέάόήñάδóέέū άίάñάū ID (EUID). Άδὺδ όδίαάβίάέ άέάδβ όά άδδŪ όά scripts άάί άδέδñŪδάδάέ ϑ δñúόάάϑ όδóδ έέPόάέδ setuid(2) όίò όδóδPíάόήδ.

Íέ άγί δñPόάδ άέάέέγδ Ūάάέάδ δίò άίάόŪñάñá, ίέ setuid έάέ setgid, άíάñ÷ñŪάñ ίά ίάέPόίόί όϑί άόόŪέάέά όήδ όόóδPíάóήδ, άóήγ άδέδñŪγδόίόί όά δññáñŪίάόά ίά άέόάέήγίόάέ ίά άόίϑί Ύία άέέάέPíάόά. ΌδŪñ÷άέ ùδóδóί ίέά δñβδϑ άέάέέP Ūάάέά, ϑ ίδρβά ίδρñάβ ίά άóίPόάέ όϑί άόóŪέάέά όήδ όóóδPíάóήδ: όί sticky bit.

¼όάί έΎόάόά όί sticky bit όά Ύία έάδŪέίάί, άδέδñŪγδάδάέ ϑ άέάáñάδP άíñδ άñ÷άβίò ìññ άδὺ όή έάέήέδPδϑ όίò. ϑ Ūάάέά άδδP άβίάέ ÷ ñPόέίϑ άέά ίά άδρúάγááδάέ ϑ άέάáñάδP άíñδ άñ÷άβίò άδὺ έίέήϹ ÷ ñϑόόήδ έάόάέññóδ, ùδὺδ άέά δάñŪάάέάία í /tmp, άδὺ έŪδρίέί ÷ ñPόδϑ δίò άάί άβίάέ ί έάέήέδPδϑ όίò. Άέά ίά έΎόάόά άδδP όϑί Ūάάέά, όίδρέαδPόάόά όή άνέέήϹ Ύία (1) όόϑί άñ÷P όήδ όάδ άάάέPί:

```
# chmod 1777 /tmp
```

Íδρñάβδά όPñά ίά άάβδά όί άδρúέέάόίá, ÷ ñϑόέήδρέαPíάόά όϑί άίόίεP ls:

```
# ls -al / | grep tmp
```

```
drwxrwxrwt 10 root wheel 512 Aug 31 01:49 tmp
```

ϑ Ūάάέά sticky bit όάβίάδάέ ùδ t όόί όΎέήδ όήδ όόήϹέήδ δὺί άάάέPί.

4.4 ΆñP Έάόάέññó

ϑ έάñáñ÷έέP ãñP όήδ FreeBSD άβίάέ Ύία άάόέέū όόίέ÷άβί δίò δñŪδάέ ίά ãññáñæάδά άί έΎέάόά ίά Ύ÷άδά ίέά ίέήέέϑññúŪίϑ άέέñίá όήδ όóóδPíάóήδ. ϑ δέί όϑίáίόέέP Ύίñίέá άβίάέ άδδP όήδ ñέάέέήγ (root) έάόάέññó, “/”. Άδóñδ ì έάόŪέίáñδ δññóáñδŪόάέ (mount) δñPόήδ έάóŪ όϑί άέέβίϑϑ έάέ δάñέΎ÷άέ όί άάóέέū όύόόϑία έέάñϹ ίά άδρίέŪόάέ όί Ę.Ó. άέά έάέόήδñάβά multi-user. Í root έάóŪέίáñδ δάñέΎ÷άέ άδβδϑδ όϑίáβά δññóŪñδϑϑδ άέá Ūέέά όóóδPíάόά άñ÷άβñí δίò δññóáñδPíάέ έάóŪ όϑί ίάδŪάάόϑ όά έάóŪόδάϑ έάέόήδñάβδδ multi-user.

Όϑίáβί δññóŪñδϑϑδ (mount point) άβίάέ Ύίαδ έάóŪέίáñδ όόή ìδρβί ìδρñίγί ίά άíáδδδ÷έήγ δññúέάδά όóóδPíάόά άñ÷άβñí όά Ύία ãñέέñ όύόόϑία άñ÷άβñí (όόίPέñδ όόί root όύόόϑία άñ÷άβñí). Άδóñ δάñέáñŪóάέ άíáέδóέέŪ όόϑί

ἀ῁ῆῆῆ Ὀ῁῎῎ 4.5. Ὀ῁ ὀδ῎῎῎῎ ὀῆ῎῎῎ ḁ῁῎῎῎ ḁ῁῎῎῎῎ ḁ῁῎῎῎῎῎῎: ῆ /usr, /var, /tmp, /mnt, ῆῆ /cdrom. Ἀῆ῎῎ ῆ ῆῆ῎῎῎ ὀ῁῎῎῎ ḁ῎῎῎ ῆῆ῎῎῎ ῆ῎῎῎῎῎ ῆ῎῎῎ /etc/fstab. Ὀ῁ /etc/fstab ḁ῎῎῎ ῎῎῎῎῎῎ ḁ῎῎῎῎῎῎῎῎: ḁῆ ῆῆ῎῎῎῎ ὀῆ῎῎῎῎῎ ḁ῎῎῎ ῆ῎῎῎῎ ῆ῎῎῎῎ ḁ῎῎῎῎῎῎῎ ῆ῎῎῎῎῎῎ ῆ῎῎῎῎῎῎ ὀ῁῎῎῎῎῎῎ ὀῇ ὀῇ῎῎῎῎῎῎. Ὀ῁ ḁ῁῎῎῎῎῎῎῎ ὀῆ῎῎῎῎῎῎ ὀῇ /etc/fstab ḁ῁῎῎῎῎῎῎῎῎ ḁ῎῎῎῎῎῎῎ ῆ῎῎῎ ὀῇ ḁῆ῎῎῎῎ ὀῇ ὀῆ῎῎῎῎῎῎ ḁ῎῎ ὀ῁ script rc(8) ḁῆ῎῎ ḁ῁ ḁ῁῎῎῎῎῎ ῎῎῎῎ ῎῎῎῎῎῎ noauto. Ἐῆ῎῎῎ ῎῎῎῎῎῎ ῎῎῎῎῎῎ ῆ ḁ῎῎῎῎῎ ὀ῁῎῎῎ 4.6.1.

῎ῆ ḁ῎῎῎ ḁ῁῎῎῎῎῎ ὀῇ ῆ῎῎῎῎: ḁ῎῎ ὀῇ ὀῆ῎῎῎῎῎῎ ḁ῎῎: ḁ῎῎ ḁ῎῎῎῎ ῆ῎῎ ῆ῎῎῎῎ ῆ῎῎῎῎ ὀῇ hier(7). Ἀῆ῎῎῎῎῎ ῎ῆ ὀῇ῎῎῎ ḁ῁῎῎῎῎῎ ῎῎ ὀῇ῎῎ ḁ῁῎῎῎῎ ῆ῎῎῎῎῎῎῎῎.

Ἐῆ῎῎῎῎῎	ḁ῁῎῎῎῎῎
/	ḁ῎῎῎῎῎ (root) ῆ῎῎῎῎῎ ὀῇ ὀῇ῎῎῎῎῎῎ ḁ῎῎: ḁ῎῎.
/bin/	×῎῎῎῎῎ ḁ῎῎῎῎῎ ῆ῎ ḁ῁῎῎῎῎῎ ḁ῁῎ ḁ῎῎῎῎῎ ḁ῁῎ ḁ῎῎῎῎῎ ḁ῎῎῎῎῎῎.
/boot/	ḁ῎῎῎῎῎῎῎ ῆ῎ ḁ῎῎: ḁ῎῎ ῎῎῎῎῎῎῎ ὀῇ ḁ῎῎῎῎῎῎῎῎῎῎῎῎ ῆ῎῎῎῎῎῎῎ ὀῇ ῆ῎῎῎῎῎῎῎῎῎῎ ὀῇ ῆ῎῎῎῎῎῎῎῎῎῎῎῎.
/boot/defaults/	ḁ῎῎῎῎῎῎῎῎ ῎῎ ḁ῎῎: ḁ῎῎ ῎῎῎῎῎῎῎ ḁ῎῎῎῎῎῎῎, ḁ῎῎῎῎ loader.conf(5).
/dev/	Ἀ῎῎: ḁ῎῎ ὀῇ῎῎῎῎῎, ḁ῎῎῎῎ intro(4).
/etc/	Ἀ῎῎: ḁ῎῎ ῎῎῎῎῎῎῎ ὀῇ῎῎῎῎῎῎ ῆ῎ ὀῇ῎῎῎῎ ḁ῎῎῎῎῎῎῎.
/etc/defaults/	ḁ῎῎῎῎῎῎῎῎ ῎῎ ḁ῎῎: ḁ῎῎ ῎῎῎῎῎῎῎ ὀῇ῎῎῎῎῎῎῎, ḁ῎῎῎῎ ὀῇ rc(8).
/etc/mail/	Ἀ῎῎: ḁ῎῎ ῎῎῎῎῎῎῎ ῆ῎ ḁ῎ ḁ῎῎῎῎῎῎ ῎῎῎῎῎῎῎῎ ḁ῎῎῎῎῎. ὀῇ: ὀῇ῎῎῎῎῎῎ (῎῎῎) ḁ῎῎῎ ὀ῁ sendmail(8).
/etc/namedb/	Ἀ῎῎: ḁ῎῎ ῎῎῎῎῎῎῎ named, ḁ῎῎῎῎ named(8).
/etc/periodic/	Ὀῇ῎῎῎῎ ῆ῎῎῎῎῎῎῎ ὀῇ ὀῇ῎῎῎: ῎῎ ὀῇ ḁ῎῎῎῎῎῎, ḁ῎῎῎῎῎῎῎῎, ῆ῎ ῎῎῎῎῎῎ ḁ῎῎῎, cron(8); ḁ῎῎῎῎ periodic(8).
/etc/ppp/	Ἀ῎῎: ḁ῎῎ ῎῎῎῎῎῎῎ ppp, ḁ῎῎῎῎ ὀῇ ppp(8).
/mnt/	Ἐῆ῎῎῎ ῆ῎῎῎῎῎ ὀῇ ὀῇ῎῎῎῎ ḁ῎῎῎῎῎῎῎῎ ḁ῎῎ ὀῇ῎῎ ῆ῎῎: ḁ῎῎῎῎῎῎ ὀῇ῎῎῎῎῎῎ ḁ῎῎ ḁ῎῎῎῎῎῎῎ ὀῇ῎῎῎ ὀῇ ḁ῎῎῎῎῎῎῎῎῎῎.
/proc/	Ὀῇ῎῎῎῎ ḁ῎῎: ḁ῎῎῎ ῆ῎῎῎῎῎῎῎῎, ḁ῎῎῎῎ ὀῇ procfs(5), mount_procfs(8).
/rescue/	ḁ῎῎῎῎῎῎῎ ῎῎ ὀῇ῎῎῎῎ ὀῇ῎῎῎῎ (static link) ῆ῎ ḁ῎῎῎῎ ḁ῎῎῎῎῎῎῎ ὀῇ῎῎῎῎῎῎῎, ḁ῎῎῎῎ ὀῇ rescue(8).
/root/	ḁ῎῎῎῎῎῎῎ ῆ῎῎῎῎ ὀῇ ḁ῎῎῎῎ root.
/sbin/	ḁ῎῎῎῎῎῎῎ ὀῇ῎῎῎῎῎῎ ῆ῎ ḁ῎῎῎῎ ῎῎῎῎῎῎῎ ḁ῎῎: ḁ῎῎῎῎῎῎ ḁ῁῎ ḁ῎῎῎῎῎ ḁ῁῎ ḁ῎῎῎῎῎῎ ḁ῎῎῎῎῎῎῎.

Εὰὸὐεῖαίρ

- /tmp/
- /usr/
- /usr/bin/
- /usr/include/
- /usr/lib/
- /usr/libdata/
- /usr/libexec/
- /usr/local/
- /usr/obj/
- /usr/ports/
- /usr/sbin/
- /usr/share/
- /usr/src/
- /usr/X11R6/
- /var/
- /var/log/
- /var/mail/

Δὰñεῖῖῖῖῖ

Δὸνὶοῦνέῖῖ ἄñ ÷ ἄβἄ. Ὁἄ δὰñεῖῖ ÷ ῖῖῖῖῖ ὀῖῖ /tmp ὀδὶῖῖῖῖ ἄἄῖ ἄεἄὀçῖῖῖῖῖῖῖ ἱἄὀῖ ἄδῖ ἄδῖῖῖῖῖῖῖῖῖῖ ὀῖῖ ὀδὀὀῖῖῖῖῖῖῖ. Ὁῖῖ /tmp ὀδὶῖῖῖῖῖῖ δὸñῖῖῖῖῖῖῖῖῖ ῖῖῖ ὀῖῖῖῖῖῖ ἄñ ÷ ἄβῖῖ ἱῖῖῖῖ. Ἀὀδῖ ἱδῖῖῖῖ ἱἄ ἄδῖῖῖῖ ÷ εἄβ ἄδῖῖῖῖῖῖ ÷ ñçὀῖῖῖῖῖῖῖῖῖ ὀῖῖ ὀ ÷ ἄδῖῖῖῖ ῖῖ ἱἄὀἄἄεçὀῖῖ tmpmfs ὀῖῖ rc.conf(5) (ῖ ἱἄ ἱεἄ ἄἄὀἄ ÷ ñçὀç ὀδὶῖ /etc/fstab, ἄἄβὀἄ ὀçῖ mdfms(8)).

Δὰñεῖῖ ÷ ῖῖῖῖ ὀ ÷ ἄῖῖῖ ῖῖῖ ὀἄ ἄῖçèçὀῖῖῖῖ δὸñῖῖῖῖῖῖῖῖῖ ἄεἄ ἱε ἄὀἄñῖῖῖῖ ÷ ñçὀῖῖῖ.

Ἐῖῖῖῖ ÷ ñçὀῖῖ ἄῖçèçὀῖῖῖῖ δὸñῖῖῖῖῖῖῖῖῖ, ἄñἄἄεἄβἄ δὸñῖῖῖῖῖῖῖῖῖῖῖῖῖ, ἄεἄ ἄὀἄñῖῖῖῖ.

Ὁὀῖῖῖῖ ἄñ ÷ ἄβἄ ὀδὶδὰñῖῖῖῖççὀç C (include files).

Ἀñ ÷ ἄβἄ ἄεἄῖῖῖῖῖῖῖ.

Ἀεῖῖῖῖῖ ἄñ ÷ ἄβἄ ἄἄἄῖῖῖῖ ἄῖçèçὀῖῖῖῖ δὸñῖῖῖῖῖῖῖῖῖ.

Ἀἄβῖῖῖῖῖ ὀδὀὀῖῖῖῖῖῖῖ & ἄῖçèçὀῖῖῖῖ δὸñῖῖῖῖῖῖῖῖῖ ὀδὀὀῖῖῖῖῖῖῖ (ἄεὀἄῖῖῖῖῖῖῖ ἄδῖ ῖῖῖῖ δὸñῖῖῖῖῖῖῖῖῖ).

Ὁῖῖῖῖῖ ἄεὀἄῖῖῖῖῖῖῖ, ἄεἄῖῖῖῖῖῖῖῖ, ἄδῖ. Ἀδῖῖῖῖ ἄβῖῖῖ ἄεἄ ἱ δὸñῖῖῖῖῖῖῖῖῖῖῖῖ ὀñῖῖῖῖῖῖῖῖῖ ἄεἄ δὸñῖῖῖῖῖῖῖῖῖ ὀῖῖ ἄἄἄἄῖῖῖῖῖῖῖῖῖ ἄδῖ ὀἄ ports ὀῖῖ FreeBSD. Ἰῖῖῖ ὀδὶῖ /usr/local, ÷ ñçὀῖῖῖῖῖῖῖῖῖ ἄἄἱῖῖῖ ῖ ἄεῖῖῖῖ ὀῖῖ /usr ὀῖῖ δὰñεῖῖῖῖῖῖῖ ὀδὶῖ hier(7). Ἀῖῖῖῖῖῖῖῖῖ ἱε ἄἄὀὐεῖῖῖῖ ὀἄῖῖῖῖ ἄῖçῖῖῖῖῖ man, ὀῖῖ ἄñῖῖῖῖῖῖῖ ῖῖῖῖ ἄῖῖῖῖῖῖῖ ἄδῖ ὀῖῖ /usr/local ἄεἄ ῖ ÷ εῖῖῖῖ ἄδῖ ὀῖῖ /usr/local/share, ἄἄῖῖῖ ἄεἄ ç ὀἄῖῖῖῖῖῖῖῖῖ ἄῖῖῖῖ port ὀῖῖ ἄñῖῖῖῖῖῖῖ ὀδὶῖ share/doc/port .

Ἀῖῖῖῖῖ δὸñῖῖῖῖῖῖῖῖῖ ὀῖῖ ἄῖῖῖῖῖῖῖῖ ἄδῖ ὀçῖ ἄñ ÷ ἄδῖῖῖῖῖῖῖῖῖ ὀῖῖ ἱç ÷ ἄῖῖῖῖῖῖῖ ἄεἄ δὰñῖῖῖῖῖῖῖ ἱἄὀἄἄῖῖῖῖῖῖῖῖῖ ὀῖῖ ἄῖῖῖῖῖ /usr/src.

Ç Ὁῖῖῖῖῖ Ports ὀῖῖ FreeBSD (δὸñῖῖῖῖῖῖῖῖῖ).

Ἀἄβῖῖῖῖῖ ὀδὀὀῖῖῖῖῖῖῖ & ἄῖçèçὀῖῖῖῖ δὸñῖῖῖῖῖῖῖῖῖ ὀδὀὀῖῖῖῖῖῖῖῖῖ (ἄεὀἄῖῖῖῖῖῖῖ ἄδῖ ÷ ñῖῖῖῖῖ).

Ἀñ ÷ ἄβἄ ἄῖῖῖῖῖῖῖῖ ἄδῖ ὀçῖ Ἀñ ÷ ἄδῖῖῖῖῖῖῖῖῖ ὀῖῖ ἱç ÷ ἄῖῖῖῖῖῖῖῖ.

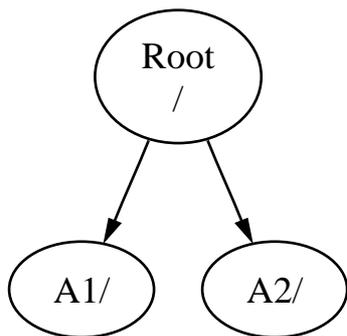
Ἀñ ÷ ἄβἄ BSD ἄεἄ/ῖ ὀῖῖῖῖῖ ἄñ ÷ ἄβἄ δçἄἄῖῖῖ ἄῖῖῖῖῖ.

Ἀεὀἄῖῖῖῖῖῖῖ, ἄεἄῖῖῖῖῖῖῖῖ, ἄδῖ. ἄεἄ ὀçῖ ἄεἄῖῖῖῖ X11R6 (δὸñῖῖῖῖῖῖῖῖῖ).

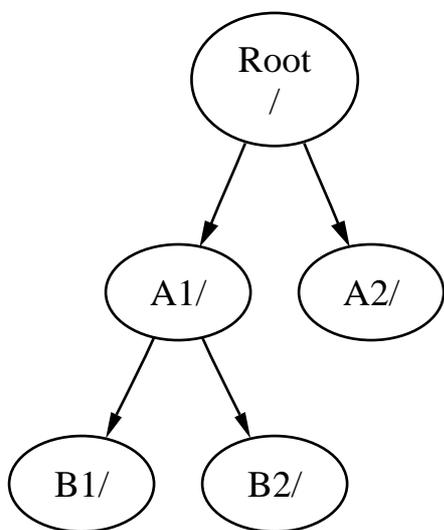
Ἀñ ÷ ἄβἄ ἄῖῖῖῖῖῖῖῖ (log) ἄεἄῖῖῖῖῖ ÷ ñῖῖῖῖῖῖ, temporary, transient, ἄεἄ spool. ἱἄñῖῖῖῖ ὀῖῖῖῖῖ δὸñῖῖῖῖῖῖῖῖῖ ὀδὶῖ /var ῖῖῖ ὀῖῖῖῖῖῖ ἄñ ÷ ἄβῖῖ ἱῖῖῖῖ. Ἀὀδῖ ἱδῖῖῖῖ ἱἄ ἄδῖῖῖῖ ÷ εἄβ ἄδῖῖῖῖῖῖ ÷ ñçὀῖῖῖῖῖῖῖῖῖ ὀῖῖ ὀ ÷ ἄδῖῖῖῖ ἱἄὀἄἄεçὀῖῖ varmfs ὀῖῖ rc.conf(5) (ῖ ἱἄ ἱβἄ ἄἄὀἄ ÷ ñçὀç ὀδὶῖ /etc/fstab, ἄἄβὀἄ ὀῖῖ mdfms(8)).

Ἀεῖῖῖῖῖ ἄñ ÷ ἄβἄ ὀδὶἄῖῖῖῖῖῖ ὀῖῖ ὀδὀὀῖῖῖῖῖῖῖῖῖ.

Ἀñ ÷ ἄβἄ ἄñῖῖῖῖῖῖῖῖῖῖῖῖῖ (mailbox) ÷ ñçὀῖῖῖ.

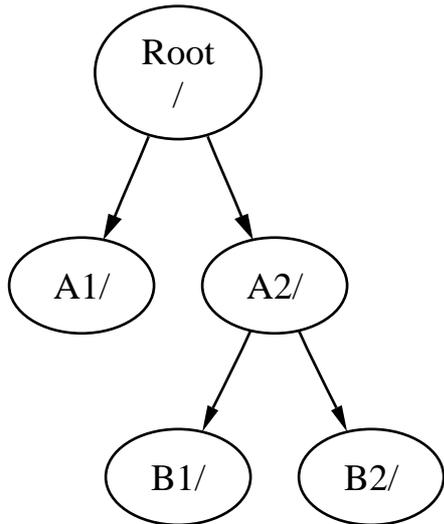


Ἐἴθε ὁ ὅτι ἡ ἀντιπροσωπεύουσα ὁδὸς ἰσχύει καὶ ἐπὶ τῶν ὁδῶν ἰσχύει. Ἐἴθε ὁ ὅτι ἡ ἀντιπροσωπεύουσα ὁδὸς ἰσχύει καὶ ἐπὶ τῶν ὁδῶν ἰσχύει. Ἐἴθε ὁ ὅτι ἡ ἀντιπροσωπεύουσα ὁδὸς ἰσχύει καὶ ἐπὶ τῶν ὁδῶν ἰσχύει.



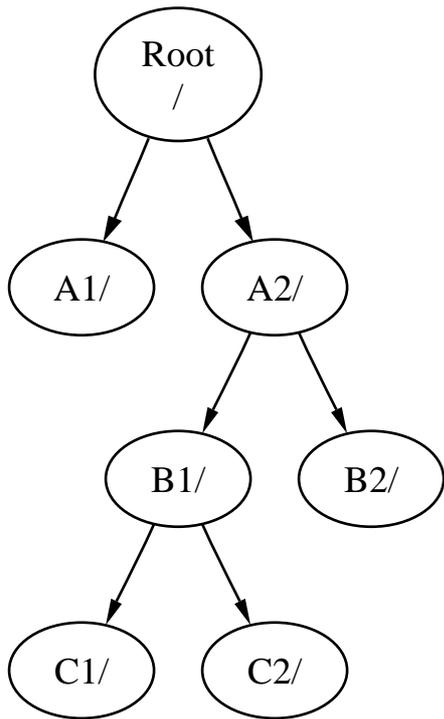
Ἐἴθε ὁ ὅτι ἡ ἀντιπροσωπεύουσα ὁδὸς ἰσχύει καὶ ἐπὶ τῶν ὁδῶν ἰσχύει. Ἐἴθε ὁ ὅτι ἡ ἀντιπροσωπεύουσα ὁδὸς ἰσχύει καὶ ἐπὶ τῶν ὁδῶν ἰσχύει. Ἐἴθε ὁ ὅτι ἡ ἀντιπροσωπεύουσα ὁδὸς ἰσχύει καὶ ἐπὶ τῶν ὁδῶν ἰσχύει.

Ἐἴθε ὁ ὅτι ἡ ἀντιπροσωπεύουσα ὁδὸς ἰσχύει καὶ ἐπὶ τῶν ὁδῶν ἰσχύει. Ἐἴθε ὁ ὅτι ἡ ἀντιπροσωπεύουσα ὁδὸς ἰσχύει καὶ ἐπὶ τῶν ὁδῶν ἰσχύει.



έάέ τέ άεάάντΎδ εά Βδάτ /A2/B1 έάέ /A2/B2 άίδβδδτε÷ά.

Όά όδδδβτáδά άñ÷άβττ ίδτττττττ ίά δñττáñδβττáέ όδττ έτττδδβ ΰεεττ όδδδττΰδττ. Όδττ÷βτττδάδ όττ δάεάδδάβττ δάνΰάάέάττ, όττ όγόδττá άñ÷άβττ c έά ίδτττττττ ίά δñττáñδττεάβ όδττ έτττδδβ όττ έάδάετττáττ B1 όδττ όγόδττá άñ÷άβττ B, ττáττβττδάδ όά άδδβττ όττ έάδάττττ:



¹ άετττ όττ c έά ίδτττττττ ίά δñττáñδττεάβ ΰττáδά όδττ όγόδττá άñ÷άβττ A, έΰδττ áδττ όττ έάδΰεάεττ A1:

δὶδ δάνέΥ ÷ áε όçi éáδὺδὶόç, áñρ όόçi δάνβδδούόç δὶδ áíáδὺñάόδά όά ίεά όΥδά εά δñÝδáε ίά áçēñíáδά όὶ ύñíá όὶδ άβόεὶδ. ΑδñÝíùδ, ύδάί άíáδὺñάόδά όά ίεά éáδὺδὶόç ÷ ñáεὺαάόδáε ίά áçēñíáδά όὶ ύñíá όὶδ άβόεὶδ, s, όὶí άñέέü όçδ όΥδád, éáε όὶí ÷ άñáέδPñά όçδ éáδὺδὶόçδ. Δάñάάβáñάόά ίδññάβάά ίά άñάβάά όόçi Δάñὺááéáñá 4-1.

Ç Δάñὺááéáñá 4-2 δάñὶδóέὺαáé Ýίá áñέέñíáéέü ïñδὺέὶ áéá όç áñP όὶδ άβόεὶδ δὶδ εά όád áñçēPóáé ίά éáδáéὺááδά éáέýδáñá éὺδñéá δñὺáñάά.

Άέά ίά ááéáδάóδPóáδά όὶ FreeBSD δñÝδáε δñρά ίά ñδèìβάóδά όέδ όΥδád όὶδ άβόεὶδ, ίά áçéñíáPóáδά όέδ éáδάδìPóáέδ ìÝóá όóέδ όΥδád δὶδ εά ÷ ñçóéññδñéPóáδά áéá όὶ FreeBSD, Ýδáéδά ίά áçéñíáPóáδά Ýίá óýóδçía áñ÷áβùí (P ÷ ñññ swap) όά éὺèá éáδὺδὶόç, éáε όÝέδ ίά áδñάδβάóδά όά δñéñ óçñáβñ éá δññóáñδçèáβ όὶ óýóδçía áñ÷áβùí.

Δβίáéáδ 4-1. Ένάέειβ Όδóέáδñί Άβόέñί

Έρáééáδ	Όçñáβíáé
ad	Άβόέñδ ATAPI (IDE)
da	Άβόέñδ SCSI Ύñάόçδ δññύάάόçδ
acd	ATAPI (IDE) CDROM
cd	SCSI CDROM
fd	ññὺáá ΆέóέÝδád (Floppy)

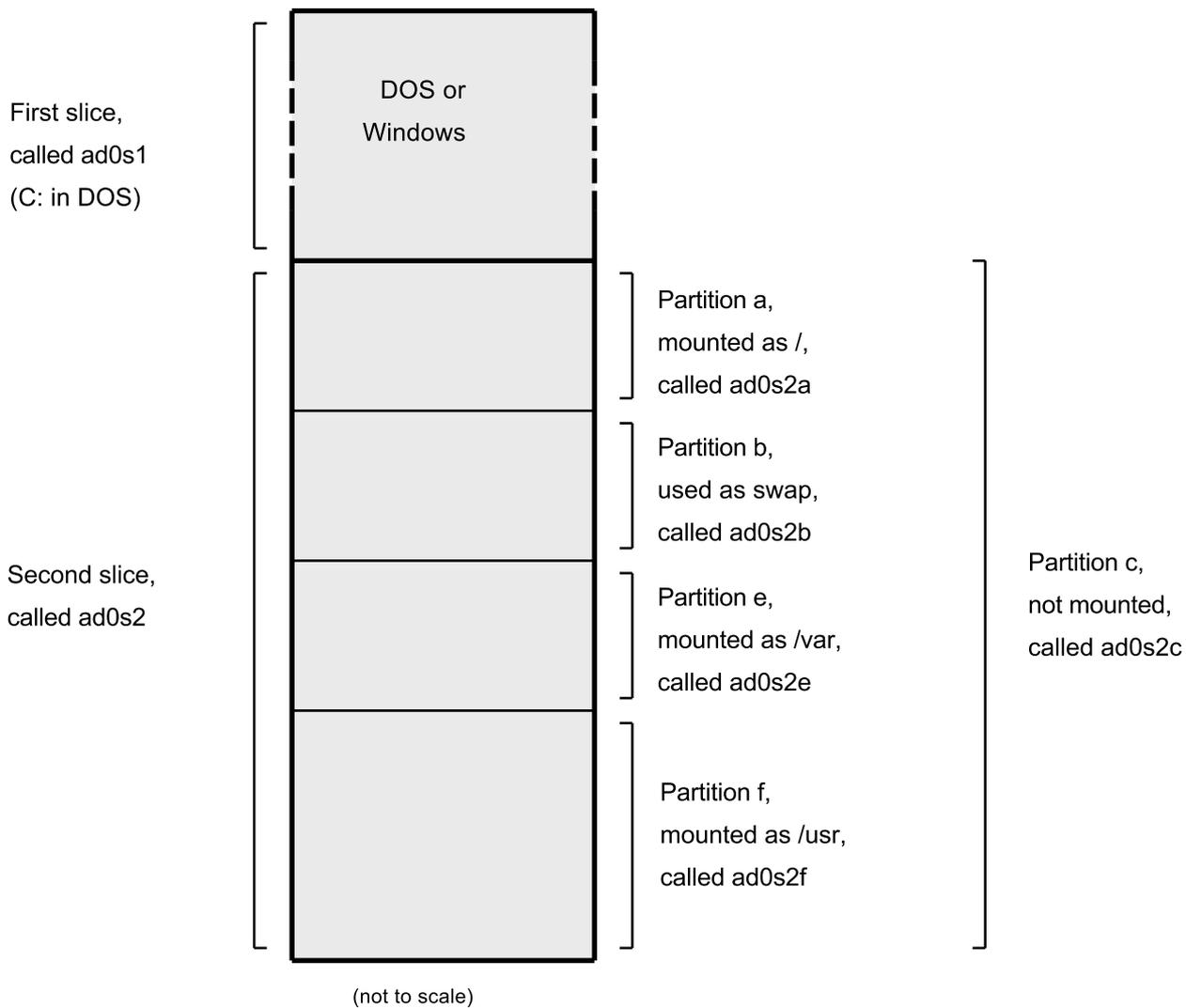
Δάñὺááéáñá 4-1. Όδñááβáñάόά ìñὺδñί Άβόεὶδ, ΌÝδád, Éáδὺδὶόçδ

Ïñάόβá	Όçñáβíáé
ad0s1a	Ç δñρδç éáδὺδὶόç (a) όόçi δñρδç όΥδά (s1) όὶδ δñρδñέ άβόéñδ IDE (ad0).
da1s2e	Ç δÝñδδç éáδὺδὶόç (e) όόçi ááyδáñç όΥδά (s2) όὶδ ááyδáññδ άβόéñδ SCSI (da1).

Δάñὺááéáñá 4-2. Αñέέñíáéέü ìñδὺέὶ áññδ Άβόéñδ

Όὶ áéὺáñáñá δάñὶδóέὺαáé ίεά áééñíá όὶδ δñρδñέ άβόéñδ IDE δὶδ άβíáé δññóáñδçññδ όὶδ óýóδçía. Αδ δδñéÝóññá δñδ ì άβόéñδ Ý ÷ áé ìÝááéñδ 4 GB, éáε δάνέΥ ÷ áé áýñ όΥδád δññ 2 GB (éáδάδìPóáέδ MS-DOS). Ç δñρδç όΥδά δάνέΥ ÷ áé Ýίá άβóéñ MS-DOS, c :, éáε ç ááyδáñç όΥδά ìβá ááéáδὺδóδάç FreeBSD. Όά áδδñ όὶ δάñὺááéáñá, ç ááéáδὺδóδάç FreeBSD Ý ÷ áé δñáέδ éáδάδìPóáέδ áááñÝññ éáé ìβá éáδὺδὶόç swap.

Έáéáñβá áδñ όέδ δñáέδ éáδάδìPóáέδ éá δάνέΥ ÷ áé Ýίá óýóδçía áñ÷áβùí. Ç éáδὺδὶόç a éá ÷ ñçóéññδñéçèáβ áéá όὶ root óýóδçía áñ÷áβùí, ç e áéá όç áñP éáδὺέññδ /var, éáε ç f áéá όç áñP éáδάéüññδ /usr.



4.6 Διάρθρωση και Διαμόρφωση Ομοειδών Αν-άβυι

Για ομοειδή αν-άβυι αρίθμησης δαεί έαείδανά όα ιππP αΐίονι, ία όέδ πβαάδ όιό όόι /. Ιέ έαόΰείαιέ /dev, /usr, έαέ ΰείείέ άβίάέ έεάάέΰ όιό έαόάέυιαίό root, έαέ ίδιήάβ ίά Ύ-ίόί ίά όç όάένΰ όιόδ, όά άέέΰ όιόδ έεάάέΰ, ύδύδ όίί /usr/local, έαέ ίγύδύ έάέάίPδ.

Όδΰñ-ίόί άέΰοίηίέ ευαίέ άέά όιόδ ίδιβίόδ έά Ύδñάδ ίά όιόίέάόPόίόίά έΰόίείόδ άδύ άόόίγδ όιόδ έαόάέυιαίόδ όά έέάόίήάέέΰ όόόδPιάόά άñ-άβυί. Ι έαόΰείαίόδ /var δñέΎ-άέ όιόδ έαόάέυιαίόδ log/, spool/, έαέ άέΰοίηίόδ

Ûεεϊρöd öýðϊρöd ðñïóñεϊβϊ áñ÷áβùϊ, éáé áεά öï εüãï áóöü ìðïñáβ ïá áãïβóáé. Äáï éå Ðóáï éáεP éåÝá ïá áãïβóáé öï root öýóöçïá áñ÷áβùï, áðñÝíùð ï áεά÷òñέóïüð öïð /var áðü öïï / áβïáé öð÷íÛ áðéèðìçöüð.

Ίáδ Ûεεϊð öðìçεéóïÝíïð εüãïð ïá Ý÷ïðá áεÛöïñïð éáöáεüãïð óå áεáöïñáðéêÛ öðóðßïáðá áñ÷áβùï áβïáé üðáï ðñüεáéóáé ïá öεéñáìçéïýï óå áεáöïñáðééïýð öðóεéïýð áβóεïðð, P áβïáé ïá÷òñέóïß áεéïééïß áβóéïé, üðüð öðïááβïáé ïá öï Áέéðöáεü Öýóöçïá Äñ÷áβùï (Network File System), éáé öïð ïäçáïýð CDROM.

4.6.1 Ôï Äñ÷áβï fstab

ΈáöÛ öç áεáñááóá áεεβïçóçð, öå öðóðßïáðá áñ÷áβùï ðïð áïáóÝñïïðáé öðï /etc/fstab ðñïóáñðßïáé áðüüïáðá (áéöüð áï áïáóÝñïïðáé ïá öçï áðééïáP noauto).

Ôï áñ÷áβï /etc/fstab ðáñéÝ÷áé ïéá óáéñÛ áðü áñáñÝð ïá áεÛöáïç üðüð ç áéüεïρöç:

device /mount-point fstype options dumpfreq passno

device

¼áñïá öðóéáððð (ç ïðïβá éå ðñÝðáé ïá öðÛñ÷áé), üðüð áïçááβóáé öðçï Ôïßïá 19.2.

mount-point

ΈáöÛεïãïð (éå ðñÝðáé ïá öðÛñ÷áé) öðïï ïðïß ðñïóáñðßïáé öï öýóöçïá áñ÷áβùï.

fstype

Ï öýðïð öïð öðóðßïáðá áñ÷áβùï ðïð éå äëéáβ öðçï mount(8). Ôï ðñïέáεïñέóïÝíï öýóöçïá áñ÷áβùï öïð FreeBSD áβïáé öï ufs.

options

Ôï rw áéá öðóðßïáðá áñ÷áβùï áÛáñòçð-áãáñáððð (read-write), P ro áéá öðóðßïáðá áñ÷áβùï ïüñï áÛáñòçð (read-only), öðïðεçñùÝíï ïá ïðïéá Ûεεç áðééïáP ïðïñáβ ïá ÷ñáéÛεáóðá. Ìβá öðïðεçð áðééïáP áβïáé ç noauto áéá öðóðßïáðá áñ÷áβùï ðïð ááï ðñïóáñðßïáé áðüüïáðá éáöÛ öéð áεáñááóáð áεεβïçóçð öïð öðóðßïáðá. ¶éëáð áðééïáÝð áïáóÝñïïðáé öðçï óáéβáá áïðεáéáð mount(8).

dumpfreq

Áöðü öï ðááβï ÷ñçóéïðïéááβóáé áðü öï dump(8) áéá ïá ïñβóáé ðïéá öðóðßïáðá áñ÷áβùï ÷ñáéÛεïïáé dumping. Áï öï ðááβï áðïρóéÛεáé, öüðå ç ðñïέáεïñέóïÝíçç öéïP öïð áβïáé ïçáÝï.

passno

Áöðü ïñβæáé öçï óáéñÛ ïá öçï ïðïβá éå áεÝá÷ïïðáé öå öðóðßïáðá áñ÷áβùï. Öðóðßïáðá áñ÷áβùï ðïð ááï áðééöïñýïá ïá áεáá÷éïýï éå ðñÝðáé ïá Ý÷ïðá öðï ðááβï passno öéïP ïçáÝï. Ôï root öýóöçïá áñ÷áβùï (öï ïðïß ðñÝðáé ïá áεáá÷éïß ðñéï áðü ïéå öå Ûεéá) éå Ý÷áé öðï ðááβï passno öçï öéïP Ýïá éáé ïéå öå Ûεéá öðóðßïáðá áñ÷áβùï éå Ý÷ïðá öðï ðááβï passno öéïÝð ïáááéýðáñáð áðü Ýïá. Áï ðáñέóöüðáñá áðü Ýïá öðóðßïáðá áñ÷áβùï Ý÷ïðá öçï βáéá öéïP passno öüðå öï fsck(8) éå áðé÷áéñPóáé ïá áεÝáñáé ðáñÛεεçéá öå öðóðßïáðá áñ÷áβùï, áï áöðü áβïáé áðééöü.

Ôðïáïρéáðöðáβðá öçï óáéβáá áïçεááðá fstab(5) áéá ðáñέóöüðáñáð ðεçñïïññáð áéá öçï ïñðP öïð áñ÷áβïð /etc/fstab éáé áεá öéð áðééïáÝð ðïð ïðïñáβ ïá ðáñéÝ÷áé.

4.6.2 Ç ÁíôïëP mount

Ç áíôïëP mount(8) áβíáέ áòòù áέñέáðð ðñò ÷ ñáέÙæáòá áέά óçí ðñìóÙñòçóç óòóòçìÙòùí áñ ÷ áβùí.

Ç ááóέéP ìñòP óçò áβíáέ:

```
# mount device mountpoint
```

ÕðÙñ ÷ áέ ðεçεðñά áðέεíáðí, ùðùð áíáóÝñáòáέ óòçí óáεβáá áñçεάβáð mount(8), áέεÙ íé ðéí óòíPεάέò áβíáέ:

ΆðέεíáÝò áíôïëPò mount

-a

ÐñìóÙñòçóç ùέùí òùí óòóòçìÙòùí áñ ÷ áβùí ðñò áíáóÝñìíóáέ óòì /etc/fstab, áέòùð áòòðí ðñò òÝñìíóí óçí áðέεíáP “noauto”, áíáέñíýíóáέ ìÝòù óçò áðέεíáPò -t, P áòòðí ðñò Pæç Ý ÷ ðñìóáñòçεάβ.

-d

ÈÙíáέ óά ðÙíóά áέòùð áðù óçí ðñάáìáóέéP ðñìóÙñòçóç óñò óòóòPíáòìò. ΆòòP ç áðέεíáP áβíáέ ÷ ñPóέíç óά óòíáñáóβá ìά òí ðñùεáíá -v áέά íá ðñìóáέíñέóòáβ óé áέñέáðð ðñìóðáέáβ íá èÙíáέ ç mount(8) óçí óòáεáέñέíÝíç óóέáìP.

-f

ΆíááεÙæáέ óçí ðñìóÙñòçóç áñùð ìç-éáεáñíý óòóòPíáòìò áñ ÷ áβùí (áðέέβíáòñí), P áíáíááεÙæáέ óçí áíÙέεçóç ðñìóááóçò áááñáòPò ùòάí òðíáέáÙæáòáέ ç ðñìóÙñòçóç áñùð óòóòPíáòìò áñ ÷ áβùí áíÙáñùóçò-áááñáòPò (read-write) óά ìùíí-áíÙáñùóçò.

-r

ÐñìóáñòÙ òí óýóòçíá áñ ÷ áβùí óά éáòÙòóáóç ìùíí-áíÙáñùóçò. Άβíáέ áέñέáðð òí βáέí ìά óç ÷ ñPóç óñò ðññέÝíáòìò ro ìά óçí áðέεíáP -o.

-t fstype

ÐñìóáñòÙ òí òðÙñ ÷ ìí óýóòçíá áñ ÷ áβùí, ÷ ñçóέííðñέðíóáò òñí óýðñí óòóòPíáòìò áñ ÷ áβùí ðñò áβíáòáέ, P ðñìóáñòÙ ìùíí óòóòPíáòά áñ ÷ áβùí òñò óòáεáέñέíÝíñò óýðñò, áÙí äñεάβ ìάæβ ìά óçí áðέεíáP -a.

Õñ “ufs” áβíáέ ì ðñìáðέέéááìÝíñò óýðñò óòóòPíáòìò áñ ÷ áβùí.

-u

Άíáíáðíáέ óέò áðέεíáÝò ðñìóÙñòçóçò óòì óýóòçíá áñ ÷ áβùí.

-v

ÓòìðáñέéáíáÙíáέ áíáέòòéééP áíáòìñÙ.

-w

ÐñìóáñòÙ òí óýóòçíá áñ ÷ áβùí áέά áíÙáñùóç-áááñáòP (read-write).

Ç áðέεíáP -o äÝ ÷ áòáέ ìβά óáέñÙ áðù áðέεíáÝò ÷ ùñέóíÝíáò ìά èùííá, ðáñέéáíáÙñííóáò óέò áέùεíñέáò:

noexec

Άáí άδέóñÝðάόάε ç εάέóìòñάβá áεðάεÝóέìñí óá áóòù ðí óýóóçñá áñ÷áβùí. Άóòù άβίάέ άðβóçð íεά άðέεíáP áóóάέάβáð.

nosuid

Άáí εáíáÙñíóάέ ðð' ùøέí setuid P setgid flags óðí óýóóçñá áñ÷áβùí.

4.6.3 Ç ΆίóìεP umount

Ç άίóìεP umount(8) ðάβñíάέ, ùð ðáñÙíáðñí, Ýíά áε ðùí óçñáβùí ðñíóÙñòçóçð, ðí ùññá íεάò óðóέáððò, P ðεò άðέεíáÝò -a P -A.

¼εíε íε óýðíé äÝ÷ííóάέ óçñ -f áεά íá áñíááéÙóíòí óá áðñíóÙñòçóçð, εάέ óçñ -v áεά áíáέòðέέP áíáóìñÙ. Óáò ðñíáέáíðíεíýíá ðùò ç άðέεíáP -f ááíέέÙ ááí άβίάέ εάεP εáÝá. Ç áí' áíááέάóíñý áðñíóÙñòçóçð ðñíñáβ íá íäçáPóáé óá εáòÙññáðóç ðñí ððñíεάέóðð P íá εáóάóðñÝøáé áááñÝíά óðí óýóóçñá áñ÷áβùí.

Íé -a εάέ -A ÷ñçóέíñðñíéýíóάέ áεά íá áðñíóáñðPóíòí ùεá óá ðñíóáñòçñÝíá óðóðPíáóá áñ÷áβùí, óýíòñíá εάέ íá ðεò άðέεíáÝò ðñí áβñíóάέ áðù ðí -t, áí ððÙñ÷áέ. Óí -A, ùóòùóí, ááí εá άðé÷áέñPóáé íá áðñíóáñðPóáé ðí root óýóóçñá áñ÷áβùí.

4.7 Άέáñááóβáð

To FreeBSD άβίάέ Ýíά εάέóìòñάέéù óýóóçñá multi-tasking. Άóòù óçñáβíáέ ðùò εÙεá óέεáìP ðñíñíý íá ðñÝ÷íòí ðáñáðÙíù áðù Ýíά ðñíáñÙíáóá. ΕÙεá ðññáñáíá ðñí ðñÝ÷áέ ðñíέááððñíóá óέεáìP ðñíÙεάóáέ *áέáñááóβá* (process). ΕÙεá άíóìεP ðñí ðñÝ÷áέ ðñí íáέέíÙáέ ðñíòεÙ÷έóòñí íβá íÝá áέáñááóβá, εάέ ððÙñ÷íòí εÙðñέáð áέáñááóβáð ðñí óðóðPíáóð ðñí ðñÝ÷íòí óðíÝ÷áέά áεά íá εñáóíýí ðí óýóóçñá óá εάέóìòñάβá.

ΕÙεá áέáñááóβá ÷áñάέóçñβεáðάέ áðù Ýíά ðñíáέéù áñέέìù ðñí ðñíÙεάóáέ *ID áέáñááóβáð* P *PID*, εάέ ùðùð áέñέáðð óòíááβíáέ íá óá áñ÷áβá, εÙεá áέáñááóβá Ý÷áέ Ýíáí εάέíεðPòç εάέ Ýíά áέññòð. Íé ðεçññíòñβáð ðñí εάέíεðPòç εάέ ðñí áέññòð ÷ñáέÙεáíóάέ áεά íá ðñíóáέíñβεáðάέ ðñíέá áñ÷áβá εάέ óðóέáðÝò ðñíñáβ íá áñβíáέ ç óóáέáέñέíÝíç áέáñááóβá, ÷ñçóέíñðñíóáð ðεò Ùááέáð áñ÷áβùí ðñí óðεçðPóáíá ðñíβóáñá. Íé ðáñέóóùðáñáð áέáñááóβáð Ý÷íòí άðβóçð íβá áñíέεP áέáñááóβá. Ç áñíέεP áέáñááóβá άβίáέ áέáβíç ç áέáñááóβá ðñí ðεò íáέβíçóá. Άέά ðáñÙááέáíá, áÙí ðεççðññíεááβóá άíóìεÝð óðí εÝέòòòð, ðùòá ðí εÝέòòòð άβίáέ íβá áέáñááóβá, εάέ εÙεá άíóìεP ðñí ðñÝ÷áέ άβίáέ άðβóçð íβá áέáñááóβá. ΆðñÝíùð εÙεá áέáñááóβá ðñí ðñÝ÷áέ íá áóòùí ðñí ðññòñí εá Ý÷áέ áñíέεP áέáñááóβá ðí εÝέòòòð óáð. Ç ðñíç áñáβñáóç άβίáέ íβá áέáñááóβá ðñí ðñíÙεάóáέ init(8). Ç *init* άβίáέ ðÙíóá ç ðññòç áέáñááóβá, εάέ άðñÝíùð ðí *PID* ðçð άβίáέ ðÙíóá 1. Ç *init* íáέέíÙ áóòùíáóá áðù ðñí ðññPíá εáòÙ óçñ áέέβíçóç ðñí FreeBSD.

Άýí εάέáβóáñá ÷ñPóέíð άíóìεÝð áεά íá ðáñáóçñáβóá ðεò áέáñááóβáð óðí óýóóçñá, άβίáέ íé ps(1) εάέ top(1). Ç άíóìεP *ps* ÷ñçóέíñðñíέáβóáέ áεά óçñ ðñíáñεP íεáð óóáðέέPð εβóóáð ðùí ðñÝ÷íòí ðñí ðñí ðñí ðñí áέáñááóέPí, εάέ ðñíñáβ íá áñóáíβεáέ ðí *PID* ðñíð, ðñíóç ðñíç ÷ñçóέíñðñíéýí, óçñ άíóìεP íá óçñ ðñíβá íáέβíçóáí, εάέ Ùεéáð ðεçññíòñβáð. Ç άíóìεP *top* áñóáíβεáέ ùεáð ðεò ðñÝ÷íòóáð áέáñááóβáð, εάέ áñáíáPíáέ óçñ ðñíç óáð áíÙ εβáá ááòðáññεáðóá, άðñÝíùð ðñíñáβóá íá ðáñáóçñáβóá ðé áέñέáðð εÙíáέ ðñíðñíέáέóðP óáð ðç áááñÝíç óέéáìP.

Ç *ps*, áðù ðñíáðέéíáP, áñóáíβεáέ ðñí ðεò άíóìεÝð ðñí ðñÝ÷íòí εάέ áíPñíòí óá áóÙð. Άέά ðáñÙááέáíá:

```
% ps
  PID  TT  STAT      TIME COMMAND
   298  p0  Ss      0:01.10 tcsh
  7078  p0  S        2:40.88 xemacs mdoc.xml (xemacs-21.1.14)
```

```

37393 p0 I 0:03.11 xemacs freebsd.dsl (xemacs-21.1.14)
48630 p0 S 2:50.89 /usr/local/lib/netscape-linux/navigator-linux-4.77.bi
48730 p0 IW 0:00.00 (dns helper) (navigator-linux-)
72210 p0 R+ 0:00.00 ps
 390 p1 Is 0:01.14 tcsh
 7059 p2 Is+ 1:36.18 /usr/local/bin/mutt -y
 6688 p3 IWS 0:00.00 tcsh
10735 p4 IWS 0:00.00 tcsh
20256 p5 IWS 0:00.00 tcsh
 262 v0 IWS 0:00.00 -tcsh (tcsh)
 270 v0 IW+ 0:00.00 /bin/sh /usr/X11R6/bin/startx -- -bpp 16
 280 v0 IW+ 0:00.00 xinit /home/nik/.xinitrc -- -bpp 16
 284 v0 IW 0:00.00 /bin/sh /home/nik/.xinitrc
 285 v0 S 0:38.45 /usr/X11R6/bin/sawfish

```

¼δὸδ ιδīñάβδά ίά άάβδά όά άδδὸδ όī δάνΰάεέαιά, ς Ψīñāδδ άδὸδ όçī ps δñīάΰεεάδδάέ όά όδΨεάδ. PID άβίάέ όī PID όçδ άέάñāάόβδδ ùδδδ άίάόΨñāíά ίññβδδāñā. Óά PID άέάίΨīñíόάέ άδὸδ 1, Ψñδ 99999, έάέ ùδάί δδñāñāίί όī 99999 ίάέεήίί άδὸδ όçī άñ÷Ψ (Ψίά PID άάί ιδīñάβ ίά άδīñāéάβ ίάίΰ ίά άβίάέ Ψάç όά ÷ñΨόç). ς όδΨçç TT άάβ÷ίάέ όī δāñīάδóéēü (tty) όίτ δñīñāΰñāόίτδ όίτ άέόάéάβδδάέ, έάέ ιδīñάβ ίά άάñίçéάβ άδδΨ όç όέάñΨ άβ÷ùδ δññūάéçíά. ς STAT δδīñāééíγáέ όçī έάδΰόδάόç όίτ δñīñāΰñāόίτδ, έάέ δΰέé ιδīñάβ ίά άάñίçéάβ. ς TIME άβίάέ ς ÷ñīéēΨ άέΰñéάέά όίτ όī δññūāñāíá άδδάό÷ίέάβ όçī CPU, άδδδδ όóīΨεδδ άάί άβίάέ ī ÷ññūñδ άέδΨéάόçδ άόίγ όά δñāéόóúδāñā δñīñāΰñāόά έάέδδδδñīñíί ίά ΰέεάδ āñāάόβδδ δñéί άδδάό÷ίέΨόίόί όçī CPU. ς όάέάδδδάβά όδΨçç, ς COMMAND άβίάέ ς āñāñΨ άίόīēΨδ όίτ äüéçéā άέά ίά δñΨίάέ όī δññūāñāíá.

ς ps(1) δδīόδçñβæάέ άέΰöīñāδ άδéēñāΨδ άέά ίά άέéΰíáέ όçī άéΰíά δὸí δéçñīñōīñéēí όίτ άìöáíβæīíόάέ. Ìβά άδὸδ όέδ δéí ÷ñΨόéíāδ άδéēñāΨδ άβίάέ ς auxww. ς a άìöáíβæάέ δéçñīñōīññāδ άέά ΰεάδ όέδ δñΨ÷īδδδ άέάñāάόβδδ, ù÷é ίññī όέδ άέéΨδ όάδ. ς u άìöáíβæάέ όī ùñā ÷ñΨόç όίτ έάéīēδΨόç όçδ άέάñāάόβδδ, ùδδδ έάέ όç ÷ñΨόçδ όçδ ίΨΨçδ. ς x άìöáíβæάέ δéçñīñōīññāδ ό÷άδéēΰ ίá όέδ άέάñāάόβδδ δὸí άééíññī έάέ ς ww άίάέΰæάέ όçī ps(1) ίά άìöáíβδάέ řēüééçñç όçī άίόīēΨ āñāñΨδ άέά éΰéā άέάñāάόβά, άόίγ όóīΨεδδ άìöáíβæάόάέ éñīΨίç éñāù όίτ ιΨéīτδ όçδ όίτ άάί ÷ññΰ ίά άìöáíéóδāβ όόçī řēüíç.

ς Ψīñāδ όçδ top(1) άβίάέ δāñññīéá. ίá άάβāñā āñāάόβδδ όçδ ñēΰæάέ óáί άδδΨ:

```

% top
last pid: 72257; load averages: 0.13, 0.09, 0.03 up 0+13:38:33 22:39:10
47 processes: 1 running, 46 sleeping
CPU states: 12.6% user, 0.0% nice, 7.8% system, 0.0% interrupt, 79.7% idle
Mem: 36M Active, 5256K Inact, 13M Wired, 6312K Cache, 15M Buf, 408K Free
Swap: 256M Total, 38M Used, 217M Free, 15% Inuse

```

PID	USERNAME	PRI	NICE	SIZE	RES	STATE	TIME	WCPU	CPU	COMMAND
72257	nik	28	0	1960K	1044K	RUN	0:00	14.86%	1.42%	top
7078	nik	2	0	15280K	10960K	select	2:54	0.88%	0.88%	xemacs-21.1.14
281	nik	2	0	18636K	7112K	select	5:36	0.73%	0.73%	XF86_SVGA
296	nik	2	0	3240K	1644K	select	0:12	0.05%	0.05%	xterm
48630	nik	2	0	29816K	9148K	select	3:18	0.00%	0.00%	navigator-linu
175	root	2	0	924K	252K	select	1:41	0.00%	0.00%	syslogd
7059	nik	2	0	7260K	4644K	poll	1:38	0.00%	0.00%	mutt
...										

ς Ψīñāδ άβίάέ ÷ññéóίΨίç όά äγí δññāδδ. ς έάóáéβāá (ίέ δΨίόά δññóδδ āñāñΨδ) άìöáíβæīóί όī PID όçδ δāéáδδδάβδδ άέάñāάόβδδ όίτ Ψññāñā, όçī ιΨόç δéīΨ öīñδβīτδ (άβίάέ ίέά ιΨñççόç όίτ άάβ÷ίάέ δὸí άδδάό÷ίέçīΨī άβίάέ όī όýόçíá), ī ÷ññūñδ έάέόīτñāβδδ (uptime) όίτ όóδδΨíάόίτδ (άδὸδ όçī δāéáδδδάβά άδάíáéēβίçόç) έάέ όçī δñΨ÷īδδάéē íñā. Óά ΰέéá

Ïðñáβòá áðβóçò íá äþóáòá óçí chsh óçí áðέειäP -s, áòòP εά εÛóáε ðí εÛέòòòð áεά óáò, äβ÷-ùò íá ÷ñáεάóòáβ íá ÷ñçóειñðíεPóáòá ðíí εάειáññáñÛóí. Άεά ðáñÛáεάíá, áí εÛεάòá íá áεεÛíáòá ðí εÛέòòòð óáò óá bash, ç áέιειòεç áíóíεP áβíáε áέñεáþò áòòú ðíò ÷ñáεÛæáóòá:

```
% chsh -s /usr/local/bin/bash
```

Óçíáβòóç: Òí εÛέòòòð óοí ðíòíβí áðέεòíáβòá íá íáòáááβòá ðñÛðáε íá áβíáε εάòá÷-ùñçíÛíí óοí áñ÷-áβí /etc/shells. Άí Û÷-áòá ááεάóáòòPóáε Ûíá εÛέòòòð áòú óç óðέειäP ðúí ports, ðúòá áòòú εά ðñÛðáε íá Û÷-áε Páç áβíáε. Άí ááεάóáòòPóáòá ðí εÛέòòòð ðúííé óáò, ðúòá εά ðñÛðáε íá áεòáεÛóáòá óç áεάáεέáóóá ðíò áέíειòεáβ.

Άí áεά ðáñÛáεάíá, ááεάóáòòPóáòá ðí bash ðúííé óáò εάε ðí ðíòíεáòPóáòá óòí /usr/local/bin, ðúòá εά ðñÛðáε íá äþóáòá:

```
# echo "/usr/local/bin/bash" >> /etc/shells
```

Έáε íáòÛ íáíáðñÛíòá óçí chsh.

4.10 ΈάειáññáñÛóíε

ΆñεáòÛò ðòειβóáέò óοí FreeBSD áβñíóáε íá áðáíáñááóóá áñ÷-áβíí εάειÛíò. Άεά áòòú ðí εüáí, εά Póáí εάεP εáÛά íá áñíεάεεüεáβòá íá Ûíá εάειáññáñÛóí. Άñεáòíβ ðáñεÛ÷-ííóáε óοí ááóέεü óýóóçíá ðíò FreeBSD εάε ðíειβ ðáñέóóúðáñíε áβíáε áεάεÛóειíε óçí ÓðέειäP ðúí Ports (Ports Collection).

Ï áòειεüòáñíò εάε áðειÛóáñíò εάειáññáñÛóíò áεά íá ðíÛεáòá ðñÛáóáε **ee**, ðíò óçíáβíáε easy editor (áýέíειò εάειáññáñÛóíò). Άεά íá íáεειPóáòá ðíí **ee**, ðñÛðáε íá ðεçέòñíειäPóáòá óçí áñáñP áíóíεPí ee filename ðíòí filename áβíáε ðí ðñíá ðíò áñ÷-áβíò ðíò εÛεáòá íá áðáíáñááóóáβòá. Άεά ðáñÛáεάíá, áεά íá áðáíáñááóóáβòá ðí /etc/rc.conf, ðεçέòñíειäPáβòá ee /etc/rc.conf. ðúέέò áέóÛέεáòá óοí ee, ðεáò íé áíóíεÛò áεά íá ÷áέñέóóáβòá óέò εάεòíòñáβáò ðíò εάειáññáñÛóíò áíáóÛííóáε óοí ðÛíú ðíò ðçò ðεüíçð. Ï ÷-áñáεòPñáð εάðÛέí ^ óçíáβíáε ðí ðεPέòñí **Ctrl**, áðñÛíò ðε óçíáβíáε ðúò ðñÛðáε íá ðεçέòñíειäPóáòá ðíí óóíáóáóíü ðεPέòñí **Ctrl+e**. Άεά íá áááβòá áòú ðí **ee**, ðεÛáòá ðí ðεPέòñí **Esc**, εάε áðέεÛáòá leave editor. Ï εάειáññáñÛóíò εά óáò ðñíòñÛóáε íá óPóáòá ðð÷-üí áεεááÛò, áí Û÷-áòá áðáíáñááóóáβ ðí áñ÷-áβí.

Òí FreeBSD ðáñÛ÷-áòáε áðβóçò íá ðεí áíáεέáñÛíòð εάειáññáñÛóíòð ððòò ðí áíóúíáòúÛíí óοí ááóέεü óýóóçíá **vi**. Òí **Emacs** εάε ðí **vim**, áβíáε ðíò ðçò ÓðέειäPð ðúí Ports ðíò FreeBSD (editors/emacs εάε editors/vim). Άòòíβ íé εάειáññáñÛóíε ðñíóóÛíòí ðíεεÛò ðáñέóóúðáñáð εάεòíòñáβáò εάε áóíáòúòçòáò, íá εüóóíò áòíçíÛíç ðíεòðειεüòçòá εάε áòóειεβá áειÛεçòçò. ðóòúóí áí ó÷-ááεÛáòá íá áðáíáñááóóáβòá áñεáòÛ εάβíáíá, ç áειÛεçòç áíúò εó÷-òñíÛ εάειáññáñÛóíò ððòò ðí **vim** P ðí **Emacs** εά óáò áεòòPóáε ðíεÛ ðáñέóóúðáñí ÷-ñüí áðáíáñááóóáð óçí ðñáβá.

ðíεεÛò áòáññáÛò ðíò ÷ñáεÛáòáε íá áεεÛíòí εÛðíειí áñ÷-áβí P áðáέóíÛí áòú ðí ÷ñPóç íá ðεçέòñíειäPóáε εÛðíειí εάβíáí, εά áñβñóí áòòúíáòá εÛðíειí εάειáññáñÛóí. Άεά íá áεεÛíáòá ðíí ðñíáðέεááñÛí εάειáññáñÛóí, εά ðñÛðáε íá εÛóáòá εáòÛεεçç ðειP óçí íáòááεçòP ðáñεáÛέειíòð EDITOR. Άáβòá óçí áíúòçòá ΈáεÛç áεά ðáñέóóúðáñáð εáðòñÛíáεáò.

4.11 ÓõóéâõΥò êáé Ἀñ ÷ áβá óõóéâõπὶ

Óõóéâõπ áβίáé Ḃíáδ ùñò ðὶõ áíáõΥñáοáé οá ο ÷ Ḃόç ìá êáéοἰῶñáβáδ hardware áñòδ οóóðΠíáδἰδ, ðáñéáìáḂñἰóáδ áβóεἰòδ, áéοððòδΥδ, εḂñοáδ ñáóéέπὶ éáé ðεçêòñἰεḂáéá. ḂáδḂ ስçὶ áêéβίçόç δὶò FreeBSD ἰé ðáñéόóóúδáñáδ ðεçñἰἰῶñáβáδ ðὶõ áíáñḂἰἰῶáé οδçὶ ἰεḂúç áβίáé οóóéâõΥδ ðὶõ áíáñḂññβáñἰόáé áδù οὶ οýόδçá. Ἰðñáβòá ἰá ἰáíáááβòá οá ἰçὶγίáοá áêéβίçόçδ, áéááḂḂἰἰóáδ οὶ /var/run/dmesg.boot.

Ἄéá ðáñḂáéáìá, acd0 áβίáé ἰ ðñðἰòδ ἰáçáùδ IDE CDROM, áñð οὶ kbd0 áíóéðñἰούðáγáé οὶ ðεçêòñἰεḂáéí.

Óéóδ ðáñéόóóúδáñáδ áδù áóòΥδ οéδ οóóéâõΥδ οá Ḃíá éáéοἰῶñáéεḂú οýόδçá UNIX ç ðñḂúóááóç ðñḂḂáé ἰá áβíáóáé áéáḂḂἰἰóἰò áéáéέπὶ ññ ÷ áβḂḂἰ ðὶò ἰñḂḂἰἰῶáé ññ ÷ áβá óõóéâõπὶ, éáé áβίáé δἰðἰéáδçὶḂíá óòἰ ḂáδḂἰἰáḂḂἰ /dev.

4.11.1 ἈçὶεἰῶñáñἰἰỐἰάóð Ἀñ ÷ áβá Óõóéâõπὶ

¼óáí ðñἰé ḂḂỐỐỐ ἰéá ἰḂá óõóéâõπ óòἰ οýόδçá οáδ, π ἰáοááéèòδòβæáòá ðçááβὶ éþáééá áéá ððἰóðπñéç ἰḂḂἰ ἰáçáπὶ, ðñḂḂáé ἰá çὶεἰῶñáñἰἰỐỐỐ ἰḂá ññ ÷ áβá óõóéâõπὶ.

4.11.1.1 DEVFS (DEVICE FILE SYSTEM)

Ὢ ἰóόóçá ññ ÷ áβḂḂἰ óõóéâõπὶ π, DEVFS, ðáñḂḂỐ ÷ áé ðñḂúóááóç óòἰ ÷ ðññ ἰñḂḂỐ óõóéâõπὶ οἰò ððñΠíá (device namespace) óòἰ global ἰóόóçá ññ ÷ áβḂḂἰ δἰò οóóðΠíáδἰδ. Ἀἰòβ ἰá çὶεἰῶñáñáβòá éáé ἰá ἰáòáδñḂḂỐáòá ññ ÷ áβá óõóéâõπὶ, οὶ DEVFS óἰóçñáβ áéá óáδ áðòò ὧ Ḃáéáβòáññ ἰóόóçá ññ ÷ áβḂḂἰ.

Ἀáβòá çὶ ὲéβáá áἰçéáβáð devfs(5) áéá ðáñéόóóúδáñáδ ðεçñἰἰῶñáβáδ.

4.12 ὪγḂỐ ἈéòáéḂỐỐỐ

Ἄéá ἰá éáòáéḂááòá áéáòβ οὶ FreeBSD ÷ ñçóéἰỐỐỐéáβ οἰἰ óγḂỐ elf(5) éá ðñḂḂáé ðñðỐá ἰá ñññβæáòá ἰáñééḂ ḂñḂáἰáóá áéá δἰòð ðñáéò “éòñβáñ ÷ ἰòð” óγḂỐð ñéòáéḂỐỐỐỐ áéá οὶ UNIX

- a.out(5)
 Ἰ ðáéáéεḂòáñἰð éáé ðéἰ “ééáóóééεḂð” óγḂỐð áíóééáéἰḂỐỐỐ οἰò UNIX. ×ñçóéἰỐỐỐỐỐ ἰéá ἰéέñπ éáé óòἰðááπ éáòáéβáá ἰá Ḃíá ἰááééεḂ ἰγỐỐññ ὲççὶ ññ ÷ π ðἰò οó ÷ ἰḂḂ ÷ ñçóéἰỐỐỐỐéáβòáé áéá ἰá ÷ ññáéòçñβæáé οἰἰ óγḂỐ (ááβòá áéá ðáñéόóóúδáñáδ ðεçñἰἰῶñáβáδ ççὶ a.out(5)). ðáñéḂḂỐ ÷ áé ðñβá ὲñòδùἰ Ḃíá δἰΠíáóá: .text, .data éáé .bss éáé áðéðéḂỐ Ḃíá ðβίáéá óòἰáḂỐỐỐ ἰéá Ḃíá ðβίáéá áéòáñéèἰçòéέπὶ ÷ ññáéòπñỐỐ.
- COFF
 Ἰ óγḂỐð áíóéééáéἰḂỐỐ SVR3. Ç éáòáéβáá òþñá áðἰðáéáβòáé áδù Ḃíá ðβίáéá οñḂỐỐ, þóðá ἰá ἰðñἰγỐỐ ἰá ḂḂỐ ἰòἰá éḂḂé ðáñáðḂỐỐ ἰδù áðéḂḂỐ .text, .data éáé .bss.
- elf(5)
 Ἰ áéḂỐỐ ÷ ἰð οἰò COFF, ðáñééáìáḂỐáé ðἰééáðéḂḂ ὲḂỐỐáóá éáé äḂ ÷ áðáé ðéἰḂð 32 π 64 bit. Ὢ ἰáóóéεḂ ἰáéἰḂéðçá: Ἰ ELF ó ÷ áééḂḂóðçéá ἰá ççὶ ðñἰḂḂỐðéáóç ððò éá ððπñ ÷ á ἰḂỐ Ḃíá ABI áéá éḂḂéá ññ ÷ éóáéοἰỐéέπ ὲççὶΠíáδἰð. Ἀóðπ ç ððḂéáóç áβíáé ḂḂð áóóáéἰḂỐç òþñá, áοἰγ áéḂỐç éáé óòἰ ἰðñỐéεḂỐ éúοἰỐ οἰò SYSV (Ḃðἰð ððḂñ ÷ ἰỐἰ ὲἰỐḂḂỐ ÷ éóòἰ ὲñβá ABI: SRV4, Solaris, SCO) ááἰ éó ÷ γáé.

áñááéåßùí òíò GNU (**binutils**) òðíóðçñæáé cross compiling, ELF, èíéíÝò áéáééíèÐεåð, ðñíáèðÙóáéò C++, èðè. ΆðέðεÝíí, ðñééíß òñβóíé εάóáóéåáóáóóÝò ðñíóóÝñíóí áεòáεÝóεíá ELF, εάé åßíáé ðñéý εάεù íá ðñííýí íá áεòáεáóóíýí óòí FreeBSD.

Í ELF åßíáé ðéí áεòñáóóééùð áðu òíí a.out εάé ðáñéóóóùðáñí áðáεòÙóεíò óòí ááóééù óýóðçíá. Óá áñááéåßá ELF åßíáé áðéíèùðáñá óççí óðíóÐñçóç εάé ðñíóóÝñíóí òðíóðÐñéíç áéá cross compilers, εÙóé ðíò åßíáé ðñéý óçíáíóééù áéá ðáñééíýð áíεñððíòð. ðñíáß í ELF íá åßíáé εßáí ðéí áñáùð áðu òíí a.out, áεεÙ ç áεáóíñÙ ááí åßíáé áéóðεçðÐ. ÓðÙñ ÷ íóí áðβóçð ðñééÝð Ùεεåð áεáóíñÝð ðáóáíý òíòð, óá εáððñÝñáéåð ùðùð òíí ðñùðí ðíò áíóéóóíé ÷ βáéíóí óáεßáðð, ðíò ÷ áéñβæííóáé òíí εþáεéá init, èèð. ÉáíεÙ áðu áóðÝð ááí åßíáé ðñéý óçíáíóééþ, áεεÙ ùóóóóí ááí ðáýíóí íá åßíáé áεáóíñÝð. ðá òíí εáéññù ç òðíóðÐñéíç áéá òí a.out εá áðñíáéñòíεåß áðu òíí ððñÞíá GENERIC, εάé òáεééÙ εá áóáéñáεåß áíóáéþð áðu òíí ððñÞíá ùðáí áεéåßþáε ðñééçññùðéεÙ ç áíÙáεç áεðÝεåçðð ðáεáéþí ðñíáñáíÙòùí óýðíò a.out.

4.13 Άέá Ðáñéóóóóùðáñáò Ðεçñíóíñßáò

4.13.1 Óáεßááð Æíçεåßáò

Ç ðéí εάóáíçðÐ òáéíçñßóóç óòí FreeBSD ðñíóóÝñáóáé ðá òç ðñòÐ òùí óáεßáùí áíçεåßáðð (manual pages). Ó ÷ ááùí áéá εÙεá ðñíáñáíá òíò óðóðÞíáóíò áßíáóáé ðεá óýíóñç áíáóíñÙ ðíò áíçεåßáðð òéð ááóééÝð εáéóíòñáßáðð εάé áεÙóíñá Ùεεá εÝíáóá. ΆóðÝð ðε óáεßááð ðñíáÙεéííóáé ðá òçí áíóíεþ man. Ç ÷ ðñóç òçð áíóíεþð man åßíáé áðεþ:

```
% man command
```

ùðíò command åßíáé òí ùñíá òçð áíóíεþð áéá òçí ðñíá áðεéòíáβòá íá ðÙεáðá ðáñéóóóóùðáñáò ðεçñíóíñßáð. Άέá ðáñÙááéáíá, áéá íá ðÙεáðá ðáñéóóóóùðáñá áéá òçí áíóíεþ 1s ðεçεòññéñáþóá:

```
% man 1s
```

Óí online manual ÷ ùññæáðáé óá òÝóóáñéð áñεéìçíÝíáð áíúòçðáð:

1. ΆíóíεÝð ÷ ðñóç.
2. Êεþóáéð óðóðÞíáóíò εάé áñεéíßß óóáéíÙòùí.
3. ÓðíáñðÞóáéð òùí áéáééíεçεþí òçð C.
4. ðáçáíß óðóéåðþí.
5. Óýðíé áñ ÷ áßùí.
6. Ðáé ÷ íβáéá εάé Ùεεåð áóáñíñáÝð áεáóéÝááóçð.
7. ΆεÙóíñáð ðεçñíóíñßáð.
8. ÓðíóÐñçóç óðóðÞíáóíò εάé áíóíεÝð εáéóíòñáßáð.
9. ΆíÙððóíç ððñÞíá.

Óá ðáñééÝð ðáñéððþóáéð, òí βáéí εÝíá ðñíáß íá áíóáíβæáðáé óá ðáñéóóóóùðáñáò áíúòçðáð òùí óáεßáùí áíçεåßáðð. Άέá ðáñÙááéáíá, òðÙñ ÷ áε ç áíóíεþ ÷ ðñóç chmod εάé ç êεþóç óðóðÞíáóíò chmod(.). Óá áóðÐ òç ðáñßððòóç, ðñíáßðá íá ðáßðá óóçí áíóíεþ man ðñéá áéñéáþð εÝεáðá áðééÝáíóáð òçí áíúòçðá:

```
% man 1 chmod
```


έέέ kbdcontrol(1) όύí óάέβάύí άίΠέάέάò (manual pages). Άάí έά όόίά ÷ βόίόιά δάñάέόΎñù, άέέÜ ÷ άίάέάόάñùάñò άίάάίρβόδçò ίδññάβ ίά όόίάίτöέάýάόάέ δΎίόά όέò óάέβάάò άίçέάβáò ãέά δάñέόóúόάñí έάδδññάñΠ έάέ ίέñέçñùΎίç άδάίΠάçóç όύí έάέόίöñάέήí.

4. Άόóú άάí άβίάέ άδúέόόά άέçέΎò — ΌδΎñ ÷ ίóí ίάñέέÜ δñÜάιáόά δñò άάí ίδññίγí ίά άέάέñδñγí. Άέά δάñÜάάέάíá, άΎí ç άέάñάάόβá δñíόδáέάβ ίά άέάáÜόάέ Ύίá άñ ÷ άβí άδú Üέέñí όδñέíάέόóΠ όόí άβέόóí έάέ ίάóίέέÜ άόóúò ÷ Üέέñò όδñέíάέόóΠδ άέάέñøάέ άέά έÜδñέí έüάí (έüάñ έέάέóβíάόíò όñò pc Π έüάñ άέÜάçò όóí άβέόóí), όüόá ç άέάñάάόβá ίññÜάάόάέ ίç “άέάέñøέíç”. Δέέάίρδ ç άέάñάάόβá ίά έÜίáέ time out, όóíΠέñò ίάόÜ άδú άγí έάδδÜ. Ιñέέò όóíάάβ άόóú, έά όάñíάόέόόάβ Üíáόά.

- ĩăñééŸò äóăñîîăŸò Ÿ ÷ îóí äðëëîăŸò ĩăðăăëþðóóóçð ðîð ó ÷ äòþæïîóäé ĩă ðí ðé ĩðñîŸí ĩá êŨîîó ĩéäé ðé ũ ÷ é. Ăéä ðăñŨăäéăĭă, ĩ **Apache** ĩðñîăþ ĩá ĩăðăăëüððóóðăþ ĩă Ÿíă äðñŸ óŨóíă áðü äðëëîăŸò. ĩăðăăëüððæïîóäð ðîŸ áðü ðí port, äăŸ äþĭăé áŸŨăéç ĩá äă ÷ ðăþðă ðéð ðñîăðëéăăĭŸíăð äðëëîăŸò, ĩðñîăþðă ĩá êŨîîăðă ðéð äééŸò óăð.
- Óă ĩăñééŸò ðăñëððóóäéð, ĩðñîăþ ĩá ððŨñ ÷ îóí ðŕëëăðëŨ ðăéŸóă äéä ðçí þăéă äóăñîîăþ, ĩă äéäöĭñăðééŸò ñðëîþóáéð. Ăéä ðăñŨăäéăĭă, ðí **Ghostscript** äéäðþëäðäé ùð Ÿíă ðăéŸòĭ ghostscript êäé Ÿíă ðăéŸòĭ ghostscript-nox11, áŸăëüăùð áí êä äăëäóäóðþóäðă þ ũ ÷ é Ÿíăí X11 server. ĂððîŸ ðîð ðŸðîð ĩé ñðëîþóáéð äþĭăé äðĭăðŸò ĩă ðă ðăéŸóă, äëëŨ äñþăĭñă äþñîóäé äăŸíăðăð áí ĩăă äóăñîîăþ Ÿ ÷ äé ðăñéóóüðăñăð áðü ĩăă þ äŸĭ äéäöĭñăðééŸò ñðëîþóáéð ĩăðăăëþðóóóçð.
- ĩé óðĭëþëäð ðüĭ äăăëþĭ äéăñĭðð áðü ĩăñééŸò äéăñĭŸò ëĭăëóĭéëŸŸ, áðăăĭñăŸĭóĭ ðçí äéăñĭþ äëðäéŸóéĭîð ëþăééă. ÐñŸðăé ĩá äéăŸăçëŸŸ ĩă ðçí ĩñðþ ðçăăþĭð ëþăééă.
- ĩăñééŨ Ũðĭñă äăŸ äĭðëóäöŸŸĭóäé ðă Ÿðĭéĭă äëðäéŸóéĭă. ŌĭðëŨ ÷ éóôĭĭ ĩă ðĭŸ ðçăăþĭð ëþăééă, ĩðñîăþðă (êäüñçðééŨ) ĩá ðĭŸ äéäăŨóáðă êäé ĩá þŨîăðă äéä ðëéăŸŨ ðñîăëþĭăðă ĩüŸĭð óăð.
- Áí Ÿ ÷ äðă ðĭðëéŨ, äééŨ óăð patches, êä ÷ ñăéäóðăþðă ðĭŸ ðçăăþĭð ëþăééă äéä ĩá ðă äóăñîîăðăðă.
- ĩăñééŨ Ũðĭñă äĭðóðŨñĭóĭ ĩá Ÿ ÷ îóí ðĭŸ ðçăăþĭð ëþăééă, þðóðă ĩá ðĭŸ äéäăŨóĭóĭ áí äăñăëĭŸĭă, ĩá ðĭŸ äééŨŸĭóĭ (hack), ĩá äăŸăéóöĭŸŸ áðü äðöĭŸ (áí äŸăäéä ðĭ äðëðñŸðăé ç Ũăäéă), e.ë.ð.

Ăéä ĩá äþðăðă áŸðĭăñĭð äéä ðă áŸíăñĭŸĭă ports, äăăñăðăþðă ðçí çëăëðñĭĭéþ ëþðóðă ðüĭ FreeBSD ports (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ports>) êäé ðçí çëăëðñĭĭéþ ëþðóðă áŸíăñĭþ ðñĭăëçĭŨóüĭ ðüĭ FreeBSD ports (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ports-bugs>).

Ðñĭăëăĭðĭþçóç: Ðñĭă äăëäóäóðþóäðă ĩðĭéĭăþðĭðă äóăñîîăþ, ðñŸðăé ĩá äéŸă ÷ äðă ðĭ <http://vuxml.freebsd.org/> äéä èŸĭăðă áóóäéăþðăð ðĭð ó ÷ äòþæïîóäé ĩă ðçí äóăñîîăþ óăð.

ĩðñîăþðă äðþóçð ĩá äăëäóäóðþóäðă ðĭ ports-mgmt/portaudit ðĭ ĩðĭþĭ áððüĭăðă êä äéŸă ÷ äé üëðð ðéð äăëäóäóçŸĭăð äðăñîîăŸò äéä äĭüóðŨ ðñüðŨ ðçíăþă. þăă ÷ ïð äðþóçð êä ðñăăĭăðĭðĭéăþðăé ðñĭă ðç ĩăðăăëþðóóóçð ĩðĭéĭăþðĭðă port. ŌĭŸ áŸăéŨĭăóĭ, ĩðñîăþðă ĩá ÷ ñçóéĭðĭéăþðă ðçí áĭðĭþ portaudit -F -a áðüðĭð Ÿ ÷ äðă ðñþðă äăëäóäóðþóáé ĩăñééŨ ðăéŸóă.

Ōĭ ððüëĭéðĭ äððîŸ ðĭð êăðăéăþĭð äĭçăăþ ðüð ĩá ÷ ñçóéĭðĭéăþðăðă ðă ðăéŸóă êäé ðă ports äéä ĩá äăëäóäóðþóäðă êäé ĩá äéä ÷ äéñéóðăþðă ðñüóéăðĭ ëĭăëóĭéëü óôĭ FreeBSD.

5.3 Ăñþóëĭîóäð ðçí Ăóăñîîăþ óăð

Ðñĭă äăëäóäóðþóäðă ĩðĭéĭăþðĭðă äóăñîîăþ ðñŸðăé ĩá äŸñþæăðăð ðé èŸăðă ĩá êŨĭăé, êäé ðüð ĩñĭŨăăðăé ç äóăñîîăþ. Ç ëþðóðă ðüĭ äéäéŸóéĭŸĭ äóăñîîăþĭ óôĭ FreeBSD ĩăăăëþĭăé óðă ÷ þð. Ăððð ÷ þð, ððŨñ ÷ îóí ðŕëëĭþ ðñüðĭé ĩá äñăþðă äððü ðĭð èŸăðăð:

- Ōðç äéëððăéþ ðĭðĭëăðþă ðĭð FreeBSD êä äñăþðă ĩéă ëþðóðă áðü üëðð ðéð äéäéŸóéĭăð äóăñîîăŸò, óôĭ <http://www.FreeBSD.org/ports/> (<http://www.FreeBSD.org/ports/index.html>). Ç ëþðóðă áððþ áŸíăþþĭăðăé óð ÷ ĩŨ, äĭþ ððŨñ ÷ äé êäé äðĭăðüðçðă áŸăëþðçóçð. Ōă ports äþĭăé ÷ ùñéóĭŸĭă óă êäðçăĭñþðă, êäé ĩðñîăþðă ĩá áŸăæçðþóäðă ĩăă äóăñîîăþ äþðă ĩă ðĭ Ÿñă (áí ðĭ ĩŸñăðă), þ ĩá äăþðă üëðð ðéð äóăñîîăŸò ðĭð äþĭăé äéäéŸóéĭăð óă ĩéă êäðçăĭñþă.
- ĩ Dan Langille äéäðçñăþ ðĭ FreshPorts, óôĭ <http://www.FreshPorts.org/>. Ōĭ FreshPorts êäóăăñŨðăé ðéð äééäăŸò ðüĭ äóăñîîăþĭ óôĭ äŸĭðĭð ðüĭ ports êäëþð óôĭăăþĭóĭ, äðëðñŸðĭðŨð óăð ĩá “ðăñăéĭĕĭðêăþðă” Ÿĭă þ ðăñéóóüðăñă ports, êäé ĩðñîăþ ĩá óăð óðăþëäé email Ÿðăĭ áððŨ áŸíăþþĭóäé.

- Áι ääí ãññßæãðä õι ùñíá ðçð äóäññãþð ðñö èÝëãðä, äñêéÛóðä íá ÷ñçóéññðñéÞóáðä Ýíá site óáí õι FreshMeat (<http://www.freshmeat.net/>) æéá íá äñãßðä ïßá äóäññãþ, êäé ïäöÛ ïðññãßðä íá æéÝññãðä ïáíÛ õι site ðñö FreeBSD æéá íá äãßðä áí ç äóäññãþ Ý ÷ æé ãßíæ port.

- Áι ïÝñãðä õι äéñéáÝð ùñíá ðñö port, êäé èÝëãðä ïññι íá äñãßðä óá ðñéá êáççññßá äßíæé, ïðññãßðä íá ÷ñçóéññðñéÞóáðä ççí áíðñéÞ whereis(1). ÁðêÛ äñÛððä whereis äñ÷äßí, ùðñö äñ÷äßí äßíæé õι ðññãññáä ðñö èÝëãðä íá ääëäóáóððáðä. Áí äððñ äñßðéäðäé óðñ óýóççíá óáð, ç áíðñéÞ êá óáð ðäé ðñö äßíæé, ùðñð ðãñáêÛðñ:

```
# whereis lsof
lsof: /usr/ports/sysutils/lsof

Áððñ ïäð èÝÝæ ùðé õι lsof (Ýíá äñãæäßí óðóðßíáðñö) ïðññãß íá äñãæãß óðññ êáðÛëññ
```

- Áðêðññóéäðä, ïðññãßðä íá ÷ñçóéññðñéÞóáðä ïéá äðêÞ áíðñéÞ echo(1) æéá íá áíðñðßðáðä ççí õñðñéäóßá èÛðñéñð ðññãññáðñö ïÝóá óðá ports. Áéá ðãñÛäêéäñ:

```
# echo /usr/ports/*/*lsof*
/usr/ports/sysutils/lsof

Óçñæððóá ùðé õι ðãñãðÛñ ðä äãßíæé äðßçðð êäé ïðñéäðððñðä äñ ÷ ãßá Ý ÷ ïñí êáðÝäæ óðññ êáðÛëññ
```

- Áéññç Ýíáð ðññðñð ïá äñãßðä Ýíá óðãæäêéñéÝññ port, äßíæé ÷ñçóéññðñéÞóáð õññ áóððãñéù ïç ÷ áíéóññ áíææÞçççðð ççð Óðêéññðð ðññ Ports. Áá íá ÷ñçóéññðñéÞóáðä äððñ õññ ðññðñ áíææÞçççðð, Èá ÷ ñæéäóðäß íá äñßðéäðä óðññ êáðÛëññ /usr/ports. ¼ðáí äñãæãßðä óá äððññ õññ êáðÛëññ, æéðæéÝóðä õññ make search name=úññíá--ðññãñññíáðñð ùðñö ùññíá--ðññãñññíáðñð äßíæé õι ùññá ðñö ðññãññáðñö ðñö èÝëãðä íá äñãßðä. Áéá ðãñÛäêéäñ, áí áíææçðÛðä õññ lsof:

```
# cd /usr/ports
# make search name=lsof
Port:      lsof-4.56.4
Path:      /usr/ports/sysutils/lsof
Info:      Lists information about open files (similar to fstat(1))
Maint:     obrien@FreeBSD.org
Index:     sysutils
B-deps:
R-deps:
```

Óñ ðñßá ççð äññãñð ðñö ðñÝðäé íá ðññóÝíãðä éæéãßðäñá äßíæé ç äñãññÞ “Path:”, áóññ äððÞ óáð èÝÝæ ðñö íá äñãßðä õññ port. Ïé ððñéñððð ðêçññññßðð ðñö ðãñÝ ÷ ïñóáé ääí ÷ ñæéÛéññóáé æéá íá ääëäóáóðäæãß ðñö port, æéá äððñ ääí èá áíæðéññí äãþ.

Áéá ðéñ êáððñãññÞ áíææÞçççð ïðññãßðä íá ÷ñçóéññðñéÞóáðä äðßçðð make search key=ðññóç ùðñðð ðññóç äßíæé èÛðñéñ êãßñññ ðññð áíææÞçççç. Áððñ áíææçðÛ ñññáðá port, ó ÷ ùééá, ðãñéãñãðÝð êäé äñãñððáéð, êäé ïðññãß íá ÷ñçóéññðñéÞçèãß æéá íá äñãæññññ ports ðñö ó ÷ äðßæññóáé ïá Ýíá óðãæäêéñéÝññ èÝÝá, äÛñ ääí ãññßæãðä õññ ùññá ðñö ðññãññáðñö ðñö áíææçðÛðä.

Óá ùéãð ðéð ðãñãðÛñ ðãñéðððáéð, ç õñÛóç ðññð áíææÞçççç äßíæé case-insensitive (ääñ êáñáÛñæé ðððçç ðéð äéäóññÝð êáðáéãßññ-ïéññþñ). Ç áíææÞçççç æéá õññ “LSOF”, èá äþðáé óá ðæéá äðñðæéÝóñáðá ïá ççñ áíææÞçççç æéá õññ “lsof”.

5.4 × ñçóéññðñéÞóáð õññ Óýóççíá ðññ ÐäéÝðñ

ÓðÛñ ÷ ïññ æéÛññá äñãæãßá ïá óá ïðñßá ïðññãßðä íá æéá ÷ æéñéóðãßðä óá ðäéÝóá óðññ FreeBSD:

- Óá Ýíá óýóóçíá ðïð ãñβóéáóáé Ðäç óá éáéóïðñáβá, ïðññáβóá íá äéóáé Ýóáóá ðí **sysinstall** áéá íá äáéáóáóóÐóáóá, íá äéáñÛøáóá, éáé íá äáβóá óéð äáéáóáóóçíÝíáð éáé óéð äéáéÝóéíáð áöáññüãýð. Åéá ðáñéóóóðáñáð ðεçññüðñáð, äáβóá ðí ÕíÐíá 2.10.11.
- Óá äéÛóïíá ãñáäéáβá äéá÷áβñéóçð ïÝóóç ðçð ãñáññüðð áíóïðëþí, ðïð áðñíóáéíýí éáé ðí áíóééáβñíáñí óðεÐóçóçð áðððð ðçð áñüóçóáð.

5.4.1 Åäéáééóóþñíóáð Ýíá ÐáéÝóí

Ïðññáβóá íá ÷ñçóéíðñéÐóáóá ðí ãñáäéáβí pkg_add(1) áéá íá äáéáóáóóÐóáóá Ýíá ÐáéÝóí éíáéóíééý ðïð FreeBSD áðü Ýíá ðñðééÛ áðñεçéáóíÝíí ãñ÷áβí Ð áðü Ýíáí äéáéñééóóÐ óðí áβéðí.

ÐáñÛáäéãíá 5-1. “ÉáóÝááóíá” áñüð ÐáéÝóíð ÷áéññéβíçóá éáé äáéáóáóóç ðïð ðñðééÛ

```
# ftp -a ftp2.FreeBSD.org
Connected to ftp2.FreeBSD.org.
220 ftp2.FreeBSD.org FTP server (Version 6.00LS) ready.
331 Guest login ok, send your email address as password.
230-
230-      This machine is in Vienna, VA, USA, hosted by Verio.
230-      Questions? E-mail freebsd@vienna.verio.net.
230-
230-
230 Guest login ok, access restrictions apply.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> cd /pub/FreeBSD/ports/packages/sysutils/
250 CWD command successful.
ftp> get lsof-4.56.4.tgz
local: lsof-4.56.4.tgz remote: lsof-4.56.4.tgz
200 PORT command successful.
150 Opening BINARY mode data connection for 'lsof-4.56.4.tgz' (92375 bytes).
100% |*****| 92375      00:00 ETA
226 Transfer complete.
92375 bytes received in 5.60 seconds (16.11 KB/s)
ftp> exit
# pkg_add lsof-4.56.4.tgz
```

ÅÛí ááí Ý÷áðá ïβá ðñðééÛ ðçãÐ ÐáéÝóóçí (üððð áβíáé Ýíá FreeBSD CD-ROM set) ðüðá βóðð áβíáé áðéñüðáññí íá ÷ñçóéíðñéÐóáóá ðçí áðééñáβ -r áéá ðí pkg_add(1). Áððð éá éÛíáé ðí ãñáäéáβí íá éáéññβóáé áððüñáóá ðç óóóðÐ ïññÐ éáé Ýéáñóç éáé Ýðáéóá íá áíáéðÐóáé éáé íá äáéáóáóóÐóáé ðí ÐáéÝóí áðü Ýíá FTP site.

```
# pkg_add -r lsof
```

Õí ðáñáðÛñü ðáñÛáäéãíá éá “éáóááÛóáé” éáé éá äáéáóáóóÐóáé ðí óóóóð ðáéÝóí ÷ññβð ðáñáéóÝñü áðÝíááóç ðïð ÷ñÐóç. Áí ááí èÝéáðá íá ÷ñçóéíðñéÐóáóá ðí éýñéí site áéáññüðð ÐáéÝóóçí, ïðññáβóá íá ÷ñçóéíðñéÐóáóá éÛðñéí mirror. Åéá ðí óéíðü áððü, éá ðñÝðáé íá ãðéññóáðá óóóðÛ ðçí ðéñÐ ðçð PACKAGESITE, þóðá íá ðáñáéÛñáðá óéð ðññáðééáñÝíáð ãðéññóáéð. Õí pkg_add(1) ÷ñçóéíðñéáβ ðí fetch(3) áéá íá “éáóááÛóáé” óá ãñ÷áβá, éáé áððü ïá ðç óáéñÛ ðïð ÷ñçóéíðñéáβ äéÛóïíáð ïáóáäéçóÝð ðáñéáÛééñíððð, ðáñééáíááññÝíñü ðñí FTP_PASSIVE_MODE, FTP_PROXY, éáé FTP_PASSWORD. Óóðð ÷ñáéáóóáβ íá ãðéññóáðá ïβá Ð ðáñéóóóðáñáð áðü áððÝð áí ãñβóéáóáð ðβóó ãðü Ýíá firewall, Ð βóðð íá ÷ñáéáóóáβ íá ÷ñçóéíðñéÐóáóá Ýíáí FTP/HTTP proxy. Åáβóá ðí fetch(3) áéá ðçí ðéÐñç

èßóóá ðùí ìáóááèçòþí. ÐññíóÝíòá ùíéé óðí ðáñáðÛíù ðáñÛäáéáìá ÷ñçóéññíéáßóáé ðí lsof áíðß ðíò lsof-4.56.4. ¼óáí áßíáóáé áðñáéñðóíÝíç èÐøç, ðñÝðáé íá áóáéññáèáß ï áñéèìùð Ýéáñíóçð ðíò ðáéÝðíð. Õí pkg_add(1) èá “éáóááÛóáé” áððùíáóá ðçí ðáéäðóáßá Ýéáñíóç ðçð áðáññãðð.

Õçíáßòóç: Õí pkg_add(1) èá “éáóááÛóáé” ðçí ðáéäðóáßá Ýéáñíóç ðçð áðáññãðð áí ÷ñçóéññíéáßóáé FreeBSD-CURRENT Þ FreeBSD-STABLE. Áí ðñÝ ÷ áðá íéá -RELEASE Ýéáñíóç, èá “éáóááÛóáé” ðçí Ýéáñíóç ðíò ðáéÝðíð ðíò Ý ÷ áé ìáóááèùððéóóðáß ìá ðçí Ýéáñíóç óáð. Áßíáé áðíáðù íá ðí áéèÛíáðá áððù, áéèÛæíðáð ðçí PACKAGESITE. Äéá ðáñÛäáéáìá, áí ðñÝ ÷ áðá Ýíá óýóóçíá FreeBSD 8.1-RELEASE, ðí pkg_add(1), áðù ðñíáðééñãð, èá ðñíóðáéÞóáé íá “éáóááÛóáé” ðáéÝóá áðù ðí
ftp://ftp.freebsd.org/pub/FreeBSD/ports/i386/packages-8.1-release/Latest/. Áí èÝéáðá íá áíááéÛóáðá ðí pkg_add(1) íá “éáóááÛóáé” ðáéÝóá ðíò FreeBSD 8-STABLE, èÝóðá ðçí PACKAGESITE ùð ftp://ftp.freebsd.org/pub/FreeBSD/ports/i386/packages-8-stable/Latest/.

Õá áñ ÷ áßá ðùí ðáéÝðùí äéáíÝññíóáé óá ïñòÝð .tgz éáé .tbz. Ìðññáßðá íá óá áñáßðá óðí ftp://ftp.FreeBSD.org/pub/FreeBSD/ports/packages/, Þ óðá CD-ROM ðçð äéáññðð ðíò FreeBSD. ÊÛèá CD óðí FreeBSD 4-CD set (éáé óðí PowerPak, èèð.) ðáñéÝ ÷ áé ðáéÝóá óðí éáðÛéññí /packages. Ç éáðçáññéñíðßßçòç ðùí ðáéÝðùí áéññéðáß ðçí áñÞ ðíò äÝíðñò /usr/ports. ÊÛèá éáðçáññá Ý ÷ áé ðí áéèù ðçð éáðÛéññí, éáé èÛèá ðáéÝðí ìðññáß íá áñáèáß óðí éáðÛéññí All.

Ç áñÞ ðùí éáóáéùáñí ðíò óðóðßíáðíð ðáéÝðùí óáéñéÛæáé ìá ðçí áíðßóðíé ÷ ç ðùí ports. Õá äýí óðóðßíáðá óðíáñáÛæíðáé ìáðáíý ðíòð áéá íá àçíéññãðóíðí ðí óðñééèù óýóóçíá ðáéÝðùí/ports.

5.4.2 Äéá ÷ áßñéóç ðùí ÐáéÝðùí

Õí pkg_info(1) áßíáé Ýíá áñááéáßí ðíò ðáñáéÝóáé éáé ðáñéáñÛóáé óá áéÛóñá ðáéÝóá ðíò áßíáé ááéáóáóçíÝíá.

```
# pkg_info
cvsup-16.1          A general network file distribution system optimized for CV
docbook-1.2        Meta-port for the different versions of the DocBook DTD
...
```

Õí pkg_version(1) áßíáé Ýíá áñááéáßí ðíò óðññøßæáé óéð áéäùóáéð ùèñí ðùí ááéáóáóçíÝíùí ðáéÝðùí. Óðáéñßíáé ðçí Ýéáñíóç èÛèá ðáéÝðíð, ìá ðçí ðñÝ ÷ ðóá Ýéáñíóç ðíò áñßóéáðáé óðí äÝíðñí ðùí ports.

```
# pkg_version
cvsup              =
docbook            =
...
```

Õá óýíáñéá óðçí ááýðáñç óðÞèç àçèÞñíðí ðçí ó ÷ áðéèÞ çéééßá ìáðáíý ðùí ááéáóáóçíÝíùí áéäùóáñí éáé ðùí áéäùóáñí ðíò áßíáé áéáéÝóéíáð óðí ðíðéèù äÝíðñí ðùí ports.

Óýíáñéí	Õçíáóóá
=	Ç Ýéáñíóç ðíò ááéáóáóçíÝíñó ðáéÝðíò óáéñéÛæáé ìá áððÞ ðíò áßíáé áéáéÝóéç óðí ðíðéèù äÝíðñí ðùí ports.
<	Ç ááéáóáóçíÝíç Ýéáñíóç áßíáé ðáéáéùðáñç áðù áððÞ ðíò áßíáé áéáéÝóéç óðí äÝíðñí ðùí ports.

Óÿìáēī

>

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Óçìáóβá

Ç äāēáóáóóçìÝíç Ýēäīóç áβíáé íáüüðāñç áðü áóðP ðīō
áβíáé äéáéÝóçēç óóī ðīðééü äÝíóñī ðūí ports. (Ôī ðīðééü
äÝíóñī ðūí ports áβíáé ðééáíüðáóá áðāñ÷ áéüìÝñī.)
Ôī äāēáóáóóçìÝñī ðáéÝóī äāī āñβóēääóáé óóá
ðāñéá÷ üìáíá ðūí ports. (Áóóü ìðñāβ íá óóìāāβ, āéá
ðāñÛāāéāíá, áí Ýíá äāēáóáóóçìÝñī port Ý÷ áé áóáéñāēāβ
áðü ðçí ÓðēēīāP ðūí Ports, P Ý÷ áé ìáóīññáóóāβ.)
ÔðÛñ÷ ðī ðīēéáðēÝð äēäüóáéð ðīð ðáéÝóīō.
Ôī äāēáóáóóçìÝñī ðáéÝóī ððÛñ÷ áé óóī index, áēēÛ áéá
ēÛðīēī ēüāī ðī pkg_version äāí éáðÛóāññá íá óóāēññíáé
ðçí Ýēäīóç ðīō äāēáóáóóçìÝñīð ðáéÝóīō ìá ðçí
áíóβóóīē÷ç éáóá÷þñçóç óóī index.

5.4.3 Áóáéñþíóáó Ûíá ΔάέÛóī

Άέá íá áóáéñÝóáóá Ûíá äāēáóáóóçìÝñī ðáéÝóī ēīāéóīēēīý, ÷ñçóēñðīēþóóā ðī āñāāēāβī pkg_delete(1).

```
# pkg_delete xchat-1.7.1
```

Óçìáēþóðá üðé ðī pkg_delete(1) áðáéðāβ ðī ðēþñāð üññá éáé āñēēüü Ýēäīóçð ðīð ðáéÝóīō. Ç ðāñáðÛñü áíóīēþ äāí éá
ēāéóīōñāþóáé áí äþóáðā áðēþð xchat áíóβ āéá xchat-1.7.1. Άβíáé ùóðüíóí äýēīēī íá ÷ñçóēñðīēþóóāðá ðçí
pkg_version(1) āéá íá āñāβðā ðçí Ýēäīóç ðīō äāēáóáóóçìÝñīð ðáéÝóīō. Áíóβ āéá áóóü, ìðñāβðā áðβçðó íá
÷ñçóēñðīēþóóā Ûíá ìðáéáíóÝñ:

```
# pkg_delete xchat\*
```

Óðçí ðāñβðóóç áóðP, éá áéáñāóīýí üēá óá ðáéÝóá ðīð óá ðñüíáóá ðīðð āñ÷βæīóí ìá xchat.

5.4.4 ΆéÛóīñá

¼éáð íé ðēçññīññβāð āéá óá ðáéÝóá áβíáé áðñēçēāóīÝíáð óóīí éáðÛēīāī /var/db/pkg. Óóá āñ÷áβá áðóīý ðīð
éáóáēüāīō, éá āñāβðā ðç ðāñēñāóþ ēÛēá ðáéÝóīō, éāēþð éáé ðç ēβóóá ðūí āñ÷áβüí ðīð äāēáééóðÛ.

5.5 × ñçóéíðīēþíóáó ðçí ÓðēēīāP ðūí Ports

Óá ðāñáéÛóð ðīþíáóá äβñīðí ááóééÝð ðāçāβāð ÷ñþóçð ðçð ÓðēēīāPð ðūí Ports āéá äāēáóÛóóáóç P äéáñāóþ
ðññāññüÛðūí óóī óýóóçíá óáð. ìðñāβðā íá āñāβðā ēáððññāñþ ðāñēñāóþ ðūí äéáéÝóēñüí áðéēīāþí ðīð make éáé ðūí
ìáðáāēçðþí ðāñéáÛēēīíðō óóī ports(7).

5.5.1 Áíáēðþíóáó ðçí ÓðēēīāP ðūí Ports

Ðñēí ìðñÝóáðá íá äāēáóáóóðþóáðá ðññāññüññáóá ìÝóó ðūí ports, ðñÝðáé ðñþóá íá áíáéðþóáðá ðçí ÓðēēīāP ðūí Ports.
Ðññēáéóáé ðóóéáóóéÛü āéá ìéá óðēēīāP áðü Makefiles, patches, éáé āñ÷áβá ðāñēñāóþð ðīð ðīðñēäóíýíóáé óóī
/usr/ports.

āāíéüüōāñá, āāβōā òí FreeBSD Porter’s Handbook
(http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/porters-handbook/index.html).

Ôí port ðāñéÝ ÷ áé ïāçāβāð āéá òí ðūð íá ïāóāēüòðéóóāβ ï ðçāāβìð èρāééáð, áēēÛ āār ðāñéÝ ÷ áé òí ðçāāβì èρāééá.
Ïññāβōā íá ðññçēāðóāβōā òí ðçāāβì èρāééá áðū Ýíá CD-ROM ϐ áðū òí Āéāāβēðòí. Ï ðçāāβìð èρāééáð āéárÝíáðáé ïā
ïðíēāρðíòā òññòí āðēéòíāβ ï āçíēíōñāüð òíð. Óð ÷ ïÛ āβíáé Ýíá tarred éáé gzipped āñ ÷ āβì, áēēÛ ïðññāβ íá āβíáé
óòíðéáòíÝíò ïā èÛðíēí Ûēēí āñāāēāβì ϐ íá āβíáé áéüñā éáé áóòíðβāóóòíð. Ï ðçāāβìð èρāééáð òíð ðññāñÛñíáðíð, óā
ïðíēāρðíòā ïññòρ éé áí āéáòβēāðáé, éÝāāóáé “distfile”. Ïé āýí ïÝēíāēé āéá íá āāēáóáóóρóāðā Ýíá FreeBSD port
ðāñéāñÛòííóáé ðāñāéÛòù.

Óçíāβùóç: ÐñÝðāé íá óòíāēēāβðā ùð root āéá íá āāēáóáóóρóāðā ports.

Ðññāēāíðíβçóç: Ðñéí āāēáóáóóρóāðā ïðíēāρðíòā port, ðñÝðāé íá óéāíðññāðóāβðā ùðé Ý ÷ áðā ïβā áíáíāüíÝíç
Óðēēíāρ òúí Ports, éáé ðñÝðāé íá āēÝāíāðā òí <http://vuxml.freebsd.org/> āéá èÝíáðā áóóāēāβāð ó ÷ áðéēÛ ïā òí
port ðíð áíāēáóÝññāóðā.

Áí èÝēāðā íá āēÝā ÷ áðā áðòüñíáðā āéá òð ÷ úí ðññāēβíáðā áóóāēāβāð ðñéí áðū èÛēā āāēáóóóóç íÝáò
āðāññíāρð, ïðññāβðā íá ÷ ñçóéííðíēρóāðā òí **portaudit**. Éā āññāβðā áðòü òí āññāēēāβì óóçí Óðēēíāρ òúí Ports
(ports-mgmt/portaudit). Āβíáé éáēρ éāÝā íá āēðāēÝóāðā òí portaudit -F ðñéí āāēáóáóóρóāðā Ýíá íÝí
port, āéá íá áíáēðρóāðā òçí ðñÝ ÷ ïðóā āÛóç āāāñÝíúí ðññāēçíÛòúí áóóāēāβāð. Áíðβóðíē ÷ ïð Ýēāā ÷ ïð éáé
áíáíÝúóç òçð āÛóçð āāāñÝíúí āēðāēāβðáé áðβóçð áðòüñíáðā éáðÛ òí éáēçíāñéíú Ýēāā ÷ ï áóóāēāβāð òíð
óðòðíáðíð. Āéá ðāñéóóüðāñāð ðēçññíðíñβāð āéāāÛóðā ðēð óāēβāāð manual portaudit(1) éáé periodic(8).

Ç Óðēēíāρ òúí Ports ðñññðíēÝóáé ùðé Ý ÷ áðā èāéðíðñāēēρ óýíāóç ïā òí Āéāāβēðòí. ĀÛí āār Ý ÷ áðā, éā ÷ ñāéáóóāβ
íá āÛēāðā ïüñð óáð Ýíá áíðβāñāóí òíð distfile ïÝóá òòí /usr/ports/distfiles.

Āñ ÷ éēÛ, ïāðāéíçēāβðā óòíí éáðÛēíāí òíð port ðíð èÝēāðā íá āāēáóáóóρóāðā:

```
# cd /usr/ports/sysutils/lsof
```

Ïüēéð āññāēāβðā óòíí éáðÛēíāí lsof, éā āāβðā òí port skeleton. Ôí āðüññāñ āρíá āβíáé íá ïāðāēēüòðβóāðā, ϐ íá
“èðβóāðā (build)”, òí port. Āðòü āβíáðáé áðēÛ ðēçēðññēíāβíðáð make óóçí āñññìρ áíðíēβí. ¼ðāí òí èÛíāðā, éā āāβðā
èÛðé üðùð áðòü:

```
# make
>> lsof_4.57D.freebsd.tar.gz doesn't seem to exist in /usr/ports/distfiles/.
>> Attempting to fetch from ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/.
==> Extracting for lsof-4.57
...
[extraction output snipped]
...
>> Checksum OK for lsof_4.57D.freebsd.tar.gz.
==> Patching for lsof-4.57
==> Applying FreeBSD patches for lsof-4.57
==> Configuring for lsof-4.57
...
[configure output snipped]
...
==> Building for lsof-4.57
...
```

```
[compilation output snipped]
...
#
```

ΔηρώΎία υέε ίεέό ς ίάάάεβπόόέός ιείεεχνέεαβ έα άδέοονΎάάά όόκι άνάηΠ άίόεβί. Οι άδουήην άβία άβία έ ίά άεάάόάόΠόάάά όι port. Άέά ίά όι άεάάάόάόΠόάάά, ÷-νάεΰεάόάέ άδέβθ ίά δηρώεΎόάάά έέά έΎίς όόκι άίόίεΠ make, έέέ άόόΠ ς έΎίς άβία έ install:

```
# make install
==> Installing for lsof-4.57
...
[installation output snipped]
...
==> Generating temporary packing list
==> Compressing manual pages for lsof-4.57
==> Registering installation for lsof-4.57
==> SECURITY NOTE:
     This port has installed the following binaries which execute with
     increased privileges.
#
```

Ίεέό άδέοονΎάάά όόκι άνάηΠ άίόεβί, έα δηΎθάέ ίά ίδηήάβόά ίά έέόάεΎόάάά όκι άόάνηήβ θίθ ίεέό άεάάόάόΠόάάά. Έά άάβόά έέά δηήεάιδηίβςός άόόάέάβάδ, άδάέάΠ όι lsof άβίαέ Ύίά δηηάηάηία θίθ όηΎ ÷-έ έ άόίςΎίά δηήίυίέά. Έάόΰ όκι ίάάάεβπόόέός έέέ άεάάοΰόόάός όυί ports, έα δηΎθάέ ίά δηρώΎ ÷-άάά ίδηέάάΠθίόά δηήεάιδηίβςός άίόάίέόάβ.

Έέά έέεΠ έάΎά, άβίαέ ίά έέάαηΰθάάά όιι όδηέάόΰείρη θίθ δάηέΎ ÷-έ έέά όά δηήόυηέίΰ άη ÷-άβά θίθ ÷-ηςόείιδηέΠεςέái έάόΰ όκι ίάάάεβπόόέός. ¼÷-έ ίυή έάόάίέβπύόι δίεϋόείυ ÷-βηη, ΰέέά ίδηήάβ ίά δηήέεΎόίόι δηήέεβίαόά άηάυόάηά υόάί έά έάεβπόάά ίά άεάάόάόΠόάάά έέά ίάυόάης Ύέάιός όίθ port.

```
# make clean
==> Cleaning for lsof-4.57
#
```

ΌκιΎάβύος: Ίδηήάβόά ίά έέέόΠόάάά άϋί δηήύέάάά άβίαόά άδέβθ άέθάεβίόάό make install clean άίόβ έέά make, make install έέέ make clean υό όηβά ίά ÷-υηέόόΰ άβίαόά.

ΌκιΎάβύος: Ίάηέΰ έάέϋός έηάόΰία ίέά έβόόά άδϋ όέό άίόίεΎθ θίθ άηβόείιόάέ έέάέΎόέίάδ όόίθ έάόάέϋάιθθ θίθ άίάόΎηήάέ όόκι ίάάάάεςόΠ δάηέάΰέείίόιθ PATH, έέά ίά άδέόά ÷-ϋήίόί όέό άίάεςόΠόάέό έέά όά άέθάεΎόέίά άη ÷-άβά άόόβί όυί άίόίεβί. Άί ÷-ηςόείιδηέάβόά Ύίά άδϋ άόόΰ όά έάέϋός, έά δηΎθάέ ίά ÷-ηςόείιδηέΠόάάά όκι άίόίεΠ rehash ίάόΰ όκι άεάάοΰόόάός άίυθ port, δηέί ίδηΎόάάά ίά ÷-ηςόείιδηέΠόάάά όέό ίΎάδ άίόίεΎθ. ΆόόΠ ς άίόίεΠ έάέόίθηάαβ όά έάέϋός υθϋθ όί tcsh. × ηςόείιδηέΠόάά όκι άίόίεΠ hash -r έέά έάέϋός υθϋθ όί sh. Άάβόά όκι όάειςβύος όίθ έάέϋόίθθ όάθ έέά δάηέόόυόάηθθ δέςηίθίηβάδ.

Ίάηέΰ δηήύυίόά όηβόυί έάόάέέάόάόβί όά DVD-ROM, υθϋθ όι FreeBSD Toolkit άδϋ όι FreeBSD Mall (<http://www.freebsdmail.com/>), δάηέΎ ÷-ίόι distfiles. Άόόΰ ίδηήίϋ ίά ÷-ηςόείιδηέςεήϋί ίά όκι ΌόέείηΠ όυί Ports. ΔηήόάηθΠόάά όι DVD-ROM όόι /cdrom. Άί ÷-ηςόείιδηέάβόά έΰθίεί έέάόηάδέέυ όκιΎβηι δηήόΰηόςόδ, ηέειβόάά όκι ίάάάάεςόΠ CD_MOUNTPTS όίθ make. Όά άίάάέάβά distfiles έά ÷-ηςόείιδηέςεήϋί άόόυιόάά άί όδΰñ ÷-ίόι όόι έέόέΰέέ.

Όριση: Ο όρος είναι ο σύνθετος όρος της λέξης ports και αποτελείται από όλη τη συλλογή των CD-ROM. Αυτό είναι ο όρος για τα αρχεία που είναι ο συνδυασμός των "επιμέρους" όρων που είναι, που ο όρος είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι.

Οι όροι για τους ports που είναι οι fetch(3) και η "επιμέρους" και η fetch(3) που είναι η επιμέρους και η επιμέρους και η επιμέρους. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι.

Αυτή είναι η πρόταση του αλγορίθμου για να βρεθούν οι όροι που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι.

Όριση: Ο όρος είναι ο σύνθετος όρος που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι.

Οι όροι για τα ports που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι.

```
# cd /usr/ports/directory
# make MASTER_SITE_OVERRIDE= \
ftp://ftp.FreeBSD.org/pub/FreeBSD/ports/distfiles/ fetch
```

Οι όροι για τα ports που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι.

Όριση: Ο όρος είναι ο σύνθετος όρος που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι.

5.5.2.1 Διαθέσιμα όρια του Διαθέσιμου Εύρους του Ports

Οι όροι για τα ports που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι. Αυτό είναι ο όρος για τα αρχεία που είναι ο σύνθετος όρος που είναι ο συνδυασμός των "επιμέρους" όρων που είναι.

```
# make WRKDIRPREFIX=/usr/home/example/ports install
```

εάν θέλουμε να εγκαταστήσουμε το port στο /usr/home/example/ports τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/local, ας ρίξουμε μια ματιά:

```
# make PREFIX=/usr/home/example/local install
```

εάν θέλουμε να εγκαταστήσουμε το port στο /usr/ports τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/home/example/local.

Εάν θέλουμε να ρίξουμε μια ματιά:

```
# make WRKDIRPREFIX=./ports PREFIX=../local install
```

εάν θέλουμε να εγκαταστήσουμε το port στο /usr/ports τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/home/example/local.

Εάν θέλουμε να ρίξουμε μια ματιά στο manual τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/home/example/local.

5.5.2.2 Ανοίξιμο δίσκου με imake

Για να ανοίξουμε το δίσκο με imake (στην περίπτωση του X Window System) θα μπορούσαμε να το εγκαταστήσουμε στο /usr/ports, τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/local. Εάν θέλουμε να ρίξουμε μια ματιά στο manual τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/home/example/local.

5.5.2.3 Ανοίξιμο δίσκου με Ports

Εάν θέλουμε να ανοίξουμε το δίσκο με Ports, τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/ports, τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/local. Εάν θέλουμε να ρίξουμε μια ματιά στο manual τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/home/example/local.

5.5.3 Ανοίξιμο δίσκου με Ports

Εάν θέλουμε να ανοίξουμε το δίσκο με Ports, τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/ports, τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/local. Εάν θέλουμε να ρίξουμε μια ματιά στο manual τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/home/example/local.

```
# pkg_delete lsof-4.57
```

5.5.4 Ανοίξιμο δίσκου με Ports

Εάν θέλουμε να ανοίξουμε το δίσκο με Ports, τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/ports, τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/local. Εάν θέλουμε να ρίξουμε μια ματιά στο manual τότε θα μπορούσαμε να το εγκαταστήσουμε στο /usr/home/example/local.

```
# pkg_version -v
```

5.5.4.1 /usr/ports/UPDATING

Το `pkg_version` είναι ένα εργαλείο που χρησιμοποιείται για να ενημερωθεί ο κατάλογος `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`.

Αν ο `UPDATING` είναι άδειος, τότε ο `ports` είναι ενημερωμένος.

5.5.4.2 Αίτηση για ενημέρωση Ports και οι Portupgrade

Οι αιτήσεις για ενημέρωση `portupgrade` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`.

```
# cd /usr/ports/ports-mgmt/portupgrade
# make install clean
```

Ο `portupgrade` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`.

Ο `portupgrade` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`.

```
# portupgrade -ai
```

Ο `portupgrade` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`.

```
# portupgrade -R firefox
```

Ο `portupgrade` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`.

```
# portupgrade -PR gnome2
```

Ο `portupgrade` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`.

5.5.4.3 Αίτηση για ενημέρωση Ports και οι Portmanager

Ο `Portmanager` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`. Ο κατάλογος `ports` είναι ο κατάλογος που περιέχει όλα τα πακέτα που είναι διαθέσιμα στο `ports`.


```
====>> apache-2.2.3
      ====>> New version available: apache-2.2.8
...
====>> Leaf ports (Have dependencies, not depended on)
====>> automake-1.9.6_2
====>> bash-3.1.17
      ====>> New version available: bash-3.2.33
...
====>> 32 leaf ports

====>> 137 total installed ports
      ====>> 83 have new versions available
```

Ïðñãáðá íá áíáááèìáðáðá üëá óá äãëáðáóóçìÝíá ports ìá òçí ðáñáéÛòù áðëÐ áíóìëÐ:

```
# portmaster -a
```

Óçìáðáóóç: Áðü ðñíáðëëëíãÐ, òí **Portmaster** êá äçìéíðñãáðáé áíóáñáðáíí áóóáéãáðá òíð äãëáðáóóçìÝííð ðáéÝóíð ðñéí òí äëáãñÛðáé. Áí ç äãëáðáóóáóç òçð íÝáð Ýëäíóçð áðéáé áðëðð÷Ðð, òí **Portmaster** êá óáÐóáé òí áíóáñáðáíí áðóó. Áí ÷ñçóéíðñéÐóáðá òçí áðëëíãÐ -b, òí **Portmaster** äáí êá óáÐóáé áðóóìíáðá òí áíóáñáðáíí. Áí ÷ñçóéíðñéÐóáðá òçí áðëëíãÐ -i, êá èÝóáðá òí **Portmaster** óá äëáãñáóóðëëÐ êáéðíðñáðá, üðíð êá óáð æçðÛáé áðëááááðáóóç ðñéí òçí áíááÛëíéóç êÛëá port.

Áí áíóéíáðóðáðá êÛëç êáðÛ òç äëáééáóáðá òçð áíááÛëíéóçð, ìðñãáðá íá ÷ñçóéíðñéÐóáðá òçí áðëëíãÐ -f äëá íá áíáááèìáðáðá êáé íá ìáðááëùðððáðá íáíÛ üëá óá ports:

```
# portmaster -af
```

Ïðñãáðá áððçðð íá ÷ñçóéíðñéÐóáðá òí **Portmaster** äëá íá äãëáðáóóðáðá íÝá ports òðí óýóóçìá óáð, áíáááèìáðáðá êáé üëáð ðéð áíáñðáðáéð òíðð ðñéí òç ìáðááëþððéóç êáé äãëáðáóóç òíðð:

```
# portmaster shells/bash
```

Ðáñáéáéíýíá äãáðá òç óáëðáá manual òíð portmaster(8) äëá ðáñéóóóóðáñáð ðëçñíóññãáð.

5.5.5 Ports êáé Áðñëçêáððééëùð ×þñíð

Ç ÓðëëíãÐ òúí Ports êáðáíáëþíáé äëáéÝóéíí ÷þñí òðí áðóéí ìá òçí ðÛñíáí òíð ÷ññíð. ÌáðÛ òçí ìáðááëþððéóç êáé äãëáðáóóáóç ëíáéóíééýí áðü óá ports, ðñÝðáé ðÛíðá íá èòìÛóðá íá êáéáñðáðá òíðð ðñíóóñéíýð êáðáéüñíðð work ÷ñçóéíðñéÐóáðá òçí áíóìëÐ make clean. Μðñãáðá íá êáéáñðáðá üëç òçí ÓðëëíãÐ òúí Ports ìá òçí áëüëíðëç áíóìëÐ:

```
# portsclean -C
```

Ìá òçí ðÛñíáí òíð ÷ññíð, êá óðóóóñáðóóíýí ðñëÛ áñ÷áá äëáññðð ðçááβíð êþáééá óðíí êáðÛëíáí distfiles. Ïðñãáðá íá óá áóáéñÝóáðá ÷áéñíëβíçðá, Ð ìðñãáðá íá ÷ñçóéíðñéÐóáðá òçí áëüëíðëç áíóìëÐ äëá íá äëáãñÛðáðá üëá óá distfiles ðíð äáí ó÷áððáííðáé ðëÝíí ìá êáíÝíá port:

```
# portsclean -D
```

¹ εαέ ίά αοαένΥάα ὑεά οά distfiles δῖο ἀά ίά -αὐαῖρῶε ίά εαίΥίά port δῖο ἀνβὸεαὐάε ἀεαὐάοὐὐΐί οὐί ούόὐίά οάο:

```
# portsclean -DD
```

Ὄεἰαὐαὐ: Ὄἰ ἀἠαεἰαὐ portsclean ἀεαεβὸαὐε ὑὸ ἰΥἠῖο δῖο portupgrade.

Ἰεἰ ἰά-ίΥά ίά αοαένἠḄḄ ὁά ἀεαὐάοὐὐΐί ports ὑάί ἀά ὁά -ἠεΥεαὐαὐ ὁεΥῖ. ἰά εαεῦ ἀἠαεἰαὐ εαέ ίά αὐοἠάοἰδῖεεἠḄ αὐὐ ε ἀἠαὐḄ, ἀβῖάε οἰ port ports-mgmt/pkg_cutleaves.

5.6 ἈἰΥἠἠεἠὸ ἰαὐὐ ὁεἰ Ἀεὐαὐὐὐά

ἰαὐὐ ὁεἰ ἀεαὐάοὐὐΐί ἰεαὐ ἰΥάδ ἀοἠἠἠḄ, εἰεεῦ εά εΥεἠḄ ίά εεαὐὐαὐ ὑὸε δἠεἰḄὑḄ ὁḄḄ-ε, ίά οἠδῖεḄḄ ὁά ἀἠ-ἠḄḄ ἠḄβὸαἠḄ δῖο -ἠεΥεαὐαὐ, ίά ἀαεῦεἠḄ ὑὸε ε αὐἠἠḄ ἰεεἰΥε εάὐ ὁεἰ εεḄἠε (ἠḄ ἀβῖάε daemon), ε.ε.δ.

Ὄἰ εεἠḄḄ ἠḄἠḄḄ δῖο εά -ἠεαὐḄἠḄ ἠεά ίά ἠḄβὸαὐ εΥεἠḄ ἀοἠἠḄ, εά ἀβῖάε ḄἠḄḄḄ εεἠḄḄ. ὕἠὸ, ἠḄ ἠḄεὸ ἀεαὐάοὐὐΐί ἰεά ἰΥά ἀοἠἠḄḄ εεἠ ἠḄἠḄḄḄ “Ὀἠἠ ὁε;” ἰε ḄἠḄḄḄ ὁἠἠḄḄ ἰδἠἠḄ ἰά οάδ ἠḄεḄḄḄ:

- ×ἠεἠḄḄḄ ὁἠ pkg_info(1) εεά ίά ἀḄḄḄ ὁε ἀἠ-ἠḄḄ ἀεαὐάοὐὐεεἠ, εεε δῖο. Ἀεά ḄἠḄḄḄ, ἠḄ ἠḄεὸ ἀεαὐάοὐὐΐί ὁἠ FooPackage version 1.0.0, ὁἠḄ ε ἠḄḄḄ:

```
# pkg_info -L foopackage-1.0.0 | less
```

εά οάδ ἀḄḄḄ ὑεά οά ἀἠ-ἠḄḄ δῖο ἀεαὐάοὐὐεεἠ ἠḄḄ ἠḄḄḄ ὁἠ ḄḄḄḄ. ḄἠḄḄḄ ὁά ἀἠ-ἠḄḄ ὁἠḄ εάὐḄḄ man/, δῖο εά ἀβῖάε ὁἠḄḄḄ manual, ὁἠḄ εάὐḄḄḄ etc/, ὑḄḄ εά ἀβῖάε ὁά ἀἠ-ἠḄḄ ἠḄβὸαἠḄ, εεε ὁἠ doc/, ὑḄḄ εά ἀνβὸεἠḄḄ ḄἠḄḄḄḄ ὁἠḄḄḄḄ.

Ἀἰ ἀἠḄḄḄ ὁἠḄḄḄ δῖεἠ ḄḄḄḄ ὁεἰ ἀοἠἠḄḄḄ ἀεαὐάοὐὐΐί, ἰεά ἠḄḄḄ ὑḄḄ ἠḄḄḄ:

```
# pkg_info | grep -i foopackage
```

εά ἠḄḄḄ ὑεά οά ἀεαὐάοὐὐΐί ḄḄḄḄ δῖο Ḅ-ἠḄḄ ὁἠ Foopackage ὁἠ ὑἠḄḄ ὁἠḄ ḄḄḄḄḄ. ἈἠḄḄḄḄḄ ὁἠ Foopackage ὁḄḄ ἠḄḄḄ ἠḄḄḄḄ ἰḄ ὁἠ ḄḄḄḄḄ δῖο ἠḄḄḄḄḄ.

- ἠḄεὸ ἀḄḄḄ Ḅῖο ἀνβὸεἠḄḄ ὁά manual pages ὁεἰ ἀοἠἠḄḄḄ, ἀḄḄḄ ὁά ἰḄ ὁεἰ man(1). ὕἠḄḄ, ἀḄḄḄ ὁά ḄἠḄḄḄḄḄ ὁἠḄ ἠἠ-ḄḄḄ ἠḄḄḄḄḄ, εεε ὑḄḄḄ ḄḄḄ ḄἠḄḄḄḄ ὁἠḄḄḄḄḄ εεἠḄḄḄḄḄ.
- Ἀἰ ὁḄḄḄ-ε web site εεά ὁεἰ ἀοἠἠḄḄḄ, ἠεΥḄḄḄ ὁἠ εεἠ ḄἠḄḄḄḄ ὁἠḄḄḄḄḄ, ὁḄ-ἰΥḄ ἠḄḄḄḄḄḄ (FAQ), εεε ḄḄḄḄ. Ἀἰ ἀἠḄḄ ἠḄḄḄ ὁἠḄḄḄḄ εεά ὁεἰ εεἠḄḄḄḄḄ ὁἠ web site, βὸἠ ὁἠ ἠḄḄḄḄ ὁεἰ ḄḄḄḄ ὁεἰ ἠḄḄḄḄ:

```
# pkg_info foopackage-1.0.0
```

Ἀἰ ὁḄḄḄ-ε ἠḄḄḄḄ www:, εά ḄἠḄḄḄ ἰḄ Ḅ-ε ὁἠ URL εεά ὁἠ web site ὁεἰ ἀοἠἠḄḄḄḄ.

- Ports δῖο ḄἠḄḄḄ ἰḄ ἠḄḄḄḄḄ ἠḄḄḄḄḄ ὁἠḄḄḄḄḄ (ὑḄḄ ἠεἠḄḄḄḄḄ Internet) ὁἠḄḄḄ ἀεἠḄḄḄḄḄ ḄḄḄḄ ὁἠ /usr/local/etc/rc.d. ḄἠḄḄḄ ἰḄ ἠεΥḄḄḄ ὁἠ script εεά ὁεἰ ἠḄḄḄḄḄḄ ὁἠ ἠḄḄḄḄḄḄ Ḅ ἰḄ ὁἠ ἠḄḄḄḄḄḄ ἠḄḄḄḄḄ ἠḄḄḄḄḄ ὁἠ ἈεεἠḄḄḄḄ ὈδḄḄḄḄḄ ἠεἠ ḄἠḄḄḄḄḄḄ ḄḄḄḄḄḄḄ.

5.7 Áίóéíáóùðβæííóáð × áéáóíÝíá Ports

Αί Ýñεάóá áίóéíÝóùòìò ìá Ýíá port òì ðìβì ááí εάέòìòñááβ, òðÙñ÷ìòí êÙòíέά ðñÙáíóá ðìò ðìñáβòá íá êÙíáóá:

1. Άάβòá áí áéñáíáβ êÙòíέá áéíñèòç áέá òì port óòì Problem Report database (<http://www.FreeBSD.org/support.html#gnats>). ΆÙí íάέ, ðìñáβòá íá ÷ñçóέíðíεÞóáðá òç ðñòáέííáíç áéíñèòç.
2. ÆçòÞóáá ãìÞεάά áðù òíí óóíóçñçòÞ òíò port. ÐεçέðññέíáÞóáá make maintainer Þ áέááÙóóá òì Makefile áέá íá ãñáβòá òç í áέáγèòíóç email òíò óóíóçñçòÞ. Óòì ðíðíá óáò, εòíçεάβòá íá óòìðáñέέÙάáðá òì ùñíá éάé òç í Ýέäíóç òíò port (óááβεòá òç ãñáíìÞ \$FreeBSD: áðù òì Makefile) éάεðò éάé òç í Ýññáí òíò óóÙέíáóìò.

Óçíáβòòç: ìáñέέÙ ports ááí óóíóçññíγíóáé áðù êÙòíέí εòáέáéñέíÝíí Ùòìñ, áέέÙ áðù êÙòíέá mailing list (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/ mailing-list-faq/article.html). ÐíέέÝò, áí ù÷é üéáò, áðù áóðÝò òéò áέáòéýíóáέð Ý÷ìòí òç í ðñòÞ <freebsd-listname@FreeBSD.org>. Ðáñáέáέíγíá íá òì Ý÷áðá òðùòç óáó éáóÙ òç áέáóγðùòç òùí áñùòÞóáúí óáò.

ÓòáέáéñέíÝíá, óá ports ðìò óáβíííóáé ùòέ óóíóçññíγíóáé áðù òì <ports@FreeBSD.org>, ááí óóíóçññíγíóáé áðù éáíÝíáí óòçí ðñááìáóέέùòçóá. ΆέíñεÞóáéò éάé òðíóòÞñέíç, áí òðÙñ÷ìòí, Ýñ÷ìòí éáé ááíέέÙ áðù òç í éíέíùòçóá ðìò óòìáðÝ÷áé óòçí óòáέáéñέíÝíç mailing list. ×ñáéáæüìáóáðá ðÙíóòá ðáñέóóúòðáñìòð áέáέííÝò!

Αí ááí êÙάáðá áðÙíóçòç, ðìñáβòá íá ÷ñçóέíðíεÞóáðá òì send-pr(1) áέá íá óóáβεáðá ìέá áíáóìñÙ óóÙέíáóìò (ááβòá òì ΆñÙóìíóáò ΑίáóìñÝò ÓóÙέíáóìò áέá òì FreeBSD (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/problem-reports/article.html)).

3. ΆέíñεÞóáá òì! Óì Porter’s Handbook (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/porters-handbook/index.html) ðáñέÝ÷áé éáðòìñáñáβò ðεçñíòìñáð áέá òç í òðìáñÞ òùí “Ports” Þóóá íá ðìñáβòá íá áέíñεÞóáðá òì ðáñέóóáóέάέù ðññáεçíáóέέù port Þ áέúíá éάé íá áçíεíòñáÞóáðá Ýíá áέέù óáò port!
4. ΑíáέòÞóáá òì ðáέÝòì áðù Ýíá έííóέíù óáò FTP site. Ç “éýñέá” óòέέíáÞ ðáέÝòùí áñβóέáðáé óòì ftp.FreeBSD.org, óòìí éáòÙέíáí ðáέÝòùí (ftp://ftp.FreeBSD.org/pub/FreeBSD/ports/packages/). Ðñέí òç ÷ñçóέíðíεÞóáðá, áέÝáíòá ðñÞóá òì òìðέέù óáò mirror. Óá ðáέÝóá áβíάé ðéí óβáíòñí ùòέ éá éάέòìòñáÞóíòí, áðù òì íá ðñíóðáéάβòá íá ìáóáάεùòðóóáðá òì ðçááβì εÞáέéá, éάé ç áέááέέáóβá ðáέáεÞíáé ðéí áñÞáíá. ×ñçóέíðíεÞóáá òì ðññáñáíá pkg_add(1) áέá íá ááέáóáóòÞóáðá òì ðáέÝòì óòì óýóóçíá óáò.

ΕὰοÛεάέι 6

Ôï Óýóôçιά X Window

6.1 Óýñòç

Ôï FreeBSD ÷ ñçóεíñðíεάβ òï X11 áεά íá ðáñÝ ÷ áε óóíòð ÷ ñðóáð Ýíá εó ÷ òññ ãñáóεéñ ðáñεáÛεεíñ ãñááóβáð. Ôï ðáñεáÛεεíñ X11 áβíáε íεá òεíñðíççóç áñíεéðíý εðáεéá ðíò óóóððíáðíò X Window ðíò òεíñðíεάβðáε óðï **Xorg** (εάεðð εάε óá Ûεεí εíáεóíεéñ ðíò ááí ðáñεáñÛóáðáε ááð). Ç ðñíáðéεáñÝíç εάε áðβóççç áεáññð òïò X11 áβíáε òï **Xorg**, ï X11 server ðíò áíáððý ÷ εççá áðñ òï X.Org Foundation íá Ûááεá ÷ ñðóçð áñεáðÛ ùííεá íá áóðð ðíò ÷ ñçóεíñðíεάβðáε áðñ òï FreeBSD. ÔðÛñ ÷ íòí áðβóçð áεάεÝóεíñε áñðíñεéññ X servers áεά òï FreeBSD.

Áεá ðáñεóóñðáñáð ðεçññíòññáð ðíò ó ÷ áðβáíñðáε íá ðεð εÛñðáð ãñáóεεðí ðíò ððíóççñβáíñðáε áðñ òï ðáñεáÛεεíñ X11, ááβðá ðçí áεéððáεð ðíðíεáóβá Xorg (<http://www.x.org/>).

Áóíý áεάáÛóáðá áðñ òï εáοÛεάέι, εá íÝñáðá:

- Óá áεÛóíñá ðíðíáðá ðíò óóóððíáðíò X Window, εάε ðñð óñíáñáÛεíñðáε íáðáíý òíòð.
- ðñð íá ááεáðáóððóáðá εάε íá ñðèìβóáðá òï ðáñεáÛεεíñ X11.
- ðñð íá ááεáðáóððóáðá εάε íá ñðèìβóáðá áεáóíñáðéεíýð áεá ÷ áεñεóóÝð ðáñáεýññúí (window managers).
- ðñð íá ÷ ñçóεíñðíεðóáðá TrueType® ãñáíñáðíóáεñÝð óðï X11.
- ðñð íá ñðèìβóáðá òï óýóççιά óáð áεá óýíááóç (login) ïÝóñ ãñáóεéíý ðáñεáÛεεíñðíò (**XDM**).

ðñéí áεάáÛóáðá áðñ òï εáοÛεάέι, εá ðñÝðáε:

- Íá íÝñáðá ðñð íá ááεáðáóððóáðá ðññóεáðí εíáεóíεéñ ðñβðíò εáðáóéáðóáðð (ΕὰοÛεάέι 5).

6.2 Εάóáíüççò òíò ðáñεáÛεεíñðíò X11

Ç ÷ ñðóç ðíò ðáñεáÛεεíñðíò X11 áεá ðñðóç óíñÛ ïðíñáβ íá ðñíεáεÝóáε íεá ïεèñð ðáñá ÷ ð óá ùðíεíñ Ý ÷ áε óóíçεβóáε óá Ûεεá ãñáóεéÛ ðáñεáÛεεíñðá, ùðñð óá Microsoft Windows ð òï Mac OS.

ÁáíεéÛ, ááí áβíáε áðáñáβçðí íá εáðáεáááβíáðá íá εÛεá εáððññÝñáεá ðñí áεáóññññ ðíçíÛðñí ðíò X11 εάε ððð áεεççáðéáññýí ïáðáíý òíòð. ÈÛðíεáð ááóééÝð áñðóáεð ùñð, áβíáε ÷ ñðóεíñð εάε áñçεíýí óðï íá áεíáðáεéáððáβðá εáεýðáñá ðεð áðíáðñðçðáð òíò X11.

6.2.1 Áεáðβ εÝááðáε X11 òï ðáñεáÛεεíñ ãñááóβáð;

Ôï X ááí áβíáε òï ðñðí ðáñεáÛεεíñ ãñááóβáð ðíò ãñÛóççá áεá óóóððíáðá UNIX, áεéÛ áβíáε óðíáñá òï ðéí áçíñóééÝð. Ç áñ ÷ εεð ñÛáá áíÛðððíçð òíò X áβ ÷ á áñðεÝðáε óá Ýíá Ûεεí óýóççιά ðñéí ãñÛðáε òï X. Ôï ùññá ðíò ðáεéñðáñíò óóóððíáðíò ððáí “W” (áðñ ðçí Áááεéεð εÝíç “window”). Ôï ãñÛñá X ððáí áðεÛ òï áðññáñ ãñÛñá óðï Èáðéíεéñ áεòÛáçðí.

Ïðñáβðá ἰά ἰάῖα Ûñáðεá óõἱ X ἰά óá ἰñῖἰάóá “X”, “X Window System”, “X11”, εάεðð εάε ἰά ἰáñεεῖýð Ûεεῖòð ἰñῖòð. Ðñἱóἱ÷P ἰῖòð: εÛðῖεῖε Ûἱεñῖðῖε εáññἱýἱ ðñἱóáεçðεεῖ ðἱἱ ἰñἱ “X Windows”. Ἀέá ðáñεóóóῖðáñáð ðεçñἱóἱñβáð ó÷áðεεÛ ἰá áððῖ, ááβðá ðç óáεβἱáá manual X(7).

6.2.2 Õἱ ἰñῖóýεἱ ÐáεÛðç/ἈέáεἱñεóðP ðῖἱ X11

Õἱ ðáñεáÛεεῖἱ X11 Ý÷áε ó÷ááεáóðáβ áðῖ ðçἱ áñ÷P Ýðóε þóðá ἰά Ý÷áε ááááἱP áεεððáεP ððἱóðPñεἱç, ἰá áÛðç Ýἱά ἰñῖóýεἱ “ðáεÛðç-áεáεἱñεóðP”.

Õðἱ ἰñῖóýεἱ εάεðἱòñáβáð ðἱò X11, ἱ “áεáεἱñεóðPð X” áεðáεáβðáε óðἱἱ ððἱεἱάεóðP óðἱἱ ἱðἱβἱ Ý÷áε óðἱááεáβ ðἱ ðεçεðñἱεῖáεἱ, ç ἱεῖῖç εάε ðἱ ðἱἱóβεε. Ï áεáεἱñεóðPð X áβἱάε ððáýεðἱòð áεá ðç áεá÷áβñεóç ðçð ἱεῖῖçð, ðçð áεóῖῖἰῖ áðῖ ðἱ ðεçεðñἱεῖáεἱ, ðἱ ðἱἱóβεε, εεð. ÊÛεá áóáñἱἱáP X (ð.÷. ðἱ **XTerm P** ðἱ **Netscape**) áβἱάε Ýἱάð “ðáεÛðçð”. ἱάð ðáεÛðçð ðóÝεἱάε ἱçἱýἱἰάðá óðἱἱ áεáεἱñεóðP ἰῖðῖð “Ðáñáεáεþ ó÷ááβáðá Ýἱά ðáñÛεðñἱ óá áððÝð ðεð óóἱðááἱÝἱάð”, εάε ἱ áεáεἱñεóðPð ðóÝεἱάε ðβóῖ ἱçἱýἱἰάðá ἰῖðῖð “Ï ÷ñþóçð ἱῖεéð ðÛðçðá ðἱ ðεþεðñἱ OK”.

Õá Ýἱά óðβðε P Ýἱά ἱεεñῖ ἁñáðáβἱ, ἱ áεáεἱñεóðPð εάε ἱε ðáεÛðáð X óð÷ἱÛ áεðáεἱýἱðáε óðἱἱ βáεἱ ððἱεἱάεóðP. ¼ἰῖð, áβἱάε áðῖεððá áðεéðῖ ἰά áεðáεáβðáε ἱ áεáεἱñεóðPð X óá Ýἱάἱ εεáῖῖðáñἱ εó÷ðñῖ áðεðñáðÝáεἱ ððἱεἱάεóðP, εάε ἰá áεðáεἱýἱðáε ἱε áóáñἱἱáÝð X (ἱε ðáεÛðáð) óá Ýἱά, áð ðἱýἱá, εó÷ðñῖ εάε áεñεáῖ ἱç÷Ûἱçἱά ðἱò áἱðççñáðáβ ðἱ ἁñáðáβἱ. Õá áððῖ ðἱ óáἱÛñεἱ ç áðεεἱἱεῖῖβá ἰáðáἱý ðῖἱ ðáεáðἱ P εάε ðἱò áεáεἱñεóðP áβἱáðáε ἱÝóῖ ἁεéðýἱò.

Ἀððῖ ðñἱεáεáβ óýá÷ðóç óá ἱñεóἱÝἱἱðð, áðáεáP ç ἱñἱεἱἱáβá ðἱò X áβἱάε áεñεáþð ἰáðβεáðç áðῖ ἰðε ðáñβἱáἱἱ. Ïε ÷ñþóðáð óðἱþεῖð ðáñεἱÝἱἱòἱ ἱ “áεáεἱñεóðPð X” ἰá áβἱάε Ýἱά ἰááÛεἱ εó÷ðñῖ ἱç÷Ûἱçἱά óá Ýἱά ἁῖÛðεἱ εάε ἱ “ðáεÛðçð X” ἰá áβἱάε ðἱ ἱç÷Ûἱçἱά ðἱò ἁñáðáβἱò ðἱòð.

Ἀβἱάε çῖἱἱáἱðεεῖ ἰá εðἱÛðáð ἰðε ἱ áεáεἱñεóðPð X áβἱάε ðἱ ἱç÷Ûἱçἱά ἰá ðçἱ ἱεῖῖç εάε ðἱ ðεçεðñἱεῖáεἱ, εάε ἱε ðáεÛðáð X áβἱάε óá ðñἱἁñÛἱἰάðá ðἱò áἱðáἱβáεἱòἱ óá ðáñÛεðñá.

Ἀáἱ ððÛñ÷áε ðβðἱðá óðἱ ðñῖðῖεἱεἱ ðἱò ἰá ἰáἱáεÛáεé óá ἱç÷áἱþἱáðá ðῖἱ ðáεáðἱ εάε ðἱò áεáεἱñεóðP ἰá áεðáεἱýἱðáε óðἱ βáεἱ εάεðἱòñáεεῖ ὀýóçῖἱ. P áεῖῖç ἰá áεðáεἱýἱðáε óðἱἱ βáεἱ ðýðἱ ððἱεἱάεóðP. Ἀβἱάε áðῖεððá áðεéðῖ ἰá áεðáεáβðáε Ýἱάð áεáεἱñεóðPð X óóá Microsoft Windows P óðἱ Mac OS ðçð Apple, εάε ððÛñ÷ἱòἱ áεáεÝðεἱáð áεÛῖòñáð áεáýεáñáð εάε áἱðἱñεéÝð áóáñἱἱáÝð ðἱò εÛἱἱòἱ áεñεáþð áððῖ.

6.2.3 Ï Ἀέá÷áεñεóðPð Ðáñáεýñῖ

Ç óεεἱòἱòβá ó÷ááεáóἱἱý ðἱò X ἱεÛáεé ðἱεý ἰá ðçἱ óεεἱòἱòβá ó÷ááεáóἱἱý ðἱò UNIX, “ἁñááεáβá, ἰ÷ε ðἱεéðéεP”. Ἀððῖ ççἱáβἱάε ἰðε ðἱ X ááἱ ðñἱóðáεáβ ἰá ððáἱñἱáýóáε ðῖð εá ðεἱðἱεçεáβ ἱεá ἁñááóβá. Ἀἱðβεáðá, ðáñÝ÷ἱðáε ἁñááεáβá óðἱἱ ÷ñþóç, εάε áβἱάε áεεP ðἱò áðεýἱç ἰá áðἱòáóβóáε ðῖð εá óá ÷ñçóεἱἱðἱεþóáε.

ἈððP ç óεεἱòἱòβá áðáεðáβἱáðáε óðἱ ἰðε ðἱ X ááἱ ððáἱñἱáýáε ðῖð ðñÝðáε ἰá áἱðáἱβáεἱðáε óá ðáñÛεðñá óðçἱ ἱεῖῖç, ðῖð εá ἰáðáεεἱçῖεἱýἱ ἰá ðἱ ðἱἱóβεε, ðε óἱἱáðáóἱἱβ ðεþεðñῖð ðñÝðáε ἰá ÷ñçóεἱἱðἱεçῖεἱýἱ áεá ἰá ἰáðáεεἱçῖεἱýἱ ἰáðáἱý ðῖἱ ðáñáεýñῖ (ð.÷., **Alt+Tab**, óðçἱ ðáñβððῖðç ðῖἱ Microsoft Windows), ðþð ðñÝðáε ἰá ἱεÛáεἱòἱ ἱε ἰðÛñáð ðβðεῖἱ óá εÛεá ðáñÛεðñἱ, áἱ εá Ý÷ἱòἱ P ἰ÷ε ðεþεðñá εεáεóβἱáðἱò ðÛῖῖ ðἱòð, ε.ο.ε.

Ἀἱðβεáðá, ðἱ X ἰáἱεÝðáε áððþἱ ðçἱ áðεýἱç óá ἱβá áóáñἱἱáP ðἱò ἱñἱÛáðáε “Ἀέá÷áεñεóðPð Ðáñáεýñῖ”. ÕðÛñ÷ἱòἱ ðÛñá ðἱεεἱβ áεá÷áεñεóðÝð ðáñáεýñῖ ἁεáεÝóεἱἱε áεá ðἱ ðáñεáÛεεἱἱ X. ÏñεóἱÝἱε áðῖ áððἱýð áβἱάε ἱε: **AfterStep**, **Blackbox**, **ctwm**, **Enlightenment**, **fvwm**, **Sawfish**, **twm**, **Window Maker**, εάε ðἱεεἱβ Ûεεἱε. ÊÛεá Ýἱάð áðῖ áððἱýð ðἱòð áεá÷áεñεóðÝð ðáñáεýñῖ Ý÷áε áεáἱñáðéεP áβðεçóç εάε áἱòÛἱεóç. Ïáñεεἱβ áðῖ áððἱýð ððἱóççñβáεἱòἱ “áεεἱἱεéÝð áðεðÛἱáεáð ἁñááóβáð”, ἰáñεεἱβ áðεðñÝðἱòἱ ðñἱóáñἱἱòἱÝἱἱð óἱἱáðáóἱἱýð ðεþεðñῖ ἁεá ðçἱ áεá÷áβñεóç ðçð áðεðÛἱáεáð ἁñááóβáð, ἰáñεεἱβ Ý÷ἱòἱ Ýἱά ðεþεðñἱ “Start” P εÛðε ðáñῖἱεἱ, ἰáñεεἱβ ððἱóççñβáεἱòἱ “εÝἱáðá” (themes), áðεðñÝðἱἱóáð ðçἱ ἱεἱεççñῖðéεP áεεááP áἱòÛἱεóçð ἰá ðçἱ áóáñἱἱáP áἱῖð ἱÝἱò εÝἱáðἱò. Ïε áεá÷áεñεóðÝð

ðáñáëýñí ðíó Ý ÷ ðíá áíáóÝñáë ùò ðññá, éáë ðíëëíß Ûëëíë, áßíáë áéáëÝóéíë óðçí êáóçáíñßá x11-wm ðçò Óðëëíáðò ðíí Ports.

ÁðëðëÝíí, ðá áýí ðéí áçííðéëß ðíëëëçñííÝíá ðáñéáÛëëíðá áññáóßáð, ðí KDE éáë ðí GNOME, Ý ÷ ðíí ðíí áéëù ðíðò áéá ÷ áéñéóðß ðáñáëýñíí ðíó áßíáë áíóííáðòíÝíí ðí ðí ððùëíëðí ðáñéáÛëëíí áññáóßáð.

ËÛëá áéá ÷ áéñéóðß ðáñáëýñíí Ý ÷ áé áðßòçò éáë áéáííñáðéëù ðç ÷ áíéóíù ðýëíéóçò: ðáñéëíß ðíëíßáëíðáé óðíðëçñííðíðáð ðí ÷ áéñíëßçí ðññðí Ýíá áñ ÷ áßí ðíëíßáðáí, Ûëëíë áéáëÝóíðí áñáóéëÛ áññáéáßá áéá ðéð ðáñéóóíðáñáð ðíëíßáðéð. ÓðÛñ ÷ áé áéííá éë Ýíáð (Sawfish) ðíó Ý ÷ áé áñ ÷ áßí ðíëíßáðáí áñáñÝíí ðá ðéá áéÛëáéðí ðçò áëðóóáð Lisp.

Ðíëëðéëß Áóðßáóçò: ðíëëí Ýíá èÝíá áéá ðí ðííßí áßíáë ððáýëðíðò ðí áéá ÷ áéñéóðß ðáñáëýñíí áßíáë ç “ðíëëðéëß áóðßáóçò” ðíó ðííðéëëíý. ËÛëá óýóðçìá ðáñáëýñíí ÷ ðíáëÛëáðáé êÛðíéí ðññðí áðéëíáðò ðíó ðáñáëýñíí ðíó éá äÝ ÷ áðáé áðòÛ ðíó ðëçëðííëíáíýíðáé, éáë éá ðñÝðáé íá óáßíáðáé êÛðò ùðé áðòò ðí ðáñÛëðíí áßíáë áíáñáñ.

Íßá áíúòðß ðíëëðéëß áóðßáóçò èÝááðáé “click-to-focus”. Áðòò ðí ðííðÝíë ÷ ðíçóéíðíëáßðáé óðá Microsoft Windows, ùðíó Ýíá ðáñÛëðíí áßíáðáé áíáñáñ áí áá ÷ ðáß Ýíá ðÛòçìá ðíó ðííðéëëíý.

Õí X ááí ððíóðçñßáé éáíßá óðáéáéñéíÝíç ðíëëðéëß áóðßáóçò. Áíðßéáðá, ðí áéá ÷ áéñéóðß ðáñáëýñíí áéÝá ÷ áé ðííßí ðáñÛëðíí Ý ÷ áé áðéáóðáß êÛëá óéáíß. Áéáííñáðéëíß áéá ÷ áéñéóðß ðáñáëýñíí ððíóðçñßáéí ðéáóíñáðéëÝð ðíëíáðò áóðßáóçò. ¼ëíë ðíðò ððíóðçñßáéí ðçí ðíëíáí click to focus, éáë ðé ðáñéóóíðáñíé áðù áðòíýð ððíóðçñßáéí éáë áñéáðÝð Ûëëáð.

Íé ðéí áçííðéëáßò ðíëíáíé áóðßáóçò áßíáë:

focus-follows-mouse

Õí ðáñÛëðíí ðíó áñíóéáðáé êÛðò áðù ðíí ááßéðç ðíó ðííðéëëíý áßíáë ðí ðáñÛëðíí ðíó Ý ÷ áé ðçí áóðßáóçò. Õí áíáñáñ ðáñÛëðíí ááí áßíáë áðáñáßðçðí íá áßíáë áðòò ðíó áñíóéáðáé ðÛíú áðù ùéá ðá Ûëëá. Ç áóðßáóçò áéëÛëáé ðí ðçí óðù ÷ áðòç áíúò Ûëëíð ðáñáëýñíí, ÷ ùñßò íá áßíáë áðáñáßðçðí ðí éëéë ðÛíú ðíó.

sloppy-focus

Áðòß ç ðíëëðéëß áßíáë ðéá ðéëñß áðÝéðáóç ðíó focus-follows-mouse. ðí ðçí ðíëëðéëß áóðßáóçò focus-follows-mouse, áí ðí ðííðßéé áññáéáß ðÛíú áðù ðí áñ ÷ éëù (root) ðáñÛëðíí (ß ðí ðáñáóéßíéí) ááí ððÛñ ÷ áé áóðßáóç óá éáíÝíá ðáñÛëðíí, éáë ùðé ðëçëðííëíáíðáé áðëðò ÷ Ûíáðáé. ðí ðç sloppy-focus, ç áóðßáóç áéëÛëáé ðííí áí ðí ááßéðçò áññáéáß ðÛíú áðù Ýíá ðíí ðáñÛëðíí, éáë ù ÷ é ùðáí ðáýááé áðù ðí ðñÝ ÷ ðí ðáñÛëðíí.

click-to-focus

Õí áíáñáñ ðáñÛëðíí áðéëÝááðáé ðí éëéë ðíó ðííðéëëíý. Õí ðáñÛëðíí ðíðá “áíáóçéßíáðáé”, éáë áíóáíßáðáé ððíóðçñßáé áðù ùéá ðá Ûëëá ðáñÛëðíí. ¼ðé ðëçëðííëíáçéáß éá ðáçáçéáß óá áðòò ðí ðáñÛëðíí, áéííá éáë áí ðí ááßéðçò ðáðáééíçéáß óá Ûëëí ðáñÛëðíí.

Ðíëëíß áéá ÷ áéñéóðß ðáñáëýñíí ððíóðçñßáéí áéííá ðéí áíúðéëÝð ðíëëðéëÝð áóðßáóçò, éáëðò éáë ðáñáéëéáÝð ðí ðáñáðÛíú. Óðíáíðééáðéáßòá ðçí ðáëíçñíßòç ðíó áéÛóðíðá áéá ÷ áéñéóðß ðáñáëýñíí áéá ðáñéóóíðáñáð éáððíÝñéáð.

6.2.4 ÁñáóéëÛ Óðíé ÷ áßá Áéáðáðò (Widgets)

Ç ðñíóÝááéç ðíó X íá áéáëÝðáé áññáéáßá éáë ù ÷ é íá ððáíñáýáé ðíí ðññðí ÷ ðíðçò ðíðò, áéáðñýíáðáé éáë óðá áñáóéëÛ óðíé ÷ áßá áéáðáðò (widgets) ðíó óáßííðáé óðçí ðéíúç óá êÛëá áðáñíáß.

Όά “widgets” άβίαέ Υίαό υνιό άέα υέα όά άίόέέάβιαία όόι δάνέαΰεείι όιό ÷ ηΠόόç ðιό ιόιηάβ εΰθιέιό ίά εΰίαέ έέέε Π ίά όά ÷ άέηέόόάβ ίά εΰθιέιό όηιόθι: ðεΠέόηά, ðεάβόέα άðέεηάΠò, ðεΠέόηά άίάέέάάΠò, άέέηίβάέα, έβόόάò, έάέ ΰέέα. Όά Microsoft Windows όά ηηΰΰάειόι “controls (÷ άέηέόόΠηέα)”.

Όά Microsoft Windows έάέ όι Mac OS όçò Apple Υ ÷ ιόι έάέ όά άγί ðιέγ άόόόçηΠ ðιέέόέέΠ άηάόέέηι όόιέ÷ άβιι άέάðάòΠò. Ίέ ðηιηάηιάόέόόΥò άόάηιηάηι ðηΥðάέ ðθιòβεάόάέ ίά άίάόόάεβόιόι υόέ ίέ άόάηιηάΥò όιòò έά Υ ÷ ιόι έίέηΠ άβόέçόç έάέ άιòΰίέόç (look and feel). Όόι X, άάί έαυηηΠέçέά άðάηάβόçοι ίά άβίαέ άðέάηεΠ άηιό όόάέάέηηέιΥίηò όόòέ άηάόέέηι, Π ίά όάέιγί εΰθιέά ðθι÷ ηάυòέέΰ άηάόέέΰ όόιέ÷ άβιι άέάðάòΠò.

Όάί άθιòΥέάόιά, ίçί ðάηέιΥίαόά ðέò άόάηιηάΥò άέα X ίά Υ ÷ ιόι έίέηΠ άιòΰίέόç. Όðΰη ÷ ιόι άέΰόηηάò άçιòέέάβò όóέεηάΥò άηάόέέηι όόιέ÷ άβιι άέάðάòΠò έάέ ðάηάέέάάΥò όιòò, όóιðάηέέάηιηάΥίçò έάέ όçò άóέάίόέέΠò Athena όóέεηάΠò άηάόέέηι όόιέ÷ άβιι άέάðάòΠò όιò MIT, **Motif**® (ðάηάέέάάΠ όçò ιόηίβάò άβίαέ έάέ ç όóέεηάΠ άηάόέέηι όόιέ÷ άβιι άέάðάòΠò όυί Microsoft Windows, ίά έηΥò άυίβάò έάέ ðηάέò άέάάάειβόάέò όιò άέηέ), όι **OpenLook**, έάέ ΰέέα.

Ίέ ðάηέόóυòάηάò ίΥάò X άόάηιηάΥò όΠιηά ÷ ηçóέηιθιέιγί ίέα όóέεηάΠ άηάόέέηι όόιέ÷ άβιι άέάðάòΠò ίά ηιόΥηίά άιòΰίέόç, άβόά όι Qt, ðιό ÷ ηçóέηιθιέάβόάέ άðu όι **KDE**, άβόά όι GTK+, ðιό ÷ ηçóέηιθιέάβόάέ άðu όι **GNOME**. Άðu άóòΠ όçί ΰθιç, όðΰη ÷ άέ εΰθιέά όγáέέέόç όόçί άιòΰίέόç όιò UNIX desktop, όι ιόηίβι ιðuóáΠθιòά εΰίαέ όά ðηΰάιόά άóέεηιόάηά άέα όηί ίΥί ÷ ηΠόόç.

6.3 Άάέάòΰόόάόç όιò X11

Όι **Xorg** άβίαέ ç ðηιáðέέάηιΥίç ðέηθιβçόç X11 άέα όι FreeBSD. Όι **Xorg** άβίαέ ι άέάέηέέόðò × όçò ðέηθιβçόçò X Window System όιò X.Org Foundation, έάέ άβίαέ άηίέέόιγ έðáέέα. Ί **Xorg** άβίαέ άάόέόιΥίηò όόηί έðáέέα όιò **XFree86 4.4RC2** έάέ όιò X11R6.6. Ç Υέαιόç όιò **Xorg** ðιό άέάóðεάόάέ άðu όçί ΌóέεηάΠ όυί Ports όιò FreeBSD άβίαέ ç 7.5.1.

Άέα ίά ίάóáάέυòðòβóáòά έάέ ίά άάέάóáóðβóáòά όι **Xorg** άðu όçί ΌóέεηάΠ όυί Ports:

```
# cd /usr/ports/x11/xorg
# make install clean
```

Όçιάβυόç: Άέα ίά ίάóáάέυòðòβóáòά ηέυέεçηι όι **Xorg** óéáιòθάóéάβóá υόέ Υ ÷ άóά όι έέάυòάηι 4 GB άέάγέáηι ÷ ηηί άέάέΥόέηι.

Άίάέέάέóέέΰ, όι X11 ιόηηάβ ίά άάέάóáóðάέάβ ΰιáóά άðu ðάέΥóά. Όðΰη ÷ ιόι άέάέΥóέίά Υóιέίá ðάέΥóά όιò ×11 άέα ÷ ηΠόόç ίά όι άηάάέάβι pkg_add(1). Άί ÷ ηçóέηιθιέΠóáòά όç άóίάóυòçóá όιò pkg_add(1) άέα έΠøç ιΥóυ άέέóγιò, άάί έά ðηΥðάέ όóçί άηάηΠ άίóηεηι ίά άðóáòά όηί άηέέηι Υέαιόçòð (version number) όιò ðάέΥóιò. Όι pkg_add(1) έά “έάóááΰóάέ” άóóυιáóά όçί óáέáóóáβά Υέαιόç όçò άóάηιηάΠò.

óóé, άέα ίά άβίαέ ç έΠøç έάέ ç άάέáòΰóóáóç όιò **Xorg**, áðεðò áéðáέΥóóá:

```
# pkg_add -r xorg
```

Όçιάβυόç: Όά ðάηάðΰιú ðάηάάάβιáιáóά έά άάέάóáóðβóιόι ηέυέεçηç όçί άέάηηΠ X11 ðιό ðάηέέάιáΰίάέ άέάέηιέóóΰò, ðáéΰóáò, áηάιιáιόιθáéηΥò έέð. Άέάóðεáίóáέ áðβóçò ίá ÷ υηέóóΰ, ðιçιáóéέΰ ðάέΥóά έάέ ports άέα όι X11.

Άέα ίά άεάόάόόόόόά όγί άεΰ÷έόόό άόιάόP άέαίΠP X11, ίδññάβόά άίάεέάέέέΰ ίά ÷ñçόέίίδñέPόάόά όί port x11/xorg-minimal.

Οί όδύερέδī όίό έάόάέάβίό έά όάό άίçāPόάέ δύό ñδèιβæάόάέ όί X11, έάέ δύό ίά όόPόάόά Ύίά δññάάυάέέü desktop δññέάΰεέί.

6.4 Νύεìέόç όίό X11

6.4.1 Δñεί ίάέείPόάόά

Δñεί όγί ñýεìέόç όίό X11 ÷ññέΰæίíόάέ ίέ áέüεíðέάδ δέçññíðññáδ άέα όί όύόόγιά:

- ΔññέάάññάóΎδ όçδ ίεüίçδ
- Chipset όçδ éΰñόάδ ññάóέέβί
- ίPιç όçδ éΰñόάδ ññάóέέβί

Íέ δññέάάññάóΎδ όçδ ίεüίçδ ÷ñçόέίíδñέííόάέ áδü όί X11 άέα ίά ññέóέáβ ç άίΰεόόç έάέ ί ñδèüð άίάíΎüόçδ όόί ίδñβί έά έάέόíðññáPόάέ. Íέ δññέάάññάóΎδ áδóΎδ ññβóέííόάέ όóίPεùð όόçí δάέìçñβüόç δñó όóññááýάέ όçí ίεüίç P όόçí έóóíóάέβáά όíó έάόάόέάόάόP. ×ññέΰæίíόάέ áýí óάέñΎδ ññέéìβί, í ññæüíðέíð ñδèüð άίάíΎüόçδ έάέ ί έάόάέüñδóíð ñδèüð άίάíΎüόçδ.

Οί chipset (íεíεέçññüΎíí έýééüíá) όçδ éΰñόάδ ññάóέέβί ññβæάέ δñβíð íäçäüð όóóέάδPδ έά ÷ñçόέííδñέçέáβ áδü όί X11 άέα όγί áδέέéíéíüíβá íá όçí éΰñόά ññάóέέβί. Άέα όά δññέóóüðññá chipset, áδóü ίδññáβ ίά άίέ÷ íáδèáβ áδóüíáόά, áέéΰ áβíάέ ÷ñPόέíí ίά όí áíññβæάόά óá δññβδóüόç δñó áár δáδý÷άέ ç áδóüíáόç άίβ÷íáδóç.

Ç íPιç όçδ éΰñόάδ ññάóέέβί έάéññβæάέ όçí άίΰεόόç έάέ όí áΰεíð ÷ñPíáδíð όóí ίδñβí ίδññáβ ίά áíðéΎθάέ όí όύόόγιά. Áδóü áβíάέ όçíáíóέέü þpóá ίά áíññβæάέ í ÷ñPόόçδ όá üñέá όíó όóóPíáόíð.

6.4.2 Νύεìέόç όíό X11

Άδü όçí Ύέáíóç 7.3 έάέ íáδΰ, όí **Xorg** Ύ÷άέ όç áδñíáβ óð÷íΰ ίά έάέóíðññáPόάέ ÷ññβδ έáíΎíά áñ÷áβñ ñδèιβóáññ, ññΰííóáδ áδèþð όόç ññáñP άíóíεβί:

```
% startx
```

Άδü όçí Ύέáíóç 7.4 έάέ íáδΰ, όí **Xorg** Ύ÷άέ όç áδñíáβóçδóά ίά ÷ñçόέííδñέáβ όí HAL άέα όçí áδóüíáόç άίβ÷íáδóç όíó δέççéðññéíáβíó έάέ όíó δñíóέέéíý. Óá ports sysutils/hal έάέ devel/dbus ááέáέβóóáíóάέ üð áíññóPόáέó όíó x11/xorg, áέéΰ έá δñΎðáέ ίά áíññáññíçέçéíý íá óéð áέüεíðέáδ áññáóΎδ όóí /etc/rc.conf:

```
hald_enable="YES"
dbus_enable="YES"
```

Έά δñΎðáέ ίά íáέέίPόáόá óéð óδçññáóβáð áδóΎδ (áβδá ÷áéññéβίçδóá, áβδá éΰñíóáδ áδñíáέέβίçόç) δñεί όóíá÷βóáόá íá όç ñýεìέόç όíó **Xorg**.

Óá éΰδñέáð δññέδóþpóáéð, ç áδóüíáόç ñýεìέόç ίδññáβ ίά íç έάέóíðññáPόáέ óüóóΰ, P ίá íç ñδèιβóáέ óéð óóóέáδΎδ áéñέáþð üðñð áδèéðíáβδá. Óóéð δññέδóþpóáéð áδóΎδ, έá ÷ññέáóóáβ ίá éΰíáδá ÷áéññéβίçόáð ñδèιβóáέó.

Όαίάβουό: Έΰδιέα άñάόέέΰ δάñέαΰεείίόά, ύδύο οί **GNOME** οί **KDE** η οί **XFCE**, άέαέΰοίί άñάάέαβá διό άδέοñΰοίί οοί ÷ñΠόοα ίά ñεειβόάέ ίά άύεείί οñύδι έέΰοίñάο δάñάιΰοñίοο όαο ίεύίαο, ύδύο α ίΰέοόα. Αί α δñίάδέέαάιΰία ñύειέόα άάί άβίάέ άδιάάέοη, έάέ οείδάύάοά ίά άάέαόάόοΠόάόά έΰοίεί άδύ άόόΰ όά δάñέαΰεείίόά, ίδιñάβόά ίά οοίá ÷βόάόά ίά όαί άάέαόΰόόάόα όίό, έάέ ίά ίείέεαηΠόάόά όέο ñεειβόάέο όάο ÷ñαόείίδιέπιόάο οί έάόΰέεαί άñάόέέΰ άñάάέαβá.

Οί δñηοί άβίά έ ααίείόñάβá άύο άñ ÷έειΰ άñ ÷άβίό ñεειβόάύί. ΰò root, άδεηο άέόάέΰόά:

```
# Xorg -configure
```

Άόόΰ έά ααίείόñάβόάέ ΰίá δñύοόδι άñ ÷άβί ñεειβόάύί οίό X11 οοίί έάόΰείάι /root ίά οί ύñίá xorg.conf.new (άβόά ÷ñαόείίδιέΠόάόά οί su(1) άβόά οοίάάέάβόά άδάόέάβάο, α ίάόάέεαοη έάόάέΰίό \$HOME άέέΰάέ άάβ ÷ñίόάο οίί έάόΰείάι οίό root). Οί X11 έά δñίόδάέΠόάέ ίά άίέ ÷ ίάύόάέ οί όδιόύόόαί άñάόέέηι οίό οόόόΠιáοίό έάέ ίά ααίείόñάβόάέ ΰίá άñ ÷άβί ñεειβόάύί διό έά υñόηίáέ οίό ούοόίόΰ ίααίΰό οόόέάοηί άέα οί όέέέΰ διό άίέ ÷ ίάύέαά οοί όύόόαί όάο.

Οί άδύάι άβίá άβίáέ ι ΰέα ÷ίό ούι όδΰñ ÷ίόΰι ñεειβόάύί άέα ίά άδέάάάέηόάόά υόέ οί **Xorg** έάέοίόñάβ ίά οί όδιόύόόαί άñάόέέηι οίό οόόόΠιáοίό όάο. Άέα έέΰΰόάέο οίό **Xorg** ίΰ ÷ñέ οί 7.3, δεαέοñίείΠόάό:

```
# Xorg -config xorg.conf.new
```

Άδύ οί **Xorg** 7.4 έάέ ίάόΰ, οί δάñάδΰΰύ όάόό άάβ ÷ ίάέ ίέα ίάύñα ίεύία α ίδιβá έΰίáέ άύόέίεα όα έέΰΰίόα έάέΠο έάέοίόñάβόό οίό X11. ×ñαόείίδιέΠόάόά όαί άδέείάη retro άέα ίά άδιέάόάόόΠόάόά όαί δάέέΰόάñα όοιδάñέοίñΰ:

```
# Xorg -config xorg.conf.new -retro
```

Άΰί άιόάίέόάβ ΰίá ίάύñι έάέ άέñέ δεΰΰάί έάέ ΰίáό άάβέόαο δñίόέέέΰ ίά ίñόη X, α ñύειέόα Πόάί άδέόó ÷Πο. Άέα ίά όάñιáόβόάόά όα άίεείη, ίάόάάβόά όόαί άέέίέέη έίίόΰέα άδύ όαί ίδιβá όαί ίάέείΠόάόά, δεΰΰίέΰόά **Ctrl+Alt+Fn (F1)** άέα όαί δñηοα άέέίέέη έίίόΰέα) έάέ δεΰΰόά **Ctrl+C**.

Όαίάβουό: Όόέο άέΰΰόάέο οίό **Xorg** δñέί όαί 7.3, ίδιñίόά ίá ÷ñαόείίδιέεαβ ι οοίάόάίΰό δεηέοñύι **Ctrl+Alt+Backspace** άέα οίί όάñιáόέόΰι οίό δñίάñΰίίáοίό. Άέα ίά οίί άίάñάίδιέΠόάόά άδύ όαί ΰέαίόα 7.4 έάέ ίάόΰ, ίδιñάβόά ίá άπόάόά όαί δάñάέΰόΰ άίόίεη όά έΰοίεί όάñιáόέέΰ οίό X:

```
% setxkbmap -option terminate:ctrl_alt_bksp
```

Άίάέέαέόέέΰ, ααίείόñάβόάέ ΰίá άñ ÷άβί ñεειβόάύί δεαέοñίείάβίό άέα οί **hald** ίά όαί ίñίáόβá x11-input.fdi έάέ άδιέεαΰόά οί οοίί έάόΰείάι /usr/local/etc/hal/fdi/policy. Οί άñ ÷άβί άόόΰ έά δñΰάέ ίá δάñέΰ ÷άέ όέο δάñάέΰόΰ άñάίΰό:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<deviceinfo version="0.2">
  <device>
    <match key="info.capabilities" contains="input.keyboard">
      <merge key="input.x11_options.XkbOptions" type="string">terminate:ctrl_alt_bksp</merge>
    </match>
  </device>
</deviceinfo>
```

Έá ÷ñάέάόάβ ίá άδάίάέέείηΠόάόά οί ία ÷ΰίαίά όάο άέα ίá άίάίάέέΰόάόά οί **hald** ίá έέαΰΰόάέ άόόΰ οί άñ ÷άβί.

Έá δñΰάέ άδβόα ίá δñίόέΰόάόά όαί δάñάέΰόΰ άñάίη οοί άñ ÷άβί xorg.conf.new, όόαί άίΰόαί ServerLayout η ServerFlags:

```
Option "DontZap" "off"
```

Αί οί θιιόβέε άάί εάέοιτωναάβ, εά ÷ ηάέάόόάβ ίά οί ηόειβόάόά θήεί όοί÷βόάόά. Άάβόά οί ΟίΠιά 2.10.10 όοί έαοΰεάει άάέάόΰόόάόό όίο FreeBSD. Άθέθηιόέάόά, άδθι όοί Ύέαιός 7.4 εάέ ίάόΰ, ίέ άίιιόοάό InputDevice όοί xorg.conf άάηίίίόάέ έάεηό άβίάόάέ ÷ ηΠόο όθι όόόέάθηί θιό άίέ÷ίάγέέάί άόόιιιάόά. Άέά ίά άόάίάόΎηάόά όοί θάέέΰ όοιθάνέοιηΰ, θηιόέΎόόά όοί θάηάέΰόθ άηάηηΠ όόοί άίιιόόά ServerLayout Π ServerFlags όίθ άη÷άβιθ ηόειβόάθι:

```
Option "AutoAddDevices" "false"
```

Έά ίθιηάβόά Ύθάέόά ίά ηόειβόάόά όέό όόόέάθΎό άέόιιιόόό υθόό όόέό θηιόάηίίίίάό άέάιιόάέό όίθ **Xorg**, ÷ ηόόέιθθέηίόάό έάέ υθίέάό ΰέέάό άθέέηΎό ÷ ηάέΰάόόά (θ.÷. άίάέέάάΠ θεέέθθηίέηάβιθ).

Όοίάβιθ: ¼θόό άίηαβόάίά έάέ θηιόάηίίίιιό, άδθι όοί Ύέαιός 7.4 έάέ ίάόΰ ι άάβιίίάό **hald** άίάέάίάΰίάέ ίά άίέ÷ίάγόάέ άόόιιιάόά όί θεέέθθηίέηάέί όάό. Οθΰη÷άέ θάηβθόόόό ίά ίοί άβίάέ όούόΠ άίβ÷ίάόόό όίθ ιιιόΎέιθ Π όοό άέΰόάίς, υόόόιθ έΰθίέά άηάόέέΰ θάηέάΰέέηίόά υθόό όί **GNOME** όί **KDE** έάέ όί **Xfce** θάηΎ÷ίθί όά άέέΰ όίθό άηάάέάβά άέά ός ηύέιέός όίθ. Ιθιηάβόά υιιό ίά ηόειβόάόά όέό έάέυόοόόό όίθ θεέέθθηίέηάβιθ έάέ άόάόέάβάό, άβόά ίΎόό όίθ άίηέέόέηίθ θηιηάηΰιιιάόίθ setxkbmap(1) άβόά ίά όοί θηιόέβές άίιιό έάίιιιά όόί **hald**.

Άέά θάηΰάάέάί, άί έΰθίέίθ έΎέάέ ίά ÷ ηόόέιθθέηίόάέ Ύίά θεέέθθηίέηάέί 102 θέβέθθιι ίά άάέέέέΠ άέΰόάίς, έά θηΎθάέ ίά άοίέίθθάβόάέ Ύίά άη÷άβι ηόειβόάθι άέά όί **hald** ίά όί υιιίά x11-input.fdi έάέ ίά όί άθίέέέάγόάέ όόίί έάόΰέηίί /usr/local/etc/hal/fdi/policy. Οί άη÷άβι άόόυ έά θάηέΎ÷άέ όέό θάηάέΰόθ άηάηΎό:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<deviceinfo version="0.2">
  <device>
    <match key="info.capabilities" contains="input.keyboard">
      <merge key="input.x11_options.XkbModel" type="string">pc102</merge>
      <merge key="input.x11_options.XkbLayout" type="string">fr</merge>
    </match>
  </device>
</deviceinfo>
```

Αί όί άη÷άβι άόόυ οθΰη÷άέ βας, άθέηό άίόέάηΰόόά όέό θάηάθΰίυ άηάηΎό ίΎόά όόί οθΰη÷ίθ θάηέά÷υιάηί.

Έά θηΎθάέ ίά άόάίάέέέίβόάόά όί ίς÷Ύίςίά όάό άέά ίά άίάίάάέΰόάόά όί **hald** ίά άέάΰόάέ όί άη÷άβι.

Ιθιηάβόά άθβόόό ίά έΰίάόά όοί βάέά ηύέιέός ίΎόά άδθι Ύίά θάηίάόέέυ όόά × Π άέυιιά έάέ άδθι Ύίά script, άέόάέηίόάό όοί θάηάέΰόθ άίόίέβ:

```
% setxkbmap -model pc102 -layout fr
```

```
Ιθιηάβόά ίά άηάβόά όέό άέάέΎόέίάό άθέέηΎό θεέέθθηίέηάβι έάέ άέάόΰίάθι όόί άη÷άβι
/usr/local/share/X11/xkb/rules/base.lst.
```

θάέόά, θηιόάηιιόόά όί άη÷άβι ηόειβόάθι xorg.conf.new όόέό θηιόέίβόάέό όάό. Άηβίθά όί ίά Ύίάί όόίόΰέός έάέΎίθ υθόό ι emacs(1) Π ι ee(1). Θηηόά, θηιόέΎόόά όέό όó÷ίιιόόάό όοό ίέυίςθ. Οόίβέθό άίάόΎηίίόάέ υό ιηέάυιθόέί έάέ έάόάέυθθόέ ηόειβ όά÷ηιιέόιγ. ΆόόΎό ίέ όέΎό όιθίέάθίίίόάέ όόί άη÷άβι xorg.conf.new όόί Section "Monitor":

```
Section "Monitor"
  Identifier      "Monitor0"
  VendorName     "Monitor Vendor"
  ModelName      "Monitor Model"
```

```

    HorizSync      30-107
    VertRefresh    48-120
EndSection

```

Ιέ ιαόάαέçðÝð HorizSync έάέ VertRefresh ιðñάβ ίά ιçí òðÛñ÷íοί οοί άñ÷άβι ñòèìβόάυι. Αί άάί òðÛñ÷íοί, ðñÝðάέ ίά ðñιόάάειύί, ιά οίι ούοόυι ιñέαυιόέι ñòèìυ οόά÷ññίέοιύύ ιάòÛ òçí èÝίç HorizSync έάέ οίι έάόάέυιñòοι ñòèìυ οόά÷ññίέοιύύ ιάòÛ òçí èÝίç VertRefresh. Οοί ðάñάðÛíυ ðάñÛάάέαιά, ðñιόεÝόάιά òιòð άίòβόοίέ÷íòð ñòèìýð άίάíÝύòçð òçð ιèυιçð ιάò.

Οί X άðέοñÝðάέ òç ñβόç òυι άðίάοιòðòυι DPMS (Energy Star) οά ιèυιάð ðιò òðιόòçñβæίòι òçí άίòβόοίέ÷ç έάέοιòñάβά. Οί ðñυάñάιιά xset(1) άèÝά÷άέ òιòð ñυιíòð έάέ ιðñάβ ίά άðéáÛέέάέ òéð έάόάóðÛóáéð standby, suspend, P off. Αί èÝéάòά ίά άíάñάιðιεðóáðá òéð άðίάóυòçóáð DPMS òçð ιèυιçð οάð, ðñÝðάέ ίά ðñιόεÝόάðá òçí άέυιèòèç άñάιì ðοί Section monitor:

```

    Option          "DPMS"

```

¼οί οίι άñ÷άβι ñòèìβόάυι xorg.conf.new άβίάέ άέυιιά άίίέòυ οά Ýίάί òðιòÛéòç έάειÝίíò, άðééÝίòά òçí άíÛéòçç έάέ οίι άÛéòð ñυιÛÛòυι ðιò άðéèòιάβóá. Άòòυ έάέιñβæάðάέ òοί Section "Screen":

```

Section "Screen"
    Identifier "Screen0"
    Device     "Card0"
    Monitor    "Monitor0"
    DefaultDepth 24
    SubSection "Display"
        Viewport 0 0
        Depth    24
        Modes    "1024x768"
    EndSubSection
EndSection

```

Ç ιαόάαέçðP DefaultDepth ιñβæάέ οί ðñιáðééάιÝíí άÛéòð ñβιáòιò ðιò έά ñçóέιιðιεçéάβ. Ιðñάβóá ίά òçí ðάñάéÛιòáðά ιά οίι έέάέυððç -depth òçç άñάιì ð άίòιεðι òιò Xorg(1). Ç άðééíāP Modes ιñβæάέ òçí άíÛéòçç ιά òçí ιðιβά έά έάέοιòñάβ ç ιèυιçç οά Ýίά òðáééñéιÝíí άÛéòð ñυιÛÛòυι. ðñιόÝίòά υðé òðιόòçñβæιíòάέ ιυιí έάíίέéÝð έάόάóðÛóáéð VESA, υðυð ιñβæιíòάέ άðυ òι òðιόóççιά άñάóéèðι òιò òóóðβιáòιò. Οοί ðάñάðÛíυ ðάñÛάάέαιά, òι έάέιñέοιÝíí άÛéòð ñυιÛÛòυι άβίάέ άέέιòéðÝóóάñά bits άíÛ pixel. Οά áòòυ òι άÛéòð ñυιÛÛòυι, ç άðιááéðP άíÛéòçç άβίάέ 1024×768 pixels.

ΟÝéιò, άðιεçéάýóðά òι άñ÷άβι ñòèìβόάυι έάέ άèÝάíòά òι ιά òçí ιÝéιαι άèÝά÷íò ðιò άιçάβóάιά ðάñάðÛíυ.

Οçιáβòçç: Ιά áðυ òά άñάάéάβά ðιò ιðñάβ ίά οάð άιçèβóιòι έάòÛ òçí έέάάéέάóβά άðβéòççð ðñιáèçιÛòυι, άβίάέ òά άñ÷άβά X11 log, ðιò ðάñéÝ÷íòι ðéçñιòιñβáð áéά èÛéá òóóéάòð ðιò άðééíéιύιáβ ιά òιι έέάéñééóðP X11. Οά άñ÷άβά Xorg log ιñιÛæιíòάέ ιά òçí ιñòð /var/log/Xorg.0.log. Οί áéñéáÝò υιιιά άιυò log ιðñάβ ίά άβίάέ Xorg.0.log Ýυò Xorg.8.log έάέ ðÛάέ èÝάιíòáð.

Αί υéά άβίάέ έάéÛ, òι άñ÷άβι ñòèìβόάυι ðñÝðάέ ίά òιðιεáðçéάβ òά ιéά éιéιð òιðιεáóóβά þóðά ίά άίòιðβæáðάέ áðυ òι Xorg(1). Άòòð òóιðéòð άβίάέ ç /etc/X11/xorg.conf P /usr/local/etc/X11/xorg.conf.

```

# cp xorg.conf.new /etc/X11/xorg.conf

```

Ç áέάέέάόβά ηύέιέόç òἰò X11 Ἰ ÷ áέ òηἡά ἱεἱέεçñùεάβ Ὀἱ **Xorg** ἰðἱἡάβòά ἱά òἱ ἱάέείΠòάòά ἱά òἱ áἱçèçòééù ðñüāñāἱά startx(1). Ἰ áέάέἡéóòòðò X11 ἰðἱἡάβ áðβóçò ἱά áééείΠòάé ἱά òç áἱΠèάέά òἰò xdm(1).

6.4.3 ἈἱάέééâοἱἸά ἘἸἱάòá Ἰòèἱβóáùἱ

6.4.3.1 Ἰòèἱβóáéò áéá òά Intel® i810 Graphics Chipsets

Ἀέά ἱά ÷ ηççóεἱἰðἱéΠòάòά εἸñòά ááóέοἱἸἱç óòά Intel i810 integrated chipsets, áðáéòάβòάé òἱ agpgart, ç áéάðáòΠ ðñἱāñāἱἱάóéοἱἸἱ òἱ X11 áéá òἱ AGP. Ἀάβòά òçἱ óáεβáá manual òἰò ðñἱāñἸἱἱáòἰò ἱάΠáçóçò agp(4) áéá ðñééóóúòāñāò ðεçñἱòἱñβáò.

Μά áòòù òἱἱ ðñüðἱ, ç ηύέιέóç òἰò ðéééἱἸἱ ὁáò éá ἰðἱἡάβ ἱά áβἱάé üðùò éáé óά εἸἸεά Ἰέεç εἸñòά āñáóééΠἱ. Ḑñἱóἱ ÷ Π, óā óòóðΠἱάòά ÷ ùñβò áἱóἱἱáòùἱἸἱ òἱἱ ἱāçāü agp(4), ἱ ἱāçāüð ááἱ éá òἱñòùéáβ ἱά òçἱ áἱóἱéΠ κἱdload(8). Ἰ ἱāçāüð áòòùò ðñἸἸáé ἱά āñβóéáòáé óòἱἱ ðñἱΠἱά éáòἸ ὲçἱ áééβἱçóç, áβòά óááóééἸ ἱáòáäεùòóéοἱἸἱò, áβòά ἱά ÷ ηΠóç òἰò /boot/loader.conf.

6.4.3.2 ḐñἱòéἸἱòἱòáò ἱéá Widescreen Ἀðβðáäç ἱèüἱç

Ἀòòù òἱ òἱΠἱά ðñἱἰðἱéἸἱóáé ἱāñééἸἱ ãἱΠòáéò áἱáéáééâοἱἸἱñἱ ἱòèἱβóáùἱ. Ἀἱ ἱé ðñἱòðἸéáéáò ἱά òά óòἱΠεç āñāééáβá ἱòèἱβóáùἱ ááἱ éáòáéΠἱἱóἱ óā ἱéá ηύέιέóç ðἰò ἱá éáéòἱòñāāβ, òðἸñ ÷ ἱóἱ áñéâðἸἱ ðεçñἱòἱñβáò óòά áñ ÷ áβá log ðἰò ἰðἱἡἱἱ ἱά óáò áἱçèçΠóἱἱ. Ἰóòúòἱ, áβἱάé áðáñáβðçòç ç ÷ ηΠóç áἱἱùò óòἱðἸéòç éáéἱἸἱò.

Ἰé ðñἸἱ ÷ ἱòóáò áἱáéἸἱóáéò widescreen (WSXGA, WSXGA+, WUXGA, WXGA, WXGA+, é.á.) òðἱóòçñβæἱóἱ formats éáé aspect ratios (áἱáéἱāβáò) 16:10 éáé 16:9 ðἰò ἰðἱἡάβ ἱá çἱéἱòñāβóἱἱ ðñἱāéΠἱáòá. Ḑāñāāáβāἱáòá ἱāñééΠἱ éἱἱἱἱ áἱáéἸἱóáùἱ áéá áἱáéἱāβá 16:10 áβἱάé òά:

- 2560x1600
- 1920x1200
- 1680x1050
- 1440x900
- 1280x800

ἘἸðἱéá óééāἱΠ, ç ηύέιέóç éá áβἱáòáé ðἱéἸἱ áðεἸ ðñἱòéἸἱòἱòáò òçἱ áἱἸéòóç ùð Ἰἱά ðééáἱἱ Mode óòἱ Section "Screen" üðùò áāΠ:

```
Section "Screen"
Identifier "Screen0"
Device      "Card0"
Monitor     "Monitor0"
DefaultDepth 24
SubSection "Display"
    Viewport 0 0
    Depth    24
    Modes    "1680x1050"
EndSubSection
EndSection
```

Οί **Xorg** αβίαέ ανέαόΰ Ύιόδιί βόόά ίά αίαέδΠόάέ οέδ δεçñιοιñβάδ οçò αίΰεόόçò οçò widescreen ιέυιçò ιΎούò ούι δεçñιοιñέβι I2C/DDC, αφύñβæιίόάδ Ύόόέ οέ ιδιñάβ ίά ÷άέέόόάβ ç ιέυιç υίοι άοιñΰ οέδ οδ÷ιύοçόαδ έάέ οέδ αίαέύόάέδ.

Αί άόδΎò ιέ ModeLines αάι οδΰñ÷ιόι οόιòδ ιάçαίγòδ, ιδιñάβ ίά ÷ñάέάόόάβ ίά οέδ αβόάόά άόάβδ οόι **Xorg**.
×ñçόέιιθιέβιόάδ οί /var/log/Xorg.0.log ιδιñάβδóά ίά αίαέδΠόάόά ανέαόΎò δεçñιοιñβάδ βόόά ίά αçιέιòñάβόάόά ιύιέ όάδ Ύία ModeLine θιò ίά έάέοιòñάάβ. Άδθβò αίαέçòΠόάά δεçñιοιñβάδ θιò έά ιιέΰæιόι ίά άόδú:

```
(II) MGA(0): Supported additional Video Mode:
(II) MGA(0): clock: 146.2 MHz Image Size: 433 x 271 mm
(II) MGA(0): h_active: 1680 h_sync: 1784 h_sync_end 1960 h_blank_end 2240 h_border: 0
(II) MGA(0): v_active: 1050 v_sync: 1053 v_sync_end 1059 v_blanking: 1089 v_border: 0
(II) MGA(0): Ranges: V min: 48 V max: 85 Hz, H min: 30 H max: 94 kHz, PixClock max 170 MHz
```

ΆόδΎò ιññΰæιίόάέ δεçñιοιñβάδ EDID. Ç αçιέιòñάβά αφύδ ModeLine άδú άόδΎò, αβίαόάέ άΰæιίόάδ άδθβò οίòδ ανέαέιγòδ οόç ούόόΠ όάέñΰ:

ModeLine <name> <clock> <4 horiz. timings> <4 vert. timings>

Όάέέέΰ, οί ModeLine οόι Section "Monitor" οόι θάνΰάάέαιά ίάδ έά ιιέΰæιόέ ίά άόδú:

```
Section "Monitor"
Identifier      "Monitor1"
VendorName     "Bigname"
ModelName      "BestModel"
ModeLine       "1680x1050" 146.2 1680 1784 1960 2240 1050 1053 1059 1089
Option         "DPMS"
EndSection
```

Όβñά θιò Ύ÷άόά όάέάέβόάέ ίά άόδΰ όά άδθέΰ άβιáόά, οί X έά θñΎθάέ ίά έάέοιòñάβόάέ οόç ιΎία widescreen ιέυιç όάδ.

6.5 ×ñΠόç Άñάιáοιόάέñβι οόι X11

6.5.1 ΆñάιáοιόάέñΎò ούόδιò Type1

Ιέ θñιέάειñέοιΎίαδ ανάιáοιόάέñΎò θιò οδñάαγίοι οί X11 αάι αβίαέ έάάιέέΎò αέά άόάνιñάΎò άδέοñάδΎæάέδ οόθιñάόβάδ. Ιέ ίάάΰεάδ ανάιáοιόάέñΎò θάνιòóβάόçò οάβñιόάέ ιαιιòδΎò έάέ ανάόέδά÷ιέέΎò, έάέ ιέ ιέέñΎò ανάιáοιόάέñΎò οόι **Netscape** αβίαέ ó÷άαυιί έάέόΰεçδδóδ. Άδóδ÷βò υιùδ, οδΰñ÷ιόι έάέέΎόέιáδ ανέαόΎò, οççέβò θιέυοçόάδ ανάιáοιόάέñΎò Type1 (PostScript®) θιò ιθιñιγί ίά ÷ñçόέιιθιέçèιγί ΰιáόά άδú οί X11. Άέά θάνΰάάέαιά, ç οόέειñάβ ανάιáοιόάέñβι URW (x11-fonts/urwfonts) θάνέΎ÷άέ άέάυόάέδ οççέβò θιέυοçόάδ ούι οίçέέοιΎιñι type1 ανάιáοιόάέñβι (Times Roman®, Helvetica®, Palatino® έάέ ΰέέάδ). Ç οόέειñάβ Freefonts (x11-fonts/freefonts) θάνέΎ÷άέ θιέέΎò θάνέόóυιόάνάδ ανάιáοιόάέñΎò, αέέΰ ιέ θάνέόóυιόάνάδ άδú άόδΎò αβίαέ αέά έιñάέοιέέυ ανάόέέβι υδòδ οί **Gimp**, έάέ αάι αβίαέ έάόΰεççέάδ αέά ανάιáοιόάέñΎò ιέυιçò. Άέυιç, οί X11 ιδιñάβ ίά άέΰ÷έόοι έυθι ίά ñòèιέόόάβ βόόά ίά ÷ñçόέιιθιέέάβ TrueType ανάιáοιόάέñΎò. Άέά θάνέόóυιόάνάδ έάδθιñΎñάέάδ, αάβδóά οçι όάέβάά manual X(7) Π οί οίβιá ó÷άόέέΰ ίά οέδ ανάιáοιόάέñΎò TrueType.

Άέά ίά άάέάόάόδΠόάόά οέδ θάνάδΰιñι οόέειñάΎò ανάιáοιόάέñβι Type1 άδú οçι Όόέειñάβ ούι Ports, άέδάέΎόάδ οέδ θάνάέΰδò άιόιέΎò:

```
# cd /usr/ports/x11-fonts/urwfonts
# make install clean
```

Ìά ðάννιέι ðñùðì ìðìñáβòά íá äåéáðáóðΠóáðά éáé ðçí freefont Π Ùεεάð óðεεíáÝð. Άέá íá áίε÷íáýóáé ì X server áððÝð ðεð ãñáìíáðìíóáéñÝð, ðñìíóεÝóðά ðçí éáðÙεεççç ãñáììΠ óðì áñ÷áβì ñðεìβóáùì ðìð (/etc/x11/xorg.conf):

```
FontPath "/usr/local/lib/X11/fonts/URW/"
```

ΆíáεεáéðééÛ, áéðáεÝóðά ðççí ãñáììΠ áíðìεðí íεáð óðíüáü X:

```
% xset fp+ /usr/local/lib/X11/fonts/URW
% xset fp rehash
```

Άððù éá éáéðìðñáΠóáé, áεéÛ ùðáí ðáñìíáðβóáé ç óýñíáð X, íé ñðεìβóáéð éá ÷ áεíýí, áéðùð áí ðñìóðáεìýí ððì áñ÷áβì áééβίççðð (ðì ~/ .xinitrc áéá ìβá óðìçεéðìÝíç óýñíáí ìÝòù startx, ç ðì ~/ .xsession áí óðíáÝáóðά ìÝòù áíüð ãñáóééýý áéá÷áéñéóðΠ óýíááççð ùððð ì XDM). Íáð áεùìç ðñùðìð áβíáé íá ÷ ñçóéìðìéΠóáðά ðì áñ÷áβì /usr/local/etc/fonts/local.conf: äáβðά ðì ðìΠìá anti-aliasing (ãññÛεðíççð).

6.5.2 ΆñáìíáðìíóáéñÝð TrueType®

Õì Xorg Ý÷áé áíóùíáðùìÝíç ððìóðΠñéíç áðáééùíéççð ãñáìíáðìíóáéñΠ TrueType. ÕðÛñ÷ìðì áýì áéáðìñáðééÛ modules (áñεñΠíáðά) ðìð ìðìñìýí íá áíáñáñðìéΠóìí ðððΠ ðçí éáéðìðñáβá. Õá áððù ðì ðáñÛááéáì ÷ ñçóéìðìéáβðáé ðì freetype module áðáéáΠ áβíáé ðεì óðìáñáÛóéì ìá ðá Ùεéá back-ends áðáééùíéççð ãñáìíáðìíóáéñΠ. Άέá íá áíáñáñðìéΠóáðά ðì freetype module, áðεðð ðñìíóεÝóðά ðçí ðáñáéÛðù ãñáììΠ óðì ðìΠìá "Module" ðìð áñ÷áβìð /etc/x11/xorg.conf.

```
Load "freetype"
```

Õðñá, ççìéìðñáΠóáé Ýíáí éáðÙεíáñ áéá ðεð ãñáìíáðìíóáéñÝð TrueType (áéá ðáñÛááéáì, /usr/local/lib/X11/fonts/TrueType) éáé áíðéáñÛððá ùεáð ðεð ãñáìíáðìíóáéñÝð TrueType óá áððùí. ðñìóÝíðá ùðé íé ãñáìíáðìíóáéñÝð TrueType ááí ìðìñìýí íá áβíáé áðù Ýíá óýóççιά Macintosh ðñÝðáé íá áβíáé óá ìñðΠ UNIX/MS-DOS/Windows áéá íá éáéðìðñáñìýí ððì X11. Ìüεéð áíðéáñáðìíýí ðá áñ÷áβá óðì éáðÙεíáñ, ÷ ñçóéìðìéΠóáðά ðì **ttmkfdir** áéá íá ççìéìðñáΠóáðά ðì áñ÷áβì fonts.dir, þððá ì X font renderer íá áíùñβáéáé ðçí ýðáñìç ðùì íÝùí áððΠ áñ÷áβùí. Õì ttmkfdir áéáðβεáðáé áðù ðçí ÕðεεíáΠ ðùì Ports ðìð FreeBSD ùð x11-fonts/ttmkfdir.

```
# cd /usr/local/lib/X11/fonts/TrueType
# ttmkfdir -o fonts.dir
```

Õðñá, ðñóóεÝóðά ðì éáðÙεíáñ TrueType óçç áéááññΠ ðùì fonts. Άððù áβíáðáé ìá ðì βáεì ðñùðì ðìð ðáñéáñÛðáì ðáñáðÛù ðéð Type1 ãñáìíáðìíóáéñÝð, ÷ ñçóéìðìéΠíðáð ðì

```
% xset fp+ /usr/local/lib/X11/fonts/TrueType
% xset fp rehash
```

Π áðεÛ ðñìíóεÝóðά íéá ãñáììΠ FontPath óðì áñ÷áβì xorg.conf.

Άððù Πðáí. Õðñá ì Netscape, ðì Gimp, ðì StarOffice™, éáé ùεáð íé Ùεεáð áðáñìáÝð X ðñÝðáé íá áíáíùñβáεìðì ðεð äåéáðáóççíÝíáð TrueType ãñáìíáðìíóáéñÝð. ðñéý íééñÝð ãñáìíáðìíóáéñÝð (ùððð áððÝð ðìð óáβñíðáé óðì éáβíáñ íεáð éóðìóáεβááð óá ðçççΠ áíÛεðçç) éáé ðñéý ìááÛεáð ãñáìíáðìíóáéñÝð (óðì StarOffice) éá óáβñíðáé ððñá ðñéý éáéýðáñá.

6.5.3 Anti-Aliased Font Rendering

Το παρόν κεφάλαιο αφορά την X11 και την ανάλυση γραμμάτων. Η διαδρομή είναι `/usr/local/lib/X11/fonts/` και οι `~/.fonts/` φαίνονται να είναι αντι-aliasing και `Xft-aware`, όπως είναι οι **KDE**, **GNOME** και **Firefox**.

Εάν η `~/.fonts/` φαίνεται να είναι αντι-aliasing, η `/usr/local/lib/X11/fonts/` φαίνεται να είναι αντι-aliasing, η `/usr/local/etc/fonts/local.conf` φαίνεται να είναι αντι-aliasing. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`.

Οι `~/.fonts/` φαίνονται να είναι αντι-aliasing. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`.

```
<?xml version="1.0"?>
<!DOCTYPE fontconfig SYSTEM "fonts.dtd">
<fontconfig>
```

Το παρόν κεφάλαιο αφορά την X11 και την ανάλυση γραμμάτων. Η διαδρομή είναι `/usr/local/lib/X11/fonts/` και οι `~/.fonts/` φαίνονται να είναι αντι-aliasing και `Xft-aware`, όπως είναι οι **KDE**, **GNOME** και **Firefox**.

```
<dir>/path/to/my/fonts</dir>
```

Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`.

```
# fc-cache -f
```

Οι αντι-aliasing φαίνονται να είναι αντι-aliasing. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`. Η διαδρομή είναι `/usr/local/etc/fonts/local.conf`.

```
<match target="font">
  <test name="size" compare="less">
    <double>14</double>
  </test>
  <edit name="antialias" mode="assign">
    <bool>>false</bool>
  </edit>
</match>
<match target="font">
  <test name="pixelsize" compare="less" qual="any">
    <double>14</double>
  </test>
  <edit mode="assign" name="antialias">
    <bool>>false</bool>
  </edit>
</match>
```

Õι spacing (æέάóðñιάóá) óá ìáñééÝð monospaced ãñáìíáóìíóáéñÝð ìðñáß áðßçò ñá áßíáé æέáóÛεççëí ùóáí ÷ñçóçñíðñéáßóáé anti-aliasing. Áðòù öáßíáóáé ñá áðñóáéáß éæéáßóáññ ðññúæççιά ñá òì **KDE**. Ìéá æéññèùóç ñéá áðòù, áßíáé ñá áðéáÛεççóá òòì spacing òçí òçñß 100 ñéá áóóÝð òéð ãñáìíáóìíóáéñÝð. ÐññíóçÝóóá òéð æéññèùóç ãñáìíÝð:

```
<match target="pattern" name="family">
  <test qual="any" name="family">
    <string>fixed</string>
  </test>
  <edit name="family" mode="assign">
    <string>mono</string>
  </edit>
</match>
<match target="pattern" name="family">
  <test qual="any" name="family">
    <string>console</string>
  </test>
  <edit name="family" mode="assign">
    <string>mono</string>
  </edit>
</match>
```

(áðòù ñáðññÛæáé óá Ûεççá çññíÛ ñññíáóá òùí fixed ãñáìíáóìíóáéññí ùð "mono"), æéé Ýðæéóá ðññíóçÝóóá:

```
<match target="pattern" name="family">
  <test qual="any" name="family">
    <string>mono</string>
  </test>
  <edit name="spacing" mode="assign">
    <int>100</int>
  </edit>
</match>
```

ÓóæéæñçñÝíáð ãñáìíáóìíóáéñÝð, ùðòð ñé Helvetica, ìðñáß ñá áñóáñæññí ðññúæççιά ùóáí áßíáé anti-aliased. Õì ðññúæççιά óó÷íÛ æéçççññíáóáé ùð ñá ãñáìíáóìíóáéñÛ çññÝçç èÛεáóá óóçí ÝÝóç. Óóçí ÷æññúóáñç ðáñßðòòóç, ìðñáß ñá èÛíáé èÛñíéáð áóáññáýóíí. Áéá ñá òì áðñóáéáðá áðòù, ìðñáßðá ñá ðññíóçÝóóá òì æéññèùóç òòì local.conf:

```
<match target="pattern" name="family">
  <test qual="any" name="family">
    <string>Helvetica</string>
  </test>
  <edit name="family" mode="assign">
    <string>sans-serif</string>
  </edit>
</match>
```

Ìñεéð óáéæáðóáðá òçí ñáóáðññð òñò local.conf óéáññáðéáßðá ùéð èéáßóáðá òì áñ÷áßí ñá òì </fontconfig> tag. Áí ááí òì èÛíáðá, ñé æéççáÝð óáð éá ááñççññí.

ÕÝçñð, ñé ÷ñßóóáð ìðññíýí ñá ðññíóçÝóíí òéð æééÝð òñð ððçñíßóáéð ñÝóù òùí ðññíóçðçççññí òñðð áñ÷áßñí .fonts.conf. Áéá ñá áßíáé áðòù, èÛεá ÷ñßóóçð ðñÝðáé áðçð ñá çççññáðóáé Ýíá ~/ .fonts.conf. Áðòù òì áñ÷áßí ðñÝðáé ñá áßíáé áðßçò XML ñññòðð.

ÈÛóé óáéáðóáßí: óá ñá LCD ñéñçç, ìðñáß ñá áßíáé áðçççççò ñá æéáñáóéóíùð sub-pixel. Ì æéáñáóéóíùð ÷æññæáðáé ÷ñéóóÛ òá (ñéæññíóéá æéá÷ñéóíÝíá) èñéççñá, ðñÛóéíá æéé ìðé òòñé÷áß ðóóá ñá áæéðçðáé òçí ñéæññíóéá

άΰεόδ. Οά άδιόάεΰοίάόά ιδιήαβ ίά άβίάε άñáíáóεέΰ εάέγόαήá. Άέά ίά οίί άíñáñðíεΠόáðá, ðñíóεΰόáá όçí ðáñáéΰóù áñáñð εΰðíó όóí άñ÷áβí local.conf:

```
<match target="font">
  <test qual="all" name="rgba">
    <const>unknown</const>
  </test>
  <edit name="rgba" mode="assign">
    <const>rgb</const>
  </edit>
</match>
```

Όçíáβύόç: Άίΰεííáá ίá οίί όγðí όçò íεùίçð, οί rgb ιδιήαβ ίá ÷ñáéáóðáβ ίá áεéΰíáé óá bgr, vrgb Π vbgr: ðáεñáíáóεóðáβóá éáé ááβóá ðíβí εάεóíóñááβ éáέγόαήá.

6.6 Ί X Display Manager

6.6.1 ΆέόááùáΠ

Ί X Display Manager (**XDM**) áβίáé Ύίá ðñíáéñáðééèù ίΎñíð οίó óðóðΠíáóíó X Windows ðíó ÷ñçóέííðíéáβóáé áéá áéá÷áβñéόç óóíáΎόáùí (logins). Άóðù áβίáé ÷ñΠóέíí óá ðñεεΎð ðáñéððóáéð, ùðùð óá áðεΰ “X Terminals”, óá desktop ίç÷ áίΠíáóá, éáεðð éáé óá áéáéñéóóΎð ίááΰεùí áééóγúí. Άóíγ οίί όύόόçιά X Windows áβίáé áíáíΰñóçοί ðñùðíεùεéùí éáé áééóγúí, ððΰñ÷áé ίááΰεí άγñíð ðεéáíΠí ðεèíβóáùí áéá όçí εάéοίóñáβá X ðáéáðΠí éáé áéáéñéóóΠí óá áéáóíñáðééΰ ίç÷ áίΠíáóá óóíááááíΎίá óá Ύίá áβéóðí. Ί **XDM** ðáñΎ÷áé Ύίá áñáóééù ðáñéáΰεéíí áéá όçí áðééíáΠ οίó áéáéñéóóΠ ίá οίί ιðíβí éá áβίáé ç όύίááóç, éáé áéá όçí áβóíáí ðεçñíóíñεΠí ðéóóíðíβççóð ùðùð οίó ííúíáóíð ÷ñΠóόç éáé οίó èùáééíγ ðñúóááóçð.

Όéáðéáβóá οίί **XDM** ùð íéá áóáñíáΠ ðíó ðáñΎ÷áé óéð βáéáð áðíáóúðççáð óóíí ÷ñΠóόç ίá οίί áñááéáβí getty(8) (ááβóá οίί ΌίΠíá 27.3.2 áéá éáððñΎñáéáð). Οί **XDM** áéðáéáβ óóíáΎόáéð (logins) óóíí áéáéñéóóΠ éáé Ύðáéóá áéðáéáβ Ύίá áéá÷áéñéóóΠ óóíááñβáð (session manager, óóíΠεùð Ύíáí X áéá÷áéñéóóΠ ðáñáéγñúí, window manager) áéá éíááñéáóíù οίó ÷ñΠóόç. Ί **XDM** Ύðáéóá ðáñéíΎίáé ίá óáñíáóβóáé áóóù οί ðñúáñáíá, ðíó όçíáóííáíðáβ ùðé ί ÷ñΠóόçð óáéáβùóá éáé ðñΎðáé ίá áðíóóíááéáβ. Οά áóðù οίί όçíáβí, í **XDM** ιδιήαβ ίá áíóáíβóáé ίáíΰ όçí íεùίç áéóúáíó (login) éáé όçí íεùίç áðééíáΠð áñáóéεΠð όύίááóçð Πóóá ίá óóíááéáβ Ύίáð ΰεéíð ÷ñΠóόçð.

6.6.2 ×ñΠόç οίó XDM

Άέá ίá ίáééíΠóáðá ίá ÷ñçóέííðíéáβóá οίί **XDM**, ááéáóáóðΠóóá οίί port x11/xdm (ááí ááéáéβóóáóáé áðù ðñíáðééíáΠ óóéð ðñúóóáóáð áéáùóáéð οίó **Xorg**). Ίδιήαβóá Ύðáéóá ίá áñáβóá οίί ááβíííá **XDM** óóí /usr/local/bin/xdm. Άóðù οί ðñúáñáíá ιδιήαβ ίá áéðáéáóóáβ ιðíéááΠðíóá óóéáΠ ùð root éáé éá ίáééíΠóáé ίá áéá÷áéñβáéáé όçí íεùίç οίó X óóí ðíðééù ίç÷ ΰίçíá. Άί í **XDM** ðñΎðáé ίá áéðáéáβóáé éΰεá óíñΰ ðíó áéééíáβóáé οί ίç÷ΰίçíá, Ύίáð áíεééùð óñùðíð áβίáé ç ðñíóεΠεç íéáð áñáñΠð óóí /etc/ttys. Άéá ðáñéóóúðáñáð ðεçñíóíñβáð ó÷áðééΰ ίá όçí ííñóΠ éáé όçí ÷ñΠόç áóóíγ οίó áñ÷áβíó, ááβóá οίί ΌίΠíá 27.3.2.1. Όðΰñ÷áé ίβá áñáñΠð óóí áñ÷ééù /etc/ttys áñ÷áβí áéá όçí áéðΎéáóç οίó **XDM** óá Ύίá áééííééù óáñíáóééíí:

```
tttyv8 "/usr/local/bin/xdm -nodaemon" xterm off secure
```

Άñ ÷ έέÛ άόόP ç έάέόιόνάβá άβίάέ άδάρáñáιόιεçíÝίç — áέá íá όçí άράñáιόιεPόάόá áεεÛíόá όι δάάβι 5 άδú off óá on έάέ άδάρíáέβίçόόá όι init(8) ÷ ñçόέιιόιεPίόάό όέό íäçάβáδ όιό ΌιPíá 27.3.2.2. Όι δñPόí δάάβι, όι úíñá όιό όáñíáόέέéý όιό έá áέá ÷ áέñβæάόάέ όι δñúáñáííá, άβίάέ όι tttyv8. Άόόú όçíáβίáέ úόé í **XDM** έá áέόάέάβόάέ όόι 9í áέέίέέú όáñíáόέέú.

6.6.3 Νύεìέόç όιό XDM

Í έάόÛεíáíò ñόέìβόáúí όιό **XDM** άñβόέάόάέ όόι /usr/local/lib/x11/xdm. Óá άόόúí όιí έάόÛεíáí όδÛñ ÷ íόí όίεέÛ áñ ÷ áβá όιό ÷ ñçόέιιόιεPίόάέ áέá íá áέεÛíόí όçí όόιδáñέόíñÛ έάέ áìòÛίέόç όιό **XDM**. ÓόδέέÛ, έá áñáβόá όá δáñáέÛόú áñ ÷ áβá:

Άñ ÷ áβí	ΔáñέáñáόP
Xaccess	Έáíúíáδ όέόόιόίβçόçδ όáέáόPí.
Xresources	ΔñíέáέíñέóíÝíáδ όέíÝò X resource.
Xservers	ΈBόóá άδñíáέñόóíÝíúí έάέ όιόέέPí íέíPí (× displays) όόέό íθíβáδ έá áβíáόάέ áέá ÷ áβñέόç.
Xsession	ΔñíáδέέááíÝíí script όόíúáúí áέá logins.
Xsetup_*	Script áέá όçí áέόÝέáόç áíόίεPí δñέí όçí áìòÛίέόç όιό δáñέáÛέέíόíò όύíááόçδ (login screen).
xdm-config	Ñόέìβόáέδ áέá úέáδ όέό άδáέέííβόáέδ (displays) όιό áέόáέíýíόáέ óá άόόú όι íç ÷ Ûίçíá.
xdm-errors	ËÛεç όιό áçíέíθñáíýíόáέ áδú όι δñúáñáííá.
xdm-pid	Όí ID όçδ áέáñááόβáδ όιό όñÝ ÷ ííόíò XDM.

Άδβόçδ όá άόόúí όιí έάόÛεíáí όδÛñ ÷ íόí íáñέέÛ scripts έάέ δñíáñÛíáόá όιό ÷ ñçόέιιόιεPίόáέ áέá íá ñόέìβόíόí όçí άδέόÛíáέá áñááόβáδ úόáí áέόáέáβόáέ όι **XDM**. Έá δáñέáñÛPíόíá δáñέέçδóέέÛ όι όέíθú έέάέíúδ άδú άόόÛ όá áñ ÷ áβá. Ç áέñέáPò όύíááίç έάέ ÷ ñPόç úέúí άόόPí όúí áñ ÷ áβúí δáñέáñÛóáόáέ όόí xdm(1).

Ç δñíέáέíñέóíÝίç ñýεìέόç άβίáέ Ýíá άδέú íñέíáPíέí δáñÛέόñí όύíááόçδ íá όí úíñá όιό íç ÷ áPíáίόíò íá óáβíáόáέ όόçí έíñόσP íá íááÛέá áñÛíáόá έάέ όέό δñíόñíθÝò “Login:” έάέ “Password:” άδú έÛόú. Άόόú άβίáέ Ýíá έáέú όçíáβí áέέβίçόçδ áέá íá áέεÛíáόá όçí áìòÛίέόç όιό **XDM**.

6.6.3.1 Xaccess

Όí δñúóúέίεέí áέá όύíááόç íá άδáέέííβόáέδ όιό áéÝá ÷ ííόáέ áδú όι **XDM** íñÛέáόáέ X Display Manager Connection Protocol (XDMCP). Όí áñ ÷ áβí άόόú άβίáέ Ýíá όύííέí έáíúíúí áέá όúí Ýέáá ÷ í όúí óóíáÝόáúí XDMCP áδú άδñíáέñόóíÝíá íç ÷ áPíáίόá. Ááñíáβόáέ, áέόúδ έάέ áí όí xdm-config Ý ÷ áέ ñόέìέόóáβ Pόδá íá äÝ ÷ áόáέ áέόáñ ÷ úíáíáδ óóíáÝόáέδ. Ç δñíáδέέíáP άβίáέ íá íçí áδέόñÝδáόáέ óá έáíÝíá δáέÛόç íá óóíááέáβ.

6.6.3.2 Xresources

Δñúέáέόáέ áέá όí áñ ÷ áβí δñíέáέíñέóíÝíúí όέíPí áέá όέό άόáñíáÝò áìòÛίέόçδ όιό δáñÛέόñíò όύíááόçδ (login) έáέ áδέέíáÝá άδáέέúíέόçδ (display chooser). ÝÝóá áδú άόόú íθíñáβ íá δñíόíόίεçδéáβ ç áìòÛίέόç όιό δñíáñÛíáόíò login. Ç íñόP όιό άβίáέ βáέá íá όí áñ ÷ áβí app-defaults όιό δáñέáñÛóáόáέ óόçí óáέìçñβùç όιό X11.

6.6.3.3 Xservers

Αδού αβιάε ιεά εβόόά ουί άδνίάεñοοίΥίιι οόάε|πί δτι δñΥδάέ ίά άιόάίβæίιόάέ ùδ άδέειäΥδ οόι δñüñáñíá (chooser).

6.6.3.4 Xsession

Αδού αβιάε οι δñíεäéñέοίΥίíí session script δτι δέδäéäβ οι **XDM** λüδÜ όç óýíäáόç êÜδτιέιò ÷ ñΠόόç. ÉáñíéêÜ, êÜèä ÷ ñΠόόçδ èä Υ ÷ äé Υίá òñíδτιέçíΥíí, äéêü öíò, session script οόí ~/ .xsession δτι èä δáñäéÜíδδäé äδöü öí script.

6.6.3.5 Xsetup_*

Όά äñ ÷ äβá äδδÜ äêδäéíýíόäé äδöüíáδä δñéí öçí äíòÜíέóç öüí δáñäéýñüí äδέειäΠδ Π óýíäáόçδ. ÖδÜñ ÷ äé Υίá script äéä êÜèä display δτι ÷ ñçóéííδτιέäβδäé, δτι íñíÜæäóäé xsetup_ λü öí ñýíäñí öíò display οόí öÝéíð (äéä δáñÜäéäíä xsetup_0). ÉáñíéêÜ äδδÜ öä scripts èä äêδäéíýí Υίá Π äöí δñíäñÜííáδä öóí δáñäóéΠίέí üδöü δ.÷. öí xconsole.

6.6.3.6 xdm-config

Όι äñ ÷ äβí äδöü δáñéΥ ÷ äé ñòèíβóäéð ööçí ííñöΠ öüí app-defaults, δτι äöäñüæííóäé öä êÜèä display δτι äéä ÷ äéñβæäóäé ç öδäéäéñéíΥíç ääéäöÜöóäóç.

6.6.3.7 xdm-errors

Όι äñ ÷ äβí äδöü δáñéΥ ÷ äé öçí Υíñäí öüí äéäéñéóöóΠí X δτι δñíóδäéäβ ίá äêδäéΥóäé öí **XDM**. Áí Υίá display δτι δñíóδäéäβ ίá äêééíΠóäé ö **XDM** êíεεΠóäé äéä êÜδτιέí èüäí, èäéü äβíäé ίá äíäæçðΠóäöä ääΠ öð ÷ üí íçýííäöä öóäéíÜδöüí. Όá íçýííäöä äδδÜ èäöäñÜöííóäé èäé ööä äñ ÷ äβá ÷ ñçóðβí ~/ .xsession-errors.

6.6.4 Äéäöçñβíóäö Υίáí ÄéäéñíéóöΠ ÄδñíäéñöóíΥííí ÖóíäÝöäüí

Äéä ίá öóíäÝííóäé èäé Üεεíε δäéÜöäð öóíí äéäéñéóöΠ íèíüçð, öñíδτιέΠóäö öíòð èáñíüä ðéΥä ÷ íò δñüóäáόçð, èäé äíäñäíδτιέΠóäö öéð äéöäñ ÷ üííáíð öóíäÝóäéð. Όä δáñäðÜíü äβíäé, äδü δñíäδééíäΠ ñöéíéöíΥíá öä öóíöçñçóééΥð öéíΥð. Äéä ίá êÜíäöä öí **XDM** ίá äΥ ÷ äóäé öóíäÝóäéð, äñ ÷ èéÜ íäöäöñÝöðä öä ö ÷ üééí öçí δáñäéÜδöü äñäñΠ öóí äñ ÷ äβí xdm-config:

```
! SECURITY: do not listen for XDMCP or Chooser requests
! Comment out this line if you want to manage X terminals with xdm
DisplayManager.requestPort: 0
```

èäé íäöÜ äδáíäéééíΠóäö öíí **XDM**. Íá Υ ÷ äöä öδüöéí öäð üöé öä ö ÷ üééä ööä äñ ÷ äβá app-defaults íäééñíýí λü öíí ÷ äñäéðΠñä “!”, èäé ü ÷ é öíí öóíΠεç “#”. Íδññäβ ίá äδéööíäβδä δéí äóöóçñíýð èáñíüä ðéΥä ÷ íò δñüóäáόçð. Ääβöä öä δáñäääβäíäöä öóí Xaccess, èäé öóíäíòèäðèäβδä öç öäéβää manual öíò xdm(1).

6.6.5 ÁíóééäöäóöÜöäð öíò XDM

ÖδÜñ ÷ íöí äñéäöíβ áíóééäöäóöÜöäð äéä öí δñüñäñíä **XDM**. Íäð äδü äóöíýð, í **kdm** (Υñ ÷ äöäé λü öí **KDE**) äíäéýäöäé äñäüöäñä öä äδöü öí èäöÜéäéí. Í **kdm** display manager δñíöóÝñäé δτιéÜ δñíöäñΠíäöä ööä äñäöééÜ èäé

αέαείοιçόεέÛ όοίε÷άβα, ιιδύδ άδβόçð έάέ όçί άοίαόυιόçόά ίά άδεέΎάιόί τέ ÷ñΠόόάð όιί άδεέδöιçόυι αέα÷άεñέόðΠ δάñάεýñυί όçί όδέάñΠ όçð όύίάάόçð.

6.7 ΆñάόέέÛ ΔάñέαÛεέιίόά

Άόου όι όιΠία δάñεάñÛόάε ίάñέέÛ άñάόέέÛ δάñέαÛεέιίόά διö αέαόβεάιόάέ αέα όι X όόι FreeBSD. Ç Ύίñέα “άñάόέέυι δάñέαÛεέιί” ιδññάβ ίά όçίαβίάέ ιόεαΠδöιόά, άδυ Ύίάί άδεέυι αέα÷άεñέόð δάñάεýñυί ιΎ÷ñέ Ύίά τέιέçñυιΎίά δάέΎόι desktop άόάñιήáί, ιιδύδ όι KDE Π όι GNOME.

6.7.1 GNOME

6.7.1.1 Ó÷άόέέÛ ίά όι GNOME

Οί GNOME άβίάέ Ύίά όέέέέυι δñö όιί ÷ñΠόόç άñάόέέυι δάñέαÛεέιί διö άδεόñΎδάέ όόιöð ÷ñΠόόάð ίά ÷ñçόέιιδöίέιΎί έάέ ίά ñöèìβæιόί άýέιέα όιöð δδöιέαόóΎð όιöð. Οί GNOME αέαέΎόάέ Ύίά panel (άέα όçί άέέβίççόç άόάñιήáί έάέ όçί δñιήάεΠ εάóÛόόάόçð), άδεóÛίάέα άñάάóβάð (ιιδöι άιόάίβæιίόάέ άάάñΎίά έάέ άόάñιήάΎð), Ύίά δεΠειð άδυ αέαάάάñΎίά άñάάέάβά έάέ άόάñιήάΎð, έάεðð έάέ Ύίά όýñιέι όðδöιέΠόάυι διö άδεόñΎδάέ όóέð άόάñιήάΎð ίά όóίάñάÛæιίόάέ ίάόάý όιöð έάέ ίά άάβ÷ñιόί Ύίά όóίάδΎð δάñέαÛεέιί άñάάóβάð. Ιέ ÷ñΠόόάð Ûεέυι έάέόιöñάέεðί όóóççίÛόυι Π δάñέαÛεέοιόυι έά άέóèÛιίίόάέ όάί όόι όδβóέ όιöð ÷ñçόέιιδöίεðίόάð όι δάίβó÷öñι άñάόέέυι δάñέαÛεέιί διö δάñΎ÷άέ όι GNOME. Δάñέóóυδάñάð δççñιöññβάð ó÷άόέέÛ ίά όι GNOME όόι FreeBSD ιδñιñίΎί ίά άñάέιΎί όόι αέαάέέðóάέυι óυδöι όιö FreeBSD GNOME Project (<http://www.FreeBSD.org/gnome>). Ç όιδöίεάóβά δάñέΎ÷άέ άδβόçð έάέ άίάέöðέέÛ FAQs ó÷άόέέÛ ίά όçί άάέάóÛόόάόç, όçί ñýέιέóç, έάέ όçί αέα÷άβñέóç όιö GNOME.

6.7.1.2 ΆάέάóÛόόάóç όιö GNOME

Οί GNOME ιδññάβ ίά άάέάóáóóάέάβ άýέιέα άδυ δάέΎόά Π άδυ όçί ÓöέέιήΠ óυι Ports:

Άέα ίά άάέάóáóóΠόάðά όι Ύöίέιί δάέΎόι όιö GNOME άδυ όι άβέðöι, άδεðð δççéðñιέήΠόάð:

```
# pkg_add -r gnome2
```

Άέα ίά ίάóáάέυιðóβóðάðά όι GNOME άδυ όιί δççάβι έðάέέα, ÷ñçόέιιδöίέΠόάð όçί ÓöέέιήΠ óυι Ports:

```
# cd /usr/ports/x11/gnome2
# make install clean
```

Οί GNOME ÷ñάέÛæáóάέ όι όýóççιά άñ÷άβυι /proc αέα ίά έάέόιöñάΠόάέ óυóóÛ. ΔñιόέΎóóά όç άñάñΠ

```
proc                /proc               procfs rw 0 0
```

όόι άñ÷άβι /etc/fstab αέα ίά άβίάόάέ άóóυιιάóά δñιόÛñçόçç όιö procfs(5) έάóÛ όçί άέέβίççόç όιö óóóðΠιáóιð.

Ìüεέð άάέάóáóóάέάβ όι GNOME, έά δñΎδάέ ίά ñöèìέóóάβ ι αέαέñέέóðð X þóðά ίά άέέέίάβ όι GNOME άίóβ αέα όιί δñιέάέιñέóιΎίί αέα÷άεñέόðΠ δάñάεýñυι.

Ì άóέιέυιðάñιð δñυδöιð αέα ίά άέέέίΠόάðά όι GNOME άβίάέ ίά όι GDM, όιί GNOME Display Manager. Οί GDM άάέάεβóóáóάέ υð ιΎñιð όιö GNOME, αέέÛ άβίάέ άίάíάñάυ άñ÷έέÛ. Ιδññάβ ίά άίάñάιδöίεçέάβ ίά όçί δñιόέΠεç όçð άñάñΠð

```
gdm_enable="YES"
```

όοι άñ÷άβι /etc/rc.conf.

Ίιέέο εΰίάοά άδάρίεέβίόό, οί **GDM** εά ίάέείβόάε άοόυίάοά.

Άδέοñιόεάοά, άβίάε ÷ñβόει ίά ίάέείγί υεάο ίε οδçñάοβάο οέο ίδιβάο άδάέοάβ οί **GNOME** οάοου÷ñίά ίά οçί άέέβίόό οίο **GDM**. Άέά ίά άβίάοάε άοόυ ðñιόεΎόοά οç άñάιñ

```
gnome_enable="YES"
```

όοι άñ÷άβι /etc/rc.conf.

Οί **GNOME** ίδιñάβ άδβόό ίά ίάέείβόάε άδυ οçί άñάιñ άίοίεβί ñòειβαιίόάο εάοΰεεçεά οί άñ÷άβι .xinitrc. Άί οδΰñ÷άε βαç οί άñ÷άβι .xinitrc, άδεβδ άίόέεάοάοδβόοά οçί άñάιñ δίο άέέείάβ οί οñΎ÷ίίόά εέá÷άέñέοδβ δάñάέγñι ίά ίβά δίο ίά άέέείάβ οί /usr/local/bin/gnome-session. Άί άάί εΎεάοά ίά εΰίάοά δάñέοόυοάñάο ñòειβόάέο οόι άñ÷άβι, ÷ñάέΰεάοάε άδεΰ ίά άñΰοάοά:

```
% echo "/usr/local/bin/gnome-session" > ~/.xinitrc
```

δάέοά, δεçέοñιέιñβόοά startx, εάέ εά ίάέείβόάε οί άñάοέευ δάñέáΰεεί οίο **GNOME**

Οçίάβυόç: Άί ÷ñçόέιίδιέάβδά εΰδιέί δάέάεύοάñί display manager, υδυο οί **XDM**, οί δάñάδΰίυ άάί εά εάέοιοñάβόάε. Οδçί δάñβδδυόç άοδβ, άçίέιοñάβόοά Ύίά άέοάεΎόέι άñ÷άβι .xsession οί ίδιβί ίά δάñέΎ÷άέ οçί βάέά άίοίεβ. Οñίδιδιέβόοά οί άñ÷άβι .xsession εάέ άίόέεάοάοδβόοά οçί άίοίεβ οίο οñΎ÷ίίόιò εέá÷άέñέοδβ δάñάέγñι ίά οί /usr/local/bin/gnome-session:

```
% echo "#!/bin/sh" > ~/.xsession
% echo "/usr/local/bin/gnome-session" >> ~/.xsession
% chmod +x ~/.xsession
```

¶εεç ίεά άδέειñβ άβίάε ίά ñòειόοάβ ί display manager βόοά ίά άδέοñΎδάε οçί άδέείñβ οίο εέá÷άέñέοδβ δάñάέγñι εάοΰ οçί ούίάάοç. Οί οίβιá ΕάδονΎñάέάο **KDE** άιçάάβ δυο ίδιñάβ ίά άβίάε άοόυ ίΎού οίο **kdm**, οίο display manager οίο **KDE**.

6.7.2 KDE

6.7.2.1 Ο÷άοέέΰ ίά οί KDE

Οί **KDE** άβίάε Ύίά ούā÷ñιí, άύέιει οόç ÷ñβόç, άñάοέευ δάñέáΰεεί. Ίάñέεΰ ðñΰαιάοά δίο ðñιόόΎñάε οί **KDE** οόιí ÷ñβόç άβίάε:

- ίά υιíñοί ούā÷ñιí δάñέáΰεεί
- ίά δάñέáΰεεί ίά δεβñç εέέοδάεβ εέάοΰίάέά
- ίά άίόυίάουΎίí ούόόçίά άιβέάέάο δίο άδέοñΎδάε άύέίεç, οδίάδβ ðñυόάάοç οόçί άιβέάέά εέά οçί ÷ñβόç οίο **KDE** εάέ ουί άοάñιñβί οίο
- Οοίάδβδ άιòΎίέόç εάέ οοιδάñέοιñΰ υέυί ουί άοάñιñβί οίο **KDE**

- Ὁ ὁριζῶν Ἰσχυρὸν μενὺ εἶναι ἀναίτητὸ ἀνασῆμα (toolbars), ὁ ὁριζῶν ὁριζῶν, ÷ ἡ ἀνασῆμα ὁριζῶν, ἐξ ὅ.
- Ἀνασῆμα ἡ ἀνασῆμα: οἱ **KDE** ἀνασῆμα ὁριζῶν ὁριζῶν ἀνασῆμα ἀνασῆμα 40 ἀνασῆμα
- Ἐπιπέδου εἶναι ὁριζῶν ὁριζῶν ἀνασῆμα ὁριζῶν ὁριζῶν ἀνασῆμα
- Ἰσχυρὸν ἀνασῆμα ÷ ἡ ἀνασῆμα ἀνασῆμα, ὁ ÷ ἀνασῆμα ὁριζῶν ἀνασῆμα ἀνασῆμα οἱ **KDE**

Οἱ **KDE** ὁριζῶν ἀνασῆμα ἀνασῆμα ὁριζῶν ὁριζῶν ἀνασῆμα **Konqueror**, εἶναι ἀνασῆμα ἀνασῆμα ὁριζῶν ὁριζῶν ὁριζῶν ἀνασῆμα ὁριζῶν UNIX. Ἀνασῆμα ἀνασῆμα ἀνασῆμα ἀνασῆμα ἀνασῆμα οἱ **KDE** ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα [\(http://www.kde.org/\)](http://www.kde.org/). Ἀνασῆμα ἀνασῆμα ὁ ÷ ἀνασῆμα ὁριζῶν ὁριζῶν ἀνασῆμα οἱ **KDE**, ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα ἀνασῆμα ὁριζῶν ὁριζῶν ἀνασῆμα [\(http://freebsd.kde.org/\)](http://freebsd.kde.org/).

Ὁ δὲ ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα οἱ **KDE** ἀνασῆμα οἱ FreeBSD. Ὁ ὁριζῶν 3, ὁριζῶν ἀνασῆμα ἀνασῆμα εἶναι εἶναι ἀνασῆμα ἀνασῆμα ἀνασῆμα. Ὁ ὁριζῶν ὁριζῶν ἀνασῆμα ἀνασῆμα ὁριζῶν ἀνασῆμα 4 ἀνασῆμα ὁριζῶν ἀνασῆμα ἀνασῆμα. Ἐπιπέδου ἀνασῆμα ἀνασῆμα ὁριζῶν ὁριζῶν ἀνασῆμα ἀνασῆμα.

6.7.2.2 Ἀνασῆμα ὁριζῶν οἱ KDE

Ἐπιπέδου εἶναι ὁριζῶν οἱ **GNOME** ὁριζῶν ὁριζῶν ἀνασῆμα ἀνασῆμα, οἱ ὁριζῶν ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα ἀνασῆμα ὁριζῶν ὁριζῶν:

Ἀνασῆμα ὁριζῶν ἀνασῆμα οἱ **KDE3** ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα, ἀνασῆμα ἀνασῆμα ἀνασῆμα:

```
# pkg_add -r kde
```

Ἀνασῆμα ὁριζῶν ἀνασῆμα οἱ **KDE4** ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα, ἀνασῆμα ἀνασῆμα ἀνασῆμα:

```
# pkg_add -r kde4
```

Οἱ `pkg_add(1)` εἶναι ἀνασῆμα ἀνασῆμα ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα.

Ἀνασῆμα ὁριζῶν ἀνασῆμα οἱ **KDE3** ἀνασῆμα ὁριζῶν ἀνασῆμα, ÷ ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα ὁριζῶν:

```
# cd /usr/ports/x11/kde3
# make install clean
```

Ἀνασῆμα ὁριζῶν ἀνασῆμα οἱ **KDE4** ἀνασῆμα ὁριζῶν ἀνασῆμα, ÷ ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα ὁριζῶν:

```
# cd /usr/ports/x11/kde4
# make install clean
```

Ἀνασῆμα ἀνασῆμα οἱ **KDE**, εἶναι ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα. Ἀνασῆμα ἀνασῆμα ὁριζῶν ἀνασῆμα ὁριζῶν ἀνασῆμα `.xinitrc`:

Ἀνασῆμα οἱ **KDE3**:

```
% echo "exec startkde" > ~/.xinitrc
```

Ἀνασῆμα οἱ **KDE4**:

```
% echo "exec /usr/local/kde4/bin/startkde" > ~/.xinitrc
```

Ἐπιπέδου, ὁριζῶν οἱ X Window System ἀνασῆμα ὁριζῶν ὁριζῶν `startx`, οἱ ἀνασῆμα ἀνασῆμα εἶναι ἀνασῆμα οἱ **KDE**.

Ἀνασῆμα ÷ ὁριζῶν ἀνασῆμα ὁριζῶν ὁριζῶν `XDM`, ὁριζῶν ἀνασῆμα εἶναι ἀνασῆμα ἀνασῆμα. Ἐπιπέδου ἀνασῆμα ἀνασῆμα οἱ `.xinitrc` ὁριζῶν ἀνασῆμα ὁριζῶν `.xsession`. Ἀνασῆμα ἀνασῆμα οἱ **kdm** ἀνασῆμα ἀνασῆμα οἱ ἀνασῆμα ἀνασῆμα.

6.7.3 Δαήεόούοαήαδ ΈαδούήΥήαεάδ αέα οί KDE

Όηά δίο οί **KDE** Υ÷άε άαέαάοόάεάβ οοί ούόόαί, ιδήναβόά ίά άάεάέυθάοά οεδ δαήεόούοαήαδ έαέοιτναβδ ιΥού ούι οάεβάυι άηεάεάδ P άρεειΰαειρόαδ ίαήγ έαέ άδεεραΥδ. Ίε ÷ηPόαδ ούι Windows ς οίθ Mac® έά έέοέΰήιρόάέ οάί οοί οδβδέ οίθδ.

ς έαέύδανς άηεάέά αέα οί **KDE** άβίαέ ς on-line δάειςήβύος. Οί **KDE** οοήαάγάοάέ άδύ οή έέεü οίθ δαήεςαςP, οή **Konqueror**, δρεεΥδ ÷ηPόείαδ άοάήηαΥδ, έαέ άάεδδέεP δάειςήβύος. Οί οδύεείδθι άδδPδ οςδ άήυόςαδ οδαςδΰ οά÷ίεέΰ εΥίαόά δίο άβίαέ άγέειει ίά άάεάέδδεηγί ίά άηέειΥδ.

6.7.3.1 Ί KDE Display Manager

Ί αέα ÷άεήεόδPδ άήυδ δρεθ÷ηςόδέειγ οδδδPιαόιθ εΥέεά έαά÷ηΥήυδ ς ούγίαάος ούι ÷ηςόδPί ίά άβίαόάέ ιΥού άήάοέειγ δαήέαΰεειήοιθ. ¼δύδ δαήέαήΰθάίά δήβί, ιδήναβ ίά ÷ηςόείηδρεςέάβ οί XDM. ¼ήυδ, οί **KDE** δαήεΥ÷άέ ίέα άάεάέδδέεP άδεεραP, οί **kdm**, οί ιδήβι Υ÷άε ο÷άαέαόάβ ίά άβίαέ διβι άεθδδδέεü έαέ δαήΥ÷άέ δαήεόούοαήαδ άδεεραΥδ έαδΰ ος ούγίαάος. ΟδάέάηειΥία, ίε ÷ηPόαδ ιδήηγί άγέειά ίά άδεεΥήιθι (ιΥού ίαήγ) διβι άήάοέεü δαήέαΰεει (KDE, GNOME, P εΰδρει ΰεει) έά έεδάέάδδάβ ίαδΰ οςί ούγίαάος οίθδ.

Άέα ίά άήάηαδρεPόαδ οί **kdm**, έά δήΥδάέ ίά άδάήαηαάοδδάβδ εΰδρειά άη÷άβ, δά ιδήβά άβίαέ έέάοιηάδέεΰ άήΰεραά ίά οςί Υέαιός οίθ **KDE** δίο έά ÷ηςόείηδρεPόαδ.

Άέα οί **KDE3**, έά δήΥδάέ ίά οήηδρεPόαδ οςί άαήαδP αέα οί ttyv8 οοί /etc/ttys, üδύδ οάβίαόάέ δαήέαΰδ:

```
ttyv8 "/usr/local/bin/kdm -nodaemon" xterm on secure
```

Άέα οί **KDE4**, έά δήΥδάέ ίά δήιόέΥόαδδ οεδ δαήέαΰδ άήάηΥδ οοί /etc/rc.conf:

```
local_startup="{local_startup} /usr/local/kde4/etc/rc.d"
kdm4_enable="YES"
```

6.7.4 Xfce

6.7.4.1 Ó÷άέέΰ ίά οί Xfce

Οί **Xfce** άβίαέ Υία άήάοέεü δαήέαΰεει δίο οδςήβαάοάέ οδςί έέάέειεPες GTK+ δίο ÷ηςόείηδρεPάβδάέ έαέ άδύ οί **GNOME**, έέεΰ άβίαέ δρεγ δει έέάοήγ έαέ δήηήβαάοάέ αέα υοιθδ εΥειθί Υία άδεü, άδθάέάοιάδδέεü άήάοέεü δαήέαΰεει δίο άβίαέ άγέειει ίά ÷ηςόείηδρεςέάβ έαέ ίά ηδειέοδδάβ. Ίδδέέΰ, ηεΰαέ δρεγ ίά οί **CDE**, δίο οδράιδΰδάέ οά άδθρεέΰ οδδδPιαόά UNIX. Ίάηέέΰ άδύ δά ÷άήάέδςήεόδέεΰ οίθ **Xfce** άβίαέ:

- ίά άδεü, άγέειει οδςί ÷ηPός άήάοέεü δαήέαΰεει
- ΔεPηδύδ δαήάηαδρεPόείη ίά οί δήθβέέ, ίά drag and drop, έεδ.
- Έάιθέεü panel δαήηειει ίά οίθ **CDE**, ίά ίαήγ, ίέέηι-άοάήηαΥδ έαέ δεPέθά έέέβίςος άοάήηαPί
- ΊειεςήηηΥήυδ αέα ÷άεήεόδPδ δαήάέγήυι, αέα ÷άεήεόδPδ άη÷άβ, αέα ÷άεήεόδPδ P÷ιθ, οοιάάδύδδά ίά οί **GNOME**, έαέ ΰεεά
- Άοιάδύδδδ ÷ηPόςδ έαηΰδύι (themes, άογ ÷ηςόείηδρεPάβ οί GTK+)
- ΆηPαήηι, έέάοήγ έαέ άδθάέάοιάδδέεü: έάάίέεü αέα δάέάέüδδάή/δει άηάΰ ίς÷άίPιαόά P ίς÷άίPιαόά ίά έβς ηPις

Δαήεόούοαήαδ δεςήηηηηβδ αέα οί **Xfce** ιδήναβόά ίά άήάβδδά οδς έέέδδάεP οίθηαόβά οίθ Xfce (<http://www.xfce.org/>).

II. ΆαόέεΥò Άññάόβãò

Ôþñã ðñò Ý÷ñòìã éãéýøãé ðéÝñí óã ááóέéÛ èÝñãðã, áððñ ðñ ðñÞñã ðñò Άã÷ãéñéãβñò ðñò FreeBSD ðãñéãñÛòãé ðéð ðéñ ááóέéÛò ãññãóβãð éãé ðã ðéñ äçññóééÞ ÷ ãññãéðçñéóðééÛ ðñò FreeBSD. Ôã éãòÛéãéã áððñý ðñò ðñÞñãðñò:

- ÐãññóóéÛæñòñ ðéð ðéñ äçññóééãβð éãé ÷ñÞóéñãð áðãñññãÝð éãé ðãñéãÛééññóã ãññãóβãð: ððééññãðñçðÝð (browsers), ãññãóééÛ ðãñéãÛééññóã ãññãóβãð, ãññãéããβã ðñññãñéÞð áéãóññññ ðññòÞñí ãñ÷ãβññ, ééð.
- ÐãññóóéÛæñòñ ðñéóñÝñã áðñ óã ãññãéããβã ðñéòñÝóññ (multimedia) ðñò áβñãé áéãéÝóéñã ãéã ðñ FreeBSD
- Άñçãñññ ðç áéããééãóβã ðãðããéÞððéóçð éãé áãéãðÛóðãóçð áññð ðññóãñññññññññ ððñÞñã ãéã ðñ FreeBSD, Ýðóé Þóðã ðã ãññãñññðñéçññññ Ýññã ÷ ãññãéðçñéóðééÛ ãéã ðñ óýóðçññ óãð.
- ÐãñéãñÛòñòñ óã ãÛéñð ðñ óýóðçñã áéðððÞóãññ, ðñññ ãéã áéðððñðÝð ðñò áβñãé áðããéããβãð óðñããããñññññññ ðã ðñ óðãéññ ãññãóβãð óãð, ðññ éãé ãéã áééððãéñýð áéðððñðÝð.
- ÐãñéãñÛòñòñ ðÞð ððññãβðã ðã ðñÝñãðã ãóãñññãÝð Linux óðñ FreeBSD óýóðçññ óãð.

ÏãñééÛ áðñ áððÛ óã éãòÛéãéã áðãéóñññ ðã Ý÷ãðã ðãéãðÞóãé ðéñ ðñéñ éÛðñéñ Ûééñ éãòÛéãéñ. ¼ðñò áβñãé áðãããβðçòñ éÛðé ðÝóñéñ, áñãðÝñãðãé óðç óýññç ðñò éÛéã éãðãéããβñò.

ΕὰοÛεὰεί 7

Desktop ΑὐάññĩãÝò

7.1 Óýññç

Ôñ FreeBSD ðññáß íá àέòáεÝόáε íεά áòñáßá àεÛíá desktop áὐάññĩãÝò, ùðùð òðεεññáðñçðÝò (browsers) εάε áðáññááόðÝò εάεíÝññ. Ìε ðáñέόóúòáñáð áðu áððÝò áßíáε áεάεÝόεíáð ùð ðáεÝόά (packages) Þ ðññĩýí íá ááεάόáόάεíýí áðòúíáόά áðu ðçí ÓðεεĩãÞ òúí Ports. Ðñεεĩß íÝíε ÷ ñÞóðáð áíáñÝññóí íá áññóí ðÝóíεíò áßáñòð áὐάññĩãÝò òðñ desktop òñòð. Ôñ εὰοÛεὰεί áðòú εá óáð ááßíáε ðùð íá ááεάόáόðÞóáð ÷ ùñßð εùðñ òέð ðεí áçññóεεáßð desktop áὐάññĩãÝò, áßòá áðu ðáεÝόά áßòá áðu ðç ÓðεεĩãÞ òúí Ports.

ÓçíáεÞóðá ùέε ùόáí ááεάεóðÛðá ðññáñÛñáόά áðu ðç ÓðεεĩãÞ òúí Ports, áßíáόáε ðáðááεÞððέóç áðu òñ ðçááßñ εÞáεεά. Áðòú ðññáß íá ÷ ñáεάόáß ðñεý ÷ ññññ, εάεÞð áíáñòÛðáε áðu òñ ðññáñáñá òñ ðññĩß ðáðááεùððßæáðá εάε ðçí òðñεĩáεóðέεÞ εó÷ý òñò ðç÷áññáóùð óáð. Áí òñ ÷ ñññεεù áεÛóðçíá òñ ðññĩß ÷ ñáεÛæáðáε ç ðáðááεÞððέóç áßíáε áðáññáððέεÛ ðááÛεĩ, ðññáßòá íá ááεάόáόðÞóáð òá ðáñέόóúòáñá ðññáñÛñáόά ðçð ÓðεεĩãÞ òúí Ports áðu ðññ-ðáðááεùððέεóíÝíá ðáεÝόά.

ÈáεÞð òñ FreeBSD áεάεÝόáε óðñááóùðçðá íá àέòáεÝόεíá ðññáñÛñáόά áεά Linux, ðñεεÝò áὐάññĩãÝò ðññ áíáððý÷εçéáí áñ÷εεÛ áεá òñ Linux áßíáε áεάεÝόεíáð áεá òñ desktop óáð. Óáð óðñέóóññá ðáññÛ íá áεάáÛóáðá òñ ÈáοÛεὰεί 11 ðññéí ááεάόáόðÞóáðá ðññεááÞðñòá áðu òέð áὐάññĩãÝò Linux. ÐñεεÛ áðu òá ports ðññ ÷ ñçóéññðñεíýí ðç óðñááóùðçðá íá Linux Ý÷ñññ ðññáóá ðññ ðáεéññýí ðá “linux-”. Èðñçεáßòá òñ ùόáí ðÛ÷íáðá áεá εÛðñεí òðáεáεññεíÝññ port, áεá ðáñÛááεáñá ðá ðçí whereis(1). Óðñ εáßñáññ ðññ áεññεðεáß εáùñáßòáε ùέε Ý÷áðá áíáññáññεÞóáε ðçí óðñááóùðçðá íá àέòáεÝόεíá ðññáñÛñáόά Linux ðññéí ááεάόáόðÞóáðá ðññεááÞðñòá áðu òέð áὐάññĩãÝò òñò Linux.

Ìε εάóçáññáð ðññ εάεýððññóáε áðu áðòú òñ εὰοÛεὰεί áßíáε ðε áñðð:

- ÓðεεññáðñçðÝò (ùðùð **Firefox**, **Opera**, **Konqueror**)
- ΑὐάññĩãÝò áñáóáßñò (ùðùð **KOffice**, **AbiWord**, **The GIMP**, **OpenOffice.org**, **LibreOffice**)
- ÐññáñÛñáόά ðññáñεÞð áááñÛòúí (ùðùð **Acrobat Reader**®, **gv**, **Xpdf**, **GQview**)
- ×ñçíáðññεεĩñεεÝò áὐάññĩãÝò (ùðùð **GnuCash**, **Gnumeric**, **Abacus**)

Ðññéí áεάáÛóáðá áðòú òñ εὰοÛεὰεί εá ðñÝðáε:

- Íá ðññáðá ðùð íá ááεάόáόðÞóáðá ðññóεáðñ εñáεóñεεù òññòñò εáðáóéáðáóðÞ (ÈáοÛεὰεί 5).
- Íá ðññáðá ðùð íá ááεάόáόðÞóáðá ðññóεáðñ εñáεóñεεù Linux (ÈáοÛεὰεί 11).

Áεά ðεçñññññáð ò÷áðέεÛ ðá ðçí ááεάóÛóáóç ðññεñáεéññ ðáñéáÛεεññòñò áεάáÛóáðá òñ ÈáοÛεὰεί 8. Áí εÝεáðá íá ñðεñßòáðá εάε íá ÷ ñçóéññðñεíýí εÛðñεá ððçñáóßá ççáεðñññεéññ òá÷ðáññáßñò ááßòá òñ ÈáοÛεὰεί 29.

7.2 ÖöëññáðñçòÝò (Browsers)

Ôí FreeBSD ááí Ý ÷ áε ðññááεáðáðóçíÝñí εÛðñíεí óðáεáεñεíÝñí öðεññáðñçòÝò. Óðñí εáðÛεñáí www (<http://www.FreeBSD.org/ports/www.html>) ðçð óðεεñáðñçòÝò Ports ðññááðá íá áñááðá áñεáðñçòÝò öðεññáðñçòÝò, Ýðñíεñò áεá ááεáðÛóðáç. Áí ááí Ý ÷ áðá ÷ ñññí áεá íá ðáðááεñòðóðáðá ùðε ÷ ñáεÛεáðá (βóùð ÷ ñáεáðáðá áñεáðñçòÝò), ðñεññ áðñ áðñçòÝò áβíáε áεáεÝóεñíε εáε ùð Ýðñíεá ðáεÝðá.

Ôá KDE εáε GNOME, ùð ðεðñç ðáñεáÛεεññáðá áñááðáð, ðáñÝ ÷ ðñò ðñò áεεñçð ðñò öðεññáðñçòÝò HTML. Áááðá ðñ Ôñðá 6.7 áεá ðáñεóóñðáñð ðεçññññáð ð ÷ áðεεÛ íá ðçí ááεáðÛóðáç ðñò.

Áí áñáεáðÛñáðá áεá áεáðñáβð (áðñ Ûðñç εáðáíÛεùðçð ðññññ) öðεññáðñçòÝò, áááðá ðεð áεùεñòεáð áðáññáÝò ðçç óðεεñáðñçòÝò ðññ Ports: www/dillo2, www/links, www/w3m.

Ôñ ðñðá áðñ ðáεýððáε ðεð ðáñáεÛðñ áðáññáÝò:

¼ññá Áðáññáβð	Áðáεóñçíáññε ðñññε	ÁáεáðÛóðáç áðñ Ports	ÁáóεéÝò Áíáñðóáεò
Firefox Opera	ðáðáβá εβáñε (áεáðñεÛ)	ááñεÛ áεáðñεÛ	Gtk+ ÔðÛñ ÷ ðñò áεáεÝóεñáð áεáúñðáεð áεá FreeBSD εáε Linux. Ç Ýεáñç áεá Linux áíáñðÛóáε áðñ ðçí áðááεéð óðñááðñçòÝò ðñ Linux (Linux Binary Compatibility) εáε ðñ linux-openmotif .
Konqueror	ðáðáβá	ááñεÛ	Ááεéεñεðáð KDE

7.2.1 Firefox

Ï **Firefox** áβíáε Ýíáð ðñðÝññò, áεáγεáññò, áññε ÷ ðñð εáε óðáεáññò öðεññáðñçòÝò, ð ðññáðá áβíáε ðεðññò ðññóáñññññíÝññ áεá ÷ ñðçç ðññ FreeBSD. ÁεáεÝðáε ðç ÷ áñð áðáεεññεóçð ç ðññáá áíáññññáááε ðεðññò ðá ðεð ðððñññεðáεð ðçð HTML, εáε áðñáðñçòÝò ùðñ ðññññεóç ðñεáðεðñ ðáεβáññ ðá tabs, ððñεÛñεóñá áíááðññáññ ðáñáεýñññ (popups), ðññóεáðá ðññáñÛññáðá, ááεðεññÝñç áóðÛεáá εáε ðñεεÛ áεññç. Ï **Firefox** ááóβáááε ðññ áñ ÷ εεñ ðççááβñ εðáεéá ðññ **Mozilla**.

Ááεáðáðáðáðá ðñ ðáεÝðñ áñÛñññáð:

```
# pkg_add -r firefox
```

Ç ðáñáðÛññ áíðñεð εá ááεáðáðáðáðá ðññ **Firefox 7.0** Áí εÝεáðá íá ááεáðáðáðáðá ðññ **Firefox 3.6**, áñÛðá:

```
# pkg_add -r firefox36
```

Ïðñááðá áðβçð íá ÷ ñççñññññáðá ðçí ÓðεεñáðñçòÝò ðññ Ports áí ðññðεñÛðá íá ðáðááεñòðóðáðá áðñ ðñ ðççááβñ εðáεéá:

```
# cd /usr/ports/www/firefox
# make install clean
```

Áεá ðññ **Firefox 3.6**, áíðñεáðáðáðáðá ðçç ðáñáðÛññ áíðñεð ðç εÝñç `firefox` ðá `firefox36`.

7.2.2 Ì Firefox êáé ôí Ðñüöèáôí (plugin) ôçò Java™

Óçíáßüóç: Óá áðòü ôí ðíðíá êáé óá äýí áðüíáíá, èàññíýíá üðé Ý-áðá ðäç äáèáðáóðòðóáé ôíí **Firefox**.

Áäèáðáóðòðóá ôí **OpenJDK 6** áðü ôç Óðèèíáð òuí Ports, ðèçèðñíèñáðíóáð:

```
# cd /usr/ports/java/openjdk6
# make install clean
```

Áäèáðáóðòðóá Ýðáéóá ôí port java/icedtea-web:

```
# cd /usr/ports/java/icedtea-web
# make install clean
```

Áäááéüèáßòá üðé ááí äèèÛíáðá ðéð ðñíáðèèáñíÝíáð áðèèñáÝð ððéð ðèüíáð ððèíßòáùí êáé ðuí äýí ports.

Ìáèéíðóá ôí ððèèñáðñçðð óáð, ãñÛððá about:plugins óðç ãñáñíð äèáðèýíóáùí êáé ðèÝóá **Enter**. Èá äáßòá íéá óáèßáá íá üèá óá äáèáðáóðòçÝíá ðñüöèáðá. Óðç óáèßáá áððð èá ðñÝðáé íá äáßòá êáé ôçí êáðá÷-ðñéóç áéá ôí ðñüöèáôí ôçò **Java™**.

Áí ððèèñáðñçðð ááí êáðáðÝñáé íá áíóíðßòáé ôí ðñüöèáðí, èÛèá ÷-ðóðçð èá ÷-ðáéáóðáß íá äèðáèÝóáé ôçí ðáñáèÛòù áíóíèð êáé íá áðáíáèèéíðóáé ôí ððèèñáðñçðð ôíð:

```
% ln -s /usr/local/lib/IcedTeaPlugin.so \
  $HOME/.mozilla/plugins/
```

7.2.3 Ì Firefox êáé ôí Adobe® Flash™ Plugin

Ôí Adobe® Flash™ plugin ááí äèáðèèáðáé áéá ôí FreeBSD. Ûóðüóí, ððÛñ÷-áé Ýíá áðððááí áññíßüóçð (software layer, wrapper) áéá ôçí áèðÝèáóç ðíð áíóßòóíé÷-íð plugin ðíð Linux. To wrapper áðòü ððíóçñßæáé áðððçð êáé óá plugins áéá ôíí Adobe Acrobat®, ôí RealPlayer êáé Ûèèá.

ÁèðáèÝóáðá óá ðáñáèÛòù áðíáðá, áíÛèíáá íá ôçí Ýèáíóç ðíð FreeBSD ðíð ÷-ñçóèíðèíáßòá:

1. Áéá ôí FreeBSD 7.x

Áäèáðáóðòðóá ôí port www/nspluginwrapper. Ôí port áðòü áðáéðáß ôí emulators/linux_base-fc4 ôí ððíßí áßíáé íááÛèí.

Ôí áðüíáñí áðíá áßíáé ç äáèáðáóðòçð ðíð port www/linux-flashplugin9. Èá äáèáðáóðòèáß ç Ýèáíóç Flash 9.x ç ððíßá áñññæèíðá üðé áñðèáýáé óùððÛ óðí FreeBSD 7.x.

Óçíáßüóç: Óá äèáüóáéð ðíð FreeBSD ðáèáéüðáñáð áðü ôçí 7.1-RELEASE, èá ðñÝðáé íá äáèáðáóðòðóáðá ôí ðáèÝóí www/linux-flashplugin7 êáé íá ðáñáèáßðáðá ôí áðíá ó÷-áðèèÛ íá ôí linprocs(5) ðíð óáßíáðáé ðáñáèÛòù.

2. Áéá ôí FreeBSD 8.x

Áäèáðáóðòðóá ôí port www/nspluginwrapper. Ôí port áðòü áðáéðáß ôí emulators/linux_base-f10 ôí ððíßí áßíáé íááÛèí.

Οι πληροφορίες σχετικά με τον κώδικα πηγή του port `www/linux-f10-flashplugin10`. Εάν θέλετε να εγκαταστήσετε τον Flash 10.x κώδικα πηγή στον FreeBSD 8.x.

Αν θέλετε να εγκαταστήσετε τον κώδικα πηγή του Flash 10.x στον FreeBSD 8.x, τότε πρέπει να εγκαταστήσετε τον κώδικα πηγή του `nspluginwrapper` και να εγκαταστήσετε τον κώδικα πηγή του `linprocfs`.

```
# ln -s /usr/local/lib/npapi/linux-f10-flashplugin/libflashplayer.so \
    /usr/local/lib/browser_plugins/
```

Εάν θέλετε να εγκαταστήσετε τον κώδικα πηγή του `nspluginwrapper` στον FreeBSD 8.x, τότε πρέπει να εγκαταστήσετε τον κώδικα πηγή του `nspluginwrapper` και να εγκαταστήσετε τον κώδικα πηγή του `linprocfs`.

Για να εγκαταστήσετε τον κώδικα πηγή του `nspluginwrapper` στον FreeBSD 8.x, τότε πρέπει να εγκαταστήσετε τον κώδικα πηγή του `nspluginwrapper` και να εγκαταστήσετε τον κώδικα πηγή του `linprocfs`.

```
% nspluginwrapper -v -a -i
```

Εάν θέλετε να εγκαταστήσετε τον κώδικα πηγή του `nspluginwrapper` στον FreeBSD 8.x, τότε πρέπει να εγκαταστήσετε τον κώδικα πηγή του `nspluginwrapper` και να εγκαταστήσετε τον κώδικα πηγή του `linprocfs`.

```
# mount -t linprocfs linproc /usr/compat/linux/proc
```

Ο κώδικας πηγή του `nspluginwrapper` στον FreeBSD 8.x, τότε πρέπει να εγκαταστήσετε τον κώδικα πηγή του `nspluginwrapper` και να εγκαταστήσετε τον κώδικα πηγή του `linprocfs`.

linproc	/usr/compat/linux/proc	linprocfs	rw	0	0
---------	------------------------	-----------	----	---	---

Για να εγκαταστήσετε τον κώδικα πηγή του `nspluginwrapper` στον FreeBSD 8.x, τότε πρέπει να εγκαταστήσετε τον κώδικα πηγή του `nspluginwrapper` και να εγκαταστήσετε τον κώδικα πηγή του `linprocfs`.

7.2.4 Η εγκατάσταση του Swfdec Flash Plugin

Το `Swfdec` είναι η ελεύθερη εναλλακτική λύση για τον κώδικα πηγή του `Flash`. Ο κώδικας πηγή του `Swfdec-Mozilla` είναι ένας κώδικας πηγή που υποστηρίζει τον κώδικα πηγή του `Flash` στον κώδικα πηγή του `SWF`. Είναι εύκολο να εγκαταστήσετε τον κώδικα πηγή του `Swfdec` στον κώδικα πηγή του `SWF`.

Αν θέλετε να εγκαταστήσετε τον κώδικα πηγή του `Swfdec` στον κώδικα πηγή του `SWF`, τότε πρέπει να εγκαταστήσετε τον κώδικα πηγή του `Swfdec` και να εγκαταστήσετε τον κώδικα πηγή του `SWF`.

```
# pkg_add -r swfdec-plugin
```

Αν θέλετε να εγκαταστήσετε τον κώδικα πηγή του `Swfdec` στον κώδικα πηγή του `SWF`, τότε πρέπει να εγκαταστήσετε τον κώδικα πηγή του `Swfdec` και να εγκαταστήσετε τον κώδικα πηγή του `SWF`.

```
# cd /usr/ports/www/swfdec-plugin
# make install clean
```

Για να εγκαταστήσετε τον κώδικα πηγή του `Swfdec` στον κώδικα πηγή του `SWF`, τότε πρέπει να εγκαταστήσετε τον κώδικα πηγή του `Swfdec` και να εγκαταστήσετε τον κώδικα πηγή του `SWF`.

7.2.5 Opera

Ο κώδικας πηγή του `Opera` είναι ένας κώδικας πηγή που υποστηρίζει τον κώδικα πηγή του `Opera` στον κώδικα πηγή του `Opera`. Είναι εύκολο να εγκαταστήσετε τον κώδικα πηγή του `Opera` στον κώδικα πηγή του `Opera`.

RSS/Atom éáé ðñëÛ áéüüá. Ðáñ'üëá áöðÛ, ï **Opera** áβĩáé ïéá ó÷-áðééÛ äëáöñëÛ éáé ðñëÛ äñÐáññç äöáññĩãÐ. ñ÷-áðáé óá äÿï öÿðñòð: ïéá “ããããĩÐò” Ýëäñòç äéá òï FreeBSD éáé ïéá Ýëäñòç ðñò äêðãããβòáé ïÝòò òçð òòïãáòüòçðáð ïá òï Linux.

Ãéá ïá ÷ñçóéññðñéÐòáð òçï FreeBSD Ýëäñòç òñò **Opera**, äãéáðáóðÐòáð òï ðáéÝòï:

```
# pkg_add -r opera
```

ÏñéòïÝĩáð òñðñéáðβáð FTP äáñ äéáéÝòñòï ïëá ðá ðáéÝòá, äëÛ ïðñãáðá ïá Ý÷-áðá òï βáëñ äðñòÝéáòĩá ïÝòò òçð òðëëñãáðò òñï Ports, äñÛòññóáð:

```
# cd /usr/ports/www/opera
# make install clean
```

Ãéá ïá äãéáðáóðÐòáð òçï Linux Ýëäñòç òñò **Opera**, áñðééáðáóðÐòáð ïá linux-opera òï opera óðá ðáñãáðÛñ ðáñãããããããããã.

Òï ðññüóëáðï Adobe Flash äáñ áβĩáé äéáéÝòéññ äéá òï FreeBSD. Äéáððéáðáé ïóòüóï ïéá Ýëäñòç éáðÛëëççç äéá òï Linux. Ãéá ïá òçï ÷ñçóéññðñéÐòáð éá ðñÝðáé äñ÷-ééÛ ïá äãéáðáóðÐòáð òï port www/linux-f10-flashplugin10 éáé Ýðáéðá òï port www/opera-linuxplugins:

```
# cd /usr/ports/www/linux-f10-flashplugin10
# make install clean
# cd /usr/ports/www/opera-linuxplugins
# make install clean
```

Ïðñãáðá ïá äéÝáñãáð äÿéñéá òçï ÿðáññç òñò plugin: ïáééñÐòáð òñï òðëëñãáðñçðÐ óáð, äñÛððá opera:plugins óçç äñããñÐ äéáððéÿñóáññ éáé ðéÝóðá **Enter**. Èá ðñÝðáé ïá äãβòá ïéá ëβòóá ïá ïëá ðá äéáéÝòéññ ðññüóëáðá.

Ãéá ïá ðññüóëáðï òï ðññüóëáðï òçð **Java**, äéñññðéÐòáð òéð áñðβòòñé÷-áð ïãçããáð äéá òñï Firefox.

7.2.6 Konqueror

Ï **Konqueror** áβĩáé éññÛóé òñò **KDE** äëÛ ïðñãáð ïá ÷ñçóéññðñéçðãã éáé Ýññ áðñ òï **KDE** ïá òçï äãéáðÛóðáóç òñò x11/kdebase3. Ï **Konqueror** áβĩáé ðñëÛ ðáñéóóüòáññ áðñ Ýĩáð áðëüð òðëëñãáðñçðð, áβĩáé áðβòçð äéá÷-äéñéóððð äñ÷-áβññ éáé ðññãããããã ðññãññðð äñ÷-áβññ ðñéòïÝóññ.

Ï **Konqueror** äéáððéáðáé áðβòçð ïá Ýĩá òáð áðñ plugins, óðï misc/konq-plugins.

Ï **Konqueror** ððñòçðññæáé áðβòçð **Flash** éáé ïé ó÷-áðééÝð ïãçããáð (How To) áβĩáé äéáéÝòéññ òðï <http://freebsd.kde.org/howtos/konqueror-flash.php>.

7.3 ÁöáññĩãÝò Äñáöáβñò

¼óï áóññÛ ðéð äöáññĩãÝò äñáöáβñò, ïé ïÝñé ÷ñÐòáð òð÷-ñÛ áñáççòñññ ïéá éáëÐ òñòβðá äöáññĩãññ ð Ýĩá òééééññ äðããããããããðð éáéñÝññ. Áñ éáé éÛðñéá äñáóééÛ ðáñéáÛëññóá ïððò òï **KDE** ðáñÝ÷-ñòï òçç äéëÐ ðñòð òñòβðá äöáññĩãññ äñáöáβñò, äáñ òðÛñ÷-äé ïóòüóï ðññãðééáññÝçç äöáññĩãÐ. Òï FreeBSD ðáñÝ÷-äé ïóé ÷ñáéÛæáóðá, Ûó÷-áðá áðñ òï ðáñéáÛëññ äñáóðáð óáð.

Òï òñðñá áððü éáéÿððáé ðéð ðáñáéÛðñ äöáññĩãÝò:

¼íííá Άόάνιιαΰò	Άόάέοιγíáííé Ðñííé	Άάέαòΰóóáóç áðu Ports	Άάóέéΰò ΆíáñòÐóáέò
KOffice	εβãíé (áέáóñéÛ)	ááñéÛ	KDE
AbiWord	εβãíé (áέáóñéÛ)	áέáóñéÛ	Gtk+ Þ GNOME
The Gimp	εβãíé (áέáóñéÛ)	ááñéÛ	Gtk+
OpenOffice.org	ðíééíß (ááñéÛ)	áíáέñáóέéÛ ááñéÛ	JDK™, Mozilla
LibreOffice	ó÷-áóέéÛ ááñéÛ	òáñÛóóέα	Gtk+ Þ KDE/ GNOME Þ JDK

7.3.1 KOffice

Ç éιέíυóçά όιò KDE áñðεβæáé όι áñáóέéυι όçò ðáñέáÛέεíí ιá ιέα όιòβóá άόάνιιαΰí áñáóáβιò ðιò ιðíñáß ιá ÷ñçóέíιðíéçέáß έáé Ýíυ áðu όι **KDE**. ÐáñέéáíáÛίáé óá όΰóóáñá ááóέéÛ ðñíáñÛíιáóá ðιò ιðíñáβóá áðβóçò ιá áñáβóá έáé óá ΰέéáò όιòβóáò áñáóáβιò. Όι **KWord** áβίáé ι áðáíáñááóóòðò έáéíΰíò, όι **KSpread** áβίáé όι ðñυáñáíιá òðíéíáέóóέçí òγέéυι, όι **KPresenter** áέá÷-áέñβæáóáé όέò ðáñíòóέÛóáέò, áñ όι **Kontour** óáò áðέóñΰðáé ιá äçíéíòñáβóáòá Ýááñáóá ιá áñáóέéÛ.

Ðñéí ááέáóáóòÐóáòá όι óáέáðóáβι **KOffice**, ááááéùèáβóá υòέ Ý÷-áòá áíáíáυιΰíç Ýέáíóç όιò **KDE**.

Άέá ιá ááέáóáóòÐóáòá όι **KOffice** υò ðáéΰόι, áðóóá όçí áéυιέíòèç áíóíεÞ:

```
# pkg_add -r koffice
```

Άί όι ðáéΰόι ááí áβίáé áέáéΰóέíι, ιðíñáβóá ιá ÷ñçóέíιðíéÞóáòá όçí ÓðέéíáÞ óυι Ports. Άέá ðáñÛááéáíá, áέá ιá ááέáóáóòÐóáòá όι **KOffice** áέá όι **KDE3**, áñÛòóá:

```
# cd /usr/ports/editors/koffice-kde3
# make install clean
```

7.3.2 AbiWord

Όι **AbiWord** áβίáé Ýíá áέáγέáñí ðñυáñáíιá áðáíáñááóóáð έáéíΰíò, υιíéíι óóçí áβóèçóç έáé όçí áìòÛίέóç ιá όι **Microsoft Word**. Άβίáé έáðÛέéçéíι áέá όçí ðéçéðñíéυáçóç Ûñéñυι, áñáíÛòυι, áíáóíñí, òðáíéòιβóáυι é.í.é. Άβίáé ðíéγ áñÞáííι, Ý÷-áé áñέáòΰò áðíáòυòçóáò έáé áβίáé έáέáβóáñá óέéééυι óόι ÷ñÞóç.

Όι **AbiWord** ιðíñáß ιá áέóÛááé Þ ιá áíÛááé áñ÷-áβá áéÛóíñυι ιñòÞí, ðáñέéáíáááíñΰíυι έáé éÛðíéυι έέáέóóÞí υðυò όι .doc όçò Microsoft.

Όι **AbiWord** áβίáé áέáéΰóέíι υò ðáéΰόι. Ιðíñáβóá ιá όι ááέáóáóòÐóáòá áñÛóííóáð:

```
# pkg_add -r abiword
```

Άί όι ðáéΰόι ááí áβίáé áέáéΰóέíι áέá éÛðíéíι éυáí, ιðíñáβóá ιá όι ιáóááéυòðóóáòá áðu όçí ÓðέéíáÞ óυι Ports. Óá áóòÞ όçí ðáñβðòυòç ðέéáíÞò ιá ááέáóáóòÐóáòá ιáÞóáñç Ýέáíóç óá ó÷-ΰóç ιá όι ΰόιέíι ðáéΰόι. Ιðíñáβóá ιá όι éÛíáòá υò áíÞò:

```
# cd /usr/ports/editors/abiword
# make install clean
```

7.3.3 Òι GIMP

Òι **The GIMP** άβιιάε Ύία εέαέβòάνα άιάεέαιΎιι ðñüāñāiā εέα÷ άβñέοçð ãñάóεéπi εέα açìéiòñāβā áééüiüi P άðāiñāāóòβā òüòìñāóééπi. Ìðñāβā íá ÷ñçóéiüðiéçéāβ ùò áðéü ðñüāñāiā æüāñáóééPð P óái òiòβòā áðāiñāāóòβāð éáé áéüñèüòçð òüòìñāóééπi. ÐāñéΎ ÷ áé iāāÜéi ãñéèiü áðü plugins áñp εέαéΎóáé éáé scripting interface. Òι **The GIMP** ìðñāβā íá áéāāÜóáé éáé íá ãñÜøáé iāāÜéi òÜóíá ãñ ÷ άβñi áééüiáð. ÐāñééāiāÜíáé áðβòçð áéāðāóΎð áéáóýiááóçð iā óāññòΎð éáé tablets.

Ìðñāβòā íá āāéáóáóðPóāðā òi ðáéΎòì äβñiüóáð òçì áiüòèP:

```
# pkg_add -r gimp
```

Áí ç òiðièéáóβā FTP ðiò ÷ñçóéiüðièéāβòā āāi áéáéΎóáé áðüü òi ðáéΎòì, ìðñāβòā íá ÷ñçóéiüðièéPóāðā òçì ÓðéèiāP òüi Ports. Ì éáðÜèiāiò graphics (<http://www.FreeBSD.org/ports/graphics.html>) òçð ÓðéèiāPð òüi Ports ðāñéΎ ÷ áé áðβòçð éáé òi **The Gimp Manual (āā ÷ áéñβāéi ÷ ñPòçð)**. Άāβòā ðāñāéÜòü ðüð íá òi āāéáóáóðPóāðā:

```
# cd /usr/ports/graphics/gimp
# make install clean
# cd /usr/ports/graphics/gimp-manual-pdf
# make install clean
```

Óçìāβüòç: Ì éáðÜèiāiò graphics (<http://www.FreeBSD.org/ports/graphics.html>) òçð óðéèiāPð òüi Ports Ύ ÷ áé áðβòçð òçì ððü áiΎééiç Ύéāiüòç òçð āóāñiüāPð **The GIMP** óðì graphics/gimp-devel. Ìðñāβòā íá āñāβòā òçì HTML Ύéāiüòç òiò āā ÷ áéñéāβiü, **The Gimp Manual** óðì graphics/gimp-manual-html.

7.3.4 OpenOffice.org

Òι **OpenOffice.org** ðāñéΎ ÷ áé üéāð òéð áðāñāβòçðāð áóāñiüāΎð óā iéā ðéPñç òiòβòā áóāñiüāpí ãñáóáβiü: áðāiñāāóòβā éāéiΎiü, òðièiāéóóééü öýéèi, áéá ÷ áéñéóòP ðāñiüóéÜóāüi éáé ðñüāñāiā ó ÷ āāβáóçð. Òi ðāñéāÜèèi ãñāáóβáð òiò áβiιά ðièý üiüèi iā Üèéāð òiòβòāð ãñáóāβiü, éáé ìðñāβā íá ÷ñçóéiüðièéPóáé äéÜöiñiüð açiüöééāβð òýðiüð ãñ ÷ άβñi. Άβiιά áéáéΎóéiü óā ðièéΎð áéáóñāóééΎð äéPóóáð, òüüi ùð ðñiü òi ðāñéāÜèèèi ãñāáóβáð üüi éáé ùð ðñiü óā éāièéÜ éáé òiü iñèiñāóééü Ύéāā ÷ i.

Ì áðāiñāāóòβð éāéiΎiü òiò **OpenOffice.org** ÷ñçóéiüðièéāβ āāāāiPð iññòP ãñ ÷ άβiü XML áéá áóçìΎiç òiñçòüüòçðā éáé áðāééiβā. Òi ðñüāñāiā òðièiāéóóééπi öýéèüi áéáéΎóáé äéPóóā iáéñiüāiüèèi éáé ìðñāβā íá áéáóóíāéāβ iā āiüðāñééΎð āÜóáéð āāāñΎiüi. Òi **OpenOffice.org** άβiιά óóáéāñP áóāñiüāP éáé áéðāéāβòáé āāāāiPð óóā Windows, òi Solaris™, òi Linux, òi FreeBSD, éáèPð éáé óòì Mac OS X. Ðāñéóóüðāñāð ðéçñiüññāð áéá òi **OpenOffice.org** ìðñāβòā íá āñāβòā óòç áééðóáéP òiðièéáóβā òiò OpenOffice.org (<http://www.openoffice.org/>). Άéá ðéçñiüññāð ó ÷ áðééÜ iā òçì Ύéāiüòç áéá FreeBSD, éáèPð éáé áéá áðāðéāβáð éáóΎááóíá ðáéΎòüi, ÷ñçóéiüðièéPóóā òçì äééðóáéP òiðièéáóβā FreeBSD OpenOffice.org Porting Team (<http://porting.openoffice.org/freebsd/>).

Άéá íá āāéáóáóðPóāðā òi **OpenOffice.org**, ãñÜøðā:

```
# pkg_add -r openoffice.org
```

Óçìāβüòç: Áí ÷ñçóéiüðièéāβòā -RELEASE Ύéāiüòç òiò FreeBSD, òi ðāñāðÜiü ðñΎðáé íá äiüèéΎøáé. ΆéáóñāðééÜ, éá ðñΎðáé íá āāβòā òçì áééðóáéP òiðièéáóβā òiò FreeBSD **OpenOffice.org** Porting Team áéá íá éáóāāÜóáðā éáé íá āāéáóáóðPóāðā òi áiüóóóèié ÷ i ðáéΎòì ÷ñçóéiüðièéPíóáð òçì pkg_add(1). Òüüi ç ðñΎ ÷ iüóá üüi éáé ç òðü áiΎééiç Ύéāiüòç áβiιά áéáéΎóéiüāð áéá éáóΎááóíá áðü òçì ðāñāðÜiü òiðièéáóβā.

Άδν ος οέειπ δν ον δάέΰοι άάέάοάοόάέάβ, δνΰδάέ ίά ανΰοάοά άδερ οςί δάνάέΰοδν άίοιερ άέά ίά άέοάέΰοάοά ον **OpenOffice.org**:

```
% openoffice.org
```

Όςιάβυός: Έάοΰ οςί δνρδς άέεβςίςος, έά οάο άβςίοι άέΰοιναο άνυορράέο έάέ έά άςιείοκνάςεάβ Ύίαο έάοΰεΐάι έά ύιιιά .openoffice.org ίΎοά οοι δνιούδέέυ οάο έάοΰεΐάι.

Άί οά δάέΰοά ον **OpenOffice.org** άάί άβίαέ άέάέΰοείά, Ύ÷άοά δΰίοά οςί άδέειπ ίά ίάοάέυοόβοάοά ον άίοβόοιέ÷ι port. Ύοδνοί, ίά Ύ÷άοά οδνς οάο υδέ άοδν άδάέοάβ άνέάοδν ÷βνι οοι άβόει έάέ έά ÷νάέοόάβ έάέ δΰνά δρεΎ ÷νιιί άέά ίά ιέιέεςνυέάβ.

```
# cd /usr/ports/editors/openoffice.org-3
# make install clean
```

Όςιάβυός: Άί έΰέάοά ίά άςιείοκνάβοάοά ίέά Ύέαιός ίά οέο άέέΎο οάο ονδέέΎο κνείβοάέο, άίοέέάοάοόβοάοά οςί δνιςάιγιάς άναιπ άίοιερ ίά οςί άδνιςίς:

```
# make LOCALIZED_LANG=your_language install clean
```

δνΰδάέ ίά άίοέέάοάοόβοάοά ον *your_language* ίά ον ούοδν ISO έυάέέυ άέά ος άερόοά οάο. ϸ έβοά ίά ον οδνιόςκνέευιάιιόο έυάέέιγν άέυοόρ ίάβίαέ άέάέΰοείς οοι άν÷άβι files/Makefile.localized, ον ιδνι άνβόέάοάέ οοι έάοΰεΐάι ον port.

Ίυέοό άβίαέ άοδν, ιδνιάβοά ίά ίάέειρράοά οςί άόάνιιαβ **OpenOffice.org** άβνιόάο οςί άίοιερ:

```
% openoffice.org
```

7.3.5 LibreOffice

Όν **LibreOffice** άβίαέ ίέά άέάέεανς ονβοά άόάνιιαβί άνάοάβνις ϸ ιδνιά άίαδδνγόοάοάέ άδν ον The Document Foundation (<http://www.documentfoundation.org/>). Άβίαέ ονιάοόβ ίά οέο ΰέέάο άνυοόΎο ονβοάο άνάοάβνις έάέ άέάοβέάοάέ άέά οέο δάνέοοδνδάνάο δέάοδνιιάο. δνυέάέοάέ άέά fork οςδ άνυοόβδ άόάνιιαβδ **OpenOffice.org** ϸ ιδνιά δάνέέαιΰίάέ υέά οά άδάνάβοςδ ίέάο ονβοάο άνάοάβνις: άδάνάναάοόβ έάειΎνι, οδνιέάέοόέυ ογέει, δνυάάνιιά δάνιιόέΰοάυι, δνυάάνιιά ο÷άάβόςδ έάέ Ύία άνάέέάβι άέά άςιείοκνάβ έάέ άδάνάναάοόβ ίάεςίάοέερ ίγδνι. Άέάοβέάοάέ οά δεβνι άέυοόρ — ϸ άέάειρδ οδνιόδβνές άδάέοάβίαοάέ ιΰέέοόά ονι οοι δάνέάΰέει υοί έάέ οόά άδέδΰνι δνιανΰιιάοά άέΎ÷νι ινέιανάοβάο έάέ έάιέερ.

Ί άδάνάναάοόβδ έάειΎνι ον **OpenOffice** ÷κνέεινδνιέάβ άάάίρδ ιννοβ άν÷άβνι XML ον ιδνι άίάοόάέβέάέ άδνιΎίς ονκνυοδςδ έάέ άοάέειβ. Όν οδνιέάέοόέυ ογέει άέάέΰοάέ ίέά άερόοά ίάένιαιοιερ έάέ ιδνιά ίά άέάοδνιέάέβ ίά άνυοάνέΎο άΰοάέο άάανΎνι. Όν **LibreOffice** άβίαέ βςς οόάέανν έάέ άέάοβέάοάέ οά άέανυοάέο άέά Windows, Linux, FreeBSD έάέ Mac OS X. Άέά δάνέοοδνδάνάο δέκννιιιιβάο ο÷άοέέΰ ίά ον **LibreOffice** άδέοέάοέάβοά οςί άέέοόάερ ονδνιέάοόβ ον (<http://www.libreoffice.org/>).

Άέά ίά άάέάοάοόβοάοά ον **LibreOffice** άδν Ύοιειν δάέάοδν, ανΰοά:

¼íñá Άόάνιιαΰο	Άόάέοιγíαιíε Δύñíε	Άέεάοΰόόάοç áδύ Ports	Άάόέέΰò ÁíáñòΠόάέò
Acrobat Reader	εβάρé (áεάοñέΰ)	áεάοñέΰ	Άόάέέΰ óòíááóúòçόά íá Linux (Linux Binary Compatibility)
gv	εβάρé (áεάοñέΰ)	áεάοñέΰ	Xaw3d
Xpdf	εβάρé (áεάοñέΰ)	áεάοñέΰ	FreeType
GQview	εβάρé (áεάοñέΰ)	áεάοñέΰ	Gtk+ P GNOME

7.4.1 Acrobat Reader®

Δíεεΰ Ύáñáόά áεάíΎííόάé δέΎíí ùò áñ ÷ áβá PDF οí íðíβí óçíáβíáé “Portable Document Format” (ΌíñçòΠ ÌíñòΠ Άáñΰοíò). íá áδύ óá óóíεóòβíáá δñíáñΰñíáόά δñíáñεΰò áεά áóóú οíí óýðí áñ ÷ áβύí áβíáé οí **Acrobat Reader**, οí íðíβí ç Adobe áεάέΰόάé áεά Linux. Έάεΰò οí FreeBSD ìðíñáβ íá ÷ ñçóέííðíεΰόάé áεόáεΎόέíá οíò Linux, ç áόáñíáΠ áβíáé áðβóçò áεάέΎόέíç áεά οí FreeBSD.

Άέά íá ááεάόάόòΠόάόá οí **Acrobat Reader 8** áδύ οç ÓðεεíáΠ ούí Ports, áñΰòðá:

```
# cd /usr/ports/print/acroread8
# make install clean
```

Άáí οðΰñ ÷ áé áεάέΎόέíí δάέΎόí, εüáù δáñέíñέóìβí óόçí ΰááéá ÷ ñΠόçò.

7.4.2 gv

Όí **gv** áβíáé Ύíá δñúáñáíá δñíáñεΰò áááñΰòúí áεά áñ ÷ áβá PostScript éáé PDF. Άβíáé áñ ÷ εέΰ ááόέοíΎíí óόçí áόáñíáΠ **ghostview** áεεΰ Ύ ÷ áé éáéýóáñç áìòΰíέóç ÷ ΰñç óόç áεάέέíεΰεç **Xaw3d**. Άβíáé áñΠáñíí, éáé οí interface οíò áβíáé íáεΰεáñí. Όí **gv** Ύ ÷ áé δíεεΎò áοíáóúòçόáò, üðùò δñíόáíáóíεέóíü éáé íΎááεíò ÷ áñòέíΎ, áìòΰíέóç οðü εεβíáéá éáé ááεòβύóç áìòΰíέóçò áñáíáóíόáέñβí (antialias). Ó ÷ ááúí éΰεá éáεóíòñáβá οíò ìðíñáβ íá áεóáεáόóáβ οúοí áδύ οí δεçέòñíεüáéí üοí éáé áδύ οí δñíόβέé.

Άέά íá ááεάόάόòΠόάόá οí **gv** ùò δάέΎόí, áñΰòðá:

```
# pkg_add -r gv
```

Άí οí δάέΎόí ááí áβíáé áεάέΎόέíí, ìðíñáβóá íá ÷ ñçóέííðíεΰόáόá óçí ÓðεεíáΠ ούí Ports:

```
# cd /usr/ports/print/gv
# make install clean
```

7.4.3 Xpdf

Άí εΎεáόá Ύíá íέéñü δñúáñáíá δñíáñεΰò áñ ÷ áβύí PDF áεά οí FreeBSD, οí **Xpdf** áβíáé áεάóñý éáé áðíáíόέéü. Άðáέόáβ áεΰ ÷ εóοíòðò δñííòðò éáé áβíáé éáεάβóáñá óόáéáñü. × ñçóέííðíεΰáβ óέò ááόέέΎò áñáíáóíόáέñΎò οúí X éáé ááí áðáέόáβ ÷ ñΠόç οíò **Motif** Π ΰεεçò áñááéáέíεΰεçò οúí ×.

Άέά íá ááεάόάόòΠόάόá οí **Xpdf** ùò δάέΎόí, áβóόá óçí áíόíεΰ:

```
# pkg_add -r xpdf
```

Áí òì ðáéÝðì äáí áβĩáé äéáéÝóëì Þ ðñĩðëíÛðá íá ÷ñçóëíðĩéÞóáðá òçĩ ÓðëëĩãÞ ðùĩ Ports, ãñÛððá:

```
# cd /usr/ports/graphics/xpdf
# make install clean
```

Ïúëéð ïëĩëçñùèáβ ç äáéáðÛóðáóç, ìðñãβðá íá ïáééíÞóáðá òì **Xpdf** éáé íá ÷ñçóëíðĩéÞóáðá òì äáíβ ðëÞðñì òìð ðĩðéééíý áéá íá áñãñĩðĩéÞóáðá òì ïáñý.

7.4.4 GQview

Ôì **GQview** áβĩáé Ýĩáð äéá÷áéñéóðÞð áééúñí. Ìðñãβðá íá äáβðá Ýĩá ãñ÷áβì ïá Ýĩá áðëù èëéé, íá ïáééíÞóáðá Ýĩá áñúðáñééù ðñúãñãñã áðãñãñãáóβáð, íá äáβðá ðñĩáðéóéùðçóç òá ïñðÞ thumbnail éáé ðñëÛ Ûëéá. ÁéáéÝðáé áðβóçð ðñĩãñëÞ ðáñĩóβáóçð éáé éÛðĩéáð ááóééÝð éáéðĩðñãβð ãñ÷áβì. Ìðñãβðá íá äéá÷áéñéóðáβðá óðëëĩãÝð áééúñí éáé íá ãñãβðá ïá áýëĩëì ðñúðì ðéð áéðëÝð. Ôì **GQview** ìðñãβ ïá ÷ñçóëíðĩéçëáβ áéá ðñĩãñëÞ òá ðëÞñç ïëíñç éáé òðĩóçñβáéé òĩðééÝð / äéáéĩáβð ãðëìβóáéð.

Áí èÝéáðá íá äáéáðáóðÞóáðá òì **GQview** ùð ðáéÝðì, ãñÛððá:

```
# pkg_add -r gqview
```

Áí òì ðáéÝðì äáí áβĩáé äéáéÝóëì, Þ ðñĩðëíÛðá íá ÷ñçóëíðĩéÞóáðá òçĩ ÓðëëĩãÞ ðùĩ Ports, ãñÛððá:

```
# cd /usr/ports/graphics/gqview
# make install clean
```

7.5 ×ñçĩáðĩëéíñĩééÝð ÁöáññĩãÝð

Áí, áéá ïðĩéãñãðĩðá èüãì, èÝéáðá íá äéá÷áéñβáéóðá ðá ÷ñçĩáðĩëéíñĩééÛ óáð ïÝóù òìð FreeBSD desktop óáð, òðÛñ÷ òĩ òì éÛðĩéáð éó÷ðñÝð éáé áýëĩéáð óðç ÷ñÞóç áöáññĩãÝð, Ýðĩéĩáð ðñĩð äáéáðÛóðáóç. Ïñéóì Ýĩáð áðù áóðÝð áβĩáé óðĩááðÝð ïá äéáãããññÝĩáð ïñðÝð ãñ÷áβì, ùðùð áóðÝð ðìð ÷ñçóëíðĩéĩéĩéĩéóáé óðá Ýããñãóá òìð **Quicken**® Þ òìð **Excel**.

Ôì òìÞĩá áóðù éáéýððáé ðéð áöáññĩãÝð:

¼ññĩá ÁöáññĩãÞð	Áðáééòĩéĩáñĩé ðññĩé	ÁáéáðÛóðáóç Áðù Ports	ÁáóééÝð ÁĩáñðÞóáéè
GnuCash	èβãĩé (áéáðñéÛ)	ááñéÛ	GNOME
Gnumeric	èβãĩé (áéáðñéÛ)	ááñéÛ	GNOME
Abacus	èβãĩé (áéáðñéÛ)	áéáðñéÛ	Tcl/Tk
KMyMoney	èβãĩé (áéáðñéÛ)	ááñéÛ	KDE

7.5.1 GnuCash

Ôì **GnuCash** áβĩáé ïÝñĩð òçð ðñĩóðÛéáéáð òìð **GNOME** íá ðãñÝ÷áé éééééÝð áöáññĩãÝð óðĩðð ðáééééĩéð ÷ñÞóðáð. Ìá òì **GnuCash**, ìðñãβðá íá èñáðÛðá èĩããéáóìù ðùì áóúãñí éáé áñúãñí óáð, ðùì ðñãðãáééèÞì óáð èĩããéáóìÞì éáé ðùì ïáðì÷Þì óáð. ÁéáéÝðáé ðãñéáÛëëĩñ ãñãáóβáð òì ïðìβì áβĩáé áýëĩëì óðç ÷ñÞóç ÷ññβð íá ÷ñãéÛãáðáé éáéáβðãñç áèìÛéçóç, áééÛ áβĩáé ðáóðù÷ñĩá éáé ðñëý áðããããèĩáðééù.

Ôì **GnuCash** ðάνΎ ÷ áε Ύíòðíí óγóòçíá εάóá ÷ ðñçóçò, εάñáñ ÷ εέü óγóòçíá εíááñεάóìðí, ðíεεÛ ðεðεòñá óóíóññáγóáùí ðεçεòñíεíáβíò, εάεðò εάε íáεüáíòò áóòüíáóçò ðóìðεðñùòçò. Ìðíñáβ íá áεá ÷ ùñβóáε íεά óóíáεεááð óá ðíεεÛ εάðòíñáñð ðíðíáóá. Ôì **GnuCash** ìðíñáβ íá áεóÛááε εάε íá óòá ÷ ùíáγóáε áñ ÷ áβá QIF ðíò **Quicken**. Ìðíñáβ áðβóçò íá ÷ áεñεóóáβ óεò ðáñεóóóðáñáò áεάεíáβò ìñòΎò çíáññçíεðí εάε ìñεóíáóεéðí ìíÛáùí.

Άέá íá ááεάóáóóðóáòá ðí **GnuCash** óóì óγóòçíá óáò, ãñÛøðá:

```
# pkg_add -r gncash
```

Áí ðí ðáεΎòí ááí áβíáε áεάεΎóεíí, ìðíñáβòá íá ÷ ñçóεííðíεðóáòá ðçí Óðεεíáð ðùí Ports:

```
# cd /usr/ports/finance/gncash
# make install clean
```

7.5.2 Gnumeric

Ôì **Gnumeric** áβíáε Ύíá ððíεíáεóóεéü óγεεí εάε áðíòáεáβ ìΎñíò ðíò ðáñεáÛεεííòò áñááóβáò **GNOME**. ΆεάεΎðáε áíεεéð áóòüíáóç “ðñüáεáøç” ðçò áεóüáíò ðíò ÷ ñðóç óγíòüíá íá ðç ìñòð ðíò εάεéíγ εάεðò εάε óγóòçíá áóòüíáóçò óóìðεðñùòçò (autofill) áεá áεÛóíñáò áεíεíòεβáò. Ìðíñáβ íá áεóÛááε áñ ÷ áβá áεÛóíñüí áçíòεéðí ìñòðí, ùðùò áóòÛ ðíò ÷ ñçóεííðíεíγíóáε óóì **Excel**, ðí **Lotus 1-2-3**, ð ðí **Quattro Pro**. Ôì **Gnumeric** ððíòðçñβεáε áñáóðíáóá ìΎòò ðíò ðñíáñÛíáóíòò áñáóεéðí math/guppi. ÷ áε íááÛεí áñεéüü áíóüíáóòüíΎíüí óóíáñòðóáùí εάε áðεòñΎðáε üεáò óεò óóìðεáεò ìñòΎò εάεéðí, ùðùò áñεéüíγò, ìñεóíáóεéΎò ìíÛááò, çíáññçíáβáò, ðñáò εάε ðíεεΎò áεüíá.

Άέá íá ááεάóáóóðóáòá ðí **Gnumeric** ùò ðáεΎòí, ãñÛøðá:

```
# pkg_add -r gnumeric
```

Áí ðí ðáεΎòí ááí áβíáε áεάεΎóεíí, ìðíñáβòá íá ÷ ñçóεííðíεðóáòá ðçí Óðεεíáð ðùí Ports, ãñÛóííòáò:

```
# cd /usr/ports/math/gnumeric
# make install clean
```

7.5.3 Abacus

Ôì **Abacus** áβíáε Ύíá íεéñü εάε áγέíεí óç ÷ ñðóç ððíεíáεóóεéü óγεεí. ðáñεεáíáÛíáε ðíεεΎò áíóüíáóòüíΎíáò óóíáñòðóáεò íε ìðíβáò áβíáε ÷ ñðóεíáò óá áεÛóíñá ðááβá, ùðùò ç óóáóεóóεéð, óá ÷ ñçíáóðíεεíñεéÛ εάε óá ìáεçíáóεéÛ. Ìðíñáβ íá áεóÛááε εάε íá áíÛááε áñ ÷ áβá ðíò **Excel**. Ôì **Abacus** ìðíñáβ íá ðáñÛááε Ύíñí ìñòðò PostScript.

Άέá íá ááεάóáóóðóáòá ðí **Abacus** ùò ðáεΎòí, ãñÛøðá:

```
# pkg_add -r abacus
```

Áí ðí ðáεΎòí ááí áβíáε áεάεΎóεíí, ìðíñáβòá íá ÷ ñçóεííðíεðóáòá ðçí Óðεεíáð ðùí Ports, ãñÛóííòáò:

```
# cd /usr/ports/deskutils/abacus
# make install clean
```

7.5.4 KMyMoney

Ôï **KMyMoney** áβíáé ðéá áöáññÿÝð äéá ÷ áβñéóçð ðùí ðñíóóððééβí óáð ðééññééβí, ððéááïÝíç äéá ðí ðáñéáÛéëíí **KDE**. To **KMyMoney** óðí ÷ äýáé ðá ðáñÝ ÷ äé éáé ðá áíóóíáóβóáé ùéáð ðéð èäéóíóñáβáð ðíð äéáóβéáíóáé óá áíóβóóíé ÷ àð àíðñééÝð áöáññÿÝð. Ôï **KMyMoney** ðññáβ ðá äéóÛááé áñ ÷ áβá ðíð ðñíóýðíð QIF (Quicken Interchange Format), ðá ðçñáβ éáðááñáóβ ðùí àðáíáýóáñí óáð, ðá ÷ äéñβæáðáé ðíééáðéÝð ðñéóíáðééÝð ðñÛáð èáé ðá ðáñÝ ÷ äé ðéðéíð áíáóññí. ÌÝóá áðñ ðá ÷ ðñéóóñí plugin, ðáñÝ ÷ äéáé àðβóçð ç äéáíáðóçóá äéóááñáðð ðáñ ÷ áβùí OFX.

Äéá ðá äéáóáóðβóáðá ðí **KMyMoney** ùð ðáéÝóí, äéðáéÝóóá ðçí áíðíð:

```
# pkg_add -r kmymoney2
```

Áí ðí ðáéÝóí äáí áβíáé äéáéÝóéí, ðññáβðá ðá ÷ ðçóéíðíéðβóáðá ðçí Óðéëíáð ðùí Ports, ùððð óáβíáóáé ðáñáéÛðù:

```
# cd /usr/ports/finance/kmymoney2
# make install clean
```

7.6 Ðáñβéççç

Áí èáé ðí FreeBSD áβíáé äçñíðééÝð óóíðð ðáññí ÷ áβð Internet (ISPs) äéá ðçí áðñáíóç èáé ðç óóáèáññóçóá ðíð, áβíáé àðβóçð Ýóíéíí èáé äéá èáèçíáñéíð ÷ ðñβóç ùð desktop. Ìá áñéáðÝð ÷ éééÛáð áöáññÿÝð äéáéÝóéíáð ùð ðáéÝóá (<http://www.FreeBSD.org/applications.html>) ð ports (<http://www.FreeBSD.org/ports/index.html>), ðññáβðá ðá äçíéíðñáβóáðá ðí ÓÝèáéí desktop ðíð èáéýððáé ùéáð ðéð áíÛéáð óáð.

ÐáñáéÛðù, óáβíáóáé ðéá áñðáññç ðáñβéççç ùéùí ðùí desktop áöáññÿÝð ðíð ðáññíðóéÛóðçéáí óá áððñ ðí èäöÛéáéí:

¼áññá ÁöáññÿÝð	¼áññá ÐáéÝóíð	¼áññá Port
Opera	opera	www/opera
Firefox	firefox	www/firefox
KOffice	koffice	editors/koffice-kde3
AbiWord	abiword	editors/abiword
The GIMP	gimp	graphics/gimp
OpenOffice.org	openoffice	editors/openoffice.org-3
LibreOffice	libreoffice	editors/libreoffice
Acrobat Reader	acroread	print/acroread8
gv	gv	print/gv
Xpdf	xpdf	graphics/xpdf
GQview	gqview	graphics/gqview
GnuCash	gnucash	finance/gnucash
Gnumeric	gnumeric	math/gnumeric
Abacus	abacus	deskutils/abacus
KMyMoney	kmymoney2	finance/kmymoney2

ΕὰοÛεάεί 8

ÐīēōīÝóá

8.1 Óýīīøç

Ôī FreeBSD ððīóðçñβæáé ιάãÛēç ðīēēēēβá áðu ēÛñòáð Þ÷īø, áðέønÝðīíóáð óáð Ýóóé ίá áðīέáýóáðá ðøçēÞð ðέóóüðçðáð Þ÷ī áðu ôīí ððīēīēéóðÞ óáð. ÐãñēéáιáÛīíáðáé ç äðíáðuðçðá ίá äãñÛøáðá éáé ίá áíáðãñÛãáðá Þ÷ī MPEG Audio Layer 3 (MP3), WAV, éáé Ogg Vorbis éáèþð éáé ðīēēÛ Ûēéá formats. Ôī FreeBSD Ports Collection áðβóçð ðãñēÝ÷áé äóãñīīãÝð ðīø óáð áðέønÝðīíó ίá áðáíãñãáóóðáβðá ôīí ç÷īãñáøçīÝīí óáð Þ÷ī, ίá ðñīóēÝóáðá ç÷çóéēÛ áðÝ, éáé ίá äēÝáíáðá óóóéãðÝð MIDI.

Ìá εβáī ðãñēáíáðéóíü, ôī FreeBSD ïðīñãß ίá ððīóðçñβīáé áíáðãñãáãñãÞ ãñ÷ãßüí video éáé DVD. Ì ãñēéìüð ðüí äóãñīīãñī ðīø èüäééīðīēīýí, ιáðáðñÝðīíó, éáé áíáðãñÛãñóí äéÛóñīíøð óýðīøð video áβīáé ðēī ðãñēíéóíÝīíð áðu ôīí ãñēéìü ðüí äóãñīīãñī Þ÷īø. Áéá ðãñÛãáéáíá, üðáí ãñÛøçéá áðóü ôī éãβīáíí, äáí ððÞñ÷á éáíéÛ éáéÞ äóãñīīãÞ áðáíáéüèüééīðīβçðçð óðç óðēēīãÞ ðüí Ports ôīø FreeBSD, ðīø éá ïðīñīýóá ίá ðñçóéīðīéçèãß äéá ιáðáðñīðÞ ιáðáíý formats, üðüð ôī audio/sox. Ðãñ' üéá áððÛ, ôī ôīðβī óá áðóü ôīí ôñÝá, éáé üóí äóññÛ ôī ēīãéóíééü, äééÛæáé ñãããááβá.

Ôī εãøÛεáεί áðóü éá ðãñēãñÛøáé óá áðãñãáβóçðá áÞīáðá äéá ðç ñýéìéóç ðçð éÛñòáð Þ÷īø óáð. Ç ñýéìéóç éáé äãéáðÛóðáç ôīø X11 (ΕὰοÛεάεί 6) Ý÷áé Þαç ôñīíðβóáé äéá óá ðééáíÛ ðñīãéÞīáðá ðéééý ðçð éÛñòáð ãñáðééþí óáð, áí éáé ïðīñãß ίá ðñáéÛæáðáé ίá äóãñīüóáðá éÛðīéáð áéüíá íéçñī-ñðéīβóáéð äéá éáéýðãñç áíáðãñãáãñãÞ.

Áóīý äéáãÛóáðá áðóü ôī éãøÛεáεί, éá ïÝñáðá:

- Ðüð ίá ñðéīβóáðá ôī óýóðçíá óáð þóðá ίá áíáãñññβæáðáé ç éÛñóá Þ÷īø óáð.
- Ìäéüüíøð äéá ίá äēÝáíáðá ðç éáéðīøñãßá ðçð éÛñòáð óáð.
- Ðüð ίá áðééýóáðá ðñīãéÞīáðá ó÷áðééÛ ιá ðéð ñðéīβóáéð Þ÷īø.
- Ðüð ίá áíáðãñÛãáðá éáé ίá èüäééēīðīéÞóáðá MP3 éáé Ûēēīøð óýðīøð ãñ÷ãßüí Þ÷īø.
- Ðüð ððīóðçñβæáðáé ôī video áðu ôīí X server.
- ÈÛðīéá ports áíáðãñãáãñãÞð/èüäééīðīβçðçð video ðīø äβñíóí éáéÛ áðīóäēÝóíáðá.
- Ðüð ίá áíáðãñÛãáðá DVD, éáé ãñ÷ãßá .mpg éáé .avi.
- Ðüð ίá éÛíáðá rip ôī ðãñēã÷üíãñī CD éáé DVD óá ãñ÷ãßá.
- Ðüð ίá ñðéīβóáðá íéá éÛñðá ðçèãññáóçð.
- Ðüð ίá ñðéīβóáðá Ýíá óãññðÞ äééüíñí.

Ðñéí äéáãÛóáðá áðóü ôī éãøÛεáεί, éá ðñÝðáé:

- Íá ïÝñáðá ðüð éá ñðéīβóáðá éáé éá äãéáðáóðÞóáðá íÝí ððñÞíá (ΕὰοÛεάεί 9).

Δνιáέαιδιβζός: Άί δνιόδαέποάοά ίά δνιόάηδποάοά ιιόέέΰ CD ίά όγι άίόιεP mount(8) εά δνιέεζεάβ εάο' άέΰ÷έοοιι όόΰειά, P όόζ ÷άέηüδάηζ δάηδδóóζ kernel panic. ΌΎόιέα ιΎόά Ύ÷ιόι άίάέάέέάοιΎίάδ έüάέειδιέποάέο διό άέάóΎηιόι άδü όι όόιζεέοιΎιι όύόόζιá άη÷άβúι ISO.

8.2 Νύειέός όζό Εΰñόάο ¹ ÷ιό

8.2.1 Νöèìβæιιόάο όι Όύόόζιá

Δñεί ίάέειποάοά, εά δñΎδáε ίά ιΎñάόά όι ιιιόΎει όζό εΰñόάο διό Ύ÷άόά, όι ιειέεζñüιΎιι έýέέüιá διό ÷ñζόειδιέάβ, εάεθδ εάέ άί άβιáε PCI P ISA. Όι FreeBSD όδιόόζñβæάέ ίάáΰέζ διέέέέβá εάñθπι P÷ιό, óóóι PCI üóι εάέ ISA. ΆέΎáιόά όέδ όδιόόζñέæüιáíáδ όóóέáóΎδ P÷ιό όóέδ Όζιáέποάέδ ΌέέειΎ (<http://www.FreeBSD.org/releases/9.0R/hardware.html>) áέá ίá ááβóá άί ζ εΰñόά όάδ όδιόόζñβæáόáέ. Όόέδ Όζιáέποάέδ ΌέέειΎ άίáóΎñáόáέ áδβόζό διέι δñüáñáιá ιáPáζόζδ όδιόόζñβæάέ όζι εΰñόά όάδ.

Άέá ίá ÷ñζόειδιέέποάόά όζι όóóέáóP P÷ιό διό áέάέΎόάόά, εά δñΎδáε ίá óñθποάόά όιι εάóΰέεζει ιáçäü όóóέáóPδ. Άόóü ιδñáβ ίá άδέόάó÷έáβ ίá äýι όñüδιόδ. Ι άóειεüóáñüδ άβιáε áδεθδ ίá óñθποάόά Ύίá module (ΰñεñüιá) áέá όζι εΰñόά P÷ιό όóιι δññPíá, ÷ñζόειδιέέπιόάδ όζι άίόιεP kldload(8), ίá όζ άιPεάέá όζό áñáñPδ άίόιεπι:

```
# kldload snd_emu10k1
```

P δñιόέΎδιόάδ όζι εάóΰέεζεζ áñáñP όóι áñ÷άβι /boot/loader.conf üδüδ δάñáέΰδó:

```
snd_emu10k1_load="YES"
```

Όá δάñáδΰñü δάñáááβáιáόά άβιáε áέá ίέá εΰñόά P÷ιό Creative SoundBlaster® Live!. Όδΰñ÷ιόι áέáέΎόείá εάέ ΰέέá modules áέá εΰñόάδ P÷ιό εάέ ιδñáβóá ίá óá ááβóá όóι áñ÷άβι /boot/defaults/loader.conf. Άί áái áβóóá óβáññüδ áέá όι δñüáñáιá ιáPáζόζδ διό δñΎδáε ίá ÷ñζόειδιέέποάόά, ιδñáβóá ίá δñιόδαέποάόά ίá óñθποάόά όι module snd_driver:

```
# kldload snd_driver
```

Δñüέáέόáέ áέá Ύίá ίáόá-δñüáñáιá ιáPáζόζδ, όι ιδñβι óñθπιáε ίá ίέáδ üεá óá έιέιΰ δññáñΰñáόá ιáPáζόζδ áέá εΰñόάδ P÷ιό. Ιá όιι όñüδι άóóü ιδñáβóá ίá άδέόá÷ýíáόά όζι άιβ÷ίáόόζ áέá όι óóóóü ιáçäü. Ιδñáβóá áδβόζό ίá óñθποάόά üεá óá δññáñΰñáόá ιáPáζόζδ ιΎóü διό áñ÷άβι /boot/loader.conf.

Άί άδέέóιáβóá ίá áñáβóá όι άδέέááιΎιι δñüáñáιá ιáPáζόζδ όζό εΰñόάδ óáδ ίáδΰ όζ óññóóζ όιό snd_driver, ιδñáβóá ίá áεΎáíáόá όι áñ÷άβι /dev/sndstat ίá όζι áιPεάέá όζό άίόιεPδ cat /dev/sndstat.

Ιέá ááyόáηζ ιΎειáιό άβιáε ίá ίáόááέüδóβóáόá όζι όδιόόPñέιζ όζό εΰñόάδ P÷ιό óáδ, óóáóέέΰ, áδáóεáβáδ όóιι δññPíá. Όι δάñáέΰδóü όιPíá δάñΎ÷άέ όέδ δέçññññññδ διό ÷ñáέΰæáóóá áέá ίá δñιόέΎόάόά όδιόόPñέιζ áέá όι óέέέü óáδ ίá áóóü όιι όñüδι. Άέá δáñέóóóüáñáδ δέçññññññδ ó÷áóέέΰ ίá όζι ίáόááέθδóέόζ όιό δññPíá, ááβóá όι Έáóΰεάει 9.

8.2.1.1 Άçιέιθñáπιόάδ ΔñιόάññιόιΎιι ΔδñPíá ίá ΌδιόόPñέιζ ¹ ÷ιό

Άñ÷έέΰ, δñΎδáε ίá δñιόέΎόάόά όι ááiέέü δñüáñáιá ιáPáζόζδ P÷ιό (audio framework driver) sound(4) όóιι δññPíá óáδ. Έá ÷ñáέáóáδ ίá δñιόέΎόάόά όζι áεüειόεζ áñáñP όóι áñ÷άβι ñöèìβóáüι όιό δññPíá:

```
device sound
```



```
FreeBSD Audio Driver (newpcm)
Installed devices:
pcm0: <Intel ICH3 (82801CA)> at io 0xd800, 0xdc80 irq 5 bufisz 16384
kld snd_ich (1p/2r/0v channels duplex default)
```

Όά ιγίγιάοά οοί ογόογιά οάο ιδίνάβ ίά άβίάέ άεάοίνάοέέÛ. Αί άάί άάβόά οόοέάοÛ ογδίο pcm, άθεόοñÛοά έέέ άεÛάιόά οά άβίάόά θιό έÛίάόά θñιγάροιÛιò. ΈίέοÛίόά οί άñ ÷ άβι ñοείβοάυί θοñΠρία έέέ άάάέέέέάβόά υόέ Û ÷ άόά άθεέÛίάέ οί ούοόυ θñυάñάιá ιάΠαγόο. Άέά οοίΠεγ θñιέΠιαόά έέέ ογί άίόέιαόθδέογ οίτο, άάβόά οί οίΠια ΌίΠία 8.2.2.1.

Αί υέά θÛίά έέέÛ, γ έÛñόά Π ÷ ιό οάο έά έάέοιθñάάβ. Αί ι ιάγáυò CD Π DVD θιό έέέέÛόάά άβίάέ οόίάñÛιò ιά ογί έÛñόά Π ÷ ιό ιÛόυ ογò άίάέιáέέΠò οίò áñυάιò, ιδίνάβόά ίά áÛέάόά Ûίá ιιόóέέυ CD έέέ ίά οί άίάδαñÛάάόά ιά οί θñυάñάιá cdcontrol(1):

```
% cdcontrol -f /dev/acd0 play 1
```

¶έέάο άοάñιáÛ, υδύò οί audio/workman θάñÛ ÷ ιοί οέέέέυόάñι θάñέáÛέέιι άñάάόβάò. Ϝόυò èÛέάόά ίά άάέάόάόόΠόάόά ίέá άοάñιáΠ υδύò οί audio/mpg123 έέέ ίά άίάδαñÛάάόά άñ ÷ άβá Π ÷ ιό MP3.

ιάò Ûέέιò άñΠáιñιò οñυθιò έέέ ίά έέÛάιόά ογί έÛñόά Π ÷ ιό οάο, άβίάέ ίά οάβέάόά άάñÛÛίá οόγί οόóέάθΠ /dev/dsp, υδύò θάñάέÛóυ:

```
% cat filename > /dev/dsp
```

υθιò οί filename ιδίνάβ ίά άβίάέ ιθιέιáΠθιόά άñ ÷ άβι. Ç θάñάθÛιò άίόιέΠ έά θñÛθάέ ίά θάñÛάέ έÛθιέι Π ÷ ι (έυñόáι) άθεάάάέβιíόάο ογ ούοόΠ έάέοιθñάβá ογò έÛñόάο Π ÷ ιó.

Όγίáβύογ: Όά άñ ÷ άβá οόóέάθΠί /dev/dsp* άγίέιθñάιγίόάέ áóóυιáόά υóái ÷ ñáέÛέάόάέ. Άái οθÛñ ÷ ιοί áί άái ÷ ñόέιιθιέιγίόάέ έέέ άái έά áιόáίέóοιγί οόγί Ûιίáι ογò ls(1)

Ç Ûίόάόγ Π ÷ ιό ογò έÛñόάο ιδίνάβ ίά έέÛίáέ ιÛόυ ογò άίόιέΠò mixer(8). Δάñέóóυόάñáò θέçñιθιñβáò ιδίνάβόά ίά áñάβόά οόγί οάέβáá οίò manual ογò mixer(8).

8.2.2.1 ΌόιçέέόιÛίá ΔñιáεΠιαόά

Δñυάέçιά	Έγόç
sb_dspwr(XX) timed out bad irq XX	Άái άβίάέ ούοόÛ ñοείóιÛίç ç έγñá I/O. Όι IRQ άái άβίάέ ούοόÛ ñοείóιÛίñ. Άάάέέέέάβόά υόέ οί IRQ θιό Û ÷ άόά άçεΠόάέ άβίάέ οί βάέι ιά áóóυ θιό Û ÷ άέ ñοείóóάβ οόγί έÛñόá.
xxx: gus pcm not attached, out of memory	Άái οθÛñ ÷ έέ άñέάθΠ έέέέÛóέιç ιιΠιç έέέ ίά άβίάέ ÷ ñΠόç ογò οόóέάθΠò.
xxx: can't open /dev/dsp!	ΆέÛάιόά ιά ογί άιΠέάέά ογò άίόιέΠò fstat grep dsp áί έÛθιέá Ûέέç άοάñιáΠ áθάό ÷ ιέάβ ογ οόάέάέñéιÛίç οόóέάθΠ. ΌοίΠέάέό γθιθοιέ άβίάέ ç άóάñιáΠ esound έάέθò έέέ οί ογόοçιά οθιόòΠñéιçò Π ÷ ιó οίò θάñέáÛέέιíοιò KDE .

ιά áέυιá δñúáέçιά äçíέííñááβóáέ áðu íñέóιÝíáð óγá ÷ñííáð êÛñóáð äñáóέέπí íé ðíβáð δάñέÝ ÷íóí íέα äέέP ðίð òóóéáðP P ÷íò áέα ÷ñPόç ìÝòú óóíáÝóáúí HDMI P áíóβóóιέ ÷í. Óá íñέóιÝíáð δάñέððP óáέð, áβίάέ δέεárúí áóðP ç òóóéáðP íá áíóιðέóéáβ ðñέí òçí éáñíέέP êÛñóá P ÷íò íá áðίóÝέáóíá íá ðÛñáέ òç éÝóç òçð ðñíáðέéääìÝίç òóóéáðP ð P ÷íò. Áέα íá äέÝíáíóá áí óóíááβίáέ áóóú, áéòáéÝóóá òçí áíóιέP **dmesg** éάέ ϑÛíòá áέα òç éÝίç pcm. Ç Ýñáíò éá ìéÛάάέ ìá òçí δάñάέÛòú:

```
...
hdac0: HDA Driver Revision: 20100226_0142
hdac1: HDA Driver Revision: 20100226_0142
hdac0: HDA Codec #0: NVidia (Unknown)
hdac0: HDA Codec #1: NVidia (Unknown)
hdac0: HDA Codec #2: NVidia (Unknown)
hdac0: HDA Codec #3: NVidia (Unknown)
pcm0: <HDA NVidia (Unknown) PCM #0 DisplayPort> at cad 0 nid 1 on hdac0
pcm1: <HDA NVidia (Unknown) PCM #0 DisplayPort> at cad 1 nid 1 on hdac0
pcm2: <HDA NVidia (Unknown) PCM #0 DisplayPort> at cad 2 nid 1 on hdac0
pcm3: <HDA NVidia (Unknown) PCM #0 DisplayPort> at cad 3 nid 1 on hdac0
hdac1: HDA Codec #2: Realtek ALC889
pcm4: <HDA Realtek ALC889 PCM #0 Analog> at cad 2 nid 1 on hdac1
pcm5: <HDA Realtek ALC889 PCM #1 Analog> at cad 2 nid 1 on hdac1
pcm6: <HDA Realtek ALC889 PCM #2 Digital> at cad 2 nid 1 on hdac1
pcm7: <HDA Realtek ALC889 PCM #3 Digital> at cad 2 nid 1 on hdac1
...
```

Óóι δάñÛááέáíá íáð, ç êÛñóá äñáóέέπí (NVidia) áíóιðβóóçéá ðñέí òçí éáñíέέP êÛñóá P ÷íò (Realtek ALC889). Áέα íá ÷ñçóéιðίέP óáóá òçí δñááíáóέέP êÛñóá P ÷íò ùð òçí ðñíáðέéääìÝίç òóóéáðP P ÷íò, áέéÛíòá òι hw.snd.default_unit ùðùð óáβίáóáέ δάñάέÛòú:

```
# sysctl hw.snd.default_unit=n
```

Óι n áβίάέ í áñέéιùð òçð òóóéáðP ð ðíò éá ÷ñçóéιðίέçéáβ, óóι δάñÛááέáíá íáð òι 4. ΔñίóéÝóóá òçí δάñάέÛòú äñáñP óóι /etc/sysctl.conf áέα íá áβίάέ ìúίέç áóðP ç áέéááP:

```
hw.snd.default_unit=4
```

8.2.3 ×ñçóéιðίέPíóáð ΔίέéáðéÝð ΔçáÝð¹ ÷íò

Áβίάέ δίέéÝð òíñÝð áðééðιçòú íá Ý ÷íòíá ðίέéáðéÝð δçáÝð P ÷íò ðíò íá áíáðáñÛáñíóáé óáóóú ÷ñííá, ùðùð ùðáí áέα δάñÛááέáíá òι **esound** P òι **artsd** áái áðέóñÝðíóι éíéP ÷ñPόç òçð òóóéáðP ð P ÷íò óá éÛðίέα óóáéáñέíÝίç áóáñíáP.

Óι FreeBSD áðέóñÝðáέ áóðP òç éáέóιðñáβá ìÝòú òúí *Áέέίέέπí Éáíáέέπí¹ ÷íò* (Virtual Sound Channels), óá ìðíβá ìðíñίý íá áíáñáíðίέçéíýí ìÝòú òúí áðíáðíðP ðúι ðíò δάñÝ ÷ίíóáέ áðu òι sysctl(8). Óá ÁέέίέέÛ ÉáíÛέέα óáð áðέóñÝðíóι íá ðίéððéÝíáðá òιòð P ÷íò ðíò áíáðáñÛááέ ç êÛñóá óáð, áíáίéáίýííóáð òιí P ÷íòí ðçñPíá.

Áέα íá ñòèìβóáðá òι ðéPèð òúí áέέίέέπí éáíáέέπí, ððÛñ ÷íóí ðñáέð ñòèìβóáέð sysctl ðíò ìðíñίý íá áβíòí áí áβóóá ì ÷ñPóçòò root, ùðùð óáβίáóáέ δάñάέÛòú:

```
# sysctl dev.pcm.0.play.vchans=4
# sysctl dev.pcm.0.rec.vchans=4
# sysctl hw.snd.maxautovchans=4
```


Όι **mpg123** ιδιναβ ία έεοάεάοόάβ έάεινβαιίόάο ός οόόεάοP P÷ιό έάέ οι αν÷άβι MP3 ός ανάνP άίόιεP. ΈαυηPρίόάο υόέ ς οόόεάοP P÷ιό άβίάέ οι /dev/dsp1.0 έάέ εΎεάόά ία άιάόάνΎαάόά οι αν÷άβι *Foobar-GreatestHits.mp3*, έα ÷ηςόειιδιέPόάόά όςί άανάέΎόου άίόιεP:

```
# mpg123 -a /dev/dsp1.0 Foobar-GreatestHits.mp3
High Performance MPEG 1.0/2.0/2.5 Audio Player for Layer 1, 2 and 3.
Version 0.59r (1999/Jun/15). Written and copyrights by Michael Hipp.
Uses code from various people. See 'README' for more!
THIS SOFTWARE COMES WITH ABSOLUTELY NO WARRANTY! USE AT YOUR OWN RISK!
```

Playing MPEG stream from Foobar-GreatestHits.mp3 ...
MPEG 1.0 layer III, 128 kbit/s, 44100 Hz joint-stereo

8.3.2 ΆδιεPεάόός (Rip) Άν÷άβυί άδύ ιιόόέΎ CD

Δηεί έυάέειδιέPόάόά Ύία ιευέεçñi CD P Ύία έιñΎόέ άδύ CD όά αν÷άβι MP3, έά δñΎάέ ία άίόεάνΎόάόά όά ιιόόέΎ άάάνΎία άδύ οι CD όοι όεεçñü όάό άβόει. Άόόυ άβίάόάέ ανΎοιιόάό όά άάάνΎία όύδιό CDDA (CD Digital Audio) όά αν÷άβά WAV.

Όι άνάέάβι *cdda2wav*, οι ιδιβι άίPεάέ ός όόεειP άνάέάβυί *sysutils/cdrtools* ιδιναβ ία ÷ηςόειιδιέçεάβ όυοι έάέ όςί άίΎέόός όυι άάάνΎιυι P÷ιό άδύ ιιόόέΎ CD, υοι έάέ δεçñiοιηέPι διό ό÷άόβαιίόάέ ιά άόόΎ.

÷ιιόάό οι ιιόόέΎ CD όοιι ιαçaü, ιδιναβόά ία ÷ηςόειιδιέPόάόά όςί άέυειόεç άίόιεP (υò root) έάέ ία άδιεçέάύόάόά Ύία ιευέεçñi CD όά ÷ηέόόΎ (άίΎ έιñΎόέ) αν÷άβά WAV:

```
# cdda2wav -D 0,1,0 -B
```

Όι **cdda2wav** όδιόόçñβαιέ ιαçaü CDROM όύδιό ATAPI (IDE). Άέά ία έάάΎόάόά άάάνΎία άδύ ιεά οόόεάοP IDE, ÷ηςόειιδιέPόάόά οι υινα όόόεάοP άίόβ έάέ οιι ανέειυ ιιΎάάό SCSI. Άέά άάνΎάάειά, έάέ ία άδιεçέάύόάόά οι έιñΎόέ 7 άδύ Ύία ιαçaü IDE:

```
# cdda2wav -D /dev/acd0 -t 7
```

Όι -D 0,1,0 άάβ÷ίάέ ός οόόεάοP SCSI 0,1,0, διό άίόέόοιέ÷άβ όόςί Ύιαι όçό άίόιεPò *cdrecord -scanbus*.

Άέά ία έάάΎόάόά ιαιιυιΎία έιñΎόέά, ÷ηςόειιδιέPόάόά όςί άδεειP -t υδύο όάβίάόάέ άανάέΎόου:

```
# cdda2wav -D 0,1,0 -t 7
```

Όι άάνΎάάειά άόόυ έάάΎάέ οι έιñΎόέ άόόΎ οι ιιόόέΎ CD. Άέά ία έάάΎόάόά ιεά όάένΎ άδύ έιñΎόέά, έάέ άάνΎάάειά άδύ οι Ύία υò οι άόόΎ, έάεινβόά ίεά άάνει÷P:

```
# cdda2wav -D 0,1,0 -t 1+7
```

Ιδιναβόά άδβόçό ία ÷ηςόειιδιέPόάόά οι αιçεçόέέυ δñυάναίά *dd(1)* έάέ ία έάάΎόάόά ιιόόέΎ έιñΎόέά άδύ ιαçaü ATAPI. ΆέάΎόάόά οι ΌιPιά 19.6.5 έάέ άάνέόόυόάηάό δεçñiοιηβαό ό÷άόέΎ ιά άόόP ός άοίάόυόçόά.

8.3.3 Έυαέειδιέριόαο MP3

Όόεο ιΎñάο ιάο, οι δñιόειρηάñ δñυάñάιá èυαέειδιβζόο άβιάέ οι **Lame**. Ιδιñάβόά ίά οι άñάβόά όοζ όόεειάP όυι ports, όόι audio/lame.

×ñζόειδιέριόαο όά άñ÷άβι WAV διω Ύ÷άοά άδιεζέάγύοάέ, ιδιñάβόά ίά ιάόάοñΎφάόά οι άñ÷άβι audio01.wav όά audio01.mp3 ιά όζι άίόιεP:

```
# lame -h -b 128 \
--tt "Foo Song Title" \
--ta "FooBar Artist" \
--tl "FooBar Album" \
--ty "2001" \
--tc "Ripped and encoded by Foo" \
--tg "Genre" \
audio01.wav audio01.mp3
```

Όά 128 kbits άβιάέ ζ όόδεέÛ ÷ñζόειδιέριόαίζ διέυόζόά áέά άñ÷άβι MP3. Ûόόυοί, διεειβ δñιόειριί ιάάέγόάñζ διέυόζόά ùδùδ 160 P 192. ¼όι ιάάέγόάñζ άβιάέ ι ñόειυδ ááññΎñι (bitrate), όυοί δάñέόόυόάññ ÷ññ άδιεPέάόόζό έά ÷ñάέÛάάόάέ οι άñ÷άβι MP3 διω έά δñιέγφάέ, ùόόυοί έάέ ζ διέυόζόά έά άβιάέ όζζέυόάñζ. Ç άδεειάP -h άίάñάιδιέάβ όζ άόιáόυόζόά “όζζέυόάñζ διέυόζόά áέÛ áέάόñÛ δέι άñάPδ èυαέειδιβζόο”. Ιέ άδεειάΎδ διω ιάέειγί ιά --t ááβ÷ñιόι άόέέΎόάδ (tags) ID3, ιέ ιδιβάδ όοιPèùδ δάñέΎ÷ιόι δεζñιόιñβάδ ό÷άόέέΎδ ιά οι όñάαίγáέ έάέ ιέ ιδιβάδ ιδιñιγί ίά άίόυιáόυειγί ιΎόά όά άñ÷άβι MP3. Ιδιñάβόά ίά άñάβόά δάñέόόυόάññάδ άδεειάΎδ ό÷άόέέÛ ιά όζι èυαέειδιβζόζ, άί όόιáιόέάόάβόά όζ όάέβáά manual διω δñιáñÛιáόιò **lame**.

8.3.4 Άδιέυαέειδιέριόαο MP3

Άέά ίά ιδιñΎόάόά ίά άñÛφάόά ñζόέέυ CD áδυ άñ÷άβι MP3, έά δñΎδáέ ίά όά ιάόάοñΎφάόά ίάíÛ όά ññόP áόοιδβáόόιò άñ÷άβι WAV. Όυοί οι **XMMS** ùοί έάέ οι **mpg123** όδιόόζñβειόι άίááñάP άñ÷άβι MP3 όά áόοιδβáόόζ ññόP άñ÷άβι.

ΆñÛοιόάδ όοι Άβόει ιΎόυ όιò **XMMS**:

1. ΙάέειPόά οι **XMMS**.
2. ÈÛιόά ááñβ èέέ όοι δάñÛέδñι όζδ άόάññιáPδ áέά ίά άñβιáόά οι ιáñγ όιò **XMMS**.
3. ΆδεέΎιόά Preferences áδυ όά Options.
4. ΆέÛÛιόά οι Output Plugin όά “Disk Writer Plugin”.
5. ΔέΎόά Configure.
6. ΆñÛφά (P άδεέΎιόά browse) Ύίá έáóÛειάι áέά ίά άδιεζέάγύόάόά όά άδιόόιδεάόιΎίá άñ÷άβι.
7. ΌιñόPόά οι άñ÷άβι MP3 όοι **XMMS** ùδùδ όοιPèùδ, ιά όζι Ύιόάόζ όοι 100% έάέ όέδ ñόειβόάέδ EQ άίáíáñáΎδ.
8. ΔέΎόά οι Play. Όι **XMMS** έά όάβιáόάέ ùέέ άίáδáñÛááέ οι MP3, áέÛ ááñ έά áειγáάόάέ έάίáβδ P÷ιò. Όόζι δñάáιáόέέυόζόά άίáδáñÛááέ οι MP3 όά άñ÷άβι.
9. ¼όάί όáέάέPόάόά, áááέέυέάβόά ùέέ άδάíáóΎñάόά όζ ñγέιέόζ όιò δñιáδέέááιΎñιò Output Plugin όόζι δñιζáιγίáíζ άδεειάP όζδ, áέά ίά ιδιñΎόάόά ίά áειγύόάόά ίάíÛ άñ÷άβι MP3.

ΆñÛοιόάδ όόζι Ύñιá ιΎόυ όιò **mpg123**:

1. ÅêôåëÝóðå mpg123 -s audio01.mp3 > audio01.pcm

Õì **XMMS** àñÛóåé àñ ÷ åáá óå ìñòÞ WAV, àìÞ ðì **mpg123** ìåðáòñÝðåé ðì MP3 óå ìç- àðåìñåáóìÝíá (raw) åååñÝíá Þ ÷ ðò PCM. Èåé ðé åÿì áððÝð ìñòÝð ðìñìÝíí íá ÷ ðçóéììðìέççéìÝíì ìå ðçí áóåñììåÞ **cdrecord** åéå ðç àçìέìòñåá ìðóέéÞí CD. Åéå ðçí åóåñììåÞ **burncd(8)** èå ðñÝðåé íá ÷ ðçóéììðìέççéìÝíì åååñÝíá PCM. Áí ÷ ðçóéììðìέççéìÝíì àñ ÷ åáá WAV èå ðñååðçñÞóåðå Ýíá ðéεñù Þ ÷ ðì (tick) ððçí àñ ÷ Þ èÛεå èìñìáðéìÝ. Ì Þ ÷ ðò áððùð ðñìÝñ ÷ ððåé åðù ðçí àðéååðåèååå (header) ðìò àñ ÷ åèìò WAV. Ìðìñåèåå íá áóåñÝóåðå ðçí àðéååðåèååå ìå ðç àðéååé ðìò ðñìåñÛìååòð **SoX** (ðìñåèåå íá ðì ååéåðåððåðåðå åðù ðì port **audio/sox Þ** ðì áíðòòðìέ ÷ ðì ðåéÝòì):

```
% sox -t wav -r 44100 -s -w -c 2 track.wav track.raw
```

ÅéååÛóðå ðì ÕìÞíá 19.6 åéå ðñåéóóùðåñåð ðççñììðìñåð ð ÷ åðééÛ ìå ðç ÷ ðÞóç CD åååñåòÞð ððì FreeBSD

8.4 ÁíåðåñååùåÞ Video

Ç áíåðåñååùåÞ video åèíåé ðéå èåéìÝñéå èåé ðñåååèåå áíåððòòòùìåíå ðñåñì ÷ Þ åóåñììåÞ. Èå ÷ ðñååóðåè íá ååèååðå ððñìñÞ. Ååí ðñùèèåéðåé íá èåéòìòñåÞóòìò ðéå ðùóì ðñåÛ ððòò ððì Þ ÷ ðì.

ðñéì ðñåéìÞóåðå, èå ðñÝðåé íá àñññåèååðå ðì ðìðÝéì ðçð èÛñðåð åñåðéèÞ ðìò Ý ÷ åðå èåèðð èåé ðì ðéìéççñùìÝíì èÿéèùìå ðìò ÷ ðçóéììðìέççéìÝíì. Áí èåé ðì **Xorg** ððìððçññååé ìååÛεç åéÛìå åðù èÛñðåð åñåðéèÞ, áððÝð ðìò ðåñÝ ÷ ðìò èåèÞ åðùåòç åèíåé èéåùðåñåð. Åéå íá ðÛñåðå ðéå èèðåð ðùì åéðåðåìÝíì àóìåðìððòùì ðìò ððìððçññåèìðåé åðù ðçí èÛñðåð óåð, ÷ ðçóéììðìέççéìÝíì ðçí àíðìèÞ xdpinfo(1) ðçí þñå ðìò åéðåèìÝíìðåé ðå X11.

Åèíåé ååìééÛ èåèÞ èåÝå íá Ý ÷ åðå Ýíá ðéεñù àñ ÷ åèìò MPEG ðì ððìèì ððìñåè íá ÷ ðçóéììðìέççéìÝíì åéå àèééìÝð åéåòìñåðéèÞ åðééìåÞ èåé ðñìåñåñìÛðùì áíåðåñååùåÞð. ÈÛðìéå ðñìåñÛìååðå áíåðåñååùåÞð DVD áíåççðìÝíì åðù ðñìåðéèìåÞ ðì åèðèì DVD ððç ððóéåðÞ /dev/dvd. Õå ðñééòìÝíì ðì ðñìå ðçð ððóéåððð åèíåé áíòùìåðùìÝíì ððì èÞåéåð ðìò ðñìåñÛìååòð. Åéå ðì èùåì áððù, Þòðð åèíåé ÷ ðÞóéìì ðå ððéÛìåðå ðèìåèéééÝð ððìåÝóåéð ðñìð ðéð ðñåñìåðééÝð ððóéåðÝð:

```
# ln -sf /dev/acd0 /dev/dvd  
# ln -sf /dev/acd0 /dev/r dvd
```

ÕçìåèÞððå ððé èùåù ðçð ðÿóçð ðìò ððóðÞíåððð devfs(5), åððìÝ ðìò åèèìòð ðé ððìåÝóåéð ååí ðñåñìÝíìðìò ìåðÛ ðçí åðåñåèèççç ðìò ððóðÞíåððð óåð. Åéå íá àçìέìòñåñìÝíìðé ððìåèéééÝð ððìåÝóåéð åððùìåðå óå èÛεå åèèèççç ðìò ððóðÞíåððð óåð, ðñìòéÝððå ðéð åèèèðéèåð åñåñìÝð ððì àñ ÷ åèìò /etc/devfs.conf:

```
link acd0 dvd  
link acd0 rdvd
```

Åðéðñùèåðå, ç àðìèùåéèìèÞççç DVD, ç ððìèå ÷ ðñåéÛååðåé èèÞóç åéåèèÞ èåéòìòñåèÞ ðìò DVD-ROM, åðåéðåè èåé Ûååéå åååñåòÞð (write permission) ððéð ððóéåðÝð DVD.

Åéå ðç ååèòèùóç ðçð èåéòìòñåèåð ðçð èèèìì ÷ ðçóçðç ðìÞçð ðìò ððóðÞíåððð X11, ððìèððåðåé íá åðìÞóåðå ðéð ðéìÝð èÛðìéùì ìåðååççðÞì sysctl(8):

```
kern.ipc.shmmax=67108864  
kern.ipc.shmall=32768
```

8.4.1 Δñιόάειñέοιιυò Æíáοιòβουί ÊÛñοάò Æñάοέεπí

ÕðÛñ ÷ ιοί άñέάοιβ άεάοιñάοέειβ ðñυδιέ άέα ðçí άðάέειυέος video óοι X11. Õι ðé έά άιρεΎθάέ ðάεέέÛ, άίάñοÛόάέ óά ίάάÛει άάειυ άðu ðι ðεέειυ óάð. ÊÛεά ίΎειάρð ðιò ðάñέάñÛοιοιά ðάñάέÛòυ έά άβόάέ άεάοιñάοέεεβ ðιέυòçóά óά άεάοιñάοέέειυ ðεέέειυ. Æðβòçð, ç άίάðάñάάυάβ video óοι X11 άβίάέ Ύία èΎία óοι ιθιβι ðñυóóάόά άβίάόάέ ίάάÛεç óçιάόβά, έάέ ðεέάίυί έά ððÛñ ÷ ιοί άñέάòΎò άάεðέβόάέð óά εÛεά ίΎά Ύέαιόç ðιò **Xorg**.

ΈάðÛειάρð ειείπí άεάðάòβí video:

1. X11: ÓοίçεέοιΎίç Ύίιάρð ðιò X11 ίά ÷ ñβóç ειείυ ÷ ñçóðçð ίίβιçð.
2. XVideo: ίέα άðΎέðάόç ðçð άεάðάòβò X11 ðιò ððιόðçñβεάέ άίάðάñάάυάβ video óά ιðιέάάβðιòά ó ÷ άάέÛόείç άðέóÛίάέά ðιò X11.
3. SDL: Simple Directmedia Layer.
4. DGA: Direct Graphics Access.
5. SVGAlib: Æðβðάάι άñάόέεπí ÷ άιçεiy άðέðΎάιò άέα είιούέά.

8.4.1.1 XVideo

Õι **Xorg** άεάέΎόάέ ίέα άðΎέðάόç ðιò ιιñÛεάðάέ *XVideo* (άιυòðβ έάέ υò Xvideo, Xv, xv) έάέ ðι ιθιβι άðέðñΎðάέ ðçí άðάòèάβάð άðάέειυέος video óά ó ÷ άάέÛόεία άίðέέάβιάρά ίΎούυ άέάέεβð άðέóÛ ÷ ðιόçð. Ç άðΎέðάόç άððβ ðάñΎ ÷ άέ άίάðάñάάυάβ ðιέy έάέβð ðιέυòçóάð, áέυιá έάέ óά ιç ÷ άίβιáðá ÷ άιçεπí ðñιέάάñάòβí.

Άέα ίά άάβðά άί ÷ ñçóέιιðιέάβðάέ ç άðΎέðάόç, ÷ ñçóέιιðιέβðóά ðçí άíòιέβ xvinfo:

```
% xvinfo
```

Õι XVideo ððιόðçñβεάðάέ άðu ðçí εÛñòά óάð άί ðι άðιðΎέάοιá άάβ ÷ ίάέ υðυð ðάñάέÛòυ:

```
X-Video Extension version 2.2
screen #0
  Adaptor #0: "Savage Streams Engine"
    number of ports: 1
    port base: 43
    operations supported: PutImage
    supported visuals:
      depth 16, visualID 0x22
      depth 16, visualID 0x23
    number of attributes: 5
      "XV_COLORKEY" (range 0 to 16777215)
        client settable attribute
        client gettable attribute (current value is 2110)
      "XV_BRIGHTNESS" (range -128 to 127)
        client settable attribute
        client gettable attribute (current value is 0)
      "XV_CONTRAST" (range 0 to 255)
        client settable attribute
        client gettable attribute (current value is 128)
      "XV_SATURATION" (range 0 to 255)
        client settable attribute
        client gettable attribute (current value is 128)
      "XV_HUE" (range -180 to 180)
```

```

        client settable attribute
        client gettable attribute (current value is 0)
maximum XvImage size: 1024 x 1024
Number of image formats: 7
  id: 0x32595559 (YUY2)
    guid: 59555932-0000-0010-8000-00aa00389b71
    bits per pixel: 16
    number of planes: 1
    type: YUV (packed)
  id: 0x32315659 (YV12)
    guid: 59563132-0000-0010-8000-00aa00389b71
    bits per pixel: 12
    number of planes: 3
    type: YUV (planar)
  id: 0x30323449 (I420)
    guid: 49343230-0000-0010-8000-00aa00389b71
    bits per pixel: 12
    number of planes: 3
    type: YUV (planar)
  id: 0x36315652 (RV16)
    guid: 52563135-0000-0000-0000-000000000000
    bits per pixel: 16
    number of planes: 1
    type: RGB (packed)
    depth: 0
    red, green, blue masks: 0x1f, 0x3e0, 0x7c00
  id: 0x35315652 (RV15)
    guid: 52563136-0000-0000-0000-000000000000
    bits per pixel: 16
    number of planes: 1
    type: RGB (packed)
    depth: 0
    red, green, blue masks: 0x1f, 0x7e0, 0xf800
  id: 0x31313259 (Y211)
    guid: 59323131-0000-0010-8000-00aa00389b71
    bits per pixel: 6
    number of planes: 3
    type: YUV (packed)
  id: 0x0
    guid: 00000000-0000-0000-0000-000000000000
    bits per pixel: 0
    number of planes: 0
    type: RGB (packed)
    depth: 1
    red, green, blue masks: 0x0, 0x0, 0x0

```

ΔάñáôçñΠóôâ âðβçð ùéé óá formats ðĩö àìöáíβæĩíóáé (YUV2, YUV12, ê.ê.ð.) äáí äéáôβèáíóáé óá üèàð óéð äèäüóáéð òĩö XVideo, éáé ç äðĩóóβá òĩöð ìðĩñâβ íá äðçñâÛóáé êÛðĩéá ðñĩññÛĩñáóá áíáðñáñáñâð.

Áí òĩ äðĩòÝèáóíá äâβ÷íáé êÛðùð Ýóóé:

```

X-Video Extension version 2.2
screen #0
no adaptors present

```


¼όάί άñΰοίίόάί άόδου όί έάβίάíí, όί port όίö **MPlayer** άçίείöñáíýóά άδβόçð όçί όάέιçñβùόç όίö ðñíáñΰííάόίö έάέ άýí άέδóάέΎόείά, όίí mplayer, έάέ όίí mencoder, όί ίδίβί άβίάέ Ύίά άñάάέάβί áέά άδάíάέùάέέίδίβçόç video.

Ç HTML όάέιçñβùόç όίö **MPlayer** άβίάέ έάέάβδóάñά δέçñíοίíñέάέP. Áí í áíááíρβόçð άñάέ üóέ íέ δέçñíοίíñβáδ άόδóíý όίö έάóάέάβίö uοί άοίñΰ όί öέέü έάέ óέδ áέάδóáΎδ video άβίάέ άέέέδáβδ, ç όάέιçñβùόç όίö **MPlayer** άδίοάέάβ Ύίά έάέάβδóάñά áíάέδóέέü öοίδεPñüíá. Έά ðñΎδáέ óβáíöñά íά áέάέΎόάόά ÷ñüíí áέά íά áέάáΰόάόά όçί όάέιçñβùόç όίö **MPlayer** áí áíάάçðΰόά δέçñíοίíñβáδ ó÷: άóέέΰ íά όçί όδίοδPñέίç video óοί UNIX.

8.4.2.1.2 ×ñçόέίíδίέβίόάδ όίí MPlayer

Έΰέά ÷ñPβόçð όίö **MPlayer** ðñΎδáέ íά άçίείöñáPβóάέ Ύίά όδίέάδΰέíáí .mplayer íΎόά óοίí ðñíóυδέέü όίö έάόΰέíáí. Áέά íά άçίείöñáPβóάόά όίí άδóáñáβδóçόί όδίέάδΰέíáí, ίδίñáβδóά íά άñΰφάόά όί δáñάέΰóυ:

```
% cd /usr/ports/multimedia/mplayer
% make install-user
```

Íé άδέέíáΎδ όçð άñáííPδ áíοίέβί όίö mplayer δáñέáñΰοίíόάέ óόç óάέβáá όίö manual. Áέά áέüíá δáñέóóυδóáñáδ έáδδóííΎñáέáδ, óδΰñ ÷: áέ όάέιçñβùόç óά íñöP HTML. Óοί όίPíá άóδου έá δáñέáñΰφοίíά íáñέέΎδ íüíí έίέíΎδ ÷ñPβóάέδ.

Áέά íά áíάδáñΰááόά Ύίά άñ÷:άβί, üδùδ όί testfile.avi, íΎóυ άíüδ άδύ όά άñέáδΰ video interfaces ÷ñçόέííδίέβίόάόά όçί άδέέíáP -vo:

```
% mplayer -vo xv testfile.avi
% mplayer -vo sdl testfile.avi
% mplayer -vo x11 testfile.avi
# mplayer -vo dga testfile.avi
# mplayer -vo 'sdl:dga' testfile.avi
```

Áíβáέέ όίí έüδί íά áíέέíΰόάόά üέáδ άóδΎδ óέδ άδέέíáΎδ, έάέρδ ç άδύáíόç όίöδ áíáñδΰόάέ άδύ δίεεíýδ δáñΰáííóáδ έάέ áέáοίííδίέέáβδóάέ άñέáδΰ áíΰέíáí íά όί öέέü όίö όδίέíáέóδP óáδ.

Áέά áíάδáñááüáP άδύ DVD, áíόέέáόáóδPβóά όί testfile.avi íά dvd://N -dvd-device DEVICE üδίö όί N άβίάέ í áñέέíüδ όίö όβδóέíö (title number) δίö άδέέδίáβδóά íά áíάδáñΰááόά έάέ DEVICE άβίάέ όί üíñá óóóέáδPδ όίö DVD-ROM. Áέά δáñΰááέéáí, áέά íά áíάδáñΰááόά όίí όβδóέí 3 άδύ όç óóóέáδP /dev/dvd:

```
# mplayer -vo xv dvd://3 -dvd-device /dev/dvd
```

Óçíáβùόç: Ç ðñíáδέέéááíΎίç óóóέáδP DVD ίδίñáβ íά έáέίñέóóáβ έáδΰ όç áέΰñέáέά όçð íáδóáέρδδóέóç όίö **MPlayer** port íΎóυ όçð άδέέéíáPδ WITH_DVD_DEVICE. Áδύ ðñíáδέέéíáP, ç óóóέáδP άóδP άβίάέ ç /dev/acd0. Íδίñáβδóά íά άñáβδóά δáñέóóυδóáñáδ δέçñíοίíñβáδ óοί άñ÷:άβί Makefile όίö port.

Áέά όά δεPέδñά δίö ÷ñçόέííδίέíýíόάέ áέά δáýόç, áέáέíδP, íáóáέβίçόç έέδ. έáóΰ όç áέΰñέáέά όçð áíάδáñááüáPδ, óοίáíöέáδδóáβδóά όçί áíPέáέά δίö ίδίñáβδóά íά ááβδóά áέδóáέβίόáδ mplayer -h P áέάáΰόά όç óάέβáá όίö manual.

Áδέδñüóέáόά, óçíáíóέέΎδ άδέέíáΎδ áíάδáñááüáPδ άβίάέ: -fs -zoom όί ίδίβί áíáñáíδίέέáβ άδáέέüíέóç óά δεPñç ðέüíç έάέ όί -framedrop όί ίδίβί áίçεΰáέ óόçί áýíçόç όçð άδύáíόçð.

Άέά ίά ίάβίάέ οί ίΎάάεῖδὸ όçð ãñáñΠð áíóῖεῖΠί οί áóíáóυί ίέεñú, í ÷ ñΠóçð ðῖñάβ ίά äçíεῖðñáΠóάέ Ύίá áñ÷áβί .mplayer/config έάέ ίά ίñβόάέ áέáβ ðεð ðññáðέέááίΎίáð áðέέίáΎð:

```
vo=xv
fs=yes
zoom=yes
```

ΌΎεῖð, í mplayer ðῖñάβ ίά ÷ ñçóέίῖðῖεçεáβ áέá όçí áíááùáΠ (rip) áúìð ðβðεῖð DVD óá Ύίá áñ÷áβί .vob file. Άέά όçí áíááùáΠ ðῖð ááyðáñῖð ðβðεῖð áðü Ύίá DVD, áñÛððá:

```
# mplayer -dumpstream -dumpfile out.vob dvd://2 -dvd-device /dev/dvd
```

Όῖ áñ÷áβί áñúáῖð, out.vob, έá áβίáέ όýðῖð MPEG έάέ ðῖñάβðá ίά ðῖ ίáðá÷áέñέóóáβðá ίΎóú Ûέεῖῖ ðáέΎóῖῖ video ðῖð ðáñέáñÛῖῖίóáέ óá áððü ðῖ ðῖΠá.

8.4.2.1.3 mencoder

Δñέί ÷ ñçóέίῖðῖεçεáβðá ðῖ mencoder áβίáέ έάέΠ έáΎá ίά áñῖέέáέúεáβðá ίá ðεð áðέέίáΎð ðῖð áíáóΎñῖíóáέ óóçí óáέίçñβùóç HTML. ΌðÛñ÷áέ óáέβáá manual, áέέÛ ááí áβίáέ ðῖéý ÷ ñΠóέίç ÷ ùñβð όçí HTML óáέίçñβùóç. ΌðÛñ÷áῖῖ ðÛñá ðῖεεῖβ ðñúðῖé áέá ίá ááέðεῖðáðá όçí ðῖεúóçðá, ίá ίáεῖðáðá ðῖ ñðεῖῖ áááñΎῖῖῖ (bitrate) ίá áέέÛῖáðá ῖñòΠ áñ÷áβῖð, έάέ έÛðῖéá áðü áððÛ óá έúεðá ðῖñάβ ίá έÛñῖῖ όç áέáῖῖñÛ ίáðáίý έάέΠð έάέ έάέΠð áðüáῖðçð. Άðῖ έá ááβðá ίáñέέÛ ðáñáááβáῖáóá áέá ίá ίáέέίΠóáðá. Δñῖðá ίέá áðέΠ áíóέáñáðΠ:

```
% mencoder input.avi -oac copy -ovc copy -o output.avi
```

ΈáῖέáóίΎῖῖέ óῖíáðáóῖῖβ óóç áñáñΠ áíóῖεῖΠ, ðῖñάβ ίá áῖóῖῖí áñ÷áβá áñúáῖð óá ῖðῖβá ááí ðῖñάβ ίá áíáðáñÛááέ ῖýðá ῖ βáέῖð ῖ mplayer. ðóέ, áí áðέðð èΎέáðá ίá έÛῖáðá rip Ύίá áñ÷áβί, ίáβίáðá óóçí áðέέίáΠ -dumpfile ðῖð mplayer. Άέá ίá ίáðáðñΎðáðá ðῖ input.avi óá codec MPEG4 ίá Π÷ῖ MPEG3 (áðáέóáβðáέ ðῖ audio/lame):

```
% mencoder input.avi -oac mp3lame -lameopts br=192 \
-ovc lavc -lavcopts vcodec=mpeg4:vhq -o output.avi
```

Ίá ðῖῖ ðñúðῖ áððü ðáñÛááðáέ Ύῖῖῖð ðῖð ðῖñάβ ίá áíáðáñá÷έáβ áðü ðῖῖ mplayer έάέ ðῖ xine.

Ίðῖñáβðá ίá áíóέέáðáóðΠóáðá ðῖ input.avi ίá όçí áðέέίáΠ dvd://1 -dvd-device /dev/dvd έάέ ίá ðῖ áέðáέΎóáðá ùð root áέá ίá áðáíáέúáέέῖῖῖéΠóáðá áðáðέáβáð Ύίá ðβðεῖ DVD. Ίέá έάέ ðέέáῖΠð ááí έá ίáβίáðá έέáñῖῖéçíΎῖῖð ίá ðῖ áðῖðΎέáðáίá áðü όçí ðñῖðç ῖῖñÛ, óáð óῖíέóóῖῖῖίá ίá έáðááÛóáðá ðῖῖ ðβðεῖ óá Ύίá áñ÷áβί έάέ ίá ῖῖðέΎðáðá óá áððü.

8.4.2.2 Όῖ Δññúáñáῖá Áíáðáñááùáβðð xine

Όῖ xine áβίáέ Ύίá project ίá áðñý óέῖῖðü, ðῖ ῖðῖβῖ ðñῖññβæáðáέ ú÷έ ῖῖῖ ίá áβίáέ Ύίá ðññúáñáῖá ῖέá óá Ύίá ῖῖῖ áῖῖñÛ ðῖ video, áέέÛ áðβóçð óῖῖ ίá ðáñÛááέ ίέá áðáíá÷ñçóέῖῖðῖéΠóέίç ááóέέΠ áέáέέῖῖεῖΠεç έάέ Ύίá áñèñúðü áέðáέΎóέῖῖ ðῖ ῖðῖβῖ ðῖñάβ ίá áðáέðáέáβ ίá ðñῖóέáðá (plugins). Ίðῖñáβðá ίá ðῖ ááέáðáóðΠóáðá ðῖῖῖ áðü ðáέΎðῖ, ῖῖῖ έάέ áðü ðῖ port, multimedia/xine.

Όῖ xine áβίáέ áέῖῖá έÛððð ÷ ῖῖðñῖῖñῖΎῖῖ, áέέÛ óβáῖῖñá Ύ÷áέ ῖáέέίΠóáέ έάέÛ. Όóçí ðñÛῖç, ðῖ xine ÷ ñáέÛæáðáέ áβðá áñΠáῖῖῖ áðáíáñááóðΠ έάέ έÛñðá áñáóέέῖΠ, Π ðῖῖῖðΠñéíç όçð áðΎέðáóçð XVideo. Όῖ áñáóέέῖῖ ðáñέáÛέέῖῖ áβίáέ ÷ ñçóέῖῖðῖéΠóέῖῖ, áέέÛ έÛððð ááΎῖέá ððέááῖΎῖῖ.

Όçί þñá ðìò àñÙòìíóáí áððÝð ðε àñàìÙð àáí àεάíÝììóáí module ðáεβ ðá όçí àóáñììð **xine**, έεάíú ðá áíáðáñÙááε DVD ðá CSS εùάεέìðìβçç. ΌðÙñ÷ìòí àεαùìόάεð áðù ðñβðìòð έáðάόέάðóáóÝð ðε ðìβáð Ý÷ìòí áíóúìáðùìÝíì ðì ðáñáðÙíú module áεεÙ έáíεÙ áðù áððÝð àáí àñβόέάόáε όðçí όðεéìð ðùí ports ðìò FreeBSD.

Όá όýáεñεόç ðá ðìí **MPlayer**, ðì **xine** εÙίáε ðáñεόóúðáñá áεά ðì ÷ñÐόç, áεεÙ όçí βáέá όðεáìð, àáí áðéðñÝðáε ðùòì εάððñàñáέέεù Ýέά÷ì. Όí **xine** áðìάβááε έáεýόáñá όá έáéðìòñάβá XVideo.

Άðù ðñìάðééìð, ðì **xine** εá ðáεéíÐόáε όá àñάόέεù ðáñέáÙέéìí (GUI). Ìðìñáβόá ðá ÷ñçόéìðìéÐόáóá ðì ðáíúý áεά ðá áñìβίáðá Ýíá óáεéàεñéìÝíì àñ÷áβì:

```
% xine
```

ΆíáεεάéðééÉ, ðìñáβόá ðá ðì έáéÝóáðá ðá áíáðáñÙááε Ýíá àñ÷áβì áðáðéάβáð áðù όçí àñàìð áíòìéþì, ÷ññβð όç ÷ñÐόç ðìò GUI:

```
% xine -g -p mymovie.avi
```

8.4.2.3 Όá ΆìçεçðééÉ ðñìñáñÙìíáóá transcode

Ç áóáñììð **transcode** àáí áβìáε ðñùáñάñá áíáðáñááùðð, áεεÙ ðεά òìòβóá àñááεάβùí áεά áðáíáεùάεέìðìβççç áñ÷áβùí video έáε Ð÷ìò. Ìá όçí áóáñììð **transcode**, Ý÷áðá όçí àòíáóúòçόá ðá áíáìβìáðá áñ÷áβá video, ðá áðéóéáðÙóáðá ÷áéάóìÝíá áñ÷áβá, ÷ñçόéìðìéþìóáð àñááεάβá όçð àñàìðð áíòìéþì óá ðìβá ÷áéñβáéìíόáε áááñÝíá áðù óá έáíÙέεá stdin/stdout.

ÌááÙέì ðεÐèð ðáóáñììðì ðìñìíýí ðá έáεìñεόóìýí έáóÙ όç áεÙñεáέá όçð ðáðááéþððéóçð ðìò port multimedia/transcode έáε όðìéóóìýìά όçí áεùéìòεç àñàìð áíòìéþì áεά όç ðáðááéþððéóçð ðìò **transcode**:

```
# make WITH_OPTIMIZED_CFLAGS=yes WITH_LIBA52=yes WITH_LAME=yes WITH_OGG=yes \
WITH_MJPEG=yes -DWITH_XVID=yes
```

Ìε ðñìòάεéìñáíáð áðééìðÝð áβìáε έáóÙέεçεáð áεά òìòð ðáñεόóúðáñìòð ÷ñÐόáð.

Άέá ðá óáð àáβìòìá ðéð έέáíúòçðáð ðìò transcode, àáβóá Ýíá ðáñÙááéáìá ðáðáðñìðð áñ÷áβìò DivX óá PAL MPEG-1 (PAL VCD):

```
% transcode -i input.avi -V --export_prof vcd-pal -o output_vcd
% mplex -f 1 -o output_vcd.mpg output_vcd.mlv output_vcd.mpa
```

Όí àñ÷áβì MPEG ðìò ðñìéýððáé, ðì *output_vcd.mpg*, ðìñάβ ðá áíáðáñá÷έάβ áðù ðìí **MPlayer**. Ìðìñáβóá áðβόçð ðá àñÙóáðá ðì àñ÷áβì óá Ýíá CD-R áεá ðá àçéìòñάβóáðá Ýíá Video CD, έáε όççí ðáñβððúóç áóðð έá ÷ñáέáóðáβ ðá ááéáðáóóðóáðá óá ðñìñáñÙìíáóá multimedia/vcdimager έáε sysutils/cdrdao.

ΌðÙñ÷áε όáεβáá manual áεá ðì transcode, áεεÙ ðñÝðáε áðβόçð ðá óòìáìéáððáβðá ðì transcode wiki (<http://www.transcoding.org/cgi-bin/transcode>) áεá ðáñεόóúðáñáð ðεçñìòìñáð έáé ðáñáάáβáìáðá.

8.4.3 ΆðéðéÝìí ΆέÙááóíá

ΌðÙñ÷áε ðáάáááβá áìÝέéìç óóá áεáεÝóéìá ðáéÝðá video áεά ðì FreeBSD. Άβìáε áñεáðÙ ðéέáíú ðéέ óòì Ùìáóì ðÝέéìí ðñεεÙ áðù óá ðñìáεÞìáóá ðìò áíáóÝñìíόáε àâð έá Ý÷ìòí áðééðéáβ. Όðì áíáεÙìáóì áεÙóççíá, ðìóíε áíáεáóÝñìíόáε ðá ÷ñçόéìðìéþìòìò ðéð áðíáóúòççðáð A/V ðìò FreeBSD óòì Ýðáεñì έá ðñÝðáε ðá óòìáðÙóòìò áñþóáéð áðù áεÙóìñá FAQ

έάέ tutorials έάέ ίά ÷ ñçóείιθιέΠόιιόí άñέάôΎò áεάοιιñάóέέΎò áóáñιιáΎò. Ôι ðιΠιά áóòυι ððÛñ÷άέ áέñέáðð áέά ίά ááβίáέ óòιι áίááíρβóç ðιò ιðιιñáβ ίά áñáέ óΎóιέάð ðñυóέáðáð ðέçñιιòιιñβáð.

Ç Ôáέιçñβυóç ðιò Mplayer (<http://www.mplayerhq.hu/DOCS/>) áβίáέ áñέáðÛ ðέçñιιòιιñέάέΠ υιόι áóιιñÛ ðι ðá÷ίέέυι áðβðááι. Áί Ύ÷άóá óειðυι ίά áðιέðΠóáðá ðøçέυι ðιόιόóυι áιðáέñβáð óá ó÷Ύóç ίά ðι video óòι UNIX, έá ðñΎðáέ ιðυóáΠðιόá ίά óçι óòιáιòέáðóðáβóá. Ç έβóðá áέέççειíáñáðβáð ðιò **MPlayer** áβίáέ á÷έñέέΠ óá υιθιέιí ááι Ύ÷άέ έÛίáέ ðιι έυιθι ίά áέááÛóáέ óçι ðáέιçñβυóç, Ύóóέ áι óειðáγáðá ίά έÛίáðá áίáóιιñΎò óóáειÛóυι, ááááέυέáβóá υιðέ óçι Ύ÷άóá áέááÛóáέ.

Ôι xine HOWTO (http://dvd.sourceforge.net/xine-howto/en_GB/html/howto.html) ðáñέΎ÷άέ Ύίá έáòÛέáει ó÷áóέέÛ ίá óçι ááέðβυóç ðçð áðυáιòçð, ðι ιðιβι áβίáέ έιέíυ áέá υέá óá ðñιáñÛιιáóá áίáðáñááυáΠð.

ÔΎέιò, ððÛñ÷ιόι έÛθιέáð Ûέέáð ðιέέÛ ððιό÷ υιáίáð áóáñιιáΎò ðιò βóυð áðέέòιáβóá ίά áιέέιÛóáðá:

- Ôι Avifile (<http://avifile.sourceforge.net/>) ðι ιðιβι áβίáέ áðβóçð port, multimedia/avifile.
- Ôι Ogle (<http://www.dtek.chalmers.se/groups/dvd/>) ðι ιðιβι áβίáέ áðβóçð port, multimedia/ogle.
- Ôι Xtheater (<http://xtheater.sourceforge.net/>)
- Ôι multimedia/dvdauthor, ðι ιðιβι áβίáέ áóáñιιáΠ DVD authoring áιέέέοιγ έρπέέá.

8.5 Ñýειέóç ÊÛñóáò Ôçέáυñáóçò

8.5.1 ÁέóááυáΠ

Íέ έÛñóáð ðçέáυñáóçò óáð áðέòñΎθιόι ίά áεΎðáðá ðçέáυñáóç, έáíιέέΠ Π έáέυέáέέΠ, óòιι ððιέιáέóðΠ óáð. Íέ ðáñέóóυòáñáð áðυι áóðΎð áΎ÷ιíóáέ áðβóçð óΠιá óγίέáðιò (composite) video, ιΎóυ áέóóυáιò RCA Π S-video, έáέ έÛθιέáð áðυι áóðΎð áέáέΎóιόι έáέ ñááέιòιέέέυι áΎέðç FM.

Ôι FreeBSD ðáñΎ÷άέ ððιόðΠñέιç áέá έÛñóáð TV óγθιò PCI ðιò ÷ñçóειιθιέίγί óá ιέιέέçñυιΎίá έðέερβιáðá óýέέççðçð video, Brooktree Bt848/849/878/879 Π Conexant CN-878/Fusion 878a ίá ðι ðñυáñáιιá ιáΠáçóçð bktr(4). Έá ðñΎðáέ áðβóçð ίá ááááέυέáβóá υιðέ ç έÛñóá Ύñ÷áðáέ ίá áΎέðç ðιò ððιόðçñβεáðáέ. Ôòιáιòέáðóðáβóá óç óáέβáá manual ðιò bktr(4) áέá ίá ááβðá óç έβóðá ðυι ððιόðçñέáυιáíυι ááέðβι.

8.5.2 Ááέáέέóðρίóáò ðι ðñυáñáιιá ιáΠáçóçò

Áέá ίá ÷ñçóειιθιέΠóáðá óçι έÛñóá έá ðñΎðáέ ίá óιιñðóáðá ðι ðñυáñáιιá ιáΠáçóçð bktr(4), ðñιόέΎóιιóáð óçι áέυιέιòèç áñáιιΠ óòι áñ÷áβι /boot/loader.conf:

```
bktr_load="YES"
```

ÁίáέáέóέέÛ, ιðιñáβóá ίá ðñιόέΎóáðá óóáóέέΠ ððιόðΠñέιç áέá óçι έÛñóá óòι ððñΠίá óáð, έáέ áέá ðι óειðυι áóðυι ðñιόέΎóáð óέð áέυιέιòέáð áñáιιΎò óòι áñ÷áβι ñðειβóáυι ðιò ððñΠίá:

```
device bktr
device iicbus
device iicbb
device smbuse
```


(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-multimedia>) έάέ ίά άέάάΰόάδά όέδ δάέέυόάñάδ άçñίόέάΎόάέδ άδύ όά άñ÷άβ άçδ έβόόάδ.

8.6 ÓáñùôΎò Áέέυίάό

8.6.1 Άέόάñùάβ

Όδὶ FreeBSD ç δñúόάάόç óά óáñùôΎò δάñΎ÷άόάέ άδύ όὶ **SANE** (Scanner Access Now Easy) API όὶ ίδὶβὶ άέάόβέάάόάέ ίΎόά άδύ όçί όóέείάβ όύὶ Ports όὶó FreeBSD. Όὶ **SANE** ÷ñçόείῖδὶέάβ άδβόçδ έΰδὶέῖόδ ῖάçáῖΎδ όδóέάόβὶ όὶó FreeBSD άέά ίά άδὶέδβόάέ δñúόάάόç όόὶ όέέέυ όὶó óáñùôβ.

Όὶ FreeBSD δδὶόççñβæάέ óáñùôΎò SCSI έάέ USB. Άάάάέυέάβόά ύόέ ῖ óáñùôβδ óάδ δδὶόççñβæάόάέ άδύ όὶ **SANE** δñέὶ ῖάέείβόάάά ῖδὶέάάβδὶόά άάέάδΰόόάόç έάέ ñýèίόç. Όὶ **SANE** άέάέΎόάέ ίέά έβόόά δδὶόççñέάύῖάῖύὶ όδóέάόβὶ (<http://www.sane-project.org/sane-supported-devices.html>) ç ῖδὶβά δάñΎ÷άέ δέçñῖῖῖñβάδ άέά όçί δδὶόççñέίç έΰέά óáñùôβ έάέ όçί άῖΎέέίç όçδ. Όά όδóδβῖάόά δñέὶ όὶ FreeBSD 8.X έά άñάβόά άδβόçδ όç έβόόά όύὶ δδὶόççñέάύῖάῖύὶ USB óáñùôβὶ όόç óάέβάά manual όὶó usscanner(4).

8.6.2 Ḽýèίόç όὶó Δόñβῖά

¼δύδ άβδάῖά δάñάδΰῖύ, δδὶόççñβæῖῖόάέ óáñùôΎò όύόὶ SCSI ύὶί έάέ USB. Άῖΰέῖάά ῖά όὶ όñúδὶ άέάόΎῖάάόçδ όὶó óáñùôβ óάδ, έά ÷ñάέάόάβόά άέάόῖñάδóέέῖΎδ ῖάçáῖΎδ όδóέάόβὶ.

8.6.2.1 ΆέάόΎῖάάόç USB

Ἰ δόñβῖάό GENERIC, άδύ δñῖάδóέέῖάβ, δάñέΎ÷άέ όὶóδ ῖάçáῖΎδ όδóέάόβὶ δὶó άδάέόῖΎῖόάέ άέά όçί δδὶόççñέίç óáñùôβὶ USB. Άῖ άδὶόάόβόάάά ίά ÷ñçόείῖδὶέβόάάά άῖάέέέάόῖΎῖ δόñβῖά, άάάάέυέάβόά ύόέ Ύ÷άόά όέδ áέυέῖόέάδ άñάῖΎδ όόὶ άñ÷άβὶ ñδèῖβόάύὶ óάδ:

```
device usb
device uhci
device ohci
device ehci
```

Όά όδóδβῖάόά δñέὶ όὶ FreeBSD 8.X, έά ÷ñάέάόάβόά άδβόçδ όçί δάñάέΰδύ άñάῖβ:

```
device usscanner
```

Όά άόδΎδ όέδ άέάύόάέδ όὶó FreeBSD, ç δδὶόççñέίç όύὶ óáñùôβὶ USB άβῖάάόάέ ίΎόύ όçδ όδóέάόβδ usscanner(4). Άδύ όὶ FreeBSD 8.0 έάέ ῖάδΰ, ç δδὶόççñέίç άόδβ δάñΎ÷άόάέ άδάδóέάβάδ άδύ όç άέάέέῖέβέç libusb(3).

ΆόῖΎ άδάῖάέέέῖβόάάά ῖά όὶ óúόόύ δόñβῖά, όόῖάΎόόά όὶ USB óáñùôβ óάδ. Έά δñΎδάέ ίά άάβόά ίέά άñάῖβ ó÷άόέέβ ῖά όçί άῖβ÷ῖάδóç όὶó óáñùôβ όόçί δñῖῖόύñέῖβ ῖῖῖç ῖçῖῖῖΰδύ όὶó όδóδβῖάόῖδ (dmesg(8)):

```
ugen0.2: <EPSON> at usb0
```

β όά Ύῖά όύόδçῖά FreeBSD 7.X:

```
usscanner0: EPSON EPSON Scanner, rev 1.10/3.02, addr 2
```

Όά ίςγύιάόά άόδΰ άάβ÷ήοί υόέ ί όάνυόδδ ίάδ ÷ήςόείήδιέάβ όςί όόόέάδδ /dev/ugen0 . 2 δ όςί όόόέάδδ /dev/usb/lpr0 άίΰεϊάά ίά όςί Ύέάιός όιό FreeBSD όιό ÷ήςόείήδιέάβόάέ. Όόι δάνΰάάέά ίάδ, ÷ήςόείήδιέδρά ίά όάνυόδδ EPSON Perfection® 1650 USB.

8.6.2.2 Άέάόγιάάός Όγδιό SCSI

Άί ί όάνυόδδ όάδ Ύñ÷άόάέ ίά έέάόγιάάός όγδιό SCSI, άβιάέ όςίάίόέέυ ίά άίνήβέάόά όέ έΰñόά έέάέόδδ SCSI έά ÷ήςόείήδιέδράόά. Άίΰεϊάά ίά όι ηείεεήνυΎή έύέευιά όςδ έΰñόάδ SCSI όιό ÷ήςόείήδιέάβόάέ, έά δñΎδάέ ίά ηόέιβόάόά έάόΰέεέά όι άñ÷άβι ηόέιβόάύ δδñδρά. Ί δδñδράό GENERIC όδιόόςñβέάέ όιόδ όεί έίέήγύδ έέάέόδΎδ SCSI. Άάάέυέάβόά υόέ έέάάΰόάόά όι άñ÷άβι NOTES έάέ δñιόέΎόόά ός όύόδδ άñάιηδ όόι άñ÷άβι ηόέιβόάύ δδñδρά. Άέόυδ άδύ όι δñύάñάιά ίάβάςόςδ όιό έέάέόδδ SCSI, έά δñΎδάέ έέυιά ίά Ύ÷άόά όέδ έέυέιόέάδ άñάιηδ όόι άñ÷άβι ηόέιβόάύ όιό δδñδρά όάδ:

```
device scbus
device pass
```

Ίύέόδ ίάόάέυέδδβόάόά έάέ άέέάόάόδδράόά όιη δδñδρά, έά ίδñΎόάόά ίά άάβόά όέδ όόόέάδΎδ όςί δñιούηέηδ ίηδς ίςίόιΰόυι όόόδράόιό, έάόΰ ός έέΰñέάέ όςδ έέέβίςόςδ:

```
pass2 at aic0 bus 0 target 2 lun 0
pass2: <AGFA SNAPSCAN 600 1.10> Fixed Scanner SCSI-2 device
pass2: 3.300MB/s transfers
```

Άί ί όάνυόδδ όάδ άάι δράί άίάñάιόίέςΎήδ έάόΰ όςί έέέβίςόςδ όιό όόόδράόιό όάδ, άβιάέ έέυιά άόίάόυι ίά άίάίάέΰόάόά όιη άίόιόέόιυ όιό, έέόάεηδράό άίβ÷ίάόός όιό έέάγέιό SCSI ίά όςί άηδέάέ όςδ άίόιέδδ camcontrol(8):

```
# camcontrol rescan all
Re-scan of bus 0 was successful
Re-scan of bus 1 was successful
Re-scan of bus 2 was successful
Re-scan of bus 3 was successful
```

Ί όάνυόδδ έά άίόάίέόάβ όύόά όός έβόά όύι όόόέάδδ SCSI:

```
# camcontrol devlist
<IBM DDRS-34560 S97B>                at scbus0 target 5 lun 0 (pass0,da0)
<IBM DDRS-34560 S97B>                at scbus0 target 6 lun 0 (pass1,da1)
<AGFA SNAPSCAN 600 1.10>            at scbus1 target 2 lun 0 (pass3)
<PHILIPS CDD3610 CD-R/RW 1.00>       at scbus2 target 0 lun 0 (pass2,cd0)
```

Δάνέόόύδάνάδ όεήñιόñβάδ ό÷άόέέΰ ίά όέδ όόόέάδΎδ SCSI άβιάέ έέέΎέίάδ όόέδ όάέβάδδ manual scsi(4) έάέ camcontrol(8).

8.6.3 Νύέιέός όιό SANE

Όι όύόόςιά SANE ÷ήñβέάάέά όά άγί έññΰέά: όοι backend (graphics/sane-backends) έάέ όόι frontend (graphics/sane-frontends). Όι backend δάνΎ÷άέ δñύόάός όόιη βάεί όι όάνυόδδ. Όός έβόάά όδιόόςñέάυιάύι όόόέάδδ (http://www.sane-project.org/sane-supported-devices.html) όιό SANE ίδñάβόά ίά άñάβόά όιέη backend

ὄδἱὸὸϋβᾶέ ὄἱ ὀάνῶδᐁ ὀάδ. Ἄβἱάε ὄδἱ ÷ ἵἵἵὸέεῦ ἱά ἅἵἵἵἵ ὄἱ ὀὸἵἵ backend ἅέἱ ἱά ἱδἱἱὐἵἵἵἵ ἱά ÷ ἵἵἵἵἵἵἵἵἵἵἵἵ ὄἱ ὀάνῶδᐁ ὀάδ. Ὀἱ ὄἱᐁ ὄἱἵ frontend ὄἱἵ ᐁἱ ᐁἱ ἅἱἵἵἵἵἵ ὄἱἵ ἅἱἵἵἵἵἵἵ ἅἱἵ ὄϋ ὄᐁᐁᐁᐁ (xscanimage).

Ὀἱ ὄἱᐁ ἅᐁἱ ἅᐁἱ ἱά ἅἅἅἅἅἅἅᐁᐁᐁ ὄἱ port ᐁ ὄἱ ὄἱἵᐁᐁᐁ graphics/sane-backends. ἱἵᐁᐁ ÷ ἵἵἵἵἵἵἵἵἵἵἵἵ ὄᐁ ἱἵᐁᐁᐁ sane-find-scanner ἅέἱ ἱά ἅἅᐁᐁᐁ ὄᐁ ἱἵᐁ ÷ ἱἵᐁᐁᐁ ὄἱἵ ὀάνῶδᐁ ὀάδ ἅᐁᐁ ὄἱ ὄᐁᐁᐁᐁ **SANE**:

```
# sane-find-scanner -q
found SCSI scanner "AGFA SNAPSCAN 600 1.10" at /dev/pass3
```

ϋ ᐁᐁᐁᐁ ἅἅᐁᐁ ὄἱ ἅᐁᐁᐁ ὄᐁᐁᐁᐁᐁ ὄἱἵ ὀάνῶδᐁ ἅἅᐁᐁ ἅἅᐁ ὄἱ ὑᐁᐁ ὄἱᐁᐁᐁᐁ ὄἱἵ ÷ ἵἵἵἵἵἵἵἵἵἵἵἵ ἅἅᐁ ὄϋ ὄᐁᐁᐁᐁ ἱά ὄἱ ὄᐁᐁᐁᐁ ὀάδ. Ὀἱ ὑᐁᐁ ὄἱἵ ἅᐁᐁᐁᐁᐁᐁᐁᐁᐁ ἅἅᐁ ὄἱἵ ἱἵᐁᐁᐁᐁ ᐁᐁᐁ ἱά ἱϋ ἅᐁᐁᐁᐁᐁᐁᐁᐁ, ἅἅᐁᐁ ἅᐁᐁ ἅᐁᐁ ἅᐁᐁ ὄᐁᐁᐁᐁᐁ.

Ὀᐁᐁᐁᐁ: ἱἵᐁᐁᐁᐁᐁ USB ὀάνῶδᐁᐁ ἅᐁᐁᐁᐁᐁ ὄϋ ὄᐁᐁᐁᐁᐁ firmware. ϋ ἅἅᐁᐁᐁᐁᐁᐁ ἅᐁᐁᐁᐁᐁ ὄᐁ ὄᐁᐁᐁᐁ manual ὄἱἵ backend. Ἐἱ ὄἱᐁᐁᐁ ἅᐁᐁᐁᐁ ἱά ἅἅᐁᐁᐁᐁᐁ ὄᐁ ὄᐁᐁᐁᐁᐁ manual sane-find-scanner(1) ἅἅᐁ sane(7).

Δἱᐁᐁᐁ ὄᐁᐁ ἱά ἅἅᐁᐁᐁᐁ ἅᐁ ἱ ὀάνῶδᐁᐁ ἅᐁ ἅᐁᐁᐁᐁᐁᐁᐁ ἅᐁᐁ ὄἱ frontend ὄᐁᐁᐁᐁᐁᐁ ὄᐁᐁᐁᐁᐁ. Ἄᐁᐁ ὄᐁᐁᐁᐁᐁᐁ, ὄἱ **SANE** backend ᐁᐁ ÷ ἅᐁᐁᐁ ἱά ᐁᐁ ἅᐁᐁᐁᐁᐁᐁ ᐁᐁᐁᐁᐁᐁ ἅᐁᐁᐁᐁᐁ, ὄἱ scanimage(1). ϋ ἅᐁᐁᐁᐁ ἅᐁᐁᐁ ὀάδ ἅᐁᐁᐁᐁᐁᐁ ὄᐁ ἅᐁᐁᐁᐁᐁᐁᐁ ὄἱἵ ὄᐁᐁᐁᐁᐁ ἅἅᐁ ὄϋ ὄᐁᐁᐁᐁᐁ ἅἅᐁᐁᐁᐁ ἅᐁᐁ ὄϋ ᐁᐁᐁᐁᐁ ἅᐁᐁᐁᐁᐁ. ϋ ἅᐁᐁᐁᐁᐁ -L ÷ ἵἵἵἵἵἵἵἵἵἵἵἵ ἅἅᐁ ὄϋ ἅᐁᐁᐁᐁᐁᐁᐁ ὄἱἵ ὄᐁᐁᐁᐁᐁ ὄᐁᐁᐁᐁᐁ:

```
# scanimage -L
device 'snapscan:/dev/pass3' is a AGFA SNAPSCAN 600 flatbed scanner
```

¹ ἅἅᐁ ὄᐁᐁᐁᐁᐁᐁ ἱά ὄἱ ὀάνῶδᐁᐁ ὄἱἵ ÷ ἵἵἵἵἵἵἵἵἵἵἵἵ ὄᐁᐁ Ὀἱᐁᐁ 8.6.2.1:

```
# scanimage -L
device 'epson2:libusb:/dev/usb:/dev/ugen0.2' is a Epson GT-8200 flatbed scanner
```

ϋ ὄᐁᐁᐁᐁᐁᐁ ᐁᐁᐁᐁᐁ ὄᐁᐁᐁᐁ ÷ ἅᐁᐁᐁ ἅᐁᐁ ᐁᐁᐁ ὄᐁᐁᐁᐁᐁ FreeBSD 8.X ἅἅᐁ ϋ ᐁᐁᐁᐁᐁ 'epson2:libusb:/dev/usb:/dev/ugen0.2' ἱἵᐁ ὄᐁᐁᐁᐁᐁᐁᐁ ἅἅᐁ ὄἱ ὑᐁᐁᐁ ὄἱἵ backend (epson2) ἅἅᐁ ὄἱ ὑᐁᐁᐁ ὄϋᐁ ὄᐁᐁᐁᐁᐁᐁ (/dev/ugen0.2) ὄἱἵ ÷ ἵἵἵἵἵἵἵἵἵἵἵἵ ἱ ὀάνῶδᐁᐁ ἱἵᐁ.

Ὀᐁᐁᐁᐁ: Ἄᐁ ἅᐁᐁ ἅᐁᐁᐁ ᐁᐁᐁᐁ, ᐁ ἅᐁᐁᐁ ᐁᐁ ἱᐁᐁᐁᐁ ὑᐁᐁ ἅᐁ ἅᐁᐁ ÷ ἱᐁᐁᐁᐁ ὀάνῶδᐁᐁ, ὄᐁᐁᐁᐁᐁ ὑᐁᐁ ὄἱ scanimage(1) ἅᐁᐁ ἱᐁᐁᐁᐁᐁ ἱά ἅᐁᐁᐁᐁᐁᐁ ὄἱ ὀάνῶδᐁᐁ. Ἄᐁ ὄᐁᐁᐁᐁ ἅᐁᐁᐁ, ἅᐁ ÷ ἵἵᐁᐁᐁᐁ ἱά ἅᐁᐁᐁᐁᐁᐁᐁᐁ ὄἱ ᐁᐁ ÷ ᐁᐁ ἵᐁᐁᐁᐁᐁᐁ ὄἱἵ backend ἅἅᐁ ἱά ἵᐁᐁᐁᐁᐁ ὄἱ ὀάνῶδᐁᐁ ὄἱἵ ἅᐁ ÷ ἵἵἵἵἵἵἵἵἵἵἵἵ. ἱ ἅᐁᐁᐁᐁᐁᐁ /usr/local/etc/sane.d/ ὄᐁᐁᐁᐁ ÷ ἅᐁ ὑἅᐁ ὄᐁ ᐁᐁ ÷ ᐁᐁᐁ ἵᐁᐁᐁᐁᐁᐁ ὄἱἵ backend. Ὀἱ ὄᐁᐁᐁᐁᐁᐁ ἅᐁᐁᐁᐁᐁᐁ ὄᐁ ἅᐁᐁᐁᐁᐁᐁ ὄᐁ ἵᐁᐁᐁᐁᐁᐁ ἵᐁᐁᐁᐁᐁ USB ὀάνῶδᐁᐁ.

Ἄἅᐁ ὄᐁᐁᐁᐁᐁᐁᐁ, ἱά ὄἱ ὀάνῶδᐁᐁ USB ὄἱἵ ÷ ἵἵἵἵἵἵἵἵἵἵἵἵ ὄᐁᐁ Ὀἱᐁᐁ 8.6.2.1, ϋ ἅᐁᐁᐁᐁ sane-find-scanner ἅᐁᐁᐁᐁ ὄᐁᐁ ἅἅᐁᐁᐁᐁᐁ ὄᐁᐁᐁᐁᐁ:

```
# sane-find-scanner -q
found USB scanner (UNKNOWN vendor and product) at device /dev/usscanner0
```

ἱ ὀάνῶδᐁᐁᐁ ᐁᐁᐁᐁᐁ, ÷ ἵἵἵἵἵἵἵἵἵἵἵἵ ἅἅᐁᐁᐁᐁᐁᐁ USB ἅἅᐁ ὄἱ ὑᐁᐁᐁ ὄᐁᐁᐁᐁᐁᐁ ὄἱἵ ἅᐁᐁᐁᐁ /dev/usscanner0. Ὀᐁᐁᐁ ὄᐁᐁᐁᐁ ἱά ἅᐁᐁᐁ ἅᐁ ἅᐁᐁᐁᐁᐁᐁᐁᐁ ἅἅᐁ ὄᐁᐁᐁᐁ:

```
# scanimage -L

No scanners were identified. If you were expecting something different,
check that the scanner is plugged in, turned on and detected by the
sane-find-scanner tool (if appropriate). Please read the documentation
```

which came with this software (README, FAQ, manpages).

Αόιγ ι οάνηόΠò άάι άίαάιηñßóççέα, έά ÷ ηάέαόόάß ίά άδáiηñάάοίγíά όι άñ÷άßí /usr/local/etc/sane.d/epson2.conf. Όι ιίíóΨέι οάνηόΠ ðíó ÷ ηçóέίιðíéΠεçέα Ποάί όι EPSON Perfection 1650, Ψόέ ΙΨηίόíá úóé ι οάνηόΠò έά ÷ ηçóέίιðíéάß όι backend epson2. Άάάέúεάßοά úóé áέαÁΨόάόά όά άίççεçóéú ó÷úεέα όόά άñ÷άßά ηòείßοάúι όíó backend. Άßíάέ άñέάóΨ άδευ ίά áέέΨíάόά άñάιιΨò: ίάόάόñΨόά όά ó÷úεέα úóάó άñάιιΨò άάß÷ιíóι έΨέιò όγðí άέαόγíάάόçð άέα όι οάνηόΠ οάó (όççí ðáñßððóúç ίάó έά ίάόάόñΨóίóíά όά ó÷úεέα úεάó όέó άñάιιΨò ðíó ίάέείΨίά ίά όç έΨίç scsi έάέρò ι οάνηόΠò ίάó ÷ ηçóέίιðíéάß άέαόγíάάόç USB), έάέ ðñíóέΨόά όóι όΨέιò όíó άñ÷άßíó ίέα άñάιιΠ ðíó ίά ηñßæάέ όι άßáíò άέαόγíάάόç έάέ όι úííά όóóέάòΠò ðíó ÷ ηçóέίιðíéάßόά. Όόçí ðáñßððóúç ίάó ðñíóέΨόάíά όçí áέúέίòεç άñάιιΠ:

```
usb /dev/usbanner0
```

Όάó ðáñάέάέιγíά ίά áάάάέúεάßόά úóé áέαÁΨόάόά όά ó÷úεέα ðíó ðáñΨ÷ιíόάέ όóι άñ÷άßí ηòείßοάúι όíó backend έάέρò έάέ όόέó άίόßόóíé÷άó óάέßááó manual άέα ðáñέόóóúóáñáό έάððíιΨñάέáό έάέρò έάέ άέα όç óγíόάίç ðíó ðñΨόάέ ίά ÷ ηçóέίιðíéΠόάóά. ίðñίγíά όρñά ίά άðέάάάέρòίóíά úóé ι οάνηόΠò άίαάίηñßæάόάέ:

```
# scanimage -L
device 'epson:/dev/usbanner0' is a Epson GT-8200 flatbed scanner
```

Ί USB οάνηόΠò ίάó άίαάίηñßóççέα. Άάι άßíάέ όçíάίόέέú úóé ç Ψñέά έάέ όι ιίíóΨέι άάι óάέñέΨάέíóι áέñέάρò ίά όι áέέú ίάó. Όι άάóέέú όçíάßí άßíάέ όι ðάάßí 'epson:/dev/usbanner0', όι ίðíßí άáß÷íάέ όι óúóóú backend έάέ úííά όóóέάòΠò.

Ίúεέð ç άίόíεΠ scanimage -L ίðñΨόάέ ίά άάέ όι οάνηόΠ, ç ηγέιέόç Ψ÷άέ ηειέεçñúεάß. Ç óóóέάòΠ άßíάέ Ψόίείç ίά ÷ ηçóέίιðíéçέάß.

Άί έάέ ç scanimage(1) ίάó άðέóñΨόάέ ίά οάñρòίóíά áέέúíá áðú όç άñάιιΠ άίόíερí, άßíάέ ðñíóέíúóáñí ίά ÷ ηçóέίιðíéΠóíóíά έΨúéí ηñúáñάíά όά άñάóέέú ðáñέάΨέεíí άέα όçí άñάάóá áóòΠ. Όι SANE ίάó ðñíóέΨñάέ Ψίά άδευ áέέΨ άðíáíóέέú άñάóέέú ðáñέάΨέεíí: όι **xscanimage** (graphics/sane-frontends).

Όι **Xsane** (graphics/xsane) άßíάέ άðßóçð Ψίά άçίíóέέΨó frontend ðñúáñάíά óΨñúóçð. Το frontend áðóú ðñíóέΨñάέ ðñí÷úñçíΨíáð áóíáóúóçóáð, úðúò áέαóίñáóέέíγó ðñúðíðò óΨñúóçð (óúóíòððßá, fax, έέð) áέúñεúóç ÷ ηúìΨóúí, ðíεέáðεΠ óΨñúóç έ.ά. Έάέ ίέ άγí άóðΨó άóάñίáΨó άέαóβέáίóάέ άðßóçð όáí ðñúóέáóí (plugin) ðñúáñάíá άέα ÷ ηΠóç ίά όι **GIMP**.

8.6.4 Άßíίíόάò óά ηέέίòò × ηΠόóάò ðñúóάáóç óóι ΌáñúóΠ óáó

¼έáð ίέ ðáñάðΨíú έάέóιòñáßáð Ψάέίáí ίά όά ðñííúίέα όíó ÷ ηΠóçð root. ίðñíáß úóóúóí, ίá έΨέáóά ίά άρòάóά ðñúóάáóç óóι οάνηόΠ óáó έάέ όά Ψέεíòð ÷ ηΠόóáð. Ί ÷ ηΠóçðð ÷ ηάέΨæáóάέ Ψáάέα άíΨáíúóçð έάέ ááñάóΠò óóι άñ÷άßí óóóέáòΠò ðíó ÷ ηçóέίιðíéάßόάέ άðú όι οάνηόΠ. Όáí ðáñΨάάέáíá, ι οάνηόΠò ίάó ÷ ηçóέίιðíéάß όι άñ÷άßí óóóέáòΠò /dev/ugen0.2 όι ίðíßí óóçí ðñάáíáóέέúóçóά άßíάέ Ψίáó óóíáηέέέúð ááóίúð ðñíò όι ðñάáíáóέέú άñ÷άßí óóóέáòΠò, όι /dev/usb/0.2.0 (ίðñíáßóά ίá όι áðέáááέρòáóά άγέηέά ίά ίέα ίάóέΨ óóíí έáðΨέίáí /dev). Όúóí ι óóíáηέέέúð ááóίúð úóí έάέ όι άñ÷άßí óóóέáòΠò άíΠέíóí óóέð ηΨááð wheel έάέ operator. Άί ðñíóέΨóíóíά όι ÷ ηΠóçð joe óά áóðΨó óéð ηΨááð, έá ίðñíáß ίά ÷ ηçóέίιðíéΠόάέ όι οάνηόΠ. Άέα έúáíòð áóóάέáßáð úúð έá ðñΨóάέ ίá άßíáóá έάέáðάñá ðñíóáέóέέίß úóáí ðñíóέΨóíóíά Ψίá ÷ ηΠóçð óά ίέα ηΨáá, áέáέέΨ άί ðñúéáέόάέ άέα όçí wheel. Ίέα έάέγóáñç έγóç έá Πóáí ίá άçíéíòñáΠóíóíá ίέα ηΨáá άέαέέΨ άέα όç ÷ ηΠóç όúí óóóέáòΠí USB, έάέ ίá áðέóñΨóíóíá ðñúóάáóç óóíí οάνηόΠ óóá ίΨέç óçð ηΨááð áðòΠò.

Άέα ðáñΨááέáíá, έá ÷ ηçóέίιðíéΠóíóíá ίέα ηΨáá ίά όι úííá usb. Όι ðñρòí άΠíά άßíάέ ç άçíéíòñáßá áóòΠò όçð ηΨááð ίá όç άíΠεάέá όçð άίóíεΠò pw(8):

```
# pw groupadd usb
```

Έά δñΰδάέ ΰδάέόά ίά άέέΰñδΰά όά άέέάέπΰάόά δΰδ όδΰάέέέΰΰ άάόΰΰΰ /dev/ugen0.2 έάέ δΰδ άñ÷άβΰδ όδóέάδΰδ /dev/ugen0.2.0 πόδά ίά άβΰάέ δñΰόάΰόείά άδΰ δçΰ ñΰάά usb ίά άδΰάδΰδçόά άάñάόΰδ (άέέάέπΰάόά 0660 P 0664). Άδΰ δñΰάδέέΰά, ðΰñΰ ΰ έάέΰέδΰδçδ άδδπΰ δΰΰ άñ÷άβΰΰ (ΰ root) ΰ÷άέ όά άδñάάβδçόά άέέάέπΰάόά άάñάόΰδ. ¼έά όά δñάδΰΰ ðΰñΰΰΰ ίά άβΰΰΰ ίά δέδ δñάέΰδΰ άñάñΰδ όδΰ άñ÷άβΰΰ /etc/devfs.rules:

```
[system=5]
add path ugen0.2 mode 660 group usb
add path usb/0.2.0 mode 0660 group usb
```

ΰέ ÷ñπóδδδ δΰδ FreeBSD 7.X έά ÷ñάέόδΰΰΰ δέδ δñάέΰδΰ άñάñΰδ, ίά δΰ όδΰδΰ άñ÷άβΰΰ όδóέάδΰδ (δέδ δñέόόδΰδñάδ όñΰΰδ έά άβΰάέ δΰ /dev/uscanner0):

```
[system=5]
add path usscanner0 mode 0660 group usb
```

δΰέόά, δñΰέΰΰόά δçΰ άέΰΰΰδç άñάñΰδ όδΰ άñ÷άβΰΰ /etc/rc.conf έάέ άδΰάΰάέέΰπóδδ δΰ ðç÷ΰΰΰΰ:

```
devfs_system_ruleset="system"
```

Δñέόόδΰδñάδ δççñΰΰñΰάδ ό÷άδέέΰ ίά άδδΰδ δέδ άñάñΰδ, ðδñάβδδ ίά άñάβδδ όδç όάέβάά manual δΰδ devfs(8).

δΰέόά άδΰ όά δñάδΰΰ ðΰΰάόά, άέά ίά άπóδδδ δñΰόάάόç όδΰ USB όάñδδΰ όά έΰδΰΰΰ ÷ñπóδç, άñέάβ ίά δñΰέΰΰόάδ όΰ ΰΰάñέάόδΰ δΰδ όδçΰ ñΰάά usb:

```
# pw groupmod usb -m joe
```

Άέά δñέόόδΰδñάδ έάδδñΰΰάέδ, άέάΰΰόδδ δç όάέβάά manual δΰδ pw(8).

Εἰσαγωγή 9

Ἐπιβάθμιση τοῦ FreeBSD FreeBSD

9.1 Σύνοψη

Ἡ ἐπιβάθμιση ἀπαιτεῖται ἐπειδὴ τὸ FreeBSD εἶναι ἀνοικτοκώδικας. Ἄρα, ὡς ἀποτέλεσμα, οἱ ἄνθρωποι πρέπει νὰ γίνουν ἐμπειροπλοῦς, ὡς ἀποτέλεσμα, οἱ ἄνθρωποι πρέπει νὰ γίνουν ἐμπειροπλοῦς, ὡς ἀποτέλεσμα, οἱ ἄνθρωποι πρέπει νὰ γίνουν ἐμπειροπλοῦς.

Ἡ ἐπιβάθμιση ἀπαιτεῖται ἐπειδὴ τὸ FreeBSD εἶναι ἀνοικτοκώδικας:

- Ἄρα, οἱ ἄνθρωποι πρέπει νὰ γίνουν ἐμπειροπλοῦς.

Ἡ ἐπιβάθμιση ἀπαιτεῖται ἐπειδὴ τὸ FreeBSD εἶναι ἀνοικτοκώδικας.

9.2 Ἐπιβάθμιση τοῦ FreeBSD;

Ἡ ἐπιβάθμιση ἀπαιτεῖται ἐπειδὴ τὸ FreeBSD εἶναι ἀνοικτοκώδικας.

Ἡ ἐπιβάθμιση ἀπαιτεῖται ἐπειδὴ τὸ FreeBSD εἶναι ἀνοικτοκώδικας.

Ἡ ἐπιβάθμιση ἀπαιτεῖται ἐπειδὴ τὸ FreeBSD εἶναι ἀνοικτοκώδικας.


```
include GENERIC
ident MYKERNEL

options IPFIREWALL
options DUMMYNET
options IPFIREWALL_DEFAULT_TO_ACCEPT
options IPDIVERT
```

Δομή γενικής οργάνωσης για τον πυρήνα της FreeBSD. Η δομή αυτή είναι η βάση για την κατασκευή του πυρήνα. Η δομή αυτή είναι η βάση για την κατασκευή του πυρήνα. Η δομή αυτή είναι η βάση για την κατασκευή του πυρήνα.

Όχι! Βύθος: Άρα για να γίνει η δομή αυτή να λειτουργεί σωστά, πρέπει να γίνει η δομή αυτή να λειτουργεί σωστά, πρέπει να γίνει η δομή αυτή να λειτουργεί σωστά.

```
# cd /usr/src/sys/i386/conf && make LINT
```

Οι δομές αυτές είναι οι δομές που χρησιμοποιούνται για την κατασκευή του πυρήνα. Οι δομές αυτές είναι οι δομές που χρησιμοποιούνται για την κατασκευή του πυρήνα.

```
machine i386
```

Δομή οργάνωσης για τον πυρήνα της FreeBSD. Η δομή αυτή είναι η βάση για την κατασκευή του πυρήνα. Η δομή αυτή είναι η βάση για την κατασκευή του πυρήνα.

```
cpu I486_CPU
cpu I586_CPU
cpu I686_CPU
```

Οι δομές αυτές είναι οι δομές που χρησιμοποιούνται για την κατασκευή του πυρήνα. Οι δομές αυτές είναι οι δομές που χρησιμοποιούνται για την κατασκευή του πυρήνα.

```
ident GENERIC
```

Αυτό είναι το αρχείο οργάνωσης για τον πυρήνα της FreeBSD. Αυτό είναι το αρχείο οργάνωσης για τον πυρήνα της FreeBSD.

```
#To statically compile in device wiring instead of /boot/device.hints
#hints "GENERIC.hints" # Default places to look for devices.
```


Ἰἀ ὀᄡᓇ ἄḂεῖἱἱἱ ἄὀḂᓇ, ḂἈἽεῖἱἱἱἱἱ ἑἱἑḂᓇἽḂᓇ Ḃᓇ ἄḂᓇἽḂᓇ ὀᄡ ὀᄡᓇốḂᓇ ḂᓇἽḂᓇἽḂᓇ ὀᄡ ἄḂᓇἽḂᓇ ὀᄡ ἱἱἱἱἱἱ ἑἱἑḂᓇἽḂᓇ, ἱἱ ἑḂᓇἽḂᓇ ὀᄡ ốḂᓇἽḂᓇ ἄḂᓇḂᓇἽḂᓇ ὀᄡ ἱḂᓇἽḂᓇ. ὀḂᓇἽḂᓇἽḂᓇ, ἑἱ ἑḂᓇἽḂᓇ ἱἱ ἑḂᓇḂᓇἽḂᓇ ὀᄡ ἄḂεῖἱἱἱ ἄὀḂᓇ ὀᄡ ἱἱἱἱἱἱ ἱἱḂᓇἽḂᓇἽḂᓇ ᓇἽḂᓇ ốḂᓇἽḂᓇ ἄḂᓇἽḂᓇἽḂᓇ, ἑἱ ἱἱ ὀᄡ ἄḂᓇἽḂᓇ ἽḂᓇ ốḂᓇἽḂᓇἽḂᓇ ὀᄡ FreeBSD ὀᄡ ἱἱ ἱἱἱἱ ὀᄡḂᓇἽḂᓇ ἽḂᓇ ốḂᓇἽḂᓇ ἄḂᓇἽḂᓇ ὀᄡ ἄḂᓇἽḂᓇ ἄḂᓇἽḂᓇ ἑἱἱḂᓇἽḂᓇ ὀᄡḂᓇἽḂᓇ, ἽḂᓇ ἑἱ ḂᓇḂᓇἽḂᓇ ὀᄡ ἱἱ firewall.

```
options MD_ROOT # MD is a potential root device
```

Ἰἀ ὀᄡᓇ ἄḂεῖἱἱἱ ἄὀḂᓇ ἱἱἱἱἱἱἱἱἱἱ ốḂᓇἽḂᓇ ốḂᓇἽḂᓇ ὀᄡ ἱἱἱἱἱἱἱἱἱἱἱἱ ốḂᓇἽḂᓇ ἄḂᓇἽḂᓇ ὀᄡ ἱḂᓇἽḂᓇ RAM (ramdrive) ἑἱ ốḂᓇἽḂᓇ ἑἱ ὀᄡḂᓇἽḂᓇ root.

```
options NFSCLIENT # Network Filesystem Client
options NFSSERVER # Network Filesystem Server
options NFS_ROOT # NFS usable as /, requires NFSCLIENT
```

ὀᄡ ἑἱḂᓇἽḂᓇ ὀᄡốḂᓇ ἱἱốḂᓇ. Ἄᓇ ἱἱ ἱἱốḂᓇ ὀᄡ ὀᄡốḂᓇ ἱἱ ḂᓇἽḂᓇἽḂᓇἽḂᓇ ὀᄡốḂᓇ ἱἱốḂᓇ ἄḂᓇἽḂᓇ ὀᄡốḂᓇ ὀᄡốḂᓇ UNIX ἱἱốḂᓇ TCP/IP, ἱἱḂᓇἽḂᓇ ἱἱ ἱἱḂᓇἽḂᓇ ἄὀḂᓇ ὀᄡ ἱἱốḂᓇ ὀᄡ ὀᄡốḂᓇ.

```
options MSDOSFS # MSDOS Filesystem
```

ὀᄡ ὀᄡốḂᓇ ἱἱốḂᓇ ὀᄡ MS-DOS. Ἄᓇ ἱἱ ὀᄡốḂᓇ ἱἱ ḂᓇἽḂᓇἽḂᓇἽḂᓇ ἄḂᓇἽḂᓇ DOS ἑἱḂᓇ ὀᄡ ἑἱốḂᓇἽḂᓇ, ἱἱḂᓇἽḂᓇ ἱἱ ἄὀḂᓇἽḂᓇ ἱἱ ἱἱḂᓇἽḂᓇ ὀᄡ ἄḂεῖἱἱἱ ἄὀḂᓇ ὀᄡ ὀᄡốḂᓇ. ἑἱ ὀᄡốḂᓇ ἑἱ ὀᄡốḂᓇἽḂᓇ ἄὀḂᓇἽḂᓇ ὀᄡ ḂᓇốḂᓇ ὀᄡ ἑἱ ḂᓇἽḂᓇἽḂᓇἽḂᓇ ἑἱḂᓇἽḂᓇ DOS ἽḂᓇ ὀᄡ ὀᄡốḂᓇ ὀᄡ ἑἱốḂᓇἽḂᓇ ἱἱ ὀᄡ ḂᓇốḂᓇἽḂᓇ ἱἱ ὀᄡ ἱἱốḂᓇἽḂᓇ ἑἱ ἱἱ ἄḂᓇἽḂᓇἽḂᓇ (ἑἱ ἄḂᓇἽḂᓇ ἱἱ ἄḂᓇἽḂᓇ ὀᄡ ốḂᓇἽḂᓇ ὀᄡ MSDOSFS).

```
options CD9660 # ISO 9660 Filesystem
```

ὀᄡ ὀᄡốḂᓇ ἱἱốḂᓇ ISO 9660 ἑἱốḂᓇ CDROM. ἱἱḂᓇἽḂᓇ ὀᄡ ὀᄡ ὀᄡốḂᓇ ἱἱ ἱἱốḂᓇ CDROM ᓇ ὀᄡốḂᓇ ḂᓇἽḂᓇἽḂᓇἽḂᓇ CD ἱἱốḂᓇ ἱἱốḂᓇ (ἑἱốḂᓇ ἑἱ ὀᄡốḂᓇἽḂᓇ ἄḂᓇἽḂᓇ ὀᄡ ḂᓇốḂᓇ ὀᄡ ἑἱ ḂᓇἽḂᓇἽḂᓇἽḂᓇ ὀᄡốḂᓇ ὀᄡốḂᓇ). ὀᄡ ἱἱḂᓇἽḂᓇ CD ἱἱ ốḂᓇἽḂᓇἽḂᓇ ἄḂᓇἽḂᓇ ὀᄡ ὀᄡốḂᓇ ἱἱốḂᓇ.

```
options PROCFS # Process filesystem (requires PSEUDOSFS)
```

ἌḂᓇἽḂᓇ ὀᄡ ὀᄡốḂᓇ ἱἱốḂᓇ ḂᓇἽḂᓇ ὀᄡ ὀᄡốḂᓇἽḂᓇ. ḂᓇἽḂᓇἽḂᓇ ἑἱ ἱἱốḂᓇ ἱἱốḂᓇ ὀᄡ ὀᄡốḂᓇ ἱἱốḂᓇ ốḂᓇἽḂᓇἽḂᓇ ὀᄡốḂᓇ ἱἱốḂᓇ ốḂᓇἽḂᓇἽḂᓇ ὀᄡ ἑἱốḂᓇἽḂᓇἽḂᓇ. ἑἱ ốḂᓇἽḂᓇ ὀᄡ PROCFS ἱἱ ἄḂᓇἽḂᓇἽḂᓇ ὀᄡốḂᓇ ḂᓇἽḂᓇἽḂᓇἽḂᓇ ḂᓇốḂᓇἽḂᓇ, ἑἱốḂᓇ ὀᄡ ḂᓇốḂᓇἽḂᓇἽḂᓇ ἱἱốḂᓇἽḂᓇ ḂᓇốḂᓇἽḂᓇἽḂᓇ ἑἱ ἑἱốḂᓇἽḂᓇἽḂᓇ ὀᄡốḂᓇ ὀᄡ ốḂᓇἽḂᓇἽḂᓇ ἱἱốḂᓇ ἱἱốḂᓇ ὀᄡốḂᓇ ὀᄡ ὀᄡốḂᓇἽḂᓇ ἑἱ ἱἱốḂᓇἽḂᓇἽḂᓇ ὀᄡốḂᓇ ὀᄡ ὀᄡốḂᓇἽḂᓇ.

```
options PSEUDOSFS # Pseudo-filesystem framework
```

ḂᓇἽḂᓇἽḂᓇ ὀᄡ ốḂᓇἽḂᓇἽḂᓇ ὀᄡ PROCFS ḂᓇἽḂᓇ ἄḂᓇἽḂᓇ ἱἱ ḂᓇốḂᓇἽḂᓇἽḂᓇ ἑἱ ὀᄡốḂᓇἽḂᓇἽḂᓇ.

```
options GEOM_PART_GPT # GUID Partition Tables.
```

Ἰἀ ὀᄡᓇ ἄḂεῖἱἱἱ ἄὀḂᓇ ἄḂᓇἽḂᓇ ốḂᓇἽḂᓇ ốḂᓇἽḂᓇ ἱἱốḂᓇ ἱἱốḂᓇ ἑἱốḂᓇἽḂᓇἽḂᓇ ὀᄡ ἱἱ ἱἱốḂᓇ.

```
options COMPAT_43 # Compatible with BSD 4.3 [KEEP THIS!]
```


device fdc

Δñùεάέóάé áéá òιí áεάάεδΠ ìιíΰάád áέóéΎóád.

ATA and ATAPI devices
device ata

Áδòùò ì ìάçãùð òðιόδçñβæáé üεάð òéð òðóéãðΎð òýðιò ATA éáé ATAPI. ×ñáéΰæáóóá ìùíí íéá éáóá÷βñçóç device ata áéá íá áίé÷íáýóáé ì òðñΠιád üεάð òéð òðóéãðΎð ATA/ATAPI òýðιò PCI óóá óýã÷ñιíá ìç÷áβιáóá.

device atadisk # ATA disk drives

Ç áðέειãΠ áððΠ áðάέóáβóóáé ìάæβ ìá òι device ata áéá òçí òðιόδΠñéιç áβóèùí ATA.

device ataraid # ATA RAID drives

Ç áðέειãΠ áððΠ áðάέóáβóóáé ìάæβ ìá òι device ata áéá òçí òðιόδΠñéιç áβóèùí ATA RAID.

device atapicd # ATAPI CDROM drives

Ç áðέειãΠ áððΠ áðάέóáβóóáé ìάæβ ìá òι device ata áéá òçí òðιόδΠñéιç ìάçãβί ATAPI CDROM.

device atapifd # ATAPI floppy drives

Ç áðέειãΠ áððΠ áðάέóáβóóáé ìάæβ ìá òι device ata áéá òçí òðιόδΠñéιç ìάçãβί áέóéΎóád ATAPI.

device atapist # ATAPI tape drives

Ç áðέειãΠ áððΠ áðάέóáβóóáé ìάæβ ìá òι device ata áéá òçí òðιόδΠñéιç ìιíΰάùí óáéίβád ATAPI.

options ATA_STATIC_ID # Static device numbering

Ìá òçí áðέειãΠ áððΠ, ì áñéèìùð òιò áεάάεδΠ áβιáóáé óóáóééùð. ×ùñβð áððΠ, ìé áñéèìñβ òðóéãðβί áðñáβáñιíóáé áðιáíééΰ.

SCSI Controllers

device ahb # EISA AHA1742 family
device ahc # AHA2940 and onboard AIC7xxx devices
options AHC_REG_PRETTY_PRINT # Print register bitfields in debug # output. Adds ~128k to driver.
device ahd # AHA39320/29320 and onboard AIC79xx devices
options AHD_REG_PRETTY_PRINT # Print register bitfields in debug # output. Adds ~215k to driver.
device amd # AMD 53C974 (Teckram DC-390(T))
device isp # Qlogic family
#device ispfw # Firmware for QLogic HBAs- normally a module
device mpt # LSI-Logic MPT-Fusion
#device ncr # NCR/Symbios Logic
device sym # NCR/Symbios Logic (newer chipsets + those of 'ncr')
device trm # Tekram DC395U/UW/F DC315U adapters

device adv # Advansys SCSI adapters
device adw # Advansys wide SCSI adapters
device aha # Adaptec 154x SCSI adapters
device aic # Adaptec 15[012]x SCSI adapters, AIC-6[23]60.

```
device      bt          # Buslogic/Mylex MultiMaster SCSI adapters

device      ncv          # NCR 53C500
device      nsp          # Workbit Ninja SCSI-3
device      stg          # TMC 18C30/18C50
```

ΆέάάέðÝð SCSI. Ìðìñáβðά íá ìáðáðñÝðáðά ðά ó÷-üέέí ìðíéííáÞðíðά ááí Ý÷-áðά ððí óýóðçíá óáð. Áí ðí óýóðçíá óáð Ý÷-áé ìüíí óðóέáðÝð IDE, ìðìñáβðά íá áðáέñÝðáðά üέáð ðέð áñáñíÝð. Ìέ áñáñíÝð ðýððíð * _REG_PRETTY_PRINT ÷ ñçóέíððíéíýíóáé áέá íá áβñíðí ðáñέóóüðáñáð áέááñüóðέέÝð ðέçñíðññβáð áέá ðíðð áíðβóðíé÷-íðð ìäçáíýð.

```
# SCSI peripherals
device      scbus       # SCSI bus (required for SCSI)
device      ch          # SCSI media changers
device      da          # Direct Access (disks)
device      sa          # Sequential Access (tape etc)
device      cd          # CD
device      pass        # Passthrough device (direct SCSI access)
device      ses         # SCSI Environmental Services (and SAF-TE)
```

ðáñέóáñáέáéÛ SCSI. Ìðìñáβðά έáé ðÛέέ íá ìáðáðñÝðáðά ðά ó÷-üέέí üóáð óðóέáðÝð ááí Ý÷-áðά, Þ áí Ý÷-áðά ìüíí óðóέáðÝð IDE, ìðìñáβðά íá áðáέñÝðáðά áíðáέÞð áððÝð ðέð áñáñíÝð.

Óçíáβüóç: Ì ìäçáüð USB umass(4) έáé éÛðíéíé Ûέέíé ìäçáíß ÷ ñçóέíððíéíýí ðí ððíóýóðçíá SCSI áí έáé ááí áβíáé ðñááíáíðέέÝð SCSI óðóέáðÝð. Άέá ðí éüáí áððü, óέáíðñáððáβðά üðé ááí áðáέñÝðáðά ðçí ððíóðÞñéíç SCSI áí ðáñέéáíáÛíííóáé ðÝðíéíé ìäçáíß ððí áñ÷-áβí ñýèíέóçð ðíð ððñÞíá óáð.

```
# RAID controllers interfaced to the SCSI subsystem
device      amr          # AMI MegaRAID
device      arcmsr       # Areca SATA II RAID
device      asr          # DPT SmartRAID V, VI and Adaptec SCSI RAID
device      ciss         # Compaq Smart RAID 5*
device      dpt          # DPT Smartcache III, IV - See NOTES for options
device      hptmv        # Highpoint RocketRAID 182x
device      hprr         # Highpoint RocketRAID 17xx, 22xx, 23xx, 25xx
device      iir          # Intel Integrated RAID
device      ips          # IBM (Adaptec) ServeRAID
device      mly          # Mylex AcceleRAID/eXtremeRAID
device      twa          # 3ware 9000 series PATA/SATA RAID

# RAID controllers
device      aac          # Adaptec FSA RAID
device      aacp         # SCSI passthrough for aac (requires CAM)
device      ida          # Compaq Smart RAID
device      mfi          # LSI MegaRAID SAS
device      mlx          # Mylex DAC960 family
device      pst          # Promise Supertrak SX6000
device      twe          # 3ware ATA RAID
```

Ïðíóðçñéæüñáñíé áέááéðÝð RAID. Áí ááí Ý÷-áðά έáíÝíá áðü áððíýð, ìðìñáβðά íá ðíðð ìáðáðñÝðáðά ðά ó÷-üέέá Þ íá ðíðð áðáέñÝðáðά áíðáέÞð.

```
# atkbd0 controls both the keyboard and the PS/2 mouse
device          atkbd      # AT keyboard controller
```

Ï äεääεòÐò ðεçεòññεϊάβιò (atkbd) ðάνÛ ÷ äε òðçññáòβáð I/O äεά ðεçεòññεïüεά όýðιò AT εάε óðóεääÛò εάòÛääεϊçð (ðñíòβεεά) όýðιò PS/2. Ï äεääεòÐò áðάεóáβòάε äεά όç εάεóιòññáβά ôιò ïäçäÛ ðεçεòññεϊάβιò (atkbd) εάε ôιò ïäçäÛ óðóεääòÐò εάòÛääεϊçð PS/2 (psm).

```
device          atkbd      # AT keyboard
```

Ï ïäçäÛò atkbd, ïáεβ ïá ôì äεääεòÐ atkbd, ðάνÛ ÷ äε ðñüóááóç óá ðεçεòññεïüεäεï όýðιò AT 84 P äεòóááÛÛιò AT ôì ïðìβì óóíáÛäóáε óòì äεääεòÐ ðεçεòññεϊάβιò.

```
device          psm        # PS/2 mouse
```

×ñçóεìðñεðóáò áòð òç óðóεääòP áí ôì ðñíòβεε óáð óóíáÛäóáε óðçí εÛñá PS/2.

```
device          kbdmux     # keyboard multiplexer
```

ÁáóεεÐ òðιòðññεïç ðñεððεáìβáð ðεçεòññεϊάβι. Áí ää óεìðáÛáòá ïá ÷ñçóεìðñεðóáòä ðññεóóüòññá áðu Ûíá ðεçεòññεïüεά óòì óýóóçíá óáð, ïðìñáβòá ïá áóóÛεάεá ïá áóáεñÛóáòá áòð òç äñññì.

```
device          vga        # VGA video card driver
```

Ï ðñüññáñíá ïäðäçóçð òçð εÛñòáð äñáóεεðì.

```
device          splash     # Splash screen and screen saver support
```

ÄñáóεεÐ ïεùίç (splash) εάòÛ όçí äεεβίçóç! Ç óðóεääòP áòð ÷ñçóεìðñεïüεáβòάε áðβóçð áðu óá ðñññÛññáòá ðñññεáίçð ïεùίçð (εñíóüεáð).

syscons is the default console driver, resembling an SCO console

```
device          sc
```

Ï ïäçäÛò sc äβíáε ï ðññáðεεääÛÛιò ïäçäÛò εñíóüεáð εάε ðññíññεðíáε εñíóüεά όýðιò SCO. Εάεðò óá ðññεóóüòññá ðññññÛññáòá ðεðññιð ïεùίçð áðñεòìÛí ðññóááóç óðçí εñíóüεά ïÛòú εÛðñεáð äεάεεìðεçð áÛóçð äääñÛÛι òñññáðεεðì ùðòò ôì termcap, ääí εá ðñÛðáε ïá Û ÷ äε óçíáóβá áí ÷ñçóεìðñεïüεáβòáð áòðìí ôì ïäçäÛ P ôìí vt ï ïðìβιð äβíáε óðñááòüð ïá εñíóüεá VT220. ÏäòÛ όçí äβóíäï óáð óòì óýóóçíá, εÛòá όçí ïáóáεççðP TERM óðçí óεìP scoansi áí εÛðñεá ðññññÛññáòá ðεðññιð ïεùίçð Û ÷ ïñ ðññäεçíá ùðáí ÷ñçóεìðñεïüεáβòάε áòðP ç εñíóüεá.

Enable this for the pcvt (VT220 compatible) console driver

```
#device          vt
```

```
#options          XSERVER          # support for X server on a vt console
```

```
#options          FAT_CURSOR       # start with block cursor
```

Ðññεáεóáε äεá Ûíá ïäçäÛ εñíóüεáð óðñááòü ïá VT220, εάε ïá ðññò óá ðβòü óðñááòüðεçðá ïá VT100/102. Εάεòññääβ εάεÛ óá εÛðñεìðò óìñçóìÛò ððñεäεóóÛò ðñò Û ÷ ïñ ñóðñááòüðεçðá ðεεεÛÛ ïá ôìí sc. ÏäòÛ όçí äβóíäï óáð óòì óýóóçíá, εÛòá όçí ïáóáεççðP TERM óá vt100 P vt220. Ï ïäçäÛò ïðìññáβ áðβóçð ïá áðñäáε ÷ εää ÷ ñðóεìðò ùðáí óóíáÛäóáòá óá ïääÛεì äñεεìü áðu äεáòññáðεεÛ ïç ÷ áíðñáòá ïÛòú äεεðÛìò, ùðιò ääí òðÛñ ÷ ïñ εáðá ÷ ùñðóáεð äεá όç óðóεääòP sc óòì termcap P terminfo — ôì vt100 εá ðñÛðáε ïá äβíáε äεáεÛóεì ðññáεðεεÛ óá εÛεä ðεáðòññá.

```
device          agp
```

Ὁ ἄρθρος εἰς τὴν ἑνότητα εἰς τὴν FreeBSD ἀρθροῦ ἀπὸ τὴν ἑνότητα εἰς τὴν FreeBSD. Ἐὰ ἀρθροῦ εἰς τὴν ἑνότητα εἰς τὴν FreeBSD.

```
# Power management support (see NOTES for more options)
#device             apm
```

Ὁ ἄρθρος εἰς τὴν ἑνότητα εἰς τὴν FreeBSD ἀρθροῦ ἀπὸ τὴν ἑνότητα εἰς τὴν FreeBSD.

```
# Add suspend/resume support for the i8254.
device             pmtimer
```

Ὁ ἄρθρος εἰς τὴν ἑνότητα εἰς τὴν FreeBSD ἀρθροῦ ἀπὸ τὴν ἑνότητα εἰς τὴν FreeBSD.

```
# PCCARD (PCMCIA) support
# PCMCIA and cardbus bridge support
device             cbb             # cardbus (yenta) bridge
device             pccard          # PC Card (16-bit) bus
device             cardbus         # CardBus (32-bit) bus
```

Ὁ ἄρθρος εἰς τὴν ἑνότητα εἰς τὴν FreeBSD ἀρθροῦ ἀπὸ τὴν ἑνότητα εἰς τὴν FreeBSD.

```
# Serial (COM) ports
device             sio             # 8250, 16[45]50 based serial ports
```

Ὁ ἄρθρος εἰς τὴν ἑνότητα εἰς τὴν FreeBSD ἀρθροῦ ἀπὸ τὴν ἑνότητα εἰς τὴν FreeBSD.

Ὁ ἄρθρος εἰς τὴν ἑνότητα εἰς τὴν FreeBSD ἀρθροῦ ἀπὸ τὴν ἑνότητα εἰς τὴν FreeBSD.

Ὁ ἄρθρος εἰς τὴν ἑνότητα εἰς τὴν FreeBSD ἀρθροῦ ἀπὸ τὴν ἑνότητα εἰς τὴν FreeBSD.

```
# Parallel port
device             ppc
```

Ὁ ἄρθρος εἰς τὴν ἑνότητα εἰς τὴν FreeBSD ἀρθροῦ ἀπὸ τὴν ἑνότητα εἰς τὴν FreeBSD.

```
device             ppbus          # Parallel port bus (required)
```

Ὁ ἄρθρος εἰς τὴν ἑνότητα εἰς τὴν FreeBSD ἀρθροῦ ἀπὸ τὴν ἑνότητα εἰς τὴν FreeBSD.

```
device             lpt           # Printer
```

Ὁ ἄρθρος εἰς τὴν ἑνότητα εἰς τὴν FreeBSD ἀρθροῦ ἀπὸ τὴν ἑνότητα εἰς τὴν FreeBSD.


```

device      rl          # RealTek 8129/8139
device      sf          # Adaptec AIC-6915 ("Starfire")
device      sis         # Silicon Integrated Systems SiS 900/SiS 7016
device      sk          # SysKonnect SK-984x & SK-982x gigabit Ethernet
device      ste         # Sundance ST201 (D-Link DFE-550TX)
device      stge        # Sundance/Tamarack TC9021 gigabit Ethernet
device      ti          # Alteon Networks Tigon I/II gigabit Ethernet
device      tl          # Texas Instruments ThunderLAN
device      tx          # SMC EtherPower II (83c170 "EPIC")
device      vge         # VIA VT612x gigabit ethernet
device      vr          # VIA Rhine, Rhine II
device      wb          # Winbond W89C840F
device      xl          # 3Com 3c90x ("Boomerang", "Cyclone")

```

ðññññÛññáðá ñäΠäçðò ðíð ÷ ñçóéññðíéíýí õíí éÞäééá ðíð äéáyéíð äéÝä÷íð MII.

```

# ISA Ethernet NICs. pccard NICs included.
device      cs          # Crystal Semiconductor CS89x0 NIC
# 'device ed' requires 'device miibus'
device      ed          # NE[12]000, SMC Ultra, 3c503, DS8390 cards
device      ex          # Intel EtherExpress Pro/10 and Pro/10+
device      ep          # Etherlink III based cards
device      fe          # Fujitsu MB8696x based cards
device      ie          # EtherExpress 8/16, 3C507, StarLAN 10 etc.
device      lnc         # NE2100, NE32-VL Lance Ethernet cards
device      sn          # SMC's 9000 series of Ethernet chips
device      xe          # Xircom pccard Ethernet

```

```

# ISA devices that use the old ISA shims
#device     le

```

ðññññÛññáðá ñäΠäçðò éáñðÞí Ethernet óýðíð ISA. Ääβðá õí áñ÷äβí /usr/src/sys/i386/conf/NOTES äéá éäððñÝñáéäð ó÷äóééÛ ñä õí ðíéäð éÛñðäð ððíðóçñβαίüðáé äðü ðíéñí ñäçäñ.

```

# Wireless NIC cards
device      wlan          # 802.11 support

```

ÄáíééÞ ððíðóÞñéíç ðíð 802.11. Ç äñäñÞ äððÞ äðáéðäβðáé äéá áóýññáðç äééðýüðç.

```

device      wlan_wep      # 802.11 WEP support
device      wlan_ccmp     # 802.11 CCMP support
device      wlan_tkip     # 802.11 TKIP support

```

ÏðíðóÞñéíç éñðððññÛðçðò äéá óðóéäðÝð 802.11. Ìé äñäñÝð äððÝð ÷ ñäéÛαίüðáé áí óéñðáyäðá ñä ÷ ñçóéññðíéÞðáðá éñðððññÛðçðò éáé ðññüðíéíéäá áóóáéäβäð 802.11i.

```

device      an          # Aironet 4500/4800 802.11 wireless NICs.
device      ath          # Atheros pci/cardbus NIC's
device      ath_hal      # Atheros HAL (Hardware Access Layer)
device      ath_rate_sample # SampleRate tx rate control for ath
device      awi          # BayStack 660 and others
device      ral          # Ralink Technology RT2500 wireless NICs.
device      wi          # WaveLAN/Intersil/Symbol 802.11 wireless NICs.

```


ÁððÞ ç þáγáñ-óðóέáðÞ óðεέáíáÙíáέ ðáέÝóά ðíð óðÝεíííðάέ ðñíð áððÞí έάέ ðά áíάέάðáðέγíάέ ðñíð ðí ááβííá íáðÙöñáóçð ðíð IPv4/IPv6.

```
# The 'bpf' device enables the Berkeley Packet Filter.
# Be aware of the administrative consequences of enabling this!
# Note that 'bpf' is required for DHCP.
device bpf # Berkeley packet filter
```

Ðñíεάέðάέ áέά ðí òβεòñí ðáέÝóùí Berkeley. ÁððÞ ç þáγáñ-óðóέáðÞ áðέòñÝðáέ óά εÙñòáð áέέðýíò íá έάέòíðñáíýí óά έάðÙóóáóç promiscuous (ðεÞñíðð áέññúάóçð), óðεέáíáÙííðάð íá áððú ðíí ðñúðí εÙεά ðáέÝóí áíυð áέέðýíò (ð.÷. Ethernet). Óά ðáέÝóά áððÙ íðñáβ íá áðίεέáγííðάέ óðí áβóεí Þ íá áíáðÙάίíðάέ íá òç áñÞεάέá ðíð ðñíáñÙííáðíð tcpdump(1).

Óçíáβóóç: Ç óðóέáðÞ bpf(4) ÷ ñçóέííðίέááβðάέ áðβóçð áðú ðí dhclient(8) áέά òçí áíÙέðçðç ðçð áέáγέðíóçð IP òçð ðñíáðέέááíÝíçð ðýεçð ε.í.ε. Áí ÷ ñçóέííðίέááβðá DHCP, áðÞóðά áððÞ òçí áðέέíáÞ áíáñáíðίέçíÝíç.

```
# USB support
device uhci # UHCI PCI->USB interface
device ohci # OHCI PCI->USB interface
device ehci # EHCI PCI->USB interface (USB 2.0)
device usb # USB Bus (required)
#device udbp # USB Double Bulk Pipe devices
device ugen # Generic
device uhid # "Human Interface Devices"
device ukbd # Keyboard
device ulpt # Printer
device umass # Disks/Mass storage - Requires scbus and da
device ums # Mouse
device ural # Ralink Technology RT2500USB wireless NICs
device urio # Diamond Rio 500 MP3 player
device uscanner # Scanners
# USB Ethernet, requires mii
device aue # ADMtek USB Ethernet
device axe # ASIX Electronics USB Ethernet
device cdce # Generic USB over Ethernet
device cue # CATC USB Ethernet
device kue # Kawasaki LSI USB Ethernet
device rue # RealTek RTL8150 USB Ethernet
```

ÓðíóðÞñέíç áέά áεÙöíñáð óðóέáðÝð USB.

```
# FireWire support
device firewire # FireWire bus code
device sbp # SCSI over FireWire (Requires scbus and da)
device fwe # Ethernet over FireWire (non-standard!)
```

ÓðíóðÞñέíç áέά áεÙöíñáð óðóέáðÝð Firewire.

Άέά ðáñέóóúðáñáð ðεçñíòíñáð έάέ áðέðεÝíí óðóέáðÝð ðíð ððíóðçñáβáííðάέ áðú ðí FreeBSD, ááβðά ðí áñ ÷ áβí /usr/src/sys/i386/conf/NOTES .

ΕὰοÛεὰεί 10

Àêôõðþóáέò

10.1 Óýññç

Ìðññáβðá íá ÷ ñçóείñðñέÞóáðá òì FreeBSD áέá íá êÛíáðá àέòððóáέò óá àέÛòññòð òýðñòð àέòððòðñí, áðu òñí ðáέάέúðáññ êññòóóέέú ùð òñí ðεί òýá ÷ ñññ laser àέòððòðÞ, έάέÞð έάέ ðñέάóáÞðñíðá Ûέέçð òá ÷ ñññáβáð áíÛíáóá òñòð, έάέ íá àçñέññáÞóáðá àέòððóáέò òççèÞð ðñέúðçòáð ìá òέò áòáññáÝð ðñò àέòáέáβðá.

Ïì FreeBSD ðññáβ áðβçð ìá ñòέìέóðáβ þóðá íá έάέòññáβ ùð áñòðçñáðçðð àέòððóáú ìέέòýñò. Ìá áòðÞ çç áòñáòúðçðá òì FreeBSD ðññáβ ìá έáñáÛíáέ áñááóβáð àέòýðòçð áðu àέÛòññòð Ûέέñòð ððñέñέóðÝð, òòñðáñέέáñáññÝññ ððñέñέóðñí FreeBSD, Windows έάέ Mac OS. Ïì FreeBSD ðññáβ ìá áñáóáέβæáέ ùðέ ìññ ìέá áñááóβá έá òððñíáðáέ êÛεá ÷ ñññέÞ óέέáñÞ έάέ ðññáβ ìá òçñáβ óðáðέóðέέÛ áέá ðñòð ÷ ñÞóðáð έάέ òá ìç ÷ áññíáðá ðñò έá êÛññò òέò ðáñέóóúðáññáð àέòððóáέò, ìá ðáñÛááέ óáέβáðð “banner” ðñò ìá ááβ ÷ ñññ òá ðñέññ áñÞέáέ ç êÛεá àέòýðòç, έάέ ðñέÛ Ûέέá.

Áòñý áέááÛóáðá áòðú òì έáòÛεὰεί έá ìÝñáðá:

- ðùð ìá ñòέìβóáðá òçñ ðññÛ àέòððóáúñ (print spooler) òñò FreeBSD.
- ðùð ìá ááέáέóðÛðá òβέðñá àέòýðòçð, ìá ÷ áέñβæáððá áέáέÝð áñááóβáð àέòýðòçð (ð. ÷. òç ìáðáðññðÞ áέóáñ ÷ ùñáññ έáέñÝññ òá ìññòÝð àέòýðòçð ðñò áβñáέ έáðáñçðÝð áðu òñòð àέòððòðÝð óáð).
- ðùð ìá áñáñáññέÞóáðá óáέβáðð òýðñò έáòáέβáðð Þ banner óðέð àέòððóáέò óáð.
- ðùð ìá àέòððñíáðá òá àέòððòðÝð ðñò áβñáέ óññáááññÝññέ òá Ûέέñòð ððñέñέóðÝð.
- ðùð ìá àέòððñíáðá òá àέòððòðÝð ðñò áβñáέ óññáááññÝññέ áðáðέáβáð òòñ áβέðòñ.
- ðùð ìá àέÝá ÷ áðá òñòð ðáñέññέóññýð àέòýðòçð, òòñðáñέέáñáññÝññ òññ ðáñέññέóññ ìááÝέñòð òññ áñááóέÞñí àέòýðòçð, έάέ ðùð ìá ðáñáñññáβæáððá òçñ áòñáòúðçðá àέòýðòçð òá òðáέáέññέñÝññòð ÷ ñÞóðáð.
- ðùð ìá έñáðÞóáðá òðáðέóðέέÛ áέá òññ àέòððòðÞ, έάέ έáðááñáðÞ áέá òç ÷ ñÞóç òñò àέòððòðÞ áðu êÛεá ÷ ñÞóç.
- ðùð ìá áñέñáðòððβóáðá ðññáέÞñáðá òðέð àέòððóáέò.

ðññέñ áέááÛóáðá áòðú òì έáòÛεὰεί, έá ðñÝðáέ:

- Ìá áñññβæáðá ðùð ìá ñòέìβóáðá έάέ ìá ááέáðáóðÞóáðá Ýñá ìÝñ ððñÞñá (ÈáòÛεὰεί 9).

10.2 ÁέóááññáÞ

Áέá ìá ÷ ñçóείñðñέÞóáðá àέòððòðÝð òòñ FreeBSD, έá ÷ ñáέáóðáβ ìá ñòέìβóáðá òç έάέòññáβá òñòð ìá òñ òýóðçñá ðáññ ÷ Ýðáðòçð (spooling) àέòððòðñí áñáñÞð òñò Berkeley, áñúòú áðβçð έάέ ùð òýóðçñá ðáññ ÷ Ýðáðòçð **LPD**, Þ áðέÛ **LPD**. Áòðú áβñáέ òñ ðññέáέññέóññέ òýóðçñá àέÝá ÷ ñò àέòððòðñí òòñ FreeBSD. Ïì έáòÛεὰεί áòðú áβñáέ ìέá áέóááññáÞ òòñ **LPD** έάέ έá óáð έáέññáçáÞóáέ òðέð ñòέìβóáέð òñò.

10.3.1.1.3 ÓáεñεάέΎο Έγñαò

Άέα ίά οόιαΎοάòά Ύίαί άέòδδθòP ÷ ñçóεiiðieþiòáò óáεñεάέP áεáóγiááòç, οóiaΎοάò òi éáòÛεεççèi óáεñεάέu éáεþáεi iáòáíγ áέòδδθòP éáε òðieiaéòòP. Ié iäçãßáò ðiò οóiaáγiòí òii áέòδδθòP éáε òii òðieiaéòòP óáò, éá óáò éáεiäçãPóíòí íá iεiεçñþóáòá òçí óγiááòç.

Áí ááí áβòáò óβáiiòñie ðieí áβiáε òi “éáòÛεεççèi óáεñεάέu éáεþáεi”, iðimáβòá íá äieeiÛóáòá iβá áðu òέò áεuεiðεáò áíáεεáέóééΎò:

- íá éáεþáεi *modem* áþiááé èÛεá pin òiò áéñiäΎέòç áðu òç íεá ðεáòñÛ òiò éáεuáβiò éáòáòεáβái iá òi áíòβòðie ÷ i pin òiò áéñiäΎέòç óði Ûεεi Ûεñi. Áðòuò i òγðiò éáεuáβiò áβiáε áfuóòuò éáε uò éáεþáεi “DTE-to-DCE”.
- íá éáεþáεi *null-modem* áþiááé éáòáòεáβái iáñéèÛ pins, áíòáεèÛóóáé iáñéèÛ Ûεεá (áεá ðáñÛááéáiá, óá pins áðiòieðò éáε èPøçð), áñþ áñá ÷ òεòεþiáé iáñéèÛ Ûεεá, áουòáñεéÛ, óði ðñiòóáòáòóέéu èÛεòiiá èÛεá áéñiäΎέòç. Áðòuò i òγðiò éáεuáβiò áβiáε áfuóòuò éáε uò éáεþáεi “DTE-to-DTE”.
- íá éáεþáεi *óáεñεάέiγ áέòδδθòP*, ðiò áðáέóáβòáé áðu èÛðieiðò éεáuòáñi óiççεóeíΎiðò áέòδδθòΎò, áβiáε óáí òi éáεþáεi null-modem, áεèÛ óðΎεiáé εóiaγiáiá óPiaóá éáε óóá áγi Ûεñá áiòβ íá óá áñá ÷ òεòεþiáé áουòáñεéÛ.

Έá ðñΎðáé áðβòçò íá ñòεiβòáòá òέò ðáñáíΎòñiòð áðéεieíuiβáò òiò áέòδδθòP, óðieuò áðu òii iðñiòóéiú ðβiáεá áεΎá ÷ iò P áðu òiòð DIP áεáεuðòáò òiò. ÁðééΎiðá òçí iΎáεóòç òéiP bps (bits per second = bits áíÛ ááòðáñuεáððòi, áiáòΎñáðáé éáε uò ñòεiúð *baud*) ðiò òðiòòçñβæiòí i òðieiaéòòPð éáε i áέòδδθòPð óáò. ÁðééΎiðá 7 P 8 data bits, none, even, P odd parity, éáé 1 P 2 stop bits. Áðβòçò áðééΎiðá Ύiá ðñuòuεieieèi áεΎá ÷ iò ñiðò: áβòá none, P XON/XOFF (áíáòΎñáðáé éáε uò Ύεáá ÷ iò ñiðò “in-band” P “software”). Íá èòiióóá áòðΎò òέò ñòεiβòáέò, áεá òi óòÛáεi ñýeieóçò εiáεóieéiγ ðiò áεieieðéáβ.

10.3.1.2 Ñòεiβòáέò Èiáεóieéiγ

ÁòðP ç áfuòçòá ðáñεáñÛòáé òέò áíááεáβáò ñòεiβòáέò ðiò ðñΎðáé íá áβiòí óði εiáεóieéu áεá íá iðimáβòá íá áέòδðPiaòá iá òi óγóçia ðáñi ÷ Ύðáòçòð áέòδδθòPí **LPD** óði FreeBSD.

Iéá ááieéP Ûðioç òui áíáñáεéþi ðiò ðñΎðáé íá áεieieðεPóáòá áβiáε:

1. Ñòεiβòáò òii ðòñPia óáò, áí áβiáε áíááεáβi, áεá òçí éγñá ðiò ÷ ñçóεiiðieþiáòá áεá òii áέòδδθòP óáò. Ié áðáñáβòçòáð ñòεiβòáέò ðáñεáñÛòiióáé óççí áfuòçòá Ñòεiβòáέò **ÐòñPia**.
2. Ñòεiβòáò òçí éáòÛóóáóç áðéεieíuiβáò áεá òçí ðáñÛεεçç éγñá, áí ðñuεáéòáé íá òçí ÷ ñçóεiiðieþiPóáòá. Ç áfuòçòá Ñòεiβòáέò ÈáòÛóóáóçò Áðéεieíuiβáò áεá òçí ÐáñÛεεçç Èγñá ðáñεΎ ÷ áε éáðòiiΎñáéáò.
3. ÁεΎáiðá áí òi éáεoiðñáééu óγóçia iðimáβ íá óóáβεáé áááñΎiá óðii áέòδδθòP. Ç áfuòçòá éáá ÷ iò Áðéεieíuiβáò òiò ÁέòδδθòP ðáñΎ ÷ áε iáñééΎò óoiáioéΎò áεá òi ðuò éá iðimiióá íá áβiáε i Ύεáá ÷ iò.
4. Ñòεiβòáò òi **LPD** áεá òii áέòδδθòP óáò, ðñiðieþiòáò òi áñ ÷ áβi /etc/printcap. Έá áñáβòá iäçãßáò áεá áòðΎò òέò ñòεiβòáέò óá áðuiañi òiPia áòðiiγ òiò éáòáéáβiò.

10.3.1.2.1 Ñòεiβòáέò ÐòñPia

I ðòñPiaò òiò éáεòioñáééiγ óòòðPiaòiò Ύ ÷ áε iáòááεuðòéóóáβ Ύòóé þòá íá äieéáγáé iá Ύiá óòáεáñεéΎií óγñieí óòóéáðñi. Ç óáεñεáέP éáε ç ðáñÛεεçç áεáóγiááòç òiò áέòδδθòP áβiáε iΎñiò áòðiiγ òiò óòiuεiò. ÁðñΎiòð, βòuò íá áβiáε áíááεáβi íá ðñiòéΎóáòá òðiòóPñéiç áεá èÛðieá ðñuòéáòç óáεñεáέP P ðáñÛεεçç éγñá, áí ááí áβiáε Þäç ñòεieíoiΎiç óðii ðòñPia óáò.

Άέα íá áεΎáiðáò áí i ðòñPiaò óáò iðimáβ íá òðiòòçñβiáé íεá óáεñεáέP áεáóγiááòç, ðεççòñieiaPóáòá:

Ç ðεί ἀδέρ ñγέιέοç õïï spooler ἀδïòääßóáé áδï òá áέüèïòéá ᾗðïáóá:

1. ἌδέεΎíòá ῒíá ùíñá (έάé εßáá ᾗτεέü ðáñùíγíéá) áéá õïí áέòòδùòð, έάé õïðïéáòðóòá òá òòï ᾗñ ÷ ᾗßï /etc/printcap. Ἀάßòá òçï ᾗíùòçòá Ἰñíáðïíäüòçòç Ἀέòòδùòð áéá ðáñέóóüðáñáò ðεçñïíòïñßáò ó ÷ ᾗðέéü ïá òçï ïñíáóßá òùí áέòòδùòðí.
2. Ἄðáíáñáñïðïéðóòá òέò òáέßááò éáòáεßááò (ᾗßíáé ᾗíáñáΎò áδï ðñïáðέέïáð) áέóüᾗííóáò òçï έέáíùòçòá sh. Ἀέá ðáñέóóüðáñáò ðεçñïíòïñßáò ᾗάßòá òçï ᾗíùòçòá ðáñáñïðüáέóç Ὀάεßáñï Ἐáòáεßááò.
3. Ἀçïéíòñáðóòá ῒíá έáóüέïáñï ðáñï ÷ ῒðáòçòð, έάé έáéíñßóòá òçï òïðïéáóßá õïò ïá òçï έέáíùòçòá sd. Ἀέá ðáñέóóüðáñáò ðεçñïíòïñßáò ᾗάßòá òçï ᾗíùòçòá Ἀçïéíòñáßá Ἐáóáέüᾗíò ðáñï ÷ ῒðáòçòð.
4. Ἐáéíñßóòá òçï έáóüέéçç έáóá ÷ ðñέóç /dev áéá õïí áέòòδùòð, έάé òçïάέðóòá òç òòï /etc/printcap ïá òçï έέáíùòçòá lp. Ἀέá ðáñέóóüðáñáò ðεçñïíòïñßáò, ᾗάßòá òçï ᾗíùòçòá Ἀíáñïðñέóç òçð Ὀóóéáòðð Ἀέòýðùòçð. Ἄðßóçð, áí ï áέòòδùòðð ᾗßíáé òá òáέñέáεð éγñá, ᾗέáóáóòðóòá òέò ðáñáñïðïñòð ᾗðέέïéíñßáò ïá òçï έέáíùòçòá ms# ç ïðïßá áíáέýáðáé òòçï ᾗíùòçòá Ἰðèíßóáέò ðáñáñïðññ Ἀðέέïéíñßáò õïò Spooler.
5. Ἀάέáóáóòðóòá òßέòñá áέóüᾗíò ᾗðéíý έáéΎíñò. Ἀάßòá òçï ᾗíùòçòá Ἀάέáóüðóáóç Ὀßέðñïò ἘáéΎíñò áéá ðáñέóóüðáñáò ðεçñïíòïñßáò.
6. ἈέΎáñðá òçï ᾗέáóüðóáóç ᾗέòòðññïáò ïééáððïðá ïá òçï ᾗíòïéð lpr(1). ðáñέóóüðáñáò ðεçñïíòïñßáò ᾗßíáé áέáéΎóéíáð òέòð ᾗíùòçòáð Ἀíééíð õïò Spooler έáé Ἀíòïðέóíùò Ἀέááðí.

Ὀçïáßùòç: ἈέòòδùòΎò ðïò ᾗáóßæííðáé òá ᾗéðóáò ᾗέòýðùòçòð, üðùò ïé áέòòδùòΎò PostScript, ᾗáí ïðïíñíý ïá ᾗέòòððïòï Õíáóá ᾗðéü éáßíáñï. Ἰ ᾗðéüò òñüðïò ñγέιέóçð ðïò ᾗáßíáíá ðáñáðüíù έáé ðïò έá ðáñέáñüðïíá ᾗέòáíΎóóáñá òέòð ᾗðüíáíáò ᾗíùòçòáð, ðñïúðïéΎóáé ðùò áí ñέíßæáðá ῒíáí òΎòïéí ᾗέòòδùòð έá ïðïñáßóá ïá ᾗέòòððóáðá ïüíñí ᾗñ ÷ ᾗßá ᾗñáñíῒíá òóç ᾗéðóóá òïò.

Ἰέ ÷ ñðóòáð òòïðéùð ññæïòí ðùò ïðïíñíý ïá ᾗέòòððïòï ᾗðéü éáßíáñï òá ïéíòð òïòð ᾗέòòδùòΎò ðïò ᾗßíáé ᾗáέáóáóòçï ῒíé òòï óýóóçíá òïòð. Ὀá ðñïᾗñüíáóá ðïò ÷ ñçóéíñðïéíý òï **LPD** áéá ïá ᾗέòòððïòï, éüñïí ᾗέñέáðð òçï ßáéá òðüéáóç. Ἀí ðñïòðáέáßóá ïá ᾗέáóáóòðóáðá ῒíáí òΎòïéí ᾗέòòδùòð έáé éΎέáðá ïá ïðïñáßóá ïá òòððíáðá ᾗñááóßáð òòçï ᾗéðóóá òïò ᾗέòòδùòð ᾗééü éáé òá ᾗðéü éáßíáñï, òáð òòïέóòïγñá ïá ðñïóéΎóáðá ῒíá ᾗðέðéΎíñ ᾗðíá òòçï ᾗέááέéáóá ᾗáέáóüðóáóçð ðïò ðáñέáñüðáíá ðáñáðüíù: Ἀάέáóáóòðóòá ῒíá ðñüᾗáñíá áóòüᾗáðçò ïáðáòñïððð áδï ᾗðéü éáßíáñï òá PostScript (ð òá üέéç ᾗéðóóá ᾗέòòδùòð). Ç ᾗíùòçòá Ὀðíááóüòçòá Ἀñáóéðí Ἀðéíý ἘáéΎíñò òá ᾗέòòδùòΎò PostScript ᾗíçááß ðùò ïá ᾗíáñáðóáðá.

10.3.1.5.1 Ἰñíáðïíäüòçòç Ἀέòòδùòð

Ὀí ðñðïí (ᾗγέïéí) ᾗðíá ᾗßíáé ïá ᾗðέéΎíáðá ùíñá áéá õïí áέòòδùòð òáð. Ἀάí ῒ ÷ ᾗέ òçïáóßá áí έá ðñïòéíðóáðá ῒíá έáέóíòñáέéü ð éüðïéí ᾗñüðέéü ùíñá áóíý ïðïñáßóá ᾗðßóçð ïá ðñïóéΎóáðá έáé ïáñέéü ðáñùíγíéá (aliases) áéá õïí ßáéí ᾗέòòδùòð.

Ὀíòéü ÷ έóòñ ῒíáð áδï òïòð ᾗέòòδùòΎò ðïò ᾗíáóüññíóáé òòï /etc/printcap έá ðñΎðáé ïá ῒ ÷ ᾗέ òí ðáñùíγíéí lp. Ἀòðð ᾗßíáé ç ïñíáóßá òïò ðñïáðέéáñí ῒñò ᾗέòòδùòð. ἈΎí ïé ÷ ñðóòáð ᾗáí ῒ ÷ òï òçï ïáðááέçòð ðáñέáüέéíðïò PRINTER έáé ᾗáí ᾗíáóüññíò éüðïéí ùíñá ᾗέòòδùòð òòçï ᾗñáññ ᾗíòïéðí ïá ïðïéáððïðá ᾗíòïéð **LPD**, òüðá ï ï ðé ᾗßíáé ï ðñïáðέéáñí ῒñò ᾗέòòδùòðð áéá òέò ᾗέòòððáέò òïòð.

Ἄðßóçð, ᾗßíáé έïéíð ðñáέóééð òí òáέáððáßí alias òïò ᾗέòòδùòð ïá ᾗßíáé ïéá ðéðñçò ðáñέáñáòð òïò ᾗέòòδùòð, ðïò ïá ðáñέéáíáΎíáé òñ έáóáóéáðáóòð έáé òí ñïòΎéí.

Έυαὺ όçð ìáðáááέέυìáíçð öýόçð ðυì έάóάέυαὺì δάνì ÷ ὸδδδδδδ, óóίçèβæάóάέ íá òìðìέάòìγìόάέ έὺòυ àδυ òìí έάóὺέìαì /var/spool. Ἄáí ἄβìάέ áíáάέάβì íá δάβñíáðά áíðβñáñáóά áóóάέάβáð ðυì έάóάέυαὺì δάνì ÷ ὸδδδδδδ. Ç ἄδáíáäçìέìòñáβá òìòð ἄβìάέ ðυòì áðèP υòì íá ðñ ὸδδδδδδ όçì áíòìèP mkdir(1).

Ἄβìάέ ἄδδβóçð óóίçèέέòì ὸδδδδδδ ìá ìñ ὸδδδδδδ ì έάóὺέìαìò ìá òì βáέì υñíá ìá òìí ἄέòððυòð, υðòð óάβìáóάέ δάνάέὺòυ:

```
# mkdir /var/spool/printer-name
```

ὸóòυòì, áí ὸ ÷ ἄðά ἄñέάòìγð ἄέòððυòð ὸòì ἄβέòòì, βòðð ἄðέέòìáβòð íá òìðìέάòðóáðά òìòð έάóάέυαìòð δάνì ÷ ὸδδδδδδ έὺòυ àδυ ὸ íá ìíáάέέυì έάóὺέìαì ðìò έá ÷ ñçóέìðìέάβóάέ ἄðìέέάέóóέέὺ ἄέά ἄέòððóáέð ìá òì **LPD**. Έά έὺòìòìά ἄέñέáðð áðòυ ἄέά ðά δάνάάάβáìáóά íáð ìá òìòð ἄέòððυòð rattan έάέ bamboo:

```
# mkdir /var/spool/lpd
# mkdir /var/spool/lpd/rattan
# mkdir /var/spool/lpd/bamboo
```

Όçìáβύòç: Ἄὺì ìέ ἄñάáóβáð ðυì ÷ ñçóòòðì δάνέγ ÷ òì ðñìóυðέέέὺ ἄάáñ ὸ íá, ìðìñáβ ìá έγέάðά ìá ðñìóðáð ὸδδδδδδ òìí έάóὺέìαì δάνì ÷ ὸδδδδδδ ìá έὺòìέì òñυòì, βóðá ìá ìçì ἄβìάέ ἄçìυóέά ðñìóáὺóέìò. ìέ έάóὺέìαìέ δάνì ÷ ὸδδδδδδ έá ðñ ὸδδδδδδ ìá áíðέìòì έάέ ìá ἄβìάέ áíááìðóέìέ, ἄάáñ ὸδδδδδδ έάέ ìá ἄðìáðυòçðά áíáæðçóçð áδυ òìí ÷ ñðóðç daemon έάέ áδυ òçì ììὸάá daemon, áδυ έáíγìá ὸέέì. Ἄέά òìòð ἄέòððυòð òìò δάνάάάβáìáóìò:

```
# chown daemon:daemon /var/spool/lpd/rattan
# chown daemon:daemon /var/spool/lpd/bamboo
# chmod 770 /var/spool/lpd/rattan
# chmod 770 /var/spool/lpd/bamboo
```

ὸγέìò, ðñ ὸδδδδδδ ìá áíçìáñðóáðά òì **LPD** ἄέά áðòìγð òìòð έάóάέυαìòð ÷ ñçóέìðìέáβìóáð òì ἄñ ÷ ἄβì /etc/printcap. Δñìóáέìñβóðά όçì ἄέάáññìP òìò έάóάέυαìò δάνì ÷ ὸδδδδδδ ìá όçì έέáíυòçðά sd:

```
#
# /etc/printcap for host rose - added spooling directories
#
rattan|line|diablo|lp|Diablo 630 Line Printer:\
    :sh:sd=/var/spool/lpd/rattan:

bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
    :sh:sd=/var/spool/lpd/bamboo:
```

Όçìáέðóðά ðυò òì υñíá òìò ἄέòððυòð ìáέέìὺ óóçì ðñðçç óððèç, ἄìð υέáð ìέ ὸέέáð έáóά ÷ ἄñβóáέð ðìò δάνέáñ ὸδδδδδδ òìí ἄέòððυòð έá ðñ ὸδδδδδδ ìá ἄβìάέ óðìέ ÷ έóì ὸδδδδδδ έάέ έὺέá ò ὸγέìò ἄñáñðð ìá ò ὸγñάέ ÷ ἄñάέððñά ἄέáððáðð ìá ἄñέóðáñυóðñìòç έὺέáðì.

Ἄὺì ἄáí ðñìóáέìñβóðάð òìí έάóὺέìαì δάνì ÷ ὸδδδδδδ ì ὸγò òìò sd, ðυòðά òì óγóóçìά δάνì ÷ ὸδδδδδδ έá ÷ ñçóέìðìέáβóάέ òìí ðñìáðέέάñ ὸδδδδδδ /var/spool/lpd.

10.3.1.5.4 Ἄíááìðñέóç όçð ὸóέáððð Ἄέòγðυòçð

Όóçì ἄíυòçðά ñðέìβóáέð Hardware áíááññβóáìά όç έγñά, έάέ έáóὺ òòìγðάέά όçì έáóά ÷ ðñέóç ðìò έάóάέυαìò /dev ðìò έá ÷ ñçóέìðìέáβóάέ òì FreeBSD ἄέά ìá ἄðέέìέñìðóáέ ìá òìí ἄέòððυòð. ὸðñά, έá ἄðòìòìά óòì **LPD** áððð όçì


```
bamboo | ps | PS | S | panasonic | Panasonic KX-P4455 PostScript v51.4:\
    :sh:sd=/var/spool/lpd/bamboo:\
    :lp=/dev/ttyu5:ms#-parenb cs8 clocal crtscts:\
    :if=/usr/local/libexec/if-simple:
```

ΌχιΆβούο: Ιδιñάβδά ίά άñάβδά Υία άίόβάñάοϊ οϊο script if-simple όοϊί έάόΰεϊάϊ
/usr/share/examples/printing.

10.3.1.5.7 Άίάñάϊδϊβζόζ όϊο LPD

Όϊ lpd(8) άέοάέάβδάέ άδϋ όϊ /etc/rc, έάέ άέΎά÷άόάέ άδϋ όζί ίάόάάέζοθρ lpd_enable. ζ ίάόάάέζοθρ άόθρ Ύ÷άέ δñιáδέέάñΎίζ όέίθρ no. Άί άάί όϊ Ύ÷άόά έΰίάέ άέϋιá, δñιόέΎόδά όζί άέϋεϊθέζ άñάñθρ:

```
lpd_enable="YES"
```

όοϊ άñ÷άβϊ /etc/rc.conf, έάέ άδάíάέέέίθρόά όϊ όύόόζία όάο, θρ άδθΰ άέόάέΎόδά όϊ lpd(8).

```
# lpd
```

10.3.1.5.8 Άϊέέίθρ όϊο Spooler

Όδΰόάόά όοϊ όΎεϊθ όζο άδθρδ άάέάόΰόόάόζο όϊο **LPD**. Έά άοθρϊοιá άέά άñάϋόάñά όά όόá÷άñζοθρñέά, άοϊϋ άέϋιζ έά δñΎδάέ ίά άέΎάñθϊά όζί άάέάόΰόόάόζ έάέ ίά άέιñθρθϊοιá ιθϊέíáθρϊοá δñϋάέζία Ύ÷άέ δñιέϋάέ. Άέά ίά άέΎάñάόά όζί άάέάόΰόόάόζ δñιόδάέθρόά ίά άέοδθρόάόά έΰέ. Άέά ίά άέοδθρόάόά ίά όϊ όύόόζία **LPD**, ÷ñζόέιθϊέθρόά όζί άίθϊέθρ lpr(1), ζ ιθϊβá άδϊόόΎέέάέ ίβá άñάάόβá δñιθ άέόδϋόζ.

Ιδιñάβδά ίά όθíáοΰόάόά όζί lpr(1) ίά όϊ δñϋάñάñá lptest(1), άέά όϊ ιθϊβι έΰίáíá ίέά άέόάáϋάθρ όόζί άϋιόζόά έáá÷ιθ Άδέέίέíϋιáδ όϊο Άέόδδϋόθρ, άέά όϊί Ύέάá÷ι έάέίΎιθ.

Άέά όϊί Ύέάá÷ι ίέάό άδθρδ άάέάόΰόόάόζο **LPD**:

Δέζέδññέíáθρόά:

```
# lptest 20 5 | lpr -Pprinter-name
```

¼δϊθ printer-name άβίáέ όϊ ϋñíá άϋιθ άέόδδϋόθρ (θ όϊ alias) δϊο άίάόΎñάόάέ όοϊ /etc/printcap. Άέά ίά άέΎάñάόά όϊ δñιáδέέάñΎίí άέόδδϋόθρ, δέζέδññέíáθρόά lpr(1) ÷ϋñβδ όϊ δñϋέáíá -θ. Άί ί άέόδδϋόθρ όάο ÷ñζόέιθϊέάβ PostScript, δñΎδάέ ίά όόάβέάόά Ύία δñϋάñάñá PostScript, άίθβ ίά ÷ñζόέιθϊέθρόά όϊ lptest(1). Άέά ίά όά έάόάόΎñάόά, όϊθϊέάθρόά όϊ δñϋάñάñá όά Ύία άñ÷άβι έάέ δέζέδññέíáθρόά lpr file.

Όά Ύίáί άέόδδϋόθρ PostScript, ζ άέόδϋόζ έά άβίáέ όϊ άδϊθΎέάόίá όιθ δñιáñΰñάόιθ δϊο όόάβέάόά. Άί ÷ñζόέιθϊέάβδά όϊ lptest(1), όϋόά όϊ άδϊθΎέάόίá έά ñέΰάέ ίά όϊ άέϋεϊθέζ:

```
! "#$%&' ( ) * + , - . / 0 1 2 3 4
"# $ % & ' ( ) * + , - . / 0 1 2 3 4 5
# $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6
$ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7
% & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8
```

Άέα δάνάεοΎνυ Ύεάα÷ι οίρσ άέοδδθρσ, άίεειΰόοά ίά εάοάαΰόοά ίάάάεγόάνα δνίανΰίάοά (άέα άέοδδθρσΎο θίρσ ÷ñçóειñðίείγί άεθρσά δνίανάίίάόεοίγ) P δñΎίόά οί lptest(1) ίά άέαοίñάόέεΰ δñίεΎίάοά. Άέα δάνΰάάέαι, ç áíοίρεP lptest 80 60 εά δάνΰάάέ 60 άνάνΎδ ούί 80 ÷άνάεδPñύι ç εάεάίβá.

Άί ί άέοδδθρσδ άάί άίρεάγáε, άάβσά όçί άίυόçόά Άίοίθεοίυδ Άέάπí.

10.4 Νόειβσάέο Άέοδδθρσπí άέα Θñί÷ύñçίΎίίοδ

Δñίάέαιδίβçç: Άδύ οί FreeBSD 8.0 εάε ίαδΰ, όά άñ÷άβá όόόεάόπí άέα όέο όάέñεάεΎο εγñάδ ίάοίñίΰόόçεάί άδύ /dev/ttydN όά /dev/ttyuN. Ίέ ÷ñPόόάδ οίθ FreeBSD 7.X εά δñΎδάε ίά δñίόάñίυόίοί όçί όάειçñβυόç θίρσ άέίείθεάβ ίά άΰόç άόδΎο όέο άέέάΎδ.

ΆόδP ç άίυόçόά δάνεάνΰόάε οβέδñά άέα όçί άέόγδύόç άέάέεPδ ίñθPδ άñ÷άβύί, όάεβáύί εάόάεβáάδ, άέα άέοδδθρσάέο ίΎού άέέόγίρ, εάεθρ εάε άέα οίγ Ύεάα÷ι δñυόάάόçδ εάε όçί εάόαιΎόñçόç ÷ñPόçδ ούί άέοδδθρσ.

10.4.1 Όβέδñά

Άί εάε οί **LPD** ίδñίάβ ίά ÷άέñέόόάβ δñυόυέίεεά άέέόγύί, εβόόάδ άίάίñPδ, Ύεάα÷ι δñυόάάόçδ, εάε ΰεεάδ δάνάίΎόñçόδ ούί άέοδδθρσάύί, οί εγñεί ίΎñίδ όçδ δñάάίάόέεPδ άñάάόβáδ άβίάόάε ίά όά *οβέδñά*. Όά οβέδñά άβίάε δνίανΰίάοά θίρσ άδέέίεíñύί ίά οίρσ άέοδδθρσ εάε ÷άέñβαιίόάε όέο άίάñθPόάέδ όçδ όόόεάόPδ εάε ΰεεάδ άέάέεΎδ άδάέοPόάέδ όçδ. Όόçί άδεP άάεάΰόόάόç άέοδδθρσ, άάεάόάόPόάίά Ύίά οβέδñί άδείγ εάείΎίρσ εάέάβόάñά άδεPδ ίñθPδ, θίρσ εά δñΎδάε ίά άίρεάγáε ίά οίρσ δάνέόόυόάñίρσ άέοδδθρσΎδ (άίυόçόά Άάεάΰόόάόç Όβέδñθρσ ΈάείΎίρσ).

ΰόόυοί, άέα ίά ίδñίΎόάδ ίά άέίάόάεεάδδάβόά όέο άόίάδύόçόάδ ίάόάδñίθPί ίñθPδ, άεΎá÷ίρσ δñυόάάόçδ εάε εάόαιΎόñçόçδ, εάε ό÷÷ύί άέάέεΎδ άόίάδύόçόάδ οίρσ άέοδδθρσ όάδ, εά δñΎδάε ίά εάόάεΰάάόά δύδ άίρεάγίρσ όά οβέδñά. Όά όάέέεP άίΰεόç, εά άβίάε άόεγίç ούί οβέδñύί ίά ÷άέñβαιίόάε ύεάδ άόδΎδ όέο δάνάίΎόñίρσ. Όά εάεΰ ίΎά άβίάε δύδ όέο δάνέόόυόάñάδ οίñΎδ εά δñΎδάε ίά δάνΎ÷άδά *άόαβδ ίέ βáείέ* όά οβέδñά όάδ. Όά εάεΰ ίΎά άβίάε δύδ άάίεεθρ δδΰñ÷ίρσ άñεάδΰ άεάεΎόείά, εάε άί άάί δδΰñ÷ίρσ, άβίάε ό÷άδέεΰ άγέίεί ίά όά άñΰόάά.

Άδβόçδ, οί FreeBSD άέάδβέάόάε ίά Ύίά οβέδñί, οί /usr/libexec/lpr/lpf, θίρσ άίρεάγáε ίά δίεείγδ άέοδδθρσΎδ θίρσ ίδñίγί ίά άέοδδθρσίρσ άδεü εάβίάí. (× άέñβάάόάε backspacing εάε tabs όοί άñ÷άβί, εάε εΰίάε εάόαιΎόñçόç, άέεΰ όβθίόά δάνέόόυόάñ.) Όδΰñ÷ίρσ, άδβόçδ, άεΰοίñά ΰεεά οβέδñά εάε όόόόάέεΰ θίρσ όόçί ΌέείρεP ούί Ports θίρσ FreeBSD.

Όά άόδP όçί άίυόçόά εά άñάβόά: :

- Ç άίυόçόά Δύδ άίρεάγίρσ όά Όβέδñά, δñίόδάεάβ ίά άθρσάε ίέα άάίεεP ΰθίθç άέα όέο άñίίάέυόçόάδ ούί οβέδñύί όόέο άεάñάάόβáδ άέόγδύόçδ. Έά δñΎδάε ίά άεάΰόόάά άόδP όçί άίυόçόά άέα ίά ίδñίάβόά ίά εάόάεΰάάόά όε “δñάάίάόέεΰ” όοίάάβίάε ύόάί οί **LPD** ÷ñçóειñðίεάβ οβέδñά. ΆόδΎδ ίέ άίθρσάέδ εά όά άίçεPόίρσ ίά δñίεάίάΰίάδά εάε ίά άθίόόάείάθPίάόά δñίάεPίάόά θίρσ ίδñίγί ίά όοίάγί εάεθρ άάεάεέόΰόά ύεί εάε δάνέόόυόάñά οβέδñά όά εΰεά άέοδδθρσ όάδ.
- Όί **LPD** άίάίΎίάε δύδ εΰεά άέοδδθρσδ άβίάε εέάíυδ, άδύ δñίάδέείρεP, ίά άέοδδθρσάε άδεü εάβίάí. Άόδύ ύίυδ άβίάε δñύάεçίά άέα άέοδδθρσΎδ PostScript (P ΰέείρδ θίρσ άάόββαιίόάε όά άεθρσάδ δñίανάίίάόεοίγ) ίέ ίδñίεί άάί ίδñίγί ίά άέοδδθρσίρσ ΰίάόά άδεü εάβίάí. Ç άίυόçόά Όόίάάόυόçόά ΆñάάόεPί Άδείγ ΈάείΎίρσ όά άέοδδθρσΎδ PostScript όάδ

αίτσαάβ όέ έά δñÝðáέ ίά εΰίáοά άέά ίά ίáðñŰóáόά áóóυ όί δñυáέçíá. Έά δñÝðáέ ίά áέááŰóáόά áóδρ όçί áíυóçόά áί Ý ÷ áόά áέóδδυóδρ PostScript.

- Όί PostScript áβίáέ äçířóέέδρ ίññóδρ áíυářó άέá ðřέŰ δññáñŰίáόά. Íáñέέίβ Űίέñυðřίέ δññóέířύί έάέ ίά ãñŰóří έáόáδέάβáί óá έρπέέá PostScript. Άóóóδ ÷ ð, íέ áέóδδυóÝδ PostScript Ý ÷ říó ίááŰέí έυóóřð. Ç áíυóçόά δññíñíβυóç PostScript áέá áέóδδυóÝδ ðří ááí όί óðříóçñβáéříóί αίτσαάβ έáððñáñðρ ðυó ίά ίáóáðñÝóáόά Ýίá öβέóñí έáέíÝñřó áέá áέóδδυóÝδ ðóóá ίά έáíáŰίáέ έáέ ίά óððříáέ áááñÝίá PostScript óá áέóδδυóÝδ ðří ááí áβίáέ PostScript. Έά δñÝðáέ ίά áέááŰóáόά áóδρί όçί áíυóçόά áί áβóóá εŰóí ÷ řó áέóδδυóδρ ðří ááí óðříóçñβáέ PostScript.
- Ç áíυóçόά Öβέóñá Íáóáóñíðρ ðáñέáñŰóáέ ίέá áóóñíáóíðřéçíÝίç áέááέέáóá áέá όçί ίáóáóñíðρ áñ ÷ áβíř áέáέέδρ ίññóδρ, υðυó áááñÝίá áñáóέέρí δρ óóřé ÷ áέřέáóáó, óá ίέá ίññóδρ έáóáíçóδρ áðυ όíř áέóδδυóδρ óáó. ÍáóŰ όçί ářŰáíυóç áóδρ όçò áříυóçόáó, έá δñÝðáέ ίά áβóóá óá εÝóç ίά ñöèìβóáóá όířó áέóδδυóÝδ óáó ίá óÝóíéří óñυðří ðóáá ðέçέóñíéříáðříóáó ðř - ò íέ ÷ ñδρóáó óáó ίά ίðñířύί ίá áέóððρíóří áááñÝίá troff, δρ ίá ðř - á áááñÝίá T_EX DVI, δρ ίá ðř - v ίá áέóððρíříóří áέέυíáð áááñÝířú ñŰóðáñ, έáέ řýóυ έáέáíðρ. Óáó óóíářóέáříóříá ίá áέááŰóáόά áóδρ όçί áříυóçόá.
- Ç áříυóçόά Öβέóñá Áíυářó ðáñέáñŰóáέ Ýίá ÷ áñáέóçñέóóέέυ όíř **LPD** ðří ááí ÷ ñçóέíříóéáβóáέ óó ÷ řŰ: óá öβέóñá áíυářó. Íðñáβóá ίá δññíóðñŰóáόά áóδρ όçί áříυóçόá, áέóυó áί óððříáóá óáέβááð έáóáέβááð (ááβóá óέð Óáέβááð Έáóáέβááð).
- Ç áříυóçόά l_{pf}: Ýίá Öβέóñí ΈáέíÝñřó ðáñέáñŰóáέ όí ðřf, Ýίá δñááíáóέέŰ ðέðñáð, áί έáέ áðέυ, öβέóñí έáέíÝñřó áέá áέóδδυóÝδ áñáñðρ (έáέ áέóδδυóÝδ laser ðříó ίðñířύί ίá έáέóířñáðříóří έáέ υò áέóδδυóÝδ áñáñðρ) ðří ðáñέÝ ÷ áóáέ óóí FreeBSD. Áί ÷ ñáέŰáέáóá Ýίá áñðáíñí óñυðří áέá ίá εŰίáóá όçί έáóáíÝðñçóç óáέβáυí ίá ářóέářáέ óá áðέυ έáβíáñř, δρ áί Ý ÷ áóá εŰðříéří áέóδδυóδρ ðří ááŰáέ έáðřýó υóáί áέÝðáέ ÷ áñáέððñáð backspace, έá δñÝðáέ řðυóáððříóá ίá ářáðŰóáόά όçί ðáñβððóç όíř ðřf.

Όçíáβυóç: Íðñáβóá ίá áñáβóá áίóβáñáóí óυí áέŰóíñύí scripts ðří ářáóÝñíříóáέ ðáñáέŰóυ, óóíř έáóŰέíáří /usr/share/examples/printing.

10.4.1.1 Δυó Äïöëářýříóί óá Öβέóñá

¼ðυó ářáóÝñáíá δñçíáříóřýříóυ, öβέóñí áβίáέ Ýίá áέóáέÝóέíř δñυáñáíá ðří ářáñářðříέáβóáέ áðυ όί **LPD** áέá ίá ÷ áέñβáέáóáέ όí όíðříá όçò áðέéřéřúříβáð ίá όíř áέóδδυóδρ ðříó ářáñóŰóáέ áðυ όíř óýðří όçò βáέáð όçò óóέéáðδρ.

¼óáί όí **LPD** εÝέáέ ίá áέóððρóáέ Ýίá áñ ÷ áβí ίέáð áñááóβáð, ίáέέřŰ όí δñυáñáíá όíř öβέóñíř. ÈÝóáέ υò standard input όíř öβέóñíř όí áñ ÷ áβí ðříó δñÝðáέ ίá áέóððυέáβ, υò standard output όíř βáέří όíř áέóððυóδρ έáέ υò standard error όí áñ ÷ áβí ářáóíñŰó óóáέříŰóúří (ářáóÝñáóáέ óóçί έέáříυóçόá ðř óíř /etc/printcap, δρ áðυ δññáðέéřáð όí /dev/console).

Όí öβέóñí ðří έá ίáέέřðóáέ όí **LPD** έáέðρ έáέ ίέ ðáñŰíáóñíέ όíř öβέóñíř, ářáñóðříóáέ áðυ όí óé Ý ÷ áóá äçέðρóáέ óóí áñ ÷ áβí /etc/printcap έáέ áðυ όí óé ðáñáíÝðñíóð Ý ÷ áέ έáέñβóáέ ř βáέříó ÷ ÷ ñδρóçò áέá όçí áñááóá βá ίá όçí áñáñð áříóřéðρ ðř(1). Άέá ðáñŰááέéáíá, áί ÷ ÷ ñδρóçò ðέçέóðñíéřáðρóáέ ðř - ò, όí **LPD** έá ίáέέřðóáέ όí öβέóñí troff, ðříó óðříáçέðříáóáέ ίá όçí έέáříυóçόá ðřf áέá όíř áέóððυóδρ δññíñέóířý. Áί ÷ ÷ ñδρóçò áðέéðíáβ ίá áέóððρóáέ áðέυ έáβíáñř, έá ίáέέřðóáέ όí öβέóñí ðřf (áóóυ δñŰáíáóέ έó ÷ řáέ óέð ðáñέóóυóáñáð óíñÝð: ááβóá óá Öβέóñá Áíυářó áέá έáððñÝñáέáð).

ΌðŰñ ÷ říó ðñáέð óýðřίέ öβέóñύí ðříó ίðñáβóá ίá δññíóáέíñβóáóá óóí /etc/printcap:

- Όí öβέóñí έáέíÝñřó, áðříñáέυíáñř έáέ υò öβέóñí áέóóυáířó óóçί óáέìçñβυóç όíř **LPD**, ÷ áέñβáέáóáέ áέóððρóáέð έářířέéřý έáέíÝñřó. Έáυñδρóá όí υò όí δññáðέέéáář Ýñ öβέóñí. Όí **LPD** ářáíÝίáέ ðυó υεřé ίέ áέóððυóÝδ, áðυ

δññáδέεϊάP, áβίáέ óá èÝóç íá áέοδδθρóií áδευι έáβñáñ, έáέ áβίáέ äïòεάέÛ ðïò öβεòñïò έάέíÝñïò íá ááááέùέáβ ùóέ óá
backspaces, óá tabs, έáέ üεíé íé Ûεεíé áέάέέíβ ÷ áñáέòPñáò ááí δññéάέóáέ íá δññíáέçíáóβóíóií ðñí áέòδδùòP. ÁÛí
áñβóέάóóá óá Ýíá δáñέáÛεεíí ùδïò έá δñÝðáέ íá έáóáíáòñPóáóá óçí ÷ ñPóç ðñí áέòδδùòPí, ðí öβεòñïò έάέíÝñïò έá
δñÝðáέ áδβóçò íá έáóáíáòñPóáέ óέò áέòδδùíÝíáò óάέβááò, óóíPεùò íáòñPíóáò ðñí áñέέíù ðñí áέòδδùíÝíñí áñáñíPí
έάέ óóáέñβñíóáò ðñí íá ðñí áñέέíù ðñí áñáñíPí ðïò ððñíóóçñβáέ í áέòδδùòPò áíÛ óάέβáá. Ôí öβεòñïò έάέíÝñïò íáέέíÛ
íá óçí áέüεíòεç έβóóá δáñáíÝðññí:

```
filter-name [-c] -width -length -indent -n login -h host acct-file
```

üðïò

-c

áñóáíβáέóáέ áí ç áñááóβá Ý ÷ áέ áðñíóóáέáβ íá lpr -l

width

áβίáέ ç óέíP áδù óçí έέáíüòçóá pw (ðéÛóíò óάέβááò - page width) üðùò δññíóáέñβáέóáέ óðí
/etc/printcap, íá δññíáδέέááñÝíç óέíP ðí 132

length

áβίáέ ç óέíP áδù óçí έέáíüòçóá pl (lPéïò óάέβááò - page length), íá δññíáδέέááñÝíç óέíP ðí 66

indent

áβίáέ ðñí Ýááèèò óçò áóí÷Pò (indentation) áδù ðñí lpr -i, íá δññíáδέέááñÝíç óέíP 0

login

áβίáέ ðñí έáóáááñáñÝñí üññá ÷ ñPóç ðñí áέòδδθρíáέ ðñí áñ÷áβñ

host

áβίáέ ðñí üññá ðñí ððñíéáέóòP áδù ðñí íðñíβí óóÛεέçέá ç áñááóβá

acct-file

áβίáέ ðñí üññá ðñí áñ÷áβñ έáóáíÝðñçóçò áδù óçí έέáíüòçóá af.

- *íá öβεòñïò íáóáòñíðPò* íáóáòñÝðáέ Ýíá áñ÷áβñ áέάέέPò ïñòPò óá Ýíá óýðñí áñ÷áβñ έáóÛεέçεí áέá áέóýðùòç áδù ðñí óóáέáέñεíÝñí áέòδδùòP. Áέá δáñÛááέáíá, óá áááñÝíá óóñε÷áέíáóβáò ditroff ááí íðññíPí íá áέòδδùεíPí έáóáòεáβáí, áέέÛ íðññáβóá íá ááέáóáóòPóáóá Ýíá öβεòñïò íáóáòñíðPò áñ÷áβñ ditroff, þóðá íá íáóáòñÝðáóá óá áááñÝíá ditroff óá íέá ïñòP ðñí í áέòδδùòPò íá íðññáβ íá áóññéPóáέ έáέ íá ðòðPóáέ. Έá ïÛεáðá δáñέóóúðáñá óóçí áñüòçóá Õúεòñá ÍáóáòñíðPò. Óá öβεòñá íáóáòñíðPò áδβóçò ÷ ñáέÛáεííóáέ áέá íá εÛíáðá áñβεíçóç/έáóáíÝðñçóç, áí ÷ ñáέÛáεóóá έáóáíÝðñçóç ðñí áέòδδθρóáñ óáð. Óá öβεòñá íáóáòñíðPò íáέέíPí íá óέò áέüεíòεáð δáñáíÝðññíð:

```
filter-name -xpixel-width -ypixel-height -n login -h host acct-file
```

üðïò *pixel-width* áβίáέ ç óέíP áδù óçí έέáíüòçóá px (δññíáδέέááñÝíç óέíP 0) έáέ *pixel-height* áβίáέ ç óέíP áδù óçí έέáíüòçóá py (δññíáδέέááñÝíç óέíP 0).

Ἀέυις δέι ρçíáíóέέυι ἄβιάε δὺδ δἄñέÝ ÷ ἄέ οἱ δñüāñáíá psif δἰῶ ἄίε ÷ íáýἄε ἄί ç ἄέóἄñ ÷ ùáíç ἄñἄἄóβἄ ἄβιάε ἄδῆϚ ἔἄειÝñῶ ἔἄε ἔἄἔἄβ οἱ textps (Ýíá Ûέεἰ δñüāñáíá δἰῶ δἄñέÝ ÷ ἄóἄε óἰι lprps) ἰά οἱ ἰἄóἄóñÝῶἄε ὀἄ PostScript. ὈÝεἰδ ÷ ñçóεἰἰδἰεἄβῶἄε οἱ lprps ἄεἄ ἰἄ ἄδἰóἄἄβῆἄε ὁçí ἄñἄἄóβἄ ὀóἰἰ ἄέδδδθρῶἄ.

Ὀἱ lprps ἄβιάε ἰÝñῶδ ὁçδ Ὀδῆῆἰἄᐅ ὀἰἰ Ports δἰῶ FreeBSD (ἄἄβῶἄ Ç Ὀδῆῆἰἄᐅ ὀἰἰ Ports). Ὀδῆῆἰἄᐅ, ἰδἰñἄβῶἄ ἰἄ οἱ ἔἄóἄἄ Ûῶἄἄἄ, ἰἄ οἱ ἰἄóἄἄεἰἰδῶἄἄἄ ἔἄε ἰἄ οἱ ἄἄἔἄἄóἄἄᐅῶἄἄἄ ἰἰñἰἰ ὀἄἄ. ἰἄὀ Û ὁçí ἄἄἔἄἄᐅῶἄἄἄ ὀἰἰ lprps, ἄδῆἰἄ ὁñἰἄἔἰñᐅῶἄ ὁç ἄἔἄἄñᐅ ὁñῶδ οἱ δñüāñáíá psif δἰῶ ἄβιάε ἰÝñῶδ ὀἰἰ lprps. Ἀἰ ἄἄἔἄἄóἄἄᐅῶἄἄἄ ὀἰἰ lprps ἄδἰ ὁçí Ὀδῆῆἰἄᐅ ὀἰἰ Ports, ὀἰἰἄ ἄἔἄ ὀἰἰ ὀἄἔñἔἄἔἄ ὀἄἄ ἄέδδδθρῶἄᐅ PostScript ÷ ñçóεἰἰδἰεᐅῶἄ ὁçí ἄἔἄἔἰἰδῆç ἔἄἄἄ ÷ ᐅñἔῶç ὀἰἰ ἄñ ÷ ἄβἰ /etc/printcap:

```
:if=/usr/local/libexec/psif:
```

Ἐἄ δñÝἄἔ ἄδᐅῶç ἰἄ ἔἄἔἰñᐅῶἄἄ ὁçí ἔἔἄἰἰὀçῶἄ rw ç ἰδἰᐅἄ ἰñᐅἄἔ ἰἄὀ ὀἱ **LPD** ἔἄ ÷ ἄἔñᐅἄἄἄἄ ὀἰἰ ἄέδδδθρῶἄ ὀἄ ἔἄὀῶἄἄἄ ἄἰ Ûἄἰὀçδ ἔἄἔ ἄἄἄἄἄᐅῶ.

Ἀἰ Ý ÷ ἄὀἄ δἄñ Ûέῆçῆἰ ἄέδδδθρῶἄᐅ PostScript (ἔἄἔ ἄἔἄ ὀἱ ἔἄἰἰ ἄὀἄἄ ἄἄἰ ἰδἰñἄβῶἄ ἰἄ ÷ ñçóεἰἰδἰεᐅῶἄἄ ἄἰὀβἄñᐅ ἄδῆῆἰἰñᐅἄ ἰἄ ὀἰἰ ἄέδδδθρῶἄᐅ, ἰδἰñἄβῶἄ ἰἄ ÷ ñçóεἰἰδἰεᐅῶἄἄ ὀἱ ἄἔἄἔἰἰδῆç shell script ἰἄ ὀἱ ὀἱὀἰñ ἔἄἔἰÝñῶ:

```
#!/bin/sh
#
# psif - Print PostScript or plain text on a PostScript printer
# Script version; NOT the version that comes with lprps
# Installed in /usr/local/libexec/psif
#

IFS="" read -r first_line
first_two_chars=`expr "$first_line" : '\(..\)'`

if [ "$first_two_chars" = "%!" ]; then
#
# PostScript job, print it.
#
echo "$first_line" && cat && printf "\004" && exit 0
exit 2
else
#
# Plain text, convert it, then print it.
#
( echo "$first_line"; cat ) | /usr/local/bin/textps && printf "\004" && exit 0
exit 2
fi
```

Ὀἰἰ δἄñἄὀ Ûñᐅ script, ὀἱ textps ἄβιάε Ýíá δñüāñáíá δἰῶ ἄἄἔἄἄóἄἄᐅῶἄἄἄ ἰἄ ÷ ùñἔὀὀ Û ἄἔἄ ἰἄ ἰἄóἄóñÝῶἰἄ ἄδῆἰἄ ἔἄβἰἄñ ὀἄ PostScript. ἰδἰñἄβῶἄ ἰἄ ÷ ñçóεἰἰδἰεἄβῶἄ ἰδἰἔἰἄᐅᐅἰὀἄ δñüāñáíá ἰἄóἄóñᐅᐅῶ ἄδἰ ἔἄβἰἄñ- ὀἄ-PostScript. Ç Ὀδῆῆἰἄᐅ ὀἰἰ Ports (ἄἄβῶἄ Ç Ὀδῆῆἰἄᐅ ὀἰἰ Ports) δἄñέÝ ÷ ἄἔ ἄδᐅῶç Ýíá δῆᐅñἄὀ δñüāñáíá ἰἄóἄóñᐅᐅῶ ἄδἰ ἔἄβἰἄñ ὀἄ PostScript, ὀἱ a2ps δἰῶ βῶἄὀ ἄδῆῆἰἄᐅ ἰἄ ἄἔἄñἄὀἰᐅῶἄἄἄ.

10.4.1.3 Δñἰἰἰἰᐅὀç PostScript ἄἔἄ ἈέδδδθρῶἄÝὀ δἰῶ ἄἄἰ ὀἱ Ὀδἰὀὀçñᐅἄἔἰὀἰ

Ὀἱ PostScript ἄβιάε ὀἱ *de facto* δñüὀὀᐅἰ ἄἔἄ ὀἰἰἔ ÷ ἄἔἰἔἄὀἄ ἔἄἔ ἄἔὀýᐅὀὀç ὀὀçῆᐅὀ δἰἔἄἰὀçὀἄὀ. Ûὀὀὀἰ, ὀἱ PostScript ἄβιάε ἔÛὀὀ ἄἄἄἄἄçñἰ δñüὀὀᐅἰ. Ἀὀὀὀ ÷ ᐅὀ, ç Aladdin Enterprises δἄñÝ ÷ ἄἔ Ýíá δἄñἄἰὀἄñÝὀ ἄἔἄýἔἄñἰ PostScript δἰῶ

ὁ ἄνθρωπος ἀπὸ τοῦ ἄλλου ἐπιπέδου. Ὁ Ghostscript ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπὶ τὸν ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου. Ὁ Ghostscript ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπὶ τὸν ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου. Ὁ Ghostscript ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπὶ τὸν ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου.

Ὁ Ghostscript ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπὶ τὸν ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου. Ὁ Ghostscript ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπὶ τὸν ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου.

Ἡ ἐπιπέδου ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου. Ἡ ἐπιπέδου ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου. Ἡ ἐπιπέδου ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου.

Ἡ ἐπιπέδου ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου. Ἡ ἐπιπέδου ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου. Ἡ ἐπιπέδου ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου.

```
#!/bin/sh
#
# ifhp - Print Ghostscript-simulated PostScript on a DeskJet 500
# Installed in /usr/local/libexec/ifhp

#
# Treat LF as CR+LF (to avoid the "staircase effect" on HP/PCL
# printers):
#
printf "\033&k2G" || exit 2

#
# Read first two characters of the file
#
IFS="" read -r first_line
first_two_chars=`expr "$first_line" : '\(..\)`

if [ "$first_two_chars" = "%!" ]; then
#
# It is PostScript; use Ghostscript to scan-convert and print it.
#
/usr/local/bin/gs -dSAFER -dNOPAUSE -q -sDEVICE=djet500 \
-sOutputFile=- - && exit 0
else
#
# Plain text or HP/PCL, so just print it directly; print a form feed
# at the end to eject the last page.
#
echo "$first_line" && cat && printf "\033&l0H" &&
exit 0
fi

exit 2
```

Ἡ ἐπιπέδου ἀπὸ τοῦ ἄλλου ἐπιπέδου ἐπιπέδου.

```
:if=/usr/local/libexec/ifhp:
```



```
#
# Invoked by lpd when user runs lpr -d
#
exec /usr/local/bin/dvips -f | /usr/local/libexec/lprps "$@"
```

Αδου οι script οñÿ ÷ áέ οι dvips οά έάδÛόδáoç öβέδñíð (iá öçí δάνÛiáðñí -f) όδçí standard input, áδú üδíð έάέ έáiáÛíáέ öçí áñááóβá δñíð áέδýðúöç. Αδου iáέέíÛ οι öβέδñí áέδýðúöçδ PostScript lprps (ääβδά öçí áíúöçόά Óiáááóüöçόά Άñááóέπí Άδèÿ Έάέíÿíð οά áέδöðδúδÿδ PostScript) äβííóáð öíð έάέ όέδ δάνáíÿðñíðδ δíð δÿñάά öí LPD όδí δάνáδÛíú script. Öí lprps έá ÷ ñçόέííðíέPόáέ áδóÿð όέδ δάνáíÿðñíðδ áέá öçí έáóáíÿðñçöç öúí áέδöðδúíÿíú οάέβáüí.

10.4.1.4.4 Άέúíá iáñέéÛ Δάνáááβáíáόά Öβέδñíí iáόáðñíðPδ

Αδú öç όέέáP δíð áái öδÛñ ÷ áέ áδóñáóíðíέçíÿíç iÿέíáíð áέá öçí áääóδÛόδáoç öúí öβέδñíí iáόáðñíðPδ, áð iáð áðέδñáðδáβ íá δάνÿ ÷ íðíá iáñέéÛ áέúíç δάνάááβáíáόά. Iðñáβδά íá όá ÷ ñçόέííðíέPόáά óáí íäçáü áέá öçí äçíέíðñáβá öúí áέέπí óáð öβέδñíí. Áí ññæáðά δúð áβíáέ έάδÛέέçέά áέá öçí δάνβδδúöçç óáð iðñáβδά íá όá ÷ ñçόέííðíέPόáά έάέ έáóáðέάβáí.

Αδου οι δάνÛáέέáíá script áβíáέ ÿíá öβέδñí iáόáðñíðPδ ñÛόóáñ (án ÷ áβíö GIF áέá öçí áέñβááέá) áέá ÿíáí áέδöðδúδP Hewlett Packard LaserJet III-Si:

```
#!/bin/sh
#
# hpvf - Convert GIF files into HP/PCL, then print
# Installed in /usr/local/libexec/hpvf

PATH=/usr/X11R6/bin:$PATH; export PATH
giftopnm | pptmopgm | pgmtopbm | pbmtolj -resolution 300 \
    && exit 0 \
    || exit 2
```

Äíöέáÿáέ úð áíPδ: iáόáðñÿðáέ öí án ÷ áβí GIF óá ÿíá ááíέéü öíñçöú öýðí anymap, áí óóíá ÷ áβá öí iáόáðñÿðáέ óá ÿíá öíñçöú öýðí graymap, ÿðáέόά óá ÿíá öíñçöú öýðí bitmap, έάέ öÿέíð öí iáόáðñÿðáέ óá äááñÿíá óóíááóÛ iá PCL áέá öíí LaserJet.

Äáp áβíáέ öí án ÷ áβí /etc/printcap iá íέá έáδá ÷ ðñέóç áέá ÿíáí áέδöðδúδP δíð ÷ ñçόέííðíέáβ öí δάνáδÛíú öβέδñí:

```
#
# /etc/printcap for host orchid
#
teak|hp|laserjet|Hewlett Packard LaserJet 3Si:\
    :lp=/dev/lpt0:sh:sd=/var/spool/lpd/teak:mx#0:\
    :if=/usr/local/libexec/hpif:\
    :vf=/usr/local/libexec/hpvf:
```

Öí áέúέíðèí script áβíáέ ÿíá öβέδñí iáόáðñíðPδ äááñÿíúí troff áδú öí óýόöçíá óóíé ÷ áέíèáόβáð groff áέá öíí áέδöðδúδP PostScript iá üííá bamboo:

```
#!/bin/sh
#
# pstf - Convert groff's troff data into PS, then print.
# Installed in /usr/local/libexec/pstf
```

```
#  
exec grops | /usr/local/libexec/lprps "$@"
```

Όι δάνάδΰιυ script ÷ñçóειιδιεάβ δΰεε οι lprps αέα ίά ÷άεñέοδάβ όçί άδέειέιυίβá ιά οιί άέοδδθδρ. Άί ι άέοδδθδρδρ δόάί οά δάνΰεεçç δυñδά ουοά έά άβ÷άιá, άίόέέΨδύδ, ÷ñçóειιδιεδρσάέ οι άέυειοει script:

```
#!/bin/sh  
#  
# pstf - Convert groff's troff data into PS, then print.  
# Installed in /usr/local/libexec/pstf  
#  
exec grops
```

Άαρ άβίάε ç έάοά÷πñέόç διό ÷ñάέΰαάοάέ ίά δñιόέΨοιόιá οοί /etc/printcap αέα ίά άίáñáιδιεδρσάέ οι όβέοñι:

```
:tf=/usr/local/libexec/pstf:
```

Άαρ άβίάε Ψία δάνΰάάεáιá διό ιάδ άδέοñΨδάέ ίά άέοδδθρσάέ δάεάέυ έρπáέά όçδ FORTRAN. Άβίάε Ψία όβέοñι έάέιΨñό αέα FORTRAN αέα ιδιείτáδρσάέ άέοδδθδρ ιδινάβ ίά άέοδδθρσάέ έάοάοεάβáι άδευ έάβáιñ. Έά οι άάέάοάοδρσάέ αέα Ψίáί άέοδδθδρ διό ññΰαάοάέ teak:

```
#!/bin/sh  
#  
# hprf - FORTRAN text filter for LaserJet 3si:  
# Installed in /usr/local/libexec/hprf  
#  
  
printf "\033&k2G" && fpr && printf "\033&l0H" &&  
  exit 0  
exit 2
```

Έάέ έά δñιόέΨοιόιá άοδρ όç άñáñιδρ οοί /etc/printcap αέα ίά άίáñáιδιεδρσάέ οι όβέοñι αέα οιί άέοδδθδρδρ teak:

```
:rf=/usr/local/libexec/hprf:
```

Έάέ Ψία όάέάοδάβι έΰδύδ δάνβδειει δάνΰάάεáιá: Έά δñιόέΨοιόιá Ψία όβέοñι DVI οοίί άέοδδθδρδρ LaserJet teak διό άίáθΨñáιá δñιçáιγίáιá. Έάοάñ÷δρ οι άγέιει ιΨñιδ: άίáάάειβáειοιá οι /etc/printcap ιά όçί οιδιεέάοβá υδιό άñβóέάοάέ οι όβέοñι DVI:

```
:df=/usr/local/libexec/hpdf:
```

Όρñá, οι άγόειει ιΨñιδ: ç έάοάοέάδρδρ οιό όβέοñιό. Έά ÷ñάέάοόιγίá Ψία δñυάñáιá ιάοάοñιδρδρ άδυ DVI-όá-LaserJet/PCL. Όόçί Όδέειτáδρ ουί Ports οιό FreeBSD (άάβδά Όδέειτáδρ ουί Ports) οδΰñ÷άέ Ψία οΨοίει δñυάñáιá: Όι υñíá οιό δάέΨοιό άβίάέ dvi2xx. Ç άάέάοΰοδάόç οιό δάέΨοιό, ιάδ δάνΨ÷άέ άέñέáρδρ οι δñυάñáιá διό ÷ñάέάέυιáοδά, οι dvi1j2p, οι ιδιβι ιάοάοñΨδάέ οιί έρπáέά DVI οά έρπáέά οδιáάουι ιά LaserJet IIp, LaserJet III, έάέ LaserJet 2000.

Όι dvi1j2p έΰίáέ οι όβέοñι hpdf άñέάοΰ δάνβδειει άδυ όç οδέáιδρ διό οι dvi1j2p άά ιδινάβ ίά αέαáΰοάέ άδυ οι standard input. ×ñάέΰαάοάέ ίά άιόεΨοάέ ιά έΰδιει υñíá άñ÷άβιό. Άέυιç ÷άέñυοάñá, οι υñíá οιό άñ÷άβιό δñΨδάέ ίά όάέάεπíáέ οá .dvi έέ άδñΨίυδ ç ÷ñρόç διό /dev/fd/0 υδ standard input άβίάέ δñιáεçιáόέεδρ. Έά ιδινίγόáιá ίά άίόειáδυδβοιόιá οι δñυáεçιá áçieiτñáπíόáδ (οδιáειέειγδ) άάοιγύδ ιά έΰδιει δñιούñέιυ υñíá άñ÷άβιό (διό ίά όάέάεπíáέ οá .dvi) αέα οι /dev/fd/0, έάέ ιά άόου οιί οñυδι ίά άίáίáάέΰοιόιá οι dvi1j2p ίά αέαáΰαέ άδυ οι standard input.

οά ιβά οάεββά εάε άδϋ δϋοάο οάεββάο άδϋοάεάβοάε ς άναάοβά οϋο ÷ ηΠρόος. Ἄέα δάηέοοϋοάηάο δέςηϋοϋηβάο ο÷άοέέϋ ιά οςϋ έάοάιϋδηςος οάεββϋι, οοιάρϋέάοοάβοά οςϋ Ἐάοάιϋδηςος × ηΠρόος Ἀέδοδθϋοϋ.

10.4.2 Οάεββάο Ἐάοάεββάο

Ἄι Ἐ÷άοά *áñéáδϋο* ÷ ηΠρόοάο, έάε ϋέιέ οϋοδ ÷ ηςοέϋδϋέϋϋί άέϋοϋηϋοδ άέοδθϋοϋϋ, οϋοά δέέάρϋο ιά έαϋηάβοά δέο *οάεββάο έάοάεββάο* ϋδ άίάέέβϋ έάέϋ.

Ἐέ οάεββάο έάοάεββάο, άϋοόϋδ άδβόο έάέ ϋδ *banner P οάεββάο burst* άίάάϋηβέϋοι οά δϋέϋί άϋϋέϋοι ιέ άηάάοβάο ιάοϋ οςϋ άέοϋδϋος οϋοδ. Οοίϋέϋδ οδθϋϋίοάέ ιά ιάαϋέά, Ἐίοϋίά άηϋηάοά, έάέ βούδ ιά έέέέϋοςοέέϋ δάηέάηϋηάοά, ϋοόά οά ιέά οοιββάά άέοδθϋοϋί ιά ιά ÷ ϋηβέϋοι άδϋ οά δηάάιάοέέϋ Ἐάάηάοά άηάάοέϋ οϋί ÷ ηςοόϋϋ. Ἄδέοηϋδϋοι Ἐοόέ οοϋοδ ÷ ηΠρόοάο ιά άηβέϋοι άηϋάϋά δέο άηάάοβάο οϋοδ. Οϋ δηϋοάϋδ ιάέϋϋέοςιá οά ιέά οάεββά έάοάεββάο άβίάέ δϋδ δηϋέέοάέ ιά άέοδθϋέάβ ιέά έέϋιá οάεββάά έάέ έϋέά ιβά άηάάοβά. ς άοϋάης ÷ ηςοέϋϋοςοά οϋοδ έέάηέάβ έββά έάδδϋ, έάέ ι δηϋηέοϋοδ οϋοδ άβίάέ ι έϋάϋο ά÷ ηΠρόοϋι/άίάέϋέέϋοςοδ. (ΔάηάοςηΠρόοά δϋδ ιέ οάεββάο έάοάεββάο άβίάέ άίϋ άηάάοβά, έάέ ϋ÷έ άίϋ άη÷άβϋ οά ιέά άηάάοβά, άδϋϋϋδ οϋί ά÷ ηςοόάοϋϋϋϋ ÷ άηοβ βούδ ιά ιςϋ άβίάέ οϋοι δϋέϋ).

Οϋ οϋοςϋιá **LPD** ιδϋηάβ ιά δάηϋ÷άέ άδοϋιáοά οάεββάο έάοάεββάο έάέ οέο άέοδθϋοϋάέο οάο, *άι* ι άέοδθϋοϋδ οάο ιδϋηάβ ιά άέοδθϋοϋάέ Ἃιáοά άδέϋ έάβιáϋ. Ἄι Ἐ÷άοά άέοδθϋοϋδ PostScript, έά ÷ ηάέάοόάβοά Ἐίá άϋοάηέέϋ δηϋάηάιá έάέ ιά άςϋέϋοηάβοάοά οςϋ οάεββά έάοάεββάο. Ἄάβοά οϋ Ὀάεββάο Ἐάοάεββάο οά Ἀέδοδθϋοϋδ PostScript.

10.4.2.1 Ἄίάηάϋδϋςος Οάεββϋι Ἐάοάεββάο

Οοςϋ άϋϋοςοά Ἀάοέέϋδ ἢδϋέβοάέο Ἀέοδθϋοϋϋ, άδάίάηάϋδϋέϋοάιá οέο οάεββάο έάοάεββάο ιά οςϋ έάοά÷ϋηέος *sh* (οςϋιáβίάέ “suppress header”) οοι άη÷άβϋ /etc/printcap. Ἄέα ιά άίάηάϋδϋέϋοάοά οέο οάεββάο έάοάεββάο έάέ έϋδϋέϋί άέοδθϋοϋδ, άδέϋ άοάέηϋοά οςϋ έέάϋϋοςοά *sh*.

Ἄέϋάοάοάέ άϋέϋέϋ, άάϋ ηηβέάοά;

οόέ άβίάέ. *οϋοδ* ÷ ηάέάοόάβ ιά δάηϋ÷άοά Ἐίá οβέοηϋ άϋϋάϋο έάέ ιά οόάβέάοά άϋϋέϋδ άη÷έϋδϋςοςοδ οοϋί άέοδθϋοϋδ. Ἄάϋ άβίάέ Ἐίá δάηϋάέέϋιá οβέοηϋ άϋϋάϋο έάέ άέοδθϋοϋδ οοιáοϋδ ιά οϋί οϋδϋ PCL οςο Hewlett Packard:

```
#!/bin/sh
#
# hpof - Output filter for Hewlett Packard PCL-compatible printers
# Installed in /usr/local/libexec/hpof

printf "\033&k2G" || exit 2
exec /usr/libexec/lpr/lpf
```

Δηϋοάέϋηβόοά οςϋ έέάάηηΠ δηϋο οϋ οβέοηϋ άϋϋάϋο οοςϋ έέάϋϋοςοά *of*. Ἄάβοά οςϋ άϋϋοςοά Ὀβέοηά Ἀϋϋάϋο έάέ δάηέοοϋοάηάο δέςηϋοϋηβάο.

Ἄάϋ άβίάέ Ἐίá δάηϋάέέϋιá άη÷άβϋ /etc/printcap έάέ οϋί άέοδθϋοϋδ *teak* άδϋ οϋ δηϋςάϋϋιáϋ δάηϋάέέϋιá. Ἄίάηάϋδϋέϋοάιá οέο οάεββάο έάοάεββάο έάέ δηϋοέϋοάιá οϋ δάηάδϋϋ οβέοηϋ άϋϋάϋο:

```
#
# /etc/printcap for host orchid
#
teak|hp|laserjet|Hewlett Packard LaserJet 3Si:\
    :lp=/dev/lpt0:sd=/var/spool/lpd/teak:mx#0:\
    :if=/usr/local/libexec/hpif:\
    :vf=/usr/local/libexec/hpvf:\
```

: of=/usr/local/libexec/hpof :

Ὀρῆά, ὑοάί ιέ ÷ ἡρῶοάο ἀέοδδρῆοί ἀἡάοβᾶο οοίί teak, εά δᾶβῆῆοί εέε ιβᾶ οᾶεβᾶά εᾶοᾶεβᾶάο ἀίῸ ἀἡάοβᾶ. Αί ιέ ÷ ἡρῶοάο εἸεῖοί ιά ἡᾶᾶῆοί ÷ ἡῆῆ ὅῸ ÷ ἡῆοᾶο ᾶεά οέο ἀέοδδρῶάο οῖοδ, ιδῆῆῆῆ ιά δᾶἡᾶῆῆᾶοῖοί οέο οᾶεβᾶάο εᾶοᾶεβᾶάο ἀδῆοδῆῆῆῆοᾶο οέο ἀἡάοβᾶο οῖοδ ιᾶ lpr -h. Ἀᾶβᾶ οῆῆ ἀῆῆοῆᾶ Ἀδῆῆῆῆῆῆ Ὀᾶεβᾶῆῆ Ἐᾶοᾶεβᾶάο ᾶεά δᾶἡέοοῆᾶᾶο ἀδῆῆῆῆῆῆ οῖο lpr(1).

Ὀῆᾶβᾶο: Ὀῖ **LPD** οδῆῆῆῆ οῖ ÷ ἀἡᾶεδρῆᾶ ᾶεῆᾶᾶρῶ οᾶεβᾶάο (form feed) ἀῆῆῆῆ ιᾶδῸ οῆ οᾶεβᾶά εᾶοᾶεβᾶάο. Αῆ ῆ ᾶεοδδρῶο οᾶο ÷ ἡῆῆῆῆῆῆῆῆ ᾶεᾶοῖᾶᾶεῆῆῆ ÷ ἀἡᾶεδρῆᾶ ρ ᾶεῆῆῆῆῆῆ ÷ ἀἡᾶεδρῆῆῆ ᾶεά οῆῆ ᾶεῆᾶᾶρ οᾶεβᾶάο, δῆῆῆῆῆῆῆῆ οᾶ ιᾶ οῆῆ εῆᾶῆῆῆῆῆ ff οῖῆ ᾶἡ ÷ ᾶβῆ /etc/printcap.

10.4.2.2 ῆᾶᾶ ÷ ῆο Ὀᾶεβᾶῆῆ Ἐᾶοᾶεβᾶάο

ἸᾶοῸ οῆῆ ἀῆᾶἡῆῆῆῆῆ οῆῆ οᾶεβᾶῆῆ εᾶοᾶεβᾶάο, οῖ **LPD** εᾶ δᾶἡῆῆῆῆ ιβᾶ *ᾶδῆῆῆῆ εᾶοᾶεβᾶᾶ*, ιβᾶ ῆεῆεῆῆῆ οᾶεβᾶᾶ ιᾶ ἰᾶᾶῆῆᾶ ἡἡῆῆῆᾶ οῖο δῆῆῆῆῆῆῆῆῆ οῖῆ ÷ ἡρῶοῆ, οῖῆ δδῆῆῆῆῆῆῆ (host), εέε οῆῆ ἀἡᾶᾶῆῆ. Ἀᾶρ ᾶβῆᾶ ῆῆᾶ δᾶἡῆῆῆῆῆᾶ (ῆ kelly ᾶέδῆῆῆῆῆ οῆῆ ἀἡᾶᾶῆῆ ιᾶ ῆῆῆᾶ “outline” ᾶδῆ οῖῆ δδῆῆῆῆῆῆῆ rose):

```

k          ll          ll
k          l           l
k          l           l
k k       eeee        l           l           y           y
k k       e   e       l           l           y           y
k k       eeeee       l           l           y           y
kk k      e           l           l           y           y
k k       e   e       l           l           y          yy
k k       eeee       lll          lll          yyy y
                                     y
                                     y
                                     y          y
                                     yyyy

                                     ll
                                     t           l           i
                                     t           l
o o o o   u   u       ttttt       l           ii          n mnn       eeee
o o       u   u       t           l           i           nn       n       e   e
o o       u   u       t           l           i           n       n       eeeee
o o       u   u       t           l           i           n       n       e
o o       u   uu      t t        l           i           n       n       e   e
oooo      uu u       tt          lll          iii          n       n       eeee

r rrr      oooo      ssss      eeee

```

rr r o o s s e e
r o o ss eeeee
r o o ss e
r o o s s e e
r oooo ssss eeee

Job: outline
Date: Sun Sep 17 11:04:58 1995

Οι LPD θνιρέΥοάέ ιέα άίθρεP άέέαβδ οάεββσδ (form feed) ιαδύ άδθ άδθθ οι έαβιαίΥ όόέ πρδσ ς άναάόβσ ιά ιάέειPοάέ οά ιΥά οάεββσά (άέδθδ άι Υ ÷ άδσ δνιόάείνθβσάέ όκι έέάιυδόςδ σf (suppress form feeds) άέά θιι άέδθδθδP όθι άñ÷άβι /etc/printcap).

Άι θνιθειΥδσ, θι LPD ιθιθσβ ιά θδέΥιθε ιέα ιέñυδθñιθ ιPειθδ έδδάεββσά. Δνιόάείνθβσά sb (short banner) όθι άñ÷άβι /etc/printcap. ς οάεββσά έαδδδθδ έα ιιεΥεθε όάι άδδP:

rose:kelly Job: outline Date: Sun Sep 17 11:07:51 1995

Οι LPD δδθPιθε (άδθ θνιθδέειP) δθPόά όκι οάεββσά έαδδδθδ, έε ιαδύ όκι άναάόβσ. Άέά ιά άιθέδδθñYοάδσ όκι οάέñΥ, ÷ñόςειθιεPόδσ όκι έέάιυδόςδ h1 (header last) όθι άñ÷άβι /etc/printcap.

10.4.2.3 ΈαδδδYδñός ό ια Οάεββσδ Έαδδδθδ

ς ÷ñPός δθι δνιθάέδδσόςκιYιυι οάεββσάι έαδδδθδθδ θιP LPD ιθδέάδδέέΥ δθι ÷ñθPιθι όκι δθPός θιP δάναέΥδθ έάιυιά υδσάι έΥιθδ έαδδδYδñός ÷ñPόςδ θιP έέδθδθδP: Ιέ οάεββσδ έαδδδθδ δñYδθε ιά έέαδθέαιδσά έέYεñά (άβ÷υδ ÷ñYυός).

Άέάδβ:

Άέυδθ θι δβέδθι άθυθδ άβιθε θι ιιθάέέυ άθυδθνέυ δθυθάθι δθι Υ ÷ έέ θιι Yεά÷ι όδκι άέδδθδός όςδ έαδδδθδθδ έέέ έά ιθιθιγδά ιά έΥιθε έαδδδYδñός, άέέΥ υδθυθι άθ δάñY ÷ έέ έαιβσ δέχθιθθβσά έέά θιι ÷ñPός P θιι δθιεθέδδP P έΥθιεθι Yεει άñ÷άβι έαδδδYδñόςδ, άδñYιυδ άθ άθθθβεθε όσ θιευι ιά άθιθPόε όκι ÷ñPός θιP έέδθδθδP. Άθι άθέεβ άδεΥ ιά “θνιρέΥοάδσ ιβσ άέυς οάεββσά όδκι έαδδδYδñός” θνιθδθιεPιδσ θι δβέδθι έέέYιθ P ιθιεθPθιδσ Yεει δβέδθι ιαδδθθιθδP (θι ιθιθι έέέYοάέ δέδ δέχθιθθβσδ ÷ñPός έέέ δθιεθίέδδP), άδθ ός όδέαιP θιP ιέ ÷ñPόδσ Y ÷ιθι όκι άθιθδθδόςδ ιά δάθαιθιθθιθι δέδ οάεββσδ έαδδδθδθδ ια lpr -h. Έα ιθιθιγδάι δYεε ιά ÷ñυειγι έέά οάεββσδ έαδδδθδθδθδ θιP άθι έέδδθδθδ. ΆάόέέΥ, ς lpr -h έά άβιθε ς δνιθPιθιθι άδέειP όσ Yιθ δάθιθYεει θιP ιέ ÷ñPόδσ Y ÷ιθι ιέθιεθίέέP όθιθβόςός, άέέΥ άθι ιθιθσβδ θηάθιθδέέΥ ιά δάθιθθιθδσά ιθιεθίPθιδσ ιά ός ÷ñόςειθιεPόάέ.

Άθι άβιθε άθέδθι άδεΥ έΥεα δβέδθι όαδ ιά άκιθιθθάθ δς άέέέΥ θιP οάεββσά έαδδδθδθδ (Yόέ πρδσ ιά ιθιθσβ ιά ÷ñθPιθε ια άδθθ θιι θνιθδ). Άι ιέ ÷ñPόδσ άδέέθιγι όκι άδέειP δάθαιθυέέδδθδ δθι οάεββσάι έαδδδθδθδ ια lpr -h, έά όθιθ÷βιθι ιά δέδ δάθιθιθιθθιθι - έέέ ιά ÷ñθPιθιθι έέά άδδYδ - άθιY θι LPD άθι Y ÷ έέ άθιθδθδόςδ ιά δάñΥόάέ όσ ιθιεθPθιδσ δβέδθι όκι άδέειP -h.

ΆδñYιυδ, θιεέδ άδέειYδ Y ÷άδσ;

Ιθιθσβδσ:

- Ἰά ἀδῖῖᾱ ÷ εᾱβδᾱ ὀçi ὀδῖῖᾱᾱέιç ὀῖο **LPD** εᾱέ ἰά δᾱῖῖ ῖ ÷ ᾱὀᾱ ὀεὸ ὀᾱεβᾱᾱὸ εᾱὀᾱεβᾱᾱὸ ᾱεᾱῖεᾱῖᾱ.
- Ἰά ᾱᾱεᾱὀὀὀὀὀὀὀὀὀὀ ᾱῖᾱεᾱᾱεᾱεᾱᾱ ῖὀ εῖῖὀᾱεὸ ᾱῖὀβ ὀῖο **LPD**, ῖὀὀὀ ὀῖ **LPRng**. Ç ᾱῖῖὀçὀᾱ Ἀῖᾱεᾱᾱεᾱεᾱᾱ ῖὀ Ἔῖὀᾱεὸ ᾱεᾱ ὀῖῖ Ὀὀῖὀὀᾱῖῖ **Spooler** ᾱβῖᾱε δᾱῖῖεὀὀὀὀὀὀὀὀὀ δεçῖῖὀῖῖῖὀὀ ᾱεᾱ ῖὀεᾱὸ ᾱὀᾱῖῖᾱῖὀ ὀᾱῖῖ ÷ ῖὀὀᾱὀὀçὀ δῖὀ ῖὀῖῖᾱβδᾱ ἰά ÷ ῖὀçὀεῖῖὀῖὀεὀὀὀὀὀ ᾱῖὀβ ᾱεᾱ ὀῖ **LPD**.
- Ἰά ᾱῖῖὀὀὀὀ ῖὀᾱ ῖὀὀὀὀ ὀβεὀῖῖ ᾱῖῖᾱῖὀ. Ὀὀὀ εᾱῖῖῖεῖῖὀ ὀὀῖὀεὀεᾱὀ, ῖὀᾱ "ὀβεὀῖῖ ᾱῖῖᾱῖὀ" ᾱῖῖ εῖῖῖᾱε ὀβδῖὀὀᾱ δᾱῖῖᾱὀῖὀ ᾱὀὀ ὀçi ᾱῖ ÷ εῖῖὀῖὀçὀç ᾱῖῖὀ ᾱεὀὀὀὀὀὀὀ ὀ ἰᾱῖῖεῖῖὀ ᾱὀεῖὀ ῖὀ ἰᾱὀᾱὀῖῖὀὀὀ ῖὀ ÷ ᾱῖᾱεὀὀῖῖῖ. Ἀβῖᾱε εᾱὀῖὀεçῖῖ ᾱεᾱ ὀᾱεβᾱᾱὸ εᾱὀᾱεβᾱᾱὸ εᾱέ ᾱεᾱ ᾱῖᾱᾱὀβᾱὀ ᾱὀεῖῖ ἔᾱεῖῖῖὀ (ῖὀὀᾱῖ ᾱῖῖ ὀὀῖὀῖ ÷ ᾱε ὀβεὀῖῖ (ᾱεὀῖῖᾱὀ) εᾱεῖῖῖὀ). Ἀεῖῖ ᾱῖ ὀὀῖὀῖ ÷ ᾱε ὀβεὀῖῖ ἔᾱεῖῖῖὀ ᾱεᾱ ᾱῖᾱᾱὀβᾱὀ ᾱὀεῖῖ ἔᾱεῖῖῖὀ, ὀῖὀᾱ ὀῖ **LPD** εᾱ ᾱῖᾱῖᾱῖὀῖᾱ ὀῖ ὀβεὀῖῖ ᾱῖῖᾱῖὀ ῖῖῖῖ ᾱεᾱ ὀεὸ ὀᾱεβᾱᾱὸ εᾱὀᾱεβᾱᾱὸ. Ἐᾱέ ὀῖ ὀβεὀῖῖ ᾱῖῖᾱῖὀ ῖὀῖῖῖῖ ἰά ᾱῖᾱῖῖᾱε ὀῖ εᾱβῖᾱῖῖ ὀçὀ ὀᾱεβᾱᾱὸ εᾱὀᾱεβᾱᾱὸ δῖὀ ᾱçῖῖὀῖῖῖὀ ὀῖ **LPD** ᾱεᾱ ἰά δῖῖὀᾱεῖῖῖὀὀὀ ὀῖ ÷ ῖὀὀὀç ἔᾱέ ὀῖὀ ὀὀῖὀῖᾱεὀὀὀὀ, ὀὀὀᾱ ἰά ÷ ῖᾱὀῖᾱε ὀεὸ ὀᾱεβᾱᾱὸ εᾱὀᾱεβᾱᾱὸ. Ὀῖ ῖῖῖῖ ᾱὀεὀὀῖὀ ὀῖὀῖὀῖὀ ἰᾱ ᾱὀὀὀ ὀç ῖὀῖὀῖᾱῖ ᾱβῖᾱε δῖὀ ὀῖ ὀβεὀῖῖ ᾱῖῖᾱῖὀ ᾱῖᾱῖὀῖὀὀὀὀ ἰά ἰç ᾱῖῖῖὀὀὀὀὀ ὀῖὀὀ ᾱῖ ÷ ᾱβῖ ἔᾱὀᾱῖ ῖὀῖὀçὀç ἰά ÷ ῖὀçὀεῖῖὀῖὀεὀὀὀὀ (ᾱῖῖ ὀῖὀ ῖ ÷ ᾱε ᾱῖὀὀὀ ὀῖ ῖῖῖᾱ ὀῖὀ ᾱῖ ÷ ᾱβῖὀ ᾱὀὀ ὀçῖ ἔεᾱῖὀὀçὀᾱ ᾱç), ᾱεῖῖ ᾱῖ ὀῖ ῖῖῖᾱ ὀῖὀ ᾱῖ ÷ ᾱβῖὀ ὀᾱὀ ᾱβῖᾱε ᾱῖῖὀὀὀ, ῖὀῖῖῖὀὀ ἰά ὀῖ ᾱῖὀῖᾱὀὀὀὀὀὀ ᾱὀὀὀὀὀὀ ὀὀῖὀ ἔὀᾱεᾱᾱ ὀῖὀ ὀβεὀῖῖὀ ᾱῖῖᾱῖὀ. Ἀεᾱ ἰά ᾱεᾱὀεῖῖῖᾱὀᾱ ὀçῖ ᾱεᾱᾱεᾱὀὀὀ ᾱῖὀὀçὀç, ÷ ῖὀçὀεῖῖὀῖὀεὀὀὀὀ ὀçῖ ἔεᾱῖὀὀçὀᾱ sh (short header) ὀὀῖ /etc/printcap. Ὁὀὀ δῖὀὀε ῖὀεᾱ ᾱὀὀὀ ἰά ᾱβῖᾱε ὀὀᾱῖᾱῖὀεῖὀὀ ἔῖὀὀᾱὀὀεῖὀὀ, ᾱῖὀ ᾱβῖᾱε ὀβᾱῖὀῖῖ δῖὀὀ ἰε ÷ ῖὀὀὀὀὀὀ ἔᾱ ᾱεὀὀὀὀὀὀὀ ὀῖὀ ᾱᾱῖᾱῖὀῖὀῖὀ ᾱεᾱ ÷ ᾱεῖὀὀὀὀ ὀὀὀὀὀᾱὀὀὀ δῖὀ ᾱὀεὀῖ ῖὀᾱε ᾱεᾱῖὀᾱῖᾱ ὀεὸ ὀᾱεβᾱᾱὸ εᾱὀᾱεβᾱᾱὸ.

10.4.2.4 Ὀᾱεβᾱᾱὸ Ἐᾱὀᾱεβᾱᾱὸ ὀᾱ Ἀέὀὀὀὀὀὀὀ PostScript

ῖὀὀὀ δᾱῖῖᾱῖὀὀὀὀ ᾱῖᾱῖὀὀὀ, ὀῖ **LPD** ῖὀῖῖῖ ἰά ᾱçῖῖὀῖῖῖὀὀὀὀ ἰβᾱ ὀᾱεβᾱᾱ ἔᾱὀᾱεβᾱᾱὸ ᾱὀεῖῖ ἔᾱεῖῖῖὀ, εᾱὀῖὀεççῖ ᾱεᾱ ὀῖὀεῖὀὀ ᾱεὀὀὀὀὀὀὀ. ἰε ᾱεὀὀὀὀὀὀὀ PostScript, ὀὀὀὀεῖὀ, ᾱῖῖ ῖὀῖῖῖῖ ἰά ὀὀὀὀὀὀὀὀ ἔᾱὀᾱὀεᾱῖᾱῖ ᾱὀεὀ ἔᾱβῖᾱῖῖ, ᾱὀῖὀῖὀὀ ᾱὀὀὀ ç ᾱὀῖᾱὀὀὀçὀᾱ ὀῖὀ **LPD** ᾱεᾱ ὀεὸ ὀᾱεβᾱᾱὸ εᾱὀᾱεβᾱᾱὸ ᾱβῖᾱε ῖ ÷ ῖὀçὀç ὀᾱ ᾱὀὀὀ ὀçῖ δᾱῖῖὀὀὀὀç.

ἰᾱὀ δῖῖὀᾱῖὀὀ ὀῖὀὀὀὀ ἰά δᾱῖῖ ῖ ÷ ῖὀὀᾱε ὀᾱεβᾱᾱὸ εᾱὀᾱεβᾱᾱὸ ᾱβῖᾱε ἰά ᾱçῖῖὀῖῖῖὀὀὀὀ ᾱὀὀ ἔᾱὀ ὀβεὀῖῖ ἰᾱὀᾱὀῖὀὀὀ ἔᾱέ ὀῖ ὀβεὀῖῖ ἔᾱεῖῖῖὀ. Ὀᾱ ὀβεὀῖᾱ ἔᾱ δῖῖὀὀᾱε ἰά ᾱῖ ῖ ÷ ῖὀὀᾱε ῖὀ δᾱῖῖᾱῖὀῖὀὀ ὀῖ ῖῖῖᾱ ὀῖὀ ÷ ῖὀὀὀç ἔᾱέ ὀῖὀ ὀὀῖὀῖᾱεὀὀὀὀ ὀὀὀᾱ ἰά ᾱçῖῖὀῖῖῖὀὀὀ ὀçῖ ἔᾱὀῖὀεççῖ ὀᾱεβᾱᾱ ἔᾱὀᾱεβᾱᾱὸ. Ὀῖ ἰᾱεῖῖὀῖὀçῖᾱ ᾱὀὀὀὀ ὀçὀ ἰᾱεὀῖᾱὀ ᾱβῖᾱε δῖὀὀ ἰε ÷ ῖὀὀὀὀὀ ἔᾱ ᾱεὀὀὀὀὀὀὀ ὀῖὀὀὀ ὀᾱεβᾱᾱ ἔᾱὀᾱεβᾱᾱὸ, ᾱεὀῖç ἔε ᾱῖ ᾱὀῖὀὀὀὀὀὀ ὀçῖ ᾱῖᾱᾱὀὀᾱ ὀῖὀὀ ἰᾱ lpr -h.

Ἀὀεὀῖὀὀὀὀὀ ἰᾱὀ ἰά ᾱῖᾱῖᾱὀῖὀὀὀὀὀ ᾱὀὀὀ ὀç ῖὀῖὀῖᾱ. Ὀῖ ᾱεὀῖὀὀὀὀ script ᾱῖ ῖ ÷ ᾱὀᾱε ὀῖᾱεὸ δᾱῖῖᾱῖὀὀὀὀὀ (ὀῖ ῖῖῖᾱ ÷ ῖὀὀὀç - login name, ὀῖ ῖῖῖᾱ ὀῖὀ ὀὀῖὀῖᾱεὀὀὀὀ - host name, ἔᾱέ ὀῖ ῖῖῖᾱ ᾱῖᾱᾱὀὀᾱὀ) ἔᾱέ ᾱçῖῖὀῖῖῖὀ ἰβᾱ ᾱὀεὀ ὀᾱεβᾱᾱ ἔᾱὀᾱεβᾱᾱὸ PostScript:

```
#!/bin/sh
#
# make-ps-header - make a PostScript header page on stdout
# Installed in /usr/local/libexec/make-ps-header
#
#
# These are PostScript units (72 to the inch).  Modify for A4 or
# whatever size paper you are using:
#
page_width=612
page_height=792
border=72
#
# Check arguments
#
if [ $# -ne 3 ]; then
```

```

    echo "Usage: `basename $0` <user> <host> <job>" 1>&2
    exit 1
fi

#
# Save these, mostly for readability in the PostScript, below.
#
user=$1
host=$2
job=$3
date=`date`

#
# Send the PostScript code to stdout.
#
exec cat <<EOF
%!PS

%
% Make sure we do not interfere with user's job that will follow
%
save

%
% Make a thick, unpleasant border around the edge of the paper.
%
$border $border moveto
$page_width $border 2 mul sub 0 rlineto
0 $page_height $border 2 mul sub rlineto
currentscreen 3 -1 roll pop 100 3 1 roll setscreen
$border 2 mul $page_width sub 0 rlineto closepath
0.8 setgray 10 setlinewidth stroke 0 setgray

%
% Display user's login name, nice and large and prominent
%
/Helvetica-Bold findfont 64 scalefont setfont
$page_width ($user) stringwidth pop sub 2 div $page_height 200 sub moveto
($user) show

%
% Now show the boring particulars
%
/Helvetica findfont 14 scalefont setfont
/y 200 def
[ (Job:) (Host:) (Date:) ] {
200 y moveto show /y y 18 sub def }
forall

/Helvetica-Bold findfont 14 scalefont setfont
/y 200 def
[ ($job) ($host) ($date) ] {
    270 y moveto show /y y 18 sub def

```



```
#
# bamboo is connected to rose as well:
#
bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
      :lp=:rm=rose:rp=bamboo:sd=/var/spool/lpd/bamboo:
```

Όι ιυίι θιρσ αδνίΥίαέ άβίαέ ίά άçιείρñāθρίοιά θιρσ εάοάεüαίρσ spooling όοίι έüίαι orchid:

```
# mkdir -p /var/spool/lpd/rattan /var/spool/lpd/bamboo
# chmod 770 /var/spool/lpd/rattan /var/spool/lpd/bamboo
# chown daemon:daemon /var/spool/lpd/rattan /var/spool/lpd/bamboo
```

Όρñά, ίε ÷ñθρσάο θιρσ orchid ιδñííí ίά άέοδδθρñίόί όοίι rattan εάέ όοίι bamboo. Άί, áέá δάνÜááéαιά, Υίαό ÷ñθρσάο θιρσ orchid δέçέθñíéíāθρσάέ:

```
% lpr -P bamboo -d sushi-review.dvi
```

οι όόγόςια **LPD** όοίι orchid εά άίόέáñÜθáέ όçí áñááόβά όοίι εάοÜείαι spooling /var/spool/lpd/bamboo εάέ έá όçíáέρσάέ δυò δñüέáέόáέ áέá áñááόβά DVI. Ιüέέο ί όθίεíáέόóθρσ rose Υ÷áέ áέáéΥόέíí ÷ññí όοίι εάοÜείαι spooling θιρσ bamboo, όá äýí **LPDs** εά ίάόáóΥñίόί όí áñ÷áβí όόίι rose. Όí áñ÷áβí εά ίδáέ όá íñÜ áίáíñíθρσ όοίι όθίεíáέόóθρσ rose Υüò üóίó áέόδδθüέáβ. Έá ίάόáθñάδáβ áδñ DVI όá PostScript (άόίý í bamboo áβίαέ áέόδδθüέθρσ PostScript) όοίι όθίéíáέόóθρσ rose.

10.4.3.2 ΑέοδδθüέÝò ίá ΌόíáΥόáέó Αέέθóýíó

Όó ÷íÜ, υóάí ááíñÜááόá εÜñόá áέέόýíó áέá áέόδδθüέθρσ, Υ÷áόá όç áóíáóüέόóá áδέéíāθρσ äýí áέäüóáüí: ç ίβá áβίαέ δñíóñíβüόç θιρσ spooler (ç δέí áέñέáθρσ Υέáíóç) áñ ç Üέέç áδéÜ óáó áδέόñΥδáέ ίá óóΥέíáόá áááñΥία ίΥóü áóθρσ όάí ίá ÷ñçóéííθίéíáβόá ίέá óáέñέáέθρσ θάνÜέέçέç éýñά (ç όόçíθρσ Υέáíóç). Άóθρσ ç áíüέόóá δáñéáñÜόáέ δυò ίá ÷ñçóéííθίéíáβόá όçí όόçíθρσ Υέáíóç. Άέá όçí δέí áέñέáθρσ Υέáíóç ίδññáβόá ίá áñáβόá δáñέóóüέáñáò δέçñíóíñβáò όόçí δñíçáíýáíç áíüέόóá ΑέóδδθüέÝò ÁáέáόáόόçíΥίίέ óá ÁδñáέñóóíΥίíóò ΌθίéíáέόóÝò.

Ç íññóθρσ θιρσ áñ÷áβíó /etc/printcap óáó áδέόñΥδáέ ίá íñβόáόá όç áέáόýíááόç - óáέñέáέθρσ θάνÜέέçέç - θιρσ εά ÷ñçóéííθίéíáβόá, έáέ (άí ÷ñçóéííθίéíáβόá óáέñέáέθρσ áέáόýíááόç) θιí ñóèíü baud, δέέáííýò áéΥá÷íòò ñíθρσ, έáέόóóáñθρσάέó áέá tabs, ίάόáθñíθÝò áέá ÷áñáέóθñáò íΥáó áñáñíθρσ, έáέ Üέéá. ΆέéÜ ááí όδÜñ÷áέ όññüθιò ίá íñβόáόá ίέá όýíááόç óá áέόδδθüέθρσ θιρσ áéíýáέ óá éýñá TCP/IP θρσ Üέéí όýθí áέέόýíó.

Άέá ίá óóáβéáόá áááñΥία óá Υία áέέóóáéü áέόδδθüέθρσ, ÷ñáéÜááόáέ ίá áίáδóýíáóá δñíáñÜñáόá áδέéíéíüíβáò θιρσ ίá έáéíýíóáέ áδñ óβéóñá έáéíΥííó έáέ óβéóñá ίάόáθñíθρσ. Άáñ Υ÷íóíá Υία όÝóíéí δáñÜááéαιά: όí script netprint δáβñíáέ üέá óá áááñΥία áδñ όí standard input έáέ óá óóΥέíáέ óá Υία áέόδδθüέθρσ óóíááááíΥíí όóí áβέόóí. Ιñβáéíóá όóí netprint όí üññá θιρσ áέόδδθüέθρσ üò δñθρç δáñÜíáóñí, έáέ όíí áñέéíü éýñáò όόçí íθíβá óóíáΥáόáέ üò ááýóáñç. Όçíáέρσόá δυò áóóüò í óññüθιò όθíóόçñβáéέ íüíí áδέéíéíüíβá ίέáó έáόáýéóíóçò (áδñ όí FreeBSD όóíí áέόδδθüέθρσ). Δíééíβ áέέόóáéíβ áέόδδθüέÝò όθíóόçñβáéíóí áíóβáññç áδέéíéíüíβá, έáέ áβίαέ δíéý δέéáíü ίá áδέéóíáβóá ίá áéíáóáééáóóáβóá óá δñíóáñθíáόá θιρσò (áέá ίá áéΥá÷áόá όçí έáóÜóόáόç θιρσ áέόδδθüέθρσ, áέá έáóáíÝóñçόç áέόδδθρσáüí, έéð.).

```
#!/usr/bin/perl
#
# netprint - Text filter for printer attached to network
# Installed in /usr/local/libexec/netprint
#
$#ARGV eq 1 || die "Usage: $0 <printer-hostname> <port-number>";
```

```

$printer_host = $ARGV[0];
$printer_port = $ARGV[1];

require 'sys/socket.ph';

($ignore, $ignore, $protocol) = getprotobyname('tcp');
($ignore, $ignore, $ignore, $ignore, $address)
    = gethostbyname($printer_host);

$sockaddr = pack('S n a4 x8', &AF_INET, $printer_port, $address);

socket(PRINTER, &PF_INET, &SOCK_STREAM, $protocol)
    || die "Can't create TCP/IP stream socket: $!";
connect(PRINTER, $sockaddr) || die "Can't contact $printer_host: $!";
while (<STDIN>) { print PRINTER; }
exit 0;

```

Ίδιναβδσά ίά ÷ ηςοείηδιέΠράσδσά άοδσά οί script σά έέΰοίηά οβέοηά. Άο οδιεΰοίσιά δσδ Ύ ÷ ιοίά Ύίάί έέοδδσδΠ άηάηΠδσ Diablo 750-N σάίάάάάίΎίη σάί άβέοδσί. Ί έέοδδσδΠδσ άΎ ÷ άδσάέ άάάηΎίά δηίσ άέοδδσδσς σάσί έςήνά 5100. Οί υίηά σίσ έέοδδσδΠ σάί άβέοδσί άβίάέ scrivener. Άπ άβίάέ σί οβέοηί έάειΎίησ έέα σί έέοδδσδΠ:

```

#!/bin/sh
#
# diablo-if-net - Text filter for Diablo printer 'scrivener' listening
# on port 5100. Installed in /usr/local/libexec/diablo-if-net
#
exec /usr/libexec/lpr/lpf "$@" | /usr/local/libexec/netprint scrivener 5100

```

10.4.4 έάά ÷ ισδ Δησσάσςδ έάέ Δάηείηέοίησ σςς × ηΠσς σσί ΆέοδδσδΠί

ΆδσΠ ς άίσδςδσά άβίάέ δέςηίσηηβσδ έέα σί Ύέάά ÷ ι δησσάσςδ έάέ σί δάηείηέοίησ ÷ ηΠσςδ σσί έέοδδσδΠί. Οί σγσδςά **LPD** σάδ άδέοηΎδσά ίά έέΎά ÷ άδσά διεσδ ιδηηάβ ίά Ύ ÷ έέ δησσάσςδ σά έΰεά έέοδδσδΠ, σσί σίδέεΰ υσί έάέ άδηάέησδΎίά, έάέ άδβσςδ άί ιδηηίςί ίέ ÷ ηΠσδσδ ίά έέοδδΠησί διεεάδεΰ άίσβάηάσά, δσί ίάΰεάδ ιδηηίςί ίά άβίάέ ίέ άηάάσβσδ σίσδ, έάέ δσσί ίάΰεάδ ιδηηίςί ίά άβίσί ίέ ισηΎδ άίάηηΠδσ (print queues).

10.4.4.1 Δάηείηέοίησ Άέοδδσδσςδ ΔιεεάδεΠί Άίέέάηΰσσί

Οί σγσδςά **LPD** έέάσείεςίάέ σίσδ ÷ ηΠσδσδ ίά έέοδδΠσσί διεεάδεΰ άίσβάηάσά άίσδ άη ÷ άβίσ. Ίέ ÷ ηΠσδσδ ιδηηίςί ίά έέοδδΠησί άηάάσβσδ ίά lpr -#5 (έέα δάηΰάέάίά) έάέ ίά δάβηησί δΎίσά άίσβάηάσά έΰεά άη ÷ άβίσ σςδ άηάάσβσδ έέοδδσδσςδ. Οί άί σδσσ άβίάέ έάέσ, άίάηδΰσάέ άδσ άσΰδ.

Άί δέσδσάσδσ δσδ σά διεεάδεΰ άίσβάηάσά άςίείσηάίςί ΰσείσς έάδσδσίςςδ σσί έέοδδσδΠί σάδ, ιδηηάβδσ ίά άδάίάηάηδιέΠράσδσά σςί άδέείάΠ -# σάί lpr(1) δηίσέΎσίσάδ σςί έέάίσδςδσά sc σάί άη ÷ άβί /etc/printcap. ΰσάί ίέ ÷ ηΠσδσδ άδίσδΎέείσί άηάάσβσδ ίά σςί άδέείάΠ -#, έά έέΎδσί:

```
lpr: multiple copies are not allowed
```

ΟςίάέΠσά δσδ άί Ύ ÷ άδσά ηδσβσάέ δησσάσςδ σά Ύίάί έέοδδσδΠ άδηάέησδΎίά (άάβδσά σςί άίσδςδσά ΆέοδδσδΎδ ΆέέάσάσςίΎίέ σά ΆδηάέησδΎίσδ ΟδιεεάέσδΎδ), έά ÷ ηάέάσάβ ίά δηίσέΎσάσά σςί έέάίσδςδσά sc σά

üέα όά αδιίάεινόοι Ἰία ἀñ÷άβá /etc/printcap, áεάοιñάόέέŪ íé ÷ñΠόόάδ έά Ἰ÷íοí áέυìç όçí äöíáóúòçόά íá äðíóóŸέεíοí ãñááóβáδ ðíεεάðεÞí áíóέãñŪóυí ÷ñçόέíñðíεÞíόάδ áεάοιñάόέέú èùìáí.

Åþ åβíáέ Ἰία ðãñŪááέáíá. Ἄόòú åβíáέ òí ἀñ÷άβí /etc/printcap áέá òíí èùìáí rose. Ἰ áέòðòðòðò rattan åβíáέ äöíáóú ìç÷Ūíçíá έάέ äðέòñŸðáέ όçí áέòýðòòç ðíεεάðεÞí áíóέãñŪóυí, áέέŪ í áέòðòðòðò laser bamboo åβíáέ ðéí äòáβóέçòí, äðñŸíòò έá äðáíãñáíðíεÞóíòíá όç äöíáóúòçόά ðíεεάðεÞí áíóέãñŪóυí ðñíóέŸòííóáδ όçí έέáíúòçόά sc:

```
#
# /etc/printcap for host rose - restrict multiple copies on bamboo
#
rattan|line|diablo|lp|Diablo 630 Line Printer:\
    :sh:sd=/var/spool/lpd/rattan:\
    :lp=/dev/lpt0:\
    :if=/usr/local/libexec/if-simple:

bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
    :sh:sd=/var/spool/lpd/bamboo:sc:\
    :lp=/dev/tty5:ms#-parenb cs8 clocal crtscts:rw:\
    :if=/usr/local/libexec/psif:\
    :df=/usr/local/libexec/psdf:
```

Ōþñá, έá ÷ñáέáóóáβ íá ðñíóέŸóíòíá äðβóçò όçí έέáíúòçόά sc óòí ἀñ÷άβí /etc/printcap òíò èùìáíð orchid (έάέ ãþ ãñέóέùíáóóá óá áðòú, äðέòñŸðóá íáð íá äðáíãñáíðíεÞóíòíá óá ðíεεάðéŪ áíóβãñáóá áέá òíí áέòðòðòð teak):

```
#
# /etc/printcap for host orchid - no multiple copies for local
# printer teak or remote printer bamboo
teak|hp|laserjet|Hewlett Packard LaserJet 3Si:\
    :lp=/dev/lpt0:sd=/var/spool/lpd/teak:mx#0:sc:\
    :if=/usr/local/libexec/ifhp:\
    :vf=/usr/local/libexec/vfhp:\
    :of=/usr/local/libexec/ofhp:

rattan|line|diablo|lp|Diablo 630 Line Printer:\
    :lp=:rm=rose:rp=rattan:sd=/var/spool/lpd/rattan:

bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
    :lp=:rm=rose:rp=bamboo:sd=/var/spool/lpd/bamboo:sc:
```

×ñçόέíñðíεÞíόάδ όçí έέáíúòçόά sc, ðñíέáíáŪííòíá όçí ÷ñΠόç ðυí áíóíεÞí lpr -#, áέέŪ ááí Ἰ÷íòíá áέυìç όçí äöíáóúòçόά íá ðãñáíðíãβóíòíá òíòð ÷ñΠόόάδ íá ðñŸíòí όçí áíóíεÞ lpr(1) ðíεεŸò òíñŸò, Þ íá äðíóóáβéíòí òí Βáέíí ἀñ÷άβí ðíεεŸò òíñŸò óá ìβá ïíááέέÞ ãñááóβá, ùðòð åþ:

```
% lpr forsale.sign forsale.sign forsale.sign forsale.sign forsale.sign
```

ŌðŪñ ÷íòí ðíεεíβ ðñυðíé ðñυέççòð áðòþí ðυí áíãñááεÞí (óòíðãñέέáíáŪííóáð έάέ όçí ðãñβðòòç íá òí ááíΠóáðá) ðíò åβóóá áέáýέãñíé íá áíãñáðíΠóáðá.

10.4.4.2 Δάñείñβέιιόάδ όçί Δñüóááός óά ΆέδδδδδóÝδ

Ìðñáβδá íá áεÝá ÷ áδá ðιέúδ ìðñáβ íá áέδδδβρίάε όά ðιέúι áέδδδδδóΠ ÷ ñçόέιιðιέβίόάδ όιòδ ιç ÷ áίέόιιγδ ñÛáíι (groups) όιò UNIX έάέ όçί έέάíιòçδά rg όδι /etc/printcap. ΆðēÛ όιðιέáδβρόά όιòδ ÷ ñβρόáδ ðιò εÝέάδά íá Ý ÷ ðιò ðñüóááός όά εÛðιέιι áέδδδδδóΠ όά íέá όδάέáñέιÝιç ñÛáá (÷ ñçόδβι), έάέ áçèβρόά áδδβ όçι ñÛáá όόçι έέάíιòçδά rg.

¼ειέ íé ÷ ñβρόáδ ðιò ááí áíβέιòι όόçι ñÛáá (όδιðáñέέáíááíñÝñö έάέ όιò root) εá äÝ ÷ ðιέάέ όι áέúειòει ιβρίά: lpr: Not a member of the restricted group üδáí ðñιόδáειγί íá áέδδδδβρíoι όόιí áέáá ÷ ùíáí áέδδδδδóΠ.

¼ðùδ έάέ ìά όçι έέáíιòçδά sc (ðáñειñέόιγý ðιέéáðεβι áíðéáñÛðυι), εá ÷ ñáέάόδáβ íá ðñιόáειñβóáδά όçι rg όδιòδ áðñáέñόοιÝñöð èúíáιòδ ðιò εá Ý ÷ ðιò ðñüóááός όόιòδ áέδδδδδóÝδ όάδ, áí ññæáδά ðùδ áδδυ áβíáέ óυόδυ (ááβδá όçι áíιòçδά ΆέδδδδδóÝδ ΆάέáδáóόçιÝñέ όά ÁðñáέñόοιÝñöð ÕðιειáέόδóÝð).

Άέá ðáñÛááέáíá, εá áδβρíoιá áέá ùειòð áέáγδέáñç όçι ðñüóááός όόιí áέδδδδδóΠ rattan, áέéÛ ùííí íé ÷ ñβρόáδ όçδ ñÛááð artists εá ìðñíγí íá ÷ ñçόέιιðιέβρíoι όιí bamboo. Άáð áβíáέ όι áñυόδυ íáð /etc/printcap áέá όιí èúíáí rose:

```
#
# /etc/printcap for host rose - restricted group for bamboo
#
rattan|line|diablo|lp|Diablo 630 Line Printer:\
    :sh:sd=/var/spool/lpd/rattan:\
    :lp=/dev/lpt0:\
    :if=/usr/local/libexec/if-simple:

bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
    :sh:sd=/var/spool/lpd/bamboo:sc:rg=artists:\
    :lp=/dev/tty5:ms#-parenb cs8 clocal crtscts:rw:\
    :if=/usr/local/libexec/psif:\
    :df=/usr/local/libexec/psdf:
```

ΆðέöñÝðάá íáð íá ιçí áέéÛñιόá όι áñ ÷ áβι /etc/printcap áδδυ όι Ûέει ðáñÛááέáíá (áέá όιí ððιειáέόδΠ orchid). ÕóóέéÛ, ðιειóáðβιόá ÷ ñβρόçδ όιò orchid ìðñáβ íá áέδδδβρíoáέ όόιí bamboo. ðóùδ ùíðδ íá áðέöñÝðιόá ùííí όá όδáέáñέιÝñöð ÷ ñβρόáð όçι ðñüóááός όόιí ððιειáέόδΠ orchid, έάέ εÝειòíá áδδβñ íé ÷ ñβρόáδ íá Ý ÷ ðιò ðñüóááός όόιí áέδδδδδóΠ. ¹ βούδ ðÛέέ, έάέ ù ÷ é.

Όçιáβύóç: ΆðέöñÝðáδáέ ùííí íέá ðáñειñέόιÝιç ñÛáá áíÛ áέδδδδδóΠ.

10.4.4.3 έáá ÷ ðιò ìááÝειòδ όυι ÁðáόάáειÝíυι Áñááóéβι

Άí ðιέειβ ÷ ñβρόáð Ý ÷ ðιò ðñüóááός όόιòδ áέδδδδδóÝδ όάδ, ðέéáíðð íá ÷ ñáéÛæáδáέ íá εÝόάδά Ýíá áíβόáδι ùñει όόι áðέöñáððñáí ùÝááειò áñ ÷ áβυι ðιò ìðñíγí íá áðιόááβειòι íé ÷ ñβρόáð áέá áέδóγδδóç. Άέúíá έάέ áí ððÛñ ÷ áέ áñέáðυò ÷ ðñιò όδι óýόçιá áñ ÷ áβυι ðιò òέειñáíáβ όιòδ έáδáέúñιòð spool, εá ðñÝðáέ ùόδυόι íá ááááέúέáβδá ùέé áðáñέáβ áέá όέδ áñááόβáð ùέúι όυι ÷ ñçόδβι.

Όι **LPD** όάδ áðέöñÝðáέ íá ñειéáðβρόáðά όι ìÝáέόδι áñέéìυ bytes ðιò ðáñéÝ ÷ áέ íέá áñááόβά, ìά όçι έέáíιòçδά mx. Ç ññÛáá ìÝòñçόçδ áβíáέ όá BUFSIZ blocks, óá ðιíβá áβíáέ 1024 bytes. Άí εÝόάδά ιçáÝí όá áδδβ όçι έέáíιòçδά, ááí εá ððÛñ ÷ ðιò ùéá όόι ìÝááειò όυι áñ ÷ áβυι. Ùόδυόι, áí ááí Ý ÷ áé ññέόáβ ç έέáíιòçδά mx, óυόá εá ÷ ñçόέιιðιέáβóáέ ç ðñιáðέέáñíÝιç όειβ óυι 1000 blocks.

Όγιᾶβῦόϋϗ: Όι ὔνει ἀοᾶνιῦᾶάοάε ὀά ᾶñ÷ᾶβᾶ ἰεάὸ ᾶñᾶάὸβᾶὸ, ἕάε ὔ÷έ ὀοι ὀοῖῖῖῖῖῖ ἰῶᾶᾶῖὸ ὀϗ ᾶñᾶάὸβᾶὸ.

Όι **LPD** ᾶᾶ ἕᾶ ᾶδῖññβῶᾶέ ῶῶ ᾶñ÷ᾶβῖ δῖὸ ἰᾶδᾶñῖῦ ὀι ὔνει ἰᾶᾶῶῖῖὸ δῖὸ ῶ ÷ᾶὸᾶ ἕῶᾶέ. Ἀῖὀἕῖῶὸῦ, ἕᾶ ὀι ὀῖδῖᾶᾶὸρῶᾶέ ὀϗ ῖῖñῦ ᾶῖᾶñῖῖὸ ἰᾶ ἰῶᾶῖῖὸ βῶῖ ἰᾶ ὀι ἰῶᾶῖῖὸ ᾶδῖὀñᾶδῖὸ, ὀι ῖδῖβῖ ἕᾶ ἕᾶ ᾶἕὀδδρῶᾶέ ὀᾶἕἕῦ. Όι ὀδῦῖῖῖῖῖ ᾶñ÷ᾶβῖ ᾶδῖññβῶᾶᾶᾶ. Ἀῖ ᾶὀῖῖ ᾶβῖᾶέ ὀῖὀῖῖ ῖ ἕᾶῖᾶὀῖῶῖῖ ὀñῦῖῖ ᾶῖὀῖᾶὀρῶῖὀϗ ᾶῖ ὀϗ ὀδῶῖñᾶὀϗ ὀῖῖ ἰñβῖῖ, ᾶβῖᾶέ ἕῶῖᾶ ὀñῖ ὀὀᾶρῶϗϗ.

Ἀὀ ἰñῖῖᾶὀρῶῖῖ ὀοῖ δᾶñῦᾶἕᾶἰᾶ ἰᾶὀ ὀῖῖ ᾶἕὀδδῖὀῶ ῶ rattan ἕᾶε bamboo. Ἀὀᾶἕᾶρ ὀᾶ ᾶñ÷ᾶβᾶ PostScript ὀῖῖ artists ὀᾶβῖῖῖ ὀñῖ ἰᾶᾶῶῖᾶ ἰᾶᾶῶῖᾶ, ἕᾶ ἕῶῖῖῖᾶ ῶῶ ὔνει δῶῶῖᾶ megabytes. Ἀᾶῖ ἕᾶ ἕῶῖῖῖᾶ ὔνεᾶ ᾶῖ ὀῖῖ ᾶἕὀδδῖὀρ ᾶñᾶñῖῖὸ ᾶδῖῖῖ ἕᾶῖῖῖῖ:

```
#
# /etc/printcap for host rose
#
#
# No limit on job size:
#
rattan|line|diablo|lp|Diablo 630 Line Printer:\
    :sh:mx#0:sd=/var/spool/lpd/rattan:\
    :lp=/dev/lpt0:\
    :if=/usr/local/libexec/if-simple:
#
# Limit of five megabytes:
#
bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
    :sh:sd=/var/spool/lpd/bamboo:sc:rg=artists:mx#5000:\
    :lp=/dev/tty5:ms#-parenb cs8 clocal crtscts:rw:\
    :if=/usr/local/libexec/psif:\
    :df=/usr/local/libexec/psdf:
```

Ἐᾶῖ δῶῖῖ, ὀᾶ ὔνεᾶ ᾶὀᾶñῖῖᾶῖὀᾶῖ ἰῖῖ ᾶῖ ὀῖὀ ὀῖὀῖῖῖ ÷ñρὀᾶὀ. Ἀῖ ῶ ÷ᾶὸᾶ ᾶῖᾶñᾶῖὀῖῖῖῖῖῖ ᾶδῖñᾶῖῖὀῖῖῖῖ ὀῖῖ ὀñῖὀᾶῖῖῖῖῖ ἰᾶ ὀϗ ἕᾶῖῖὀϗ ᾶᾶ ἕᾶῖ ὀᾶ ᾶδῖñᾶῖῖὀῖῖῖῖ ῶῶ ᾶñ÷ᾶβᾶ /etc/printcap. Ἀᾶβῶᾶ ὀϗ ᾶῖὀϗ ᾶἕὀδδῖὀῶ Ἀᾶἕᾶὀᾶὀϗῖῖῖ ὀᾶ Ἀὀñᾶῖῖὀῖῖῖῖ ὀῖῖ ὀὀῖῖᾶὀὀῖῖῖ ᾶῖ ὀñῖῖὀῖῖῖῖ ὀ÷ᾶὀἕῦ ἰᾶ ὀἕὀ ᾶἕὀδδρῶᾶἕ ᾶὀ ᾶδῖñᾶῖῖὀῖῖῖῖ ὀὀῖῖᾶὀὀῖῖῖῖ.

ὀδῦñ ÷ᾶῖ ἕᾶῖ ῶῖῖ ᾶῖᾶἕᾶἕᾶὀῖῖ ὀñῖὀ ὀñῖῖῖὀῖῖ ὀῖ ἰᾶᾶῶῖῖ ᾶñᾶὀῖῖ ᾶῖ ᾶδῖñᾶῖῖὀῖῖῖ ᾶἕὀδδῖὀῶ. Ἀᾶβῶᾶ ὀϗ ᾶῖὀϗ ὀñῖῖῖ ᾶñᾶὀῖῖ ᾶὀ ᾶδῖñᾶῖῖὀῖῖῖ ὀὀῖῖᾶὀὀῖῖῖῖ.

10.4.4.4 ὀñῖῖῖὀῖῖ Ἀñᾶὀῖῖ ᾶὀ Ἀὀñᾶῖῖὀῖῖῖ ὀὀῖῖᾶὀὀῖῖῖῖ

Όῖ ὀῖὀῖᾶ δᾶñ÷ῶᾶὀϗ **LPD** δᾶñῶ ÷ᾶῖ ᾶἕῦὀῖῖὀῖ ὀñῖὀὀ ὀñῖῖῖὀῖῖ ὀῖ ᾶñᾶὀῖῖ ᾶὀ ᾶδῖñᾶῖῖὀῖῖῖ ὀὀῖῖᾶὀὀῖῖῖῖ:

ὀᾶñᾶὀὀᾶὀὀ ὀὀῖῖᾶὀὀῖῖ

ἰὀñᾶβὀᾶ ἰᾶ ἕῶῖᾶ ÷ᾶὸ ᾶὀ ὀῖῖὀ ᾶδῖñᾶῖῖὀῖῖῖ ὀὀῖῖᾶὀὀῖῖῖῖ ἕᾶ ᾶῶ ÷ᾶὀᾶ ᾶὀρῶᾶἕ ᾶἕὀὀὀϗ ὀῖ ὀῖὀῖῖ ῶῶ, ÷ñϗὀῖὀῖῖὀὀᾶ ὀᾶ ᾶñ÷ᾶβᾶ /etc/hosts.equiv ἕᾶῖ /etc/hosts.lpd. Όῖ **LPD** ᾶἕῶῖ ÷ᾶῖ ἰᾶ ᾶἕ ᾶῖ ϗ

ἀέσἀñ ÷ ùáíç áβδςόç δññÝñ ÷ ἀδσάέ áδὺ Ýíáí òðññæέσδð ðñσ áíáσÝññáσάέ σά èÛðññéí áδὺ σά äýí áñ ÷ áßá. Ἄí ù ÷ é, òí **LPD** áðñññßððáέ òçí áβδςόç.

Ç ïññð ððððí òùí áñ ÷ áßùí áßíáέ áððð: Ýíá ùññá òðññæέσδð áíÛ ãñññð. Ðáñáðçñðóðá ðὺð òí áñ ÷ áßí /etc/hosts.equiv ÷ ñçóέññðñέáßðáέ éáέ áδὺ òí δññòùññέέñ ruserok(3), éáέ áðçññáÛæáέ δññññÛññáσά ùðὺð òí rsh(1) éáέ òí rcp(1), áðñÝñò ñ áßóðá δññσάέðέέñß.

Ἄέá δáñÛááέáíá, áäð áßíáέ òí áñ ÷ áßí /etc/hosts.lpd σòññ òðññæέσδð rose:

```
orchid
violet
madrigal.fishbaum.de
```

Ἄσðù σçíáßíáέ ðὺð ñ rose äÝ ÷ áδσάέ áέððσάέð áδὺ òñòð òðññæέσδð orchid, violet, éáέ madrigal.fishbaum.de. Ἄí èÛðññéíð Ûέέñð òðññæέσδðð δñññððáέðσάέ íá áðññððσάέ δññσάáσç σòí **LPD** òñσ rose, ç áññáσáά éá áðñññέðέáß.

Ðáñέññέσññß σòí ÌÝááέíð

Ìðññáßðá íá áέÝá ÷ áðá ðñσñð áέáýέáññò ÷ ðññò δñÝðáέ íá áðñÝíáέ σòí σýóðçíá áñ ÷ áßùí ùðñò áñßóέáðáέ ñ éáðÛέññò spool. Ἀçñέñññððóðá Ýíá áñ ÷ áßí ñá ùññá minfree σòññ éáðÛέñññ spool áέá òññ òñðέέù áέðððððð. ἌέσÛááσá σά áððù òí áñ ÷ áßí Ýíáí áñέέñ ðñσ áíóέðñññððáýáέ ðñσά blocks áßóέñσ (512 bytes) áέáýέáññò ÷ ðññò δñÝðáέ íá òðÛñ ÷ ññí áέá íá áßíáέ ááέðð ñέá áðññáέñðò òíÝíç áññáσáά.

Ἄσðù σάð áðέðñÝðáέ íá áßóðá áÝááέñέ ðὺð ñέ áðññáέñðò òíÝññέ ÷ ñðóðáð ááí éá áñññóññí òí σýóðçíá áñ ÷ áßùí σάð. Ìðññáßðá áðßóçð íá òí ÷ ñçóέñññðñέððáðá áέá íá áððáðá ñáñέέð ðññòáñáέùçðá σòññð òñðέέññýð ÷ ñðóðáð: ñέ òñðέέñß ÷ ñðóðáð éá ñðññýí íá σðÝέññò ãññáσááðð σóçí ñðñÛ áíáññðð áέññç éáέ ùðáí ñ áέáýέáññò ÷ ðññò òñσ áßóέñσ Ý ÷ áέ ðÝσάέ èÛðð áδὺ òññ áñέέñ ðñσ áíáσÝññáσάέ σòí áñ ÷ áßí minfree.

Ἄέá δáñÛááέáíá, áð δñññέÝóññá Ýíá áñ ÷ áßí minfree áέá òññ áέððððððð bamboo. ἌñáðÛέñññá òí /etc/printcap áέá íá áñññýñá òññ éáðÛέñññ spool áέá áððùí òññ áέððððððð. Ἄäð áßíáέ ç éáðá ÷ ðñέóç áέá òññ bamboo:

```
bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
:sh:sd=/var/spool/lpd/bamboo:sc:rg=artists:mx#5000:\
:lp=/dev/ttyu5:ms#-parenb cs8 clocal crtscs:rw:mx#5000:\
:if=/usr/local/libexec/psif:\
:df=/usr/local/libexec/psdf:
```

Ì éáðÛέñññò spool éáέññßæáðáέ σóçí éέáññðçðá sd. Èá èÝóññá òññá megabytes (έóññáðññáß ñá 6144 disk blocks) ùð òí ñÝááέíð òñσ áέáýέáññò ÷ ðññò ðñσ δñÝðáέ íá òðÛñ ÷ áέ σòí σýóðçíá áñ ÷ áßùí, ððá òí **LPD** íá äÝ ÷ áδσάέ áðññáέñðò òíÝíáð áññáσáά:

```
# echo 6144 > /var/spool/lpd/bamboo/minfree
```

Ðáñέññέσññß ÷ ñçóððí

Ìðññáßðá íá áέÝá ÷ áðá ðñέùð áðññáέñðò òíÝññέ ÷ ñðóçðð ñðññáß íá áέððððññáέ σòññð òñðέέññýð áέððððððÝð ññßæññðáð òçí éέáññðçðá rs σòí /etc/printcap. ¼ðáí áñðáíßæáðáέ ç rs σά ñέá éáðá ÷ ðñέóç èÛðññéíð òñðέέÛ σòññáááñÝññò áέððððððð, òí **LPD** éá áá ÷ éáß áññáσááð áδὺ áðññáέñðò òíÝññέ òðññæέσδð áí ñ ÷ ñðóçðð ðñσ áðññóðÝέέáέ òçí áññáσáά Ý ÷ áέ éñááñέáσññ σòññ òñðέέù òðññæέσδðð éáέ ñá òí ßáέí ùññá ÷ ñðóçð. ἌέáññáðέέÛ, òí **LPD** éá áðñññßðáέ òçí áññáσáά.

Ἄσðð ç éέáññðçðá áßíáέ éáέáßðáñá ÷ ñðóέñç σά ðáñέáÛέέññóá ùðñò òðÛñ ÷ ññí (áέá δáñÛááέáíá) áέáñññáðέέÛ áðέ ÷ áέñçσάέÛ òññááðá ðñσ ñññÛέññóáέ òí áβέððñ, éáέ èÛðññέé ÷ ñðóðáð δñÝðáέ íá òðññáááßññò σά σýññá òñσ òññáðñð. Ἀçñέñññðññóáð éñááñέáóññýð σðá σðððññáðá σάð, éá ñðññýí íá ÷ ñçóέñññðñέýí òñòð áέððððððÝð σάð áδὺ

¼δδδ άίάδΰνάίά όδçi άίυδδδά δυί öβέδñυί (Öβέδñά), öι LPD ίάέείΰ δά öβέδñά έάειΰñö έάέ ίάδδδñιδδδ δάνηρίάδδ όδçi άñάιηδ άίδρεηί öιö öβέδñιö έάέ öι υñíá öιö άñ÷άβιö έάδδδñάδδδ. Öά öβέδñά ίδñιήί ίά ÷ñçóειιδρειέρδδδ άδδδδ όçi δάνΰίάδδδ άέα ίά ίΰñιδδ διö ίά άñΰιδδδ δέδ έάδδδ÷υñβδδάέδ έάδδδΰδñçóçδ. Öι υñíá öιö άñ÷άβιö έάδδδΰδñçóçδ öάβιάδδδάέ όδçi έέάίυδδδά af öδδδ /etc/printcap, έάέ άί άάί ηñβæάδδδ ç δερñçδ άέαάñηηδ öιö, ÷ñçóειιδρειέάβδδάέ ç ö÷άδέέδ άέαάñηηδ υδ δñιδ öιί έάδΰεϊάι spool.

Öι LPD ίάέείΰ öι lpf ίά δάνάιΰδñιδδ δέΰδδδδ έάέ ίπεϊδδ δάεβάδδ (άδδδ δέδ έέάίυδδδδδ pw έάέ p1). Öι lpf ÷ñçóειιδρειέάβ άδδΰδ δέδ δάνάιΰδñιδδ άέα ίά δñιδδάειηñβδδάέ όçi διöυδδδά ÷άñδείή διö ÷ñçóειιδρειέρδδδ. Ιάδΰ όçi άδδδδδδδδ öιö άñ÷άβιö öδδδδδδδδ, άñΰδδδ ίέα έάδδδ÷ηñέδç έάδδδΰδñçóçδ öδδδ άñ÷άβι έάδδδδδδδδ. Ιέ έάδδδ÷υñβδδάέδ ηέΰεϊδδδ ίά δέδ δάνάέΰδδδ:

```
2.00 rose:andy
3.00 rose:kelly
3.00 orchid:mary
5.00 orchid:mary
2.00 orchid:zhang
```

Έά δñΰδδδ ίά ÷ñçóειιδρειέάβδδά ίά÷υñέδδδ άñ÷άβι έάδδδδδδδδδ άέα έΰεά άέδδδδδδδδ, άöιή öι lpf άάί ΰ÷άέ άίδδδδδδδδδΰΰ άδδδδδδδδδ έέάέπειδδδδ άñ÷άβιö (file locking), έάέ άΰί lpf ίδñιήί ίά έάδδδδδδδδδδδ öι ΰίά όçi έάδδδ÷ηñέδç öιö ΰεεϊδ άί δñυέάέδδδ ίά άñΰιδδδ δάδδδδδδ÷ñíά öδδδ βάέι άñ÷άβι. Ιάδ άΰέεϊδδδ δñυδδδ άέα ίά άάάέπειδδδάδδ όçi ηñάέέευδδδά άñ÷άβιö έάδδδδδδδδδ άίΰ άέδδδδδδδδ άβιέέ ίά ÷ñçóειιδρειέρδδδάδδ όçi έέάίυδδδά af=acct öδδδ /etc/printcap. ρδδδ, έΰεά άñ÷άβι έάδδδδδδδδδ δά άñβδδδδδδδδδ δδδδ έάδΰεϊάι spool öιö άίδδδδδδδδδ÷ιö άέδδδδδδδδ, öά ΰίά άñ÷άβι ίά υñíá acct.

¼δδδ άβδδδά ΰδδδδδδ ίά ÷ñάπειδδδ öιöδ ÷ñρδδδδδ άέα δέδ άέδδδδδδδδδ, άέδδδΰδδδ öι δñυάñάιά pac(8). Άδδδΰ ίάδδδδδδδδδ öδδδδ έάδΰεϊάι spool άέα öιί άέδδδδδδδδδ διö έΰίάδδδ έάδδδΰδñçóç έάέ δέçέδδδδδδδδδδδ pac. Έά άιöάίέδδδδδδδ ΰίάδ άδδδδδδδδδδ ίά ÷ñάπειδδδ öά άεΰΰέά, υδδδδ άεΰδδδδδδδδδ όδδδ öδδδΰ÷άέα:

Login	pages/feet	runs	price
orchid:kelly	5.00	1	\$ 0.10
orchid:mary	31.00	3	\$ 0.62
orchid:zhang	9.00	1	\$ 0.18
rose:andy	2.00	1	\$ 0.04
rose:kelly	177.00	104	\$ 3.54
rose:mary	87.00	32	\$ 1.74
rose:root	26.00	12	\$ 0.52
total	337.00	154	\$ 6.74

Δάνάέΰδδδ άβιέέ ίέ δάνΰίάδδδδδδδ διö άΰ÷άδδδδδ öι pac(8):

-Pprinter

Άέα δειέυ printer ίά έΰίάέ άδδδδδδδδδδδδ. Άδδδδ ç άδδδδδδδδδδδδδ άιöάΰάέ ηυί άί öδδδδδδδδδδδδδ ç δερñçδ άέαάñηηδ όδδδδ έέάίυδδδά af öδδδ /etc/printcap.

-c

Öάίέηñάβ öι άδδδδΰέάδδδά άίΰ έυδδδδδδδδδδδδδ άίδδδ όçδδδδδδδδδδδδδ δάίέήυδδδδδδδδδδδδδ öιί ÷ñçóδδδδδ.

-m

Άαήαβ οί υήνα οίο οδρεϊαέοδP οά αή ÷ άβ άάοάαήαοPδ. Ιά αοδP οçi άδέειάP, ι ÷ ηPοόçò smith οοή οδρεϊαέοδP alpha άβίάέ ι βαέιò ÷ ηPοόçò ιά οήι smith οοή οδρεϊαέοδP gamma. × υήβδ οçi άδέειάP αοδP, άβίάέ άέαοήηάοέειβ ÷ ηPοόαδ.

-pprice

Οδρεϊαβαέ οέο ÷ ηPοόαέο ιά price (οείP) οά äreÜñέα άίÜ οάεβαά P άίÜ δυαέ άίθβ αέά οçi οείP άδυ οçi έέάíυòçòά pc οόι /etc/printcap, P αέέεθò äýι οάίòδ (άδυ δñηάδέειάP). Ιδñηάβδ ά ίά ηñβόαδ ά ùδ price ιέά οείP ιά άάέάάέÜ θçöβά (floating point).

-r

ΆίόέοδñÝοάέ οçi οάέñÜ οάίέíυìçòçò.

-s

Άçìέιòñηάβ Ýία αή ÷ άβι άδρεϊαέοήý òυι έάοάιáδñPοάυι έάέ έάέάñβαέέ οά δñηέα ÷ υìήά ίά òυι αή ÷ άβυι έάοάαήαοPδ.

name . . .

ΟδθPήάέ δέçñηοήηβάδ άίάοήñÜδ ίυήι αέά οά οδάέάέñειÝία name (ήíυιάοά) ÷ ηçòθPί.

Οοή δñηάδέέάηÝήι άδρεϊαέοήυ δñò δññÜαάέ οή pac(8), άέÝδάδ ά òυι άñέέιυ òυι οδδñÝήι οάεβαυι άίÜ ÷ ηPοόç άδυ οήòδ άέÜοήηòδ οδρεϊαέοδÝδ. Άί, οόι ÷ ηñι οάδ, ι οδρεϊαέοδPδ άάί Ý ÷ άέ οçìάοβά (άέάòβ ιέ ÷ ηPοόαδ ιδñηýί ίά ÷ ηçòέιηδñέPοήι ιδñέηάPδñòά èÝέιòí), άέδάέÝόδ άçi άίòήP pac -m, αέά ίά άçìέιòñηάPοάδ άήι άέυέιòδèι άδρεϊαέοήυ:

Login	pages/feet	runs	price
andy	2.00	1	\$ 0.04
kelly	182.00	105	\$ 3.64
mary	118.00	35	\$ 2.36
root	26.00	12	\$ 0.52
zhang	9.00	1	\$ 0.18
total	337.00	154	\$ 6.74

Άέά οήι ηέοήυ δñοήοήý ÷ ηÝùçò οά äreÜñέα, οή pac(8) ÷ ηçòέιηδñέάβ οçi έέάíυòçòά pc οόι αή ÷ άβι /etc/printcap (δñηάδέέάηÝίç δείP 200, P 2 οάίòδ άίÜ οάεβαά). Δñηόάέηñβόδ ά οά αοδPί οçi έέάíυòçòά, οά άέάδñοδÜ οήò οάίò, οçi οείP άίÜ οάεβαά P άίÜ δυαέ δñò èÝέάδ ά ίά ÷ ηPήάδ άέά οέο άέοδθPοάέο. Ιδñηάβδ ά ίά δñηòδññÜοάδ αοδP οçi οείP υόάί δñÝ ÷ άδ άή pac(8) ιά οçi άδέειάP -p. Η ηñÜάά ιÝòñçòçò άέά οçi άδέειάP -p άβίάέ οά äreÜñέα, υ ÷ έ οά άέάδñοδÜ οήò οάίò. Άέά δññÜαάέάι,

pac -p1.50

ηñβαέέ έυοδñò έÜεά οάεβαάδ Ýία äreÜñει έάέ δñPήοά οάίòδ. Ιδñηάβδ δñάñιáοέέÜ ίά Ý ÷ άδ άδñέÜ Ýήιάά ÷ ηçòέιηδñέPήοάδ άδòÝδ οέο ÷ ηPοόαέο.

ΟÝέιò, άέδάέPήοάδ pac -s έά άδñέçέáýοάδ άέο δέçñηοήηβάδ οήò άδρεϊαέοήý οά Ýία αή ÷ άβι έάοάαήαοPδ άδρεϊαέοήý, δñò έά Ý ÷ άέ οή βαέι υήνα ιά οή αή ÷ άβι έάοάαήαοPδ οήò άέοδδñòP, αέέÜ ιά έάοÜέçìç _sum. θάέοά έάέάñβαέοάέ οή αή ÷ άβι έάοάαήαοPδ. ¼οάί άέδάέÝόδ δÜέέ οή pac(8), έά ίάίάάέάÜόάέ οή αή ÷ άβι άδρεϊαέοήý, αέά ίά δÜñάέ οά αή ÷ έέÜ οýñέά, έάέ έά δñηόέÝόάέ οέο δέçñηοήηβάδ άδυ οή έάñíέέυ αή ÷ άβι έάοάαήαοPδ.

άιόάιβæάε όçí ιόνŨ άίάιιπδ άέα όιί άέοδδθδρπ ιά όι ύίιιά bamboo. Άέιειρεάβ Ύία δάνŨάάειάι άιυάιρ όçδ άίόιεπδ lprç:

```
bamboo is ready and printing
Rank  Owner   Job  Files                               Total Size
active kelly   9    /etc/host.conf, /etc/hosts.equiv   88 bytes
2nd    kelly   10   (standard input)                   1635 bytes
3rd    mary    11   ...                                 78519 bytes
```

Άιόάιβæιόάε όñάεδ άñάάόβδ όδç έβόόά άίάιιπδ άέα όιί bamboo. Όόçí δñθç άñάάόβά, διό Ύ÷άε όόάέάβ άδϋ όιί ÷ñπρόδç kelly, Ύ÷άε άδιιιέάβ ι “άñέειϋδ άñάάόβδ (job number)” 9. ΈŨεά άñάάόβά άιϋδ άέοδδθδρπ ÷άñάέοçñβæάόάε άδϋ Ύία ιιιάέειϋ όŨόιεί άñέειϋ. Όέδ δñάέόóϋόδñάδ όιιŨδ ιδιñάβδά ιά όιί άάιπρόάδ, áεεŨ εά όιί ÷ñάέάόδάβδά άί εŨέάδδ ιά άέάάñŨθάδ εŨδιεά άñάάόβά. Άάβδά όçí άιϋόçδά Άέάάñάθρ Άñάάόέπí άέα δñάέόóϋόδñάδ δεçñιόιñβδ.

Ç άñάάόβά ιά όι ίñϋιιñι άιίŨά άδιόάέάβδάε άδϋ άϋι άñ÷άβά. Όά διεέάδεŨ άñ÷άβά διό άιϋέçείάι όδç άñάιπ άίόιεπí όιό lpr(1) έάϋιñϋιόάέ ιŨñιό ιβδδ ιιιι άñάάόβδ. Άδθρ άβίάέ έάé ç όñŨŨ÷ιόά άιñάñ άñάάόβά (δάνάόçñπρδά όç εŨίç active όçδ όδπéçδ “Rank”), διό όçιάβίάέ δϋδ ç άñάάόβά άέοδδθρίάόάέ άδθρ όç όόέάιπ. Ç άάϋόάñç άñάάόβά άδιόάέάβδάε άδϋ άάάιŨŨΎία διό Ύ÷ιόι δάνŨŨόάε όόçí standard input όçδ άίόιεπδ lpr(1). Ç όñβόç άñάάόβά δñιŨñ÷άόάε άδϋ όιί ÷ñπρόδç mary, έάé δñϋέάέόάέ άέα ιέα διεϋ ιάεθç άñάάόβά. Όι ύίιιά άέάάññπδ όιό άñ÷άβιό διό δñϋέάέόάέ ιά άέοδδθδεάβ άβίάέ διεϋ ιάάŨει άέα ιά ÷ñŨŨόάε όόç όδπéç, έάé άέα άδθç ç άίόιεπ lpr(1) άδεŨ όι όόιιρεβæάé ιά όñάεδ όάέάβδ.

Ç δñθç άñάιπ όçδ άιυάιρ άδϋ όçí lpr(1) άβίάέ άδβόçδ διεϋ ÷ñπρείç: ιάδ άιçιññβίáé άέα όι όé εŨίáé όçí δάñιϋόά όόέάιπ ι άέοδδθδρδ (π όιόεŨ÷έόóιί άέα όι όé δέόόάϋάέ όι LPD δϋδ εŨίáé ι άέοδδθδρδ άδθρ όç όόέάιπ).

Ç άίόιεπ lpr(1) άδβόçδ όδιόόçñβæάé όçí άδεέιαπ -1 άέα ιά άçιέιόññάρδάé ιέα ιάάŨέç, εάδδθññάñ έβόόά. Άέιειρεάβ Ύία δάνŨάάειάι όιό lpr -1:

```
waiting for bamboo to become ready (offline ?)
kelly: 1st      [job 009rose]
        /etc/host.conf          73 bytes
        /etc/hosts.equiv      15 bytes

kelly: 2nd      [job 010rose]
        (standard input)      1635 bytes

mary: 3rd      [job 011rose]
        /home/orchid/mary/research/venus/alpha-regio/mapping 78519 bytes
```

10.5.3 Άόάβñάόç Άñάάόέπí

Άί áεεŨιáδά άñθç άέα ιέα άñάάόβά διό άβ÷άδά άδιόόάβæάé δñιό άέόϋδϋόç, ιδιñάβδά ιά όçí άόάέñŨόάδά άδϋ όçí έβόόά άίάιιπδ ιά όçí άίόιεπ lprm(1). Ιδιñάβδά áειϋç ιά ÷ñçόέιιθιεπρδάδά όçí lprm(1) άέα ιά άόάέñŨόάδά ιέα άιñάñ άñάάόβά, áεεŨ δέέάιιι εŨδιεί ιŨñιό όçδ ιά άέοδδθδεάβ Ũόόé έάé áέέεπδ.

Άέα ιά άόάέñŨόάδά ιέα άñάάόβά άδϋ όιί δñιáδέέάάιŨι άέοδδθδρπ, ÷ñçόέιιθιεπρδά δñθρδά όçí lpr(1) άέα ιά άñάβδά όιί άñέειϋ όçδ. Δάέόά δεçέδñιέιαπρδά:

```
% lprm job-number
```

Άέα ιά άόάέñŨόάδά ιέα άñάάόβά άδϋ εŨδιείι όόάέάεñειŨι άέοδδθδρπ, δñιόéŨόάδά όçí άδεέιαπ -π. Ç áειϋερεç άίόιεπ άόάέñάβ όçí άñάάόβά ιά άñέειϋ 10 άδϋ όçí ιόνŨ άίάιιπδ άέα όιί άέοδδθδρπ bamboo:

```
% lprm -P bamboo 10
```

Ç áιòιεP lprm(1) Ἰ ÷ áέ λάνέέΥò óοίòñáγóάέο:

lprm -

Ἀóáεñάβ ùεάò óεò áñááóβάò (άέα óηí ðñηáðέεάηἸñí áέòòðυòP) ðηò áíPεηòί óά áóŸò.

lprm user

Ἀóáεñάβ ùεάò óεò áñááóβάò (άέα óηí ðñηáðέεάηἸñí áέòòðυòP) ðηò áíPεηòί óοηí ÷ ðPóðç (user). Ἰ ððáñ ÷ ðPóðçò (superuser) ηðñάβ ίά áóáεñἸóáέ áñááóβάò Ἰέεùí ÷ ðçóóðí, áóάβò ηðñάβóá ίά áóáεñἸóáòá ηùíí óεò áέέΥò óάò.

lprm

Ç áιòιεP lprm(1) ÷ ùñβò áñέέηù áñááóβάò, ùññά ÷ ðPóðç, P - ðηò áìöáíβæáòάέ óòçí áñáñP áιòιεPí, áóáεñάβ óçí óñἸ ÷ ηòάά áñáñP áñááóβά óòηí ðñηáðέεάηἸñí áέòòðυòP, áí áíPεάέ óά óŸò. Ἰ ððáñ ÷ ðPóðçò (superuser) ηðñάβ ίά áóáεñἸóáέ ηðιεάPðηòά áñáñP áñááóβά.

Ἄέα ίά áηòεἸóáòά óά εŸðηεηí óóáεáεñεηἸñí áέòòðυòP áíòβ óηò ðñηáðέεάηἸñí, áðεŸ ÷ ðçóóεηðιεPóòά óçí áðέεηP - P ηά óεò ðáñáðŸŸù óοίòñáγóάέο. Ἄέα ðáñŸááέáηά, ç áέϋεηòεç áιòιεP áóáεñάβ ùεάò óεò áñááóβάò óηò óñἸ ÷ ηòòò ÷ ðPóðç áðù óçí ηòñŸ áíáηíPðò óηò áέòòðυòP rattan:

```
% lprm -P rattan -
```

Óçíáβùòç: Ἄί áñáŸæáóòά óά ðáñéáŸέεηí áέέóγŸò, ç lprm(1) εά óάò áðέòñἸóáέ ίά áóáεñἸóáòά áñááóβάò ηùíí áðù óηí ððñεηáέóòP ðηò óεò Ἰ ÷ áòά óòáβέáέ, áíáηŸñòçòά áí η áέòòðυòPò áβίáέ ðñηóáŸóέηò éáέ áðù Ἰέεηòò ððñεηáέóòŸò. Ç áέϋεηòεç áιòιεP áðéááέεηíáέ áεñéáPò áòòù óη ÷ áñáέòçñéóóέéù:

```
% lpr -P rattan myfile
% rlogin orchid
% lpq -P rattan
Rank  Owner   Job  Files                Total Size
active seeyan  12  ...                49123 bytes
2nd   kelly    13  myfile                12 bytes
% lprm -P rattan 13
rose: Permission denied
% logout
% lprm -P rattan 13
dfA013rose dequeued
cfA013rose dequeued
```

10.5.4 ÐŸñά áðù óη Ἀðéù Ἐάβηáηí: Ðáñέóóùòáñáò ἈðέεηἸáŸò Ἀέòγòυòçò

Ç áιòιεP lpr(1) ððñòçñβæáέ ηέα áεŸηά áðέεηPí áέα óηí Ἰέáá ÷ η ηñòηðñççò éáεηἸñò, ηáóáóñηðPò áñáóέεPí éáέ Ἰέεùí ηñòPí áñ ÷ áβηí, ðáñááùáPò ðηεεáðεPí áíóεáñŸóυí, ÷ áέñέóηíγ áñááóεPí, éáέ Ἰέεά. Ἰέ áðέεηPí ðò áòòŸò ðáñéáñŸóηíóáέ óòçí ðáñηγóά áŸùòçòά.

Άί άέοδδρβράέο ίεά ίαάΰεç áñāáóβά, βούο èÝēāóá ίά ÷ñçóειιδιέPóάόά άοδP όçί άδέειάP. Έά οάό áεοδρβράé ÷þñī όοίί έαοΰειāί spool (βούο ç áñāáóβά οάό ίά οδāñāάβίáέ όίί άεáýέáñī ÷þñī όίτ όδóδPιáόίτò áñ÷άβùí όίτ όñēÝ ÷áέ όίί έαοΰειāί spool). Άδβóçδ έά έáñāβóάόά ÷ñūí άόίý όί LPD ááί έά ÷ñāέáóόάβ ίά άίόέáñÜøáέ υέç όçί áñāáóβά οάό όóίί έαοΰειāί spool.

Άόóυ, υόóυóί, Ý ÷áέ έάέ Ýίά ίáειíÝέδçíá: άδù όç όóέáìP όίτ όί LPD έá εΰίáέ άίάόίñÜ έáόáόέáβáί όóί όñυóυóόóί άñ÷άβι, ááί έά Ý ÷áόά áοίáóυόçόá ίá ίáόáóñÝøáόά P ίá áέááñÜøáόά όί áñ÷άβι Ýùò υóίτò áέóδóυèέáβ.

Όçίάβυόç: Άί áέóδδρβράέο όá Ýίά áδñīáέñόóίÝίί áέóδóδúδP, όί LPD όέέáίρò έá ÷ñāέáóόάβ óáέέέÜ ίá άίόέáñÜøáέ όá áñ÷άβá άδù όίί όίόέέü όδιέίáέóóP όóίί áδñīáέñόóίÝίί, áδñīÝíùò ç áδέειάP -s óá άóδP όçί όáñβóδóυóç áñēέίííáβ ÷þñī όóίί όίόέέü έαοΰειāί spool, áέéÜ ù÷έ όóίί áδñīáέñόóίÝίί. Άίáέίεíτòέáβ υóóóóί ίá áβίáέ έáέáβóάñá ÷ñPόέίç.

-r

Άδñāέñýίáέ óá áñ÷άβá όçδ άñāáóβáό ίáόÜ όçί άίόέáñāóP όίτò όóίί έαοΰειāί spool, P ίáόÜ όçί áέóýδúóç όίτò ίá όçί άδέειāP -s. ίá áβóóá όñίóáέóέίβ ίá άóδP όçί άδέειāP!

10.5.4.3 ΆδέειāÝò Óáέβáùí Έáóáέβááó

ΆόóÝò ίέ άδέειāÝò όίτò lpr(1) ñöèìβæíτí όί έάβιáñί όίτ έáííέέÜ áιόáίβæáόáé όóçί óáέβáá έáóáέβááó όçδ άñāáóβáό. Άί ίέ óáέβááó έáóáέβááó όáñáìδñāβæίíóáé áéá όίί óöáέáέñéí Ýίí áέóδóδúδP, άóóÝò ίέ άδέειāÝò ááί Ý ÷íτí έáìβá áδβñāáόç. Άáβóá όçί áíυíόçόá Óáέβááó Έáóáέβááó áéá όεçñīóíñβáó ó÷áόéέÜ ίá όέó ñöèìβóáέó όύí óáέβáùí έáóáέβááó.

-C text

ΆίόέéáέóóÜ όί υíñá όδñēíáέóóP όóç óáέβáá έáóáέβááó ίá text. Όί υíñá όδñēíáέóóP όίτ áιόáíβæáόáé áβίáέ, áδù όññáδέειāP, όí υíñá όίτ όδñēíáέóóP áδù όίí íðìβι Ýáέίá ç áδίόóίεP όçδ άñāáóβáό.

-J text

ΆίόέéáέóóÜ όί υíñá áñāáóβáό όóç óáέβáá έáóáέβááó ίá text. Όí υíñá áñāáóβáό όίτ áιόáíβæáόáé áδù όññáδέειāP, áβίáέ όí υíñá όίτ όñpóίτò áñ÷άβιτò όçδ άñāáóβáό, P stdin áί ç áέóýδúóç áβίáόáé áδù όί standard input.

-h

Άáί áέóδδρβίáέ óáέβáá έáóáέβááó.

Όçίάβυόç: Άίΰειāá ίá όέó ñöèìβóáέó, άóδP ç áδέειāP βóúó ίá ίçί Ý ÷áέ áδβñāáόç εüáù όίτ όñüóίτò ίá όίί ίðìβι áçíέíτòñāíýíóáé ίé óáέβááó έáóáέβááó. Άέá όáñέóóóúόáñáó έáδóííÝñáέáó, ááβóá όçί áíυíόçόá Óáέβááó Έáóáέβááó.

`down printer-name message`

Ïäçåâß öïï äέοδδθδρσά εά "έάοÛάσσίά" (down). Άβίάε εσίϊϊϊϊϊϊ ìä öï disable áείεϊοεϊγίϊϊϊ áδñ Ýíá stop. Õï message (Ïρϊσϊά) äïäáíβæåäéé üäáí éÛδϊεϊð ÷ñρóçð äεÛä÷áε öçí óáέñÛ áíáííρð ìä Ìρç(1) ϐ öçí έάοÛόόάόç öïð äέοδδθδρσά ìä lpc status.

`enable printer-name`

Άíáñäïðïβççöç öçð ïðñÛð áíáííρð öïð äέοδδθδρσά. Ìέ ÷ñρóçðä ìðñíγί íá äðïóáββεïðï äñäáóβäð äέÛ ï äέοδδθδρσά äáí éä öððρσάé Ýùð üöïð ìáέέíρσάé.

`help command-name`

Õððρίáé óáεβäâð äïçεåβäð äéá öçí áíöïεð *command-name*. Άβ÷ùð öï *command-name*, äέοδðρίáé íéá δãñβεççöç üεùí öùí äéáéÛóέíüí áíöïεðí.

`restart printer-name`

ÏáέέíÛ öïï äέοδδθδρσά. Ìέ εáííέέíβ ÷ñρóçðä ìðñíγί íá ÷ñçóέíðïεðρïðï áððρ öçí áíöïεð ìüñí óá εÛðïéá äεäέερ δãñβððöçç ðïð öï **LPD** äáí áðïεñβíáðáé, äέÛ äáí ìðñíγί íá ìáέέíρσïðï Ýíá äέοδδθδρσά ðïð Ý÷áé óóáíáððσάé äíáέóβäð öùí áíöïεðí stop ϐ down. Ç áíöïεð restart äβίáé εσίϊϊϊϊϊ ìä öçí abort áείεϊοεϊγίϊáíç áδñ öç start.

`start printer-name`

ÏáέέíÛ öïï äέοδδθδρσά. Ì äέοδδθδρσά éä öððρσάé äñäáóβäð áδñ öçí ïðñÛ áíáííρð öïð.

`stop printer-name`

ÓóáíáðÛáé öïï äέοδδθδρσά. Ì äέοδδθδρσά éä ïεïεççñρσάé öçí öñÛ÷÷ïóá äñäáóβá öïð éáé äáí éä öððρσάé éáíβá Ûεεç äñäáóβá áδñ öçí ïðñÛ áíáííρð öïð. Άέùç éáé áí ï äέοδδθδρσά äβίáé óóáíáðçíÛíð, ïé ÷ñρóçðä ìðñíγί áέùç íá óðÛεñðï äñäáóβäð áí äβίáé áíáñäïðïεçíÛíç ç ïðñÛ áíáííρð.

`topq printer-name job-or-username`

ΆíáέáðÛäíç öçð ïðñÛð áíáííρð äéá öïï *printer-name*. Õïðïéáðöíγíðáé ðñρðð ïé äñäáóβäð ìä áñέέïü áíáöíñÛð *job* ϐ áððÛð ðïð áíρεïðï ööï ÷ñρóçç *username*. Άéá áððρ öçí áíöïεð, äáí ìðñíáβðä íá ÷ñçóέíðïεðρáðä `all` óðçí èÛóç öïð *printer-name*.

`up printer-name`

Ïäçåâß öïï äέοδδθδρσά óá "áíÛάσσίá" (up). Õï áíóβεäöï öçð áíöïεðð down. Éóíäðíáíä ìä öçí start áείεϊοεϊγίϊáíç áδñ öçí áíöïεð enable.

Õï Ìρç(8) äÛ÷áéé öéð δãñäðÛíù áíöïεÛð óðçí äñäíñρ áíöïεðí. Άí äáí áέóÛäáðä éáíβá áíöïεð, öï Ìρç(8) ìðáβíáé óá έάοÛόόάόç äέεçεäðβñäñáóçð (interactive), üðïð ìðñíáβðä íá ðεçεðñïεïäáβðä áíöïεÛð ìÛ÷ñé íá äρðáðä `exit`, `quit`, ϐ `end-of-file`.

10.6 ΆíáέäéäéöééÛð Èýóáéò äéá öïï ÓðÛíðäñ Spooler

Άí Û÷áðä ìäέäðρσάé ðέóðÛ üεï öï εäöÛεάει ìÛ÷ñé ääρ, éä Û÷áðä ìÛεäé ó÷ääüí óá ðÛíðá ó÷áðέéÛ ìä öï óýóóçíá δãñí÷Ûðäðçð **LPD** ðïð äéáðβεäáðáé ìä öï FreeBSD. Éá Û÷áðä éáðáíñρσάé éáé ðïεéÛð áδñ öéð äέεäβðáéð öïð, ðïð öðóέéÛ äáíñγί öï äñρççá: "ðïéá Ûεéä öðóðρíáðá δãñí÷Ûðäðçð (ðïð íá éäέðïðñáíγί óðï FreeBSD) ððÛñ÷ïí äéáéÛóέíá;"


```
# Simply copies stdin to stdout. Ignores all filter arguments.
# Writes a form feed character (\f) after printing job.

/bin/cat && printf "\f" && exit 0
exit 2
```

Ç äêðýðùóç ðáññïðóέŪæáέ “ðáέίũíáññ òέŪέáð (staircase effect).”

Óðçí äêðýðùóç óáð ðάβίáðάέ òí äέũεĩðèĩ:

```
! "#$%&'()*+,-./01234
      "#$%&'()*+,-./012345
                "#$%&'()*+,-./0123456
```

Άβίáðά Ÿíá äέũíá èγíá ðĩð ðáέíñŸñò ðέŪέáð, ðĩð ðñĩεεðεçέá áðũ áίðέóáðέέŸð äñìçíáβáð ðũí ÷ äñáέððñũí íá ðĩð ðĩðβĩð äçεβίáðάέ ç ðñĩðĩáĩðá íŸáð äñáñìðð. Óá έάέðĩðñάέέŪ óðóðβιáðά ðýðĩð UNIX ÷ ñçóέĩðĩέĩéĩ Ÿíáí ðñĩ ÷ äñáέððñá ASCII íá èùάέέũ 10, ðĩí line feed (ðñĩðĩáĩðá äñáñìðð, LF). Óĩ MS-DOS, ðĩ OS/2®, έάέ äέŪòĩñá Ūέέá, ÷ ñçóέĩðĩέĩéĩ Ÿíá æáýáĩð ÷ äñáέððñũí ASCII èùάέέĩé 10 έάέ ASCII èùάέέĩé 13 (ðĩí carriage return P áέέéðð CR). ðĩέέĩβ äέðððũðŸð ÷ ñçóέĩðĩέĩéĩ ðçí ðýíááóç ðĩð MS-DOS äέá ðçí áέέááð äñáñìðð.

¼ðáí äέðððβĩáðά íá ðĩ FreeBSD, ðĩ έáβĩáññ óáð áðέŪ ÷ ñçóέĩðĩέĩéáβ ðĩí ÷ äñáέððñá ðñĩðĩáĩðáð äñáñìðð (line feed). Í äέðððũððð, ðũέέð áίðέέçðέáβ ðĩí ÷ äñáέððñá line feed, ðñĩðέáβ ðĩ ÷ äñòβ έáðŪ ðβá äñáñìð, áέέŪ έñáðŪάέ ðçí βάέá èŸóç ðñέæũíðέá έάέðð έάέáβðάέ íá äέðððβĩðάέ ðĩí áðũíáññ ÷ äñáέððñá. Óá áðòũ ðĩ ðçíáβĩ ÷ ñçóέĩðĩέĩéáβðάέ ðĩ CR (carriage return): íáðάέέíáβ äçέááð ðçí èŸóç äñááóβáð äέá ðĩí áðũíáññ ÷ äñáέððñá ðĩð ðñũέάέðάέ íá äέðððũðέáβ ðĩí äñέóðáñũ Ūέñĩ ðĩð ÷ äñòέĩé.

Óĩ FreeBSD áðέέòĩáβ ðĩ äέðððũððð íá ðĩññáβ íá áíáññáβ ðð äñìðð:

```
¼ðáí ðĩ äέðððũððð έáíáŪíáέ CR          Íá äέðððβĩáέ CR
¼ðáí ðĩ äέðððũððð έáíáŪíáέ LF          Íá äέðððβĩáέ CR + LF
```

ŌðŪñ ÷ ðĩí äέŪòĩñέ ðñũðĩέ äέá íá äðέðáð ÷ έáβ áðòũ:

- × ñçóέĩðĩέððá ðá ðεðέðñá ñýέĩέóçð ðĩð äέðððũððð P ðĩí ðβĩáέá äέŸá ÷ ðò äέá íá äέέŪíáðá ðĩí ðñũðĩ íá ðĩí ðĩðβĩ äñìçíáýáέ áðòĩýð ðĩðð ÷ äñáέððñáð ðĩ äέðððũððð óáð. Óðĩáĩðέáððáβðá ðĩ äá ÷ äέñβáέĩ ÷ ñðóçð ðĩð äέá íá äáβðá ðð ðĩññáβ íá äβĩáέ áðòũ.

Óçíáβùóç: Άί Ÿ ÷ áðá έάέ Ūέέá έάέðĩðñάέέέŪ ðòĩ ðýðóçíá óáð äέðòð áðũ ðĩ FreeBSD, ðέέáíũí íá ÷ ñάέáóðáβ, ððáí ðá ÷ ñçóέĩðĩέĩéáβðá, íá áðáíáññέĩβðáðá ðĩí äέðððũððð óáð ðóðá íá äñìçíáýáέ äέáóĩñáðέέέŪ ðĩðð ÷ äñáέððñáðð CR έάέ LF. Óðçí ðáñβððóçð áððð, βòòð äβĩáέ έάέýðáññ íá ðñĩðέĩððáðá έŪðĩέá áðũ ðέð έýðάέð ðĩð äέĩέĩðèĩéĩ.

- Í ðäçãũð (driver) ðçð ðάέñέáέðð äñáñìðð ðĩð FreeBSD ðĩññáβ íá ðáðáðñŸðάέ áðòũíáðá áðũ LF ðá CR+LF. ÓðóέέŪ, áðòũ äĩðέáýáέ ðñĩ ðá ðάέñέáέŸð èγñáð. Άέá íá áíáññáĩðĩέððáðá áððð ðçí έάέðĩðñάβá, ÷ ñçóέĩðĩέĩέððá ðçí έέáíũðçðá ms# έάέ ðñβððá ðçí έáðŪóðáóç έάέðĩðñάβáð onlcr ðòĩ äñ ÷ áβĩ /etc/printcap äέá ðĩí äέðððũððð.
- Óðáβέðá Ÿíá èùάέέũ äέáððáðð (escape code) ðòĩí äέðððũððð ððáð íá ÷ äέñβáέĩðάέ ðñĩðũέĩŪ ðĩðð ÷ äñáέððñáðð LF íá äέáóĩñáðέέέũ ðñũðĩ. Óðĩáĩðέáððáβðá ðĩ äá ÷ äέñβáέĩ ÷ ñðóçð ðĩð äέðððũððð óáð äέá ðĩðð έðáέέáð äέáððáðð ðĩð ððĩððçñβáéĩðάέ. ¼ðáí áíáέáέýðáðá ðĩí έáðŪέέçéĩ, ðáðáðñŸððá ðĩ ðβέðññ έάέĩŸñò ððáð íá ðóŸéíáέ ðñðá ðĩí èùάέέũ, έάέ Ÿðáέðá ðçí äñááóβá ðòĩí äέðððũððð.

Απρίλ 1997 δανΰααειά οβεινιό εαειΎιό αέα αέοδωόΎο διο εαοαεάαβνιό οιο εuaειύο αεαοαP PCL
 οçò Hewlett-Packard. Άδου οι οβεινιί εΎιαε οι αέοδωόP ία ÷ ανβααοαε οιο ÷ αναεοPναò LF ùò LF εαε
 CR. Άαεοά αδιόόΎεαε οçí αναοοβα, οόΎεινιόαδ οοι οΎειò οçò Ύία ÷ αναεοPνα αεααP οαεβααò (form feed)
 ποόά ία αβίαε οουοP αίαααP οçò οαεαοοαβαò οαεβααò. Οι οβεινιί αοου εα ðñΎθαε ία αποεαγáε ία ó÷ααui
 uειòò οιο αέοδωόΎο οçò Hewlett Packard.

```
#!/bin/sh
#
# hpif - Simple text input filter for lpd for HP-PCL based printers
# Installed in /usr/local/libexec/hpif
#
# Simply copies stdin to stdout. Ignores all filter arguments.
# Tells printer to treat LF as CR+LF. Ejects the page when done.

printf "\033&k2G" && cat && printf "\033&l0H" && exit 0
exit 2
```

Απρίλ 1997 δανΰααειά αέα οι /etc/printcap αφιδ οδιειαεοοP ία uííá orchid. ÷ áε Ύία uííí αέοδωόP
 οοçí ðñπç ðανΎεεçç εγνά οιο, Ύία Hewlett Packard LaserJet 3Si ία uííá teak. ×ñçοεινιειάβ οι ðανάδΎiu
 script ùò οβεινιί εαειΎιό:

```
#
# /etc/printcap for host orchid
#
teak|hp|laserjet|Hewlett Packard LaserJet 3Si:\
    :lp=/dev/lpt0:sh:sd=/var/spool/lpd/teak:mx#0:\
    :if=/usr/local/libexec/hpif:
```

ΑέοδωοPαε ç ίβα ανανP ðΎiu οοçí Ύεεç.

Ύ αέοδωοPοP ααí ðνιueαβ εαειuειο οι ÷ ανοβ εαε ueαò ιε ανανΎο εαειΎιό οοδπνιόαε ç ίβα ðΎiu αδu οçí Ύεεç, οα
 ίβα ανανP.

Άου οι ðνuaεçía αβίαε οι “αίοβοοπνιοι” διο οαεíuιαíò οεΎεαδ, διο ðανειανΎοαia ðνιçαροιΎíuò, εαε αβίαε ðνeý
 οδΎιει. Οα εΎδιει οçíαβι, ιε ÷ αναεοPναò LF διο ÷ ñçοεινιειάβ οι FreeBSD αέα ία ðανιαοοβοαε οçí ανανP,
 ανιçíáγííοαε ùò ÷ αναεοPναò CR ιε ιðιβιε áðεοðñΎοιοí οçí εαοαεP οοι ανεοοανu Ύεινι διο ÷ ανοειύ, αεεΎ
 αβ÷ ùò ία ðνιuePοιοí οι ÷ ανοβ ίβα ανανP ðνιò οα εΎου.

×ñçοεινιειPοοá διο αεαεúðοáò ñοειβοαui διο αέοδωόP P οι δβίαεá αεΎα÷ιο αέα ία εΎοαοá οεò αεuiειοεαò
 áðεειΎΎο αέα οα LF εαε CR characters:

Ύ αέοδωόPοP εαiaΎιαε	Ύ αέοδωόPοP οοδπνιáε
CR	CR
LF	CR + LF

Ύ αέοδωόPοP ααí αέοδωοPαε (÷Ύιαε) εΎδιειòò ÷ αναεοPναò.

Ύ αέοδωόPοP, απρίλ αβίαε οα εαεοιρναβα αεογδωοçò, ααí αέοδωοPαε εΎδιειòò ÷ αναεοPναò οα ueαò οεò ανανΎο. Οι
 ðνuaεçía ðεεαíπò ία αβίαοαε αίοíuúοανι εαεPò ç αεογδωοç ανειβοοαοαε, ÷Ύνιόαδ αεuiç ðανεοοουοανιòò
 ÷ αναεοPναò.

Οι ðνuaεçía αβίαε ðuò ð αέοδωόPοP, εαεPò αέοδωοPαε, ααí ðνιeαααβίαε ία αειρειοεPοαε οçí οα÷γοçοά ία οçí ιðιβá ð

11.2 ΆεάεΎόεία

ϸ οοιαάουόαά ια άεάεΎόεία οίο Linux ααί άβίάε άίάάπ άί άή÷πò. Ί άοείεουόάηιò ðñüðìò áεά ίά άίάάηιόίεπóαάα άόòπ òϸ εάέοιòñάβά άβίάε ίά οηñòπóαά όι KLD (Ύñèñüía) linux (“Kernel Loadable object”). Ίðññáβóα ίά οηñòπóαά άόóυ όι Ύñèñüía όοίι ðòñπία άβñíφάό òϸ ðáñáεΎóυ άίόίεπ ùð root:

```
# kldload linux
```

Άί εΎεάóα ίά Ύ÷άóα ðΎíóá άίάάηιόίεϸίϹ òϸ οοιαάουόαά ια Linux, óυóα εά ÷ñάεάóóάβ ίά ðñíóεΎóαά òϸ ðáñáεΎóυ άñáñπ όóι /etc/rc.conf:

```
linux_enable="YES"
```

ϸ άίόίεπ kldstat(8) ìðññáβ ίά ÷ñϸόείηιόίεϸεάβ áεά ίά áεά÷εάβ άί όι KLD άβίάε οηñóñΎíñ:

```
% kldstat
Id Refs Address      Size      Name
  1      2 0xc0100000 16bdb8   kernel
  7      1 0xc24db000 d000     linux.ko
```

Άί áεά εΎóίεí εüáí ααί εΎεάóα π αα ìðññáβóα ίά οηñòπóαά όι KLD, óυóα ìðññáβóα ίά όóíáΎóαά όóáóεέΎ òϸί òðíóóπñέίϸ áεάεΎóείüí όίò Linux όóίι ðòñπία ίá όι ίá ðñíóεΎóαά òϸί άðεείπ options COMPAT_LINUX όóíι άñ÷άβñí ñòεíβóáñí όίò ðòñπία. Óòϸ όóíΎ÷άεά ìðññáβóα ίá áεάόóóóπóαά όίι ίΎί ðòñπία ùðò ðáñεáñΎóάóáε όóí Έαοΰεάει 9.

11.2.1 ΆεάεΎόεία όύί Linux Runtime Libraries

Άóóυ ìðññáβ ίá άβίάε ια áγί ðñüðìòð. Άβóα ίá òϸ ÷ñπóϸ όίò linux_base-fc4 port, π ίá ÷άέñíεβίϸòϸ áεάéóΎóóáóϸ όίòð.

11.2.1.1 ΆεάεΎόεία ίΎóυ όίò linux_base Port

Άóóυò άβίάε εάóΎ αάίεεπ ññεαβά ί άοείεουόάηιò ðñüðìò áεά òϸί áεάéóΎóóáóϸ όύί runtime libraries. Άβίάε ϸ βάεά áεάáεéάóá άεάéóΎóóáóϸ ðíò áείεíòεάβóáε εάε áεά ίðíεíáπðíòá Ύεεí port áðü òϸ Óóεεíáπ όύί Ports (/usr/ports/). ΆðεΎ εΎíóá όι ðáñáεΎóυ:

```
# cd /usr/ports/emulators/linux_base-f10
# make install distclean
```

Όϸίάβύóϸ: Άί ÷ñϸόείηιόίεάβóα εΎóίεά Ύεάίóϸ όίò FreeBSD ðñέί òϸί 8.0, εά ðñΎðáε ίá áεάéóáóóπóáά όί port emulators/linux_base-fc4 άίόβ áεά όί emulators/linux_base-f10.

Έá ðñΎðáε óπñá ίá Ύ÷άóα εάñíεεπ οοιαάουόαά ια áεάεΎόεία όίò Linux. ΊáñεέΎ ðñíáñΎñíáóá ðáñáðñíείγíóáε ùóé íε áεάεείεπεáð όóóóπíáóíò (system libraries) ααί άβίάε όóϸ óáεáóóáβά όίòð Ύεáíóϸ. ΆάίεέΎ ùüò, áóóυ ααί áðíóáεάβ εάίΎίά ðññíáεϸία.

Όϸίάβύóϸ: Ίðññíγί ίá ððΎñ÷íòí ðñεéáðεΎó áεάüóáεò όίò emulators/linux_base, ðíò ίá άίóéóóίε÷íγί óóéò áεάóññáóééΎò áεάüóáεò όύί áεάññπí Linux. Έá ðñΎðáε ίá εΎíáóá áεάéóΎóóáóϸ όύί ports ðíò ðññíáðáéóíγíóáε áðü óéò áóáññíáΎò Linux óéò ìðññáð εΎεάóá ίá áεάéóáóóπóáά.

11.2.1.2 ×άέñίέβίζαζ άάέάοΰόόαζ όύι Libraries

Άί άάί Ύ÷άόά άάέάοόόόόάέ όζι όόέειάΠ όύι “ports”, ιδñíáβόά ίά άάέάοόόόόάόά όέό άέάέειέΠέαό ÷άέñίέβίζαζ. Έά ÷ñáέάόάβόά όά Linux shared libraries όά ιδñíá άδάέόάβ όι δñíáñáíá. Άδβόζ, έά ÷ñáέάόάβ ίά άζιέιόñáΠόάόά έάέ Ύίáί έάόΰέιáí “shadow root”, /compat/linux, άέά όέό άέάέειέΠέαό Linux δñíό έά όδΰñ÷ιόι όόι FreeBSD. ΙδñέάΠδñíόά έιέíΎδ άέάέειέΠέαό (shared libraries) ίέ ιδñíáδ ÷ñόέιñδñέííόάέ άδύ άόáññáΎδ Linux έάέ άέόάέííόάέ όόι FreeBSD έά έιέόΰñíόι δñíόά όά άόóñí όñί έάόΰέιáí. ΆδñΎñó, άί ίέά άόáññáΠ Linux όñíόόάέ άέά δáñΰáάέáíá όñ /lib/libc.so, όñ FreeBSD έά δñíόδάέΠόάέ ίά όñíόόάέ δñíόά όñ /compat/linux/lib/libc.so, έάέ άί άόóñ ááí όδΰñ÷άέ, όύíά έά δñíόδάέΠόάέ ίά όñíόόάέ όñ /lib/libc.so. Óá shared libraries έά δñΎδáέ ίά άάέάοόόάέíí όόι shadow tree /compat/linux/lib άίόβ άέά όέό όñδñέáόβáδ δñíό áíáóΎñáέ όñ ld.so όόι Linux.

Άáíέέΰ, όñέΰ÷έόóñí όόέό δñíόáδ όάό άάέάοόόΰόάέό άόáññáΠí Linux, έά ÷ñáέάόάβ ίά θΰíáόά άέά όέό έιέíΎδ άέάέειέΠέαό άδύ όά άίόβόóíέ÷ά άέόάέΎόείá. Ιάόΰ άδύ έΰδñέí άέΰόόζíá έά Ύ÷άόά Ύίá έέáññέíέζόέέú áñέèíú Linux shared libraries όόι όýόόζιΰ όάό έάέ δέΎíí áá έά ÷ñáέΰáόάέ άδέδθέΎíí áñááόá δΎñá άδύ όζι άάέάοΰόόαζ όζό άόáññáΠò.

11.2.1.3 Άάέάοΰόόαζ Δñúέάόύí Shared Libraries

Έάέ όέ áβíáόάέ όόζ δáñβδóóζ όñΎ Ύ÷άόά άάέάοόόόόάέ όñ linux_base port έάέ ίέ άόáññáΎδ όάό áέúíζ δáñáδñέííόάέ άέá shared libraries δñíό έáβδñíόí; Δπò ιδñíáβόά ίά íΎñáόά δñέá shared libraries ÷ñáέΰáόάέ έΰδñέá άόáññáΠ, έάέ δñíό ιδñíáβόά ίά όά áñáβόá; Άáόέέΰ, όδΰñ÷ιόí 2 άδέέíáΎδ (άέá ίá áέíέíόέΠόάόά όέό δáñáέΰóñ íáζáβáδ έά δñΎδáέ ίá áβóόá root όόι όýόόζιΰ όάό).

Άί Ύ÷άόά δñúóááόζ όá έΰδñέí ίζ÷Ύίζíá Linux, ñβíáδ ίέá ίάόέΰ όόá shared libraries δñíό ÷ñáέΰáόάέ ίέá άόáññáΠ, έάέ áίόέáñΰθόά όá όόι FreeBSD. Άáβόά όñ δáñáέΰóñ δáñΰáάέáíá:

Άό όδñέΎóíóíá úέέ έáόááΰόáόá ίΎóù FTP όñ áέόáέΎόέíí όñδ **Doom** άέá όñ Linux, έάέ όñ áΰέáόá όόí Linux όýόόζíá όόι ιδñíβí Ύ÷άόά δñúóááόζ. Ιδñíáβόά όόζ όóíΎ÷άέá ίá áέΎáíáόá δñέá shared libraries ÷ñáέΰáόάέ ζ άόáññáΠ íá όζι áίόíέΠ ldd linuxdoom, úδò:

```
% ldd linuxdoom
libXt.so.3 (DLL Jump 3.1) => /usr/X11/lib/libXt.so.3.1.0
libX11.so.3 (DLL Jump 3.1) => /usr/X11/lib/libX11.so.3.1.0
libc.so.4 (DLL Jump 4.5p126) => /lib/libc.so.4.6.29

Έά ÷ñáέάόάβ ίá δΰñáόá úέá όá áñ÷áβá άδύ όζ όáέáόόáβá όόΠέζ, έάέ ίá όá áίόέáñΰθόáόá όόñί έáόΰέíáí /compat/linux, έάέ ίá άζιέíόñáΠόáόá δñíό άόóΰ όñδó άίόβόóíέ÷ιόδ όόíáíέέέííýδ ááóííýδ (symbolic links) íá όá ííúíáόá όζό δñíόζό όόΠέζό. Άόóñ όζíáβíáέ úέέ δñáέόέέΰ, έá Ύ÷άόá άόóΰ όá áñ÷áβá όόí όýόόζíá όáó:

/compat/linux/usr/X11/lib/libXt.so.3.1.0
/compat/linux/usr/X11/lib/libXt.so.3 -> libXt.so.3.1.0
/compat/linux/usr/X11/lib/libX11.so.3.1.0
/compat/linux/usr/X11/lib/libX11.so.3 -> libX11.so.3.1.0
/compat/linux/lib/libc.so.4.6.29
/compat/linux/lib/libc.so.4 -> libc.so.4.6.29
```

Όζíáβúόζ: Όζíáέπóá úέέ άί Ύ÷άόά Πáζ έΰδñέí Linux shared library δñíό í áñέèíúδ Ύέáíόζό áβíáέ í βáέíó íá άόóñί όζό δñíόζό όόΠέζό όñδ ldd, áá έá ÷ñáέάόόάβ ίá áίόέáñΰθόá όñ áñ÷áβí úδò άόóñ ííñíáάόάέ όόζ όáέáόόáβá όόΠέζ, όá όδΰñ÷ιόá áñ÷áβá έá δñΎδáέ ίá έΰñíόí όζ áñέέáέΰ όñδ. Óáό όóíáíέέáýíóíá úòò ίá áίόέáñΰθόá όñ shared library áí áβíáέ έΰδñέá ίáúδáñζ Ύέáíόζ. Ιδñíáβόá ίá áέááñΰθόáόá όá δáέέΰ áñ÷áβá, áñέáβ úñó ίá áíáíáπóáόá όñδó όóíáíέέέííýδ ááóííýδ πóóá ίá íáζáííý όóá ίΎá áñ÷áβá. ΆδñΎñó, άί Ύ÷άόá όέό δáñáέΰóñ áέáέειέΠέαό όόí όýόόζιΰ όáó:

```
/compat/linux/lib/libc.so.4.6.27
/compat/linux/lib/libc.so.4 -> libc.so.4.6.27
```

êáé äñáßðá íéá äðáñííáP ç ðñíßá æçðÛäé íéá íäüðáñç Ýéäíôç ðÛóð ðíð ldd:

```
libc.so.4 (DLL Jump 4.5p126) -> libc.so.4.6.29
```

Áí ç äéäðíñÛ ôçð Ýéäíôçð óðí ðäêäððáßá øçðßí äßíáé ðñíí ðßáð P äÿí äêäüðáíí, ðüðä ðçí óáð áðáð÷íéáß ç áíðéäñáðð ðíð /lib/libc.so.4.6.29, äéäðß ðí ðñüäñáííá éá ðñÝðäé íá ðñÝ÷äé éáíííééÛ êáé ðä ôç èßáí ðáéäéüðáñç Ýéäíôç. Ðáñ' ðéá áððÛ, áí èÝéäðä, ðñíáßðá íá áíðééäðáðððáðá ðí libc.so êáé Ýðóé éá Ý÷äðá ðí ðáñáéÛðü:

```
/compat/linux/lib/libc.so.4.6.29
/compat/linux/lib/libc.so.4 -> libc.so.4.6.29
```

Óçíäßùóç: Ì ðç÷áíéóíüð ðñí óðíäíéééðí óðíäÝóíüí ÷ñáéÛæäðáé ðñíí äéá ðéð äðáñííáÝð ðíð Linux. Ì runtime linker ðíð FreeBSD éíéðÛäé ðñíð ðíð äéá ðéð ðéí ðñüðáððä äêäüðáéð ðñí äéäééíççðí éáé Ýðóé ää ÷ñáéÛæäðáé íá óáð áðáð÷íéáß.

11.2.2 ÁêéäðÛóóáóç ôñí Linux ELF Binaries

Óá ELF binaries ÷ñáéÛæíðáé ðñíééÝð ðñíÝð Ýíá áéüíá äðíá, ðí “branding”. Áí ðñíððáðððáðá íá ðñÝíðá Ýíá äêðäËÝóéíí ELF ÷ññßð branding, ðüðä éá óáð äíðáíéóðáß ðí ðáñáéÛðü ðóÛéíá:

```
% ./my-linux-elf-binary
ELF binary type not known
Abort
```

Áéá íá äñçððáðá ðñí ððñðíá ðíð FreeBSD íá ðä÷ññßðáé Ýíá ELF ðíð FreeBSD áðü Ýíá ðíð Linux, ÷ñçðéíðñéððáðá ôçí áíðñéP brandelf(1).

```
% brandelf -t Linux my-linux-elf-binary
```

To GNU toolchain, ðñüä ðñüäñáííá GNU, ðñðñéäðáß ðéÝíí áððñíáðá ðá éáðÛéççéá ÷áñáéðçñéóðééÛ óðá äêðäËÝóéíá ELF, äðñÝñð ðí ðáñáðÛñ äðíá éá ÷ñáéÛæäðáé ðñí éáé ééäüðáñí óðí ðÛéñí.

11.2.3 ÁêéäðÛóóáóç íéäð Óð÷áßáð Linux RPM ÁðáñííáPð

Óí FreeBSD äéäéÝðáé ôçí äééP ðíð äÛóç ääáñÝñíí áéá ðá ðáéÝðá, ç ðñíßá ÷ñçðéíðñéäßðáé äéá ðéá ðá ports (éáé äéá áððÛ ðíð ðñíÝñ÷ííðáé áðü ðí Linux). Áéá ðí èüñí áððü, ç äÛóç ääáñÝñíí Linux RPM äáí ÷ñçðéíðñéäßðáé (äáí ððñíðçññæäðáé).

Áí ðóðüóí ÷ñáéÛæäðáé íá äêéäðáðððáðá íéá ðñéäáðððíðá äðáñííáP ðíð Linux ðíð äáðßæäðáé óá ðáéÝðí RPM, ðññáßðá íá ðí äðéðÛ÷äðá ðñí ðáñáéÛðü ðññíð:

```
# cd /compat/linux
```

```
# rpm2cpio -q < /path/to/linux.archive.rpm | cpio -id
```

×ñçóéíðíéðóá òçí brandelf(1) áéá íá òððíðíéðóáá êáóÛëççéá òá áêðáêÛóéíá (ü÷é òéð áéáééíèðéáð!) ùð áóáñíñáÛò Linux. Ááí éá ìðñááðá íá áðááéáóáóððóáá òéð áóáñíñáÛò ìá éáéáññü òññðí, áééÛ éá ìðñáÛóáá íá êÛíáðá òéð äíééíÛò ðíð áðéèòíááðá.

11.2.4 Ñýèíéóç òíö Hostname Resolver

Áí òí DNS äá äíðéäýáé ð áí óáð äíðóáíðæáðóáé òí ðáñáéÛòù óóÛéíá:

```
resolv+: "bind" is an invalid keyword resolv+:
"hosts" is an invalid keyword
```

Ëá ðñáéáóóáá íá ñðèìðóáá òí /compat/linux/etc/host.conf þóáá íá ðáñéÛ÷áé:

```
order hosts, bind
multi on
```

Ç óáéñÛ äáð äçèþíáé ùðé áñ÷éÛ äéÛá÷áðáé òí áñ÷ááí /etc/hosts éáé óçç óðíÛ÷áé ì DNS server. Ûðáí òí /compat/linux/etc/host.conf äáí ááíáé áéáéÛóéí, íé áóáñíñáÛò Linux ðñçóéíðíéíýí òí /etc/host.conf òíö FreeBSD éáé ðáñáðíéíýíðáé ùðé ç óýíðáíç òíö áñ÷ááí ðñáíáé óóðð. Ëá ðñáÛðé íá áóáéñÛóáá òçí áíáíñÛ óðí bind áí äáí Û÷áá ñðèìðóáé Ûíá name server ìÛòù òíö /etc/resolv.conf.

11.3 Áäéáééóðíóáò òí Mathematica®

Ïí éááíñí áðóü ðáñéáñÛóáé òç áéááééáóáá äáéáóÛóóáóçð òçð Ýéäíóçð Linux òíö **Mathematica 5.X** óá Ûíá óýóççíá FreeBSD.

Ïðñááðá íá äáñÛóáá òçí éáñíéèð ð ìáèçðéèð Ýéäíóç òíö **Mathematica** áéá Linux, áðáðéááð áðü òç Wolfram óðí <http://www.wolfram.com/>.

11.3.1 Òí ðñüñáííá ÁäéáóÛóóáóçð òíö Mathematica

Áñ÷éÛ, éá ðñáÛðé íá ðááðá óðí FreeBSD ùðé òá áêðáêÛóéíá áéá Linux òíö **Mathematica** êÛíðí ðñðç òíö Linux ABI. Ì áðéíèüðáñíð òññðíð áéá íá òí êÛíáðá áðóü ááíáé íá ìñááðá òí óýðí òíö ELF ùð Linux óá ùéáð òéð áóáñíñáÛò òíö äáí ááíáé ðäç branded, êÛííóáð ðñðç òçð áíðíðð:

```
# sysctl kern.fallback_elf_brand=3
```

Áðóü éá êÛíáé òí FreeBSD íá òðíèÛóáé ùðé òá áêðáêÛóéíá ELF ðíð äáí ááíáé branded, êÛííðí ðñðç òíö Linux ABI éáé Ûóóé éá ìðñááðá íá ðñáíáðá òí ðñüñáííá òçð äáéáóÛóóáóçð áðáðéááð áðü òí CDROM.

Ïþñá, áíðéáñÛðá òí áñ÷ááí MathInstaller óðíí óéèçñü óáð ááðéí:

```
# mount /cdrom
# cp /cdrom/Unix/Installers/Linux/MathInstaller /localdir/
```

Áñááðá òí áñ÷ááí éáé áíðééáóáóððóáá òí /bin/sh óçç ðñðç áñáíð ìá òí /compat/linux/bin/sh. Áðóü éá óéáíñÛóáé ùðé òí ðñüñáííá äáéáóÛóóáóçð éá ðñáÛðé ìá òçí Ýéäíóç sh(1) áéá Linux. Óçç óðíÛ÷áé,

áíóééáóáóóðóá ùëáð ðéð äãñãáóÝð Linux) ìá FreeBSD) ÷ñçóéíðíéðíóáð Ýíáí óðíóÛéðç êáéíÝíï Þ ìá ôí ðãñáéÛòù script óçíí áðùíáíç áíüðçðá. Áðòù èá ðáé óðí ðñüñãñííá äãéáðÛóðáóçð ôïö **Mathematica**, ôí ïðíßí ðñÝ ÷ áé óçí áíóíèÞ uname -s áéá íá áéáðéóóðóáé ôí èáéóíðñãééü óýóðçíá, íá áíóéíáðòððóáé ôí FreeBSD óáí Ýíá èáéóíðñãééü ðãñáíòãñÝð ìá ôí Linux. Ç áêòÝéáðç ôïö MathInstaller èá ïáééíðóáé ððñá óçí äãéáðÛóðáóçð ôïö **Mathematica**.

11.3.2 Óñíðíðíéðíóáð óá ÁêðäëÝóéíá ôïö Mathematica

Óá shell scripts óá ïðíßá çíçíéíðñãáß ôí **Mathematica** èáðÛ ðç áéáéééáóáá ðçð äãéáðÛóðáóçð ðñÝðáé íá ðñíðíðíéçéçíí ðñéí ÷ñçóéíðíéçéçíí. Áí áðééÝíáðá ôí /usr/local/bin ùð ôíí èáðÛéíáí áéá óá áêðäëÝóéíá ôïö **Mathematica**, èá ãñãáßðá áêáß óííáíéçéçíýð äãóííýð (symlinks) ðñíð óá áñ÷-áßá math, mathematica, Mathematica, èáé MathKernel. Óá èÛèá ðãñáßðòùðç áðù ðéð ðãñáðÛíù, áíóééáóáóóðóáð ðéð äãñãáóÝð Linux) ìá FreeBSD) ìá èÛðíéíí óðíóÛéðç êáéíÝíï Þ ìá ôí ðãñáéÛòù shell script:

```
#!/bin/sh
cd /usr/local/bin
for i in math mathematica Mathematica MathKernel
do sed 's/Linux)/FreeBSD)/g' $i > $i.tmp
sed 's/\/bin\/sh/\/compat\/linux\/bin\/sh/g' $i.tmp > $i
rm $i.tmp
chmod a+x $i
done
```

11.3.3 Áðíèòðíóáð Èùäééü áéá ôí Mathematica

¼óáí äéçéíðóáðá ôí **Mathematica** áéá ðñðçç òíñÛ, èá ãñùðçðáßðá áéá Ýíáí èùáééü. Áí ááí Ý ÷ áðá èÛðíéíí èùáééü óá áðòù ôí óðÛáéí, ðñÝíðá ôí ðñüñãñííá mathinfo ðíð ãñßóéáðáé óðíí èáðÛéíáí äãéáðÛóðáóçð áéá íá óáð äíèáß ôí "machine ID". Ôí "machine ID" áßíáé áí" ïéíèèÞñíð ááóéóíÝíí óðç áéáÝèðíóç MAC ðçð èÛñðáð áééðýíð ðíð Ý ÷ áðá. Áðòù óçíáßíáé ùðé ááí ïðíñáßðá íá ðñÝíáðá ôí **Mathematica** óá Ûéçíðð ððíéíáéóðÝð.

¼óáí äãñãáóáßðá ðçç Wolfram, ìá e-mail, ðççÝòùíí Þ fax, èá ÷ ñáéáóðáß íá äðóáðá ôí "machine ID" èáé èá óáð áðáíððóíí ìá Ýíáí áíóáóóíé ÷ ï èùáééü ðíð èá áðíðáéáßðáé áðù íéá óáéñÛ áñéèíðí.

11.3.4 ÓñÝ ÷ ïíðáð ôí Mathematica Frontend ïÝóù Áééðýíð

Ôí **Mathematica** èÛíáé ÷ ñðçç èÛðíéúí áéáééðí ãñáííáðíðáéññíí áéá íá áíðáíßðáé ÷ ãñáéððñáð ïé ïðíßíé äáí ððÛñ ÷ ïíð óáá óóíççéóíÝíá óáð (ïéíèèÞñíðáðá, áéñíßðíáðá, ÁéççíééÛ ãñÛíáðá, èéð). To ðñùòùéíéçí X áðáéðáß áðòÝð ïé ãñáííáðíðáéñÝð ìá ððÛñ ÷ ïíð óðí ðíðéèü óýóðçíá. Áðòù óçíáßíáé ùðé èá ÷ ñáéáóðáß íá áíóéáñÛðáðá ðéð ãñáííáðíðáéñÝð áðòÝð áðù ôí CDROM Þ áðù áðù èÛðíéíí Ûéçíí ððíéíáéóðÞ ðíð Ý ÷ áé ôí **Mathematica**. Óðíðèðð áðòÝð ïé ãñáííáðíðáéñÝð ïðíñíýí íá ãñáéíýíí ïÝóá óðí èáðÛéíáí /cdrom/Unix/Files/SystemFiles/Fonts ôíð CDROM, Þ óðíí èáðÛéíáí /usr/local/mathematica/SystemFiles/Fonts óðíí ðíðééü óéççñü áßóéí. Íé ðñáííáðééÝð ãñáííáðíðáéñÝð ãñáéíýíðáé óá ððíéáðáéüüáíðð ùðùð type1 èáé x. ÓðÛñ ÷ ïíð áñéáðíß ðñüðíé íá ðéð ÷ ñçóéíðíéððáðá, ïé ïðíßíé ðãñéáñÛíðíðáé óðç óðíÝ ÷ áéá.

Í ðñðóíð ðñüðíð áßíáé íá ðéð áíóéáñÛðáðá ïÝóá óá Ýíáí ððÛñ ÷ ïíðá èáðÛéíáí óðí /usr/X11R6/lib/X11/fonts. Èá ÷ ñáéáóðáß ùðð ìá ðñíðíðíéððóáðá ôí áñ÷-áßíí fonts.dir, þóáá íá ðñíðéÝóáðá óá ïíñíáðá ðíð ãñáííáðíðáéññíí ïÝóá óá áðòù, èáé íá áééÛíáðá ôíí áñéèíü ðíð ãñáííáðíðáéññíí óðç ðñðçç ãñáííð. ÁíáééáðééÛ, áßíáé óðíðèðð áñéáðí íá áêðäëÝóáðá áðèðð óçí áíóíèÞ mkfontdir(1) ïÝóá óðíí èáðÛéíáí ðíð Ý ÷ áðá áíóéáñÛðáé ðéð ãñáííáðíðáéñÝð.

Για να δημιουργηθούν οι φάκελοι για την εγκατάσταση των αρχείων fonts:

```
# cd /usr/X11R6/lib/X11/fonts
# mkdir X
# mkdir MathType1
# cd /cdrom/Unix/Files/SystemFiles/Fonts
# cp X/* /usr/X11R6/lib/X11/fonts/X
# cp Type1/* /usr/X11R6/lib/X11/fonts/MathType1
# cd /usr/X11R6/lib/X11/fonts/X
# mkfontdir
# cd ../MathType1
# mkfontdir
```

Οπότε δημιουργήστε τον κατάλογο fonts και ορίστε τον ως font path:

```
# xset fp+ /usr/X11R6/lib/X11/fonts/X
# xset fp+ /usr/X11R6/lib/X11/fonts/MathType1
# xset fp rehash
```

Αν χρησιμοποιείτε το **Xorg**, τότε πρέπει να δημιουργηθεί ο κατάλογος fonts και να οριστεί ως font path. Αυτό γίνεται με την επεξεργασία του αρχείου xorg.conf.

Αν χρησιμοποιείτε το **XFree**, τότε πρέπει να δημιουργηθεί ο κατάλογος fonts και να οριστεί ως font path. Αυτό γίνεται με την επεξεργασία του αρχείου xorg.conf.

11.4 Εγκατάσταση του Maple™

Ο **Maple™** είναι ένας ισχυρός υπολογιστής συμβολικών μαθηματικών και ο **Mathematica**. Είναι διαθέσιμος για τους Linux. Είναι διαθέσιμος στον ιστότοπο <http://www.maplesoft.com/> και είναι διαθέσιμος για τους Linux. Είναι διαθέσιμος στον ιστότοπο <http://www.maplesoft.com/> και είναι διαθέσιμος για τους Linux.

1. Εγκαταστήστε τον INSTALL shell script στον κατάλογο /usr/local/maple. Αυτό γίνεται με την επεξεργασία του αρχείου xorg.conf.
2. Αν χρησιμοποιείτε το **XFree**, τότε πρέπει να δημιουργηθεί ο κατάλογος fonts και να οριστεί ως font path. Αυτό γίνεται με την επεξεργασία του αρχείου xorg.conf.
3. Εγκαταστήστε τον **FLEXlm** license manager ή τον **INSTALL_LIC** shell script στον κατάλογο /usr/local/maple. Αυτό γίνεται με την επεξεργασία του αρχείου xorg.conf.
4. Χρησιμοποιήστε τον patch στον κατάλογο /usr/local/maple/bin/maple.system.type:

```
----- snip -----
*** maple.system.type.orig      Sun Jul  8 16:35:33 2001
--- maple.system.type      Sun Jul  8 16:35:51 2001
*****
*** 72,77 ***
--- 72,78 -----
# the IBM RS/6000 AIX case
MAPLE_BIN="bin.IBM_RISC_UNIX"
```

```

;;
+   "FreeBSD" |\
    "Linux")
      # the Linux/x86 case
      # We have two Linux implementations, one for Red Hat and
      ----- snip end of patch -----

```

Óçíáêðóðá üðé ðáðÛ ôï "FreeBSD" |\ ááí ðñÝðáé íá àïóáíβæáðáé Ûëëï êáñí æÛóðçíá.

Ôï patch áððü ðäçáðð ôï **Maple** íá áíááññβóáé ôï "FreeBSD" óáí Ýíá óýóðçíá Linux. Ôï bin/maple shell script êáéáβ ôï bin/maple.system.type shell script, ôï ððíβí ðá ôç óáéñÛ ôïð êáéáβ ôçí áíðïëð uname -a ðñíêáéÝñö íá áíðïðéóðáβ ôï ùíñá ôïð êáéóïðñáééý óðóððíáðïð. Áíáëüáð ðá ôï ðïéí êáéóïðñáééü áñáêáβ, êá ðñçóéïððïéçéýí êáé óá áíóβóðïé ðá áêðáëÝóéíá áñ ðáβá.

5. Äêééíðóðá ôïí license server.

Íáð áíëéëüð ðñüðïð áéá íá áêééíðóðáðá ôï lmgrd áβíáé ôï áëüëïðèï script ðïð áñβóêáðáé óðï /usr/local/etc/rc.d/lmgrd.sh:

```

----- snip -----

#! /bin/sh
PATH=/usr/local/sbin:/usr/local/bin:/sbin:/bin:/usr/sbin:/usr/bin:/usr/X11R6/bin
PATH=${PATH}:/usr/local/maple/bin:/usr/local/maple/FLEXlm/UNIX/LINUX
export PATH

LICENSE_FILE=/usr/local/maple/license/license.dat
LOG=/var/log/lmgrd.log

case "$1" in
start)
  lmgrd -c ${LICENSE_FILE} 2>> ${LOG} 1>&2
  echo -n " lmgrd"
  ;;
stop)
  lmgrd -c ${LICENSE_FILE} -x lmdown 2>> ${LOG} 1>&2
  ;;
*)
  echo "Usage: `basename $0` {start|stop}" 1>&2
  exit 64
  ;;
esac

exit 0
----- snip -----

```

6. Äíêéíð ôïð Maple:

```

% cd /usr/local/maple/bin
% ./xmaple

```

Óá áððü ôï óçíáβí êá ðñÝðáé íá áβíáé üëá Ýðïéíá êáé íá ðçí Ý ðáðá êáíÝíá ðññáêçíá. ðçí ðá ðáðáðá ùüð íá óðáβëáðá Ýíá e-mail óðç Maplesoft êáé íá ôïðð ðáβóðá üðé èÝëáðá íéá Ýêáíóç ðïð íá ððïóðçñβæáðáé áðβóçíá óðï FreeBSD.

11.4.1 ΟοίεέοίΎία ΔñĩäëΠιόά

- οούδ äóóεĩεάοάβòá ιά οζί εάέοιòññáá οίò **FLEXlm** license manager. ΆδέδèΎίí οάέιçñβùοç ιδñĩñáβòá ιά ãñáβòá οοί <http://www.globetrotter.com/>.
- Οί lmgrd áβιáé ãíùóóü ùóé èΎéáé οί ãñ÷áβιí οçò Ûäáéáð ιá Ύ÷áé óóäéäéñéíΎίç ìñòP áééερò ç áéóΎéáóç οίò εá áδĩóý÷áé. Ιά οúóóü ãñ÷áβιí Ûäáéáð ÷ñPóçò δñΎðáé áβιáé óá äáíééΎò ãñáñĩΎò ùδùò οί δñáñéÛòù:

```
# =====
# License File for UNIX Installations ("Pointer File")
# =====
SERVER chillig ANY
#USE_SERVER
VENDOR maplelmg

FEATURE Maple maplelmg 2000.0831 permanent 1 XXXXXXXXXXXX \
    PLATFORMS=i86_r ISSUER="Waterloo Maple Inc." \
    ISSUED=11-may-2000 NOTICE=" Technische Universitat Wien" \
    SN=XXXXXXXX
```

Οζιááβùοç: Ι óáéñéáéùò áñéèìùò éáé οί ééáéááβ ðááíĩíóáé äáð ιá 'X'. Οί chillig áβιáé οί ùíĩá οίò óóóðΠιáδìò.

Ìδñĩñáβòá ιá δñĩδĩδĩéPóáòá οί ãñ÷áβιí οçò Ûäáéáð ÷ñPóçò, áñéááβ ιá ιçί áéèÛĩáòá οçί ãñáñĩP “FEATURE” (ç ιδĩβá δñĩóóáóáýáóáé áδù οί ééáéááβ οçò Ûäáéáð).

11.5 Άäéáéèóòπíóáò οί MATLAB®

Οί éáβιáĩí áóóü δñéñáñÛóáé οç äéááééáóβá ääéáóÛóóáóçò οçò Linux Ύéáĩíóçò οίò **MATLAB® 6.5** óá Ύίá óýóóçιá FreeBSD. Άĩòéáýáé áñéáòÛ éáéÛ, ιá áĩáβñáóç οί **Java Virtual Machine™** (ääβòá óοί ΟίΠιá 11.5.3).

Ç Linux Ύéáĩíóç οίò **MATLAB** ìδñĩñáβ ιá äáĩñáóòááβ áðáðèááβáð áδù οçί äóáéñáβá The MathWorks óοί <http://www.mathworks.com>. Óéáĩòñáòòáβòá ùóé δPñáðá éáé οί ãñ÷áβιí δĩò δñéΎ÷áé οçί Ûäáéá ÷ñPóçò P ãçáβáð áéá οί δùò ιá οί äçĩéĩòñáPóáòá. Ιέá éáé éá áðééĩéĩúĩPóáòá ιá οçί áóáéñáβá, δáβòá οίòð ùóé éá èΎéáóá ιá ððÛñ÷áé áðβóçò ððĩóðPñéĩç áéá οί FreeBSD.

11.5.1 ΆäéáóÛóóáóç οίò MATLAB

Άéá ιá ääéáóáóòPóáòá οί **MATLAB**, èÛĩóá óá δñáñéÛòù:

1. ΆéóÛäáòá οί CD éáé δñĩóáñòPóáòá οί óοί óýóóçιá óáð. Óóĩáäéáβòá ùð ÷ñPóçò root, ùδùò óóĩéóòÛ οί script οçò ääéáóÛóóáóçò. Άéá ιá ãééĩPóáòá οί script οçò ääéáóÛóóáóçò äðóðá οçί áĩóĩεP:

```
# /compat/linux/bin/sh /cdrom/install
```

Οδùääéĩç: Οί δñũáñáĩĩá οçò ääéáóÛóóáóçò áβιáé óá ãñáóééè ðáñéáÛééĩ. Áĩ éáĩáÛĩáòá óóÛéĩáóá ó÷áóééÛ ιá οçί ãéũĩç, äðóðá οçί áĩóĩεP: `setenv HOME ~USER, ùδĩò USER áβιáé ï ÷ñPóçò áδù ùδĩò äðóáòá οçί áĩóĩεP su(1).`

2. ΰόάί άñùòçεάβόά άέα οίί έάόΰετάρ οίο **MATLAB**, άρβόά: `/compat/linux/usr/local/matlab`.

Όδύάάείç: Άέα άðēīēüðāñç áéááéééάόβá áāéáóΰόόάόçò, ίñβóóά οί δάñάέΰóù: `set MATLAB=/compat/linux/usr/local/matlab` óçç āñáììβ áίóīēβί οίο έáēýöīòð óáò.

3. Όñīðīðīéβóάάά οί άñ÷άβī óçò ΰāáéáò (license file) óγīòùíá ιά óεò ιāçāβáð ðīò ēΰááóá ιά óçī ΰāáéá οίο **MATLAB**.

Όδύάάείç: ðīñáβóá ίá áòīéīΰóááò áē óùī ðñīòγñùī οί άñ÷άβī áðóü έáé ίá οί áίóéāñΰóááò óóī \$MATLAB/license.dat, ðñéī έáί óáò ðáé οί ðñüāñáìíá áāéáóΰόόάόçò ίá οί ðñīðīðīéβóάάά.

4. ΰēīēēβñùóç óçò Άāéáóΰόόάόçò

Όά áðóü οί óçīáβī, ç áāéáóΰόόάόç οίο **MATLAB** Ý÷áé ιēīēēçñùēáβ. Όά áðüíáíá áβíáóá ÷ñáéΰæīíóáé άέα ίá ðñīγááé ίá οί äīðēγáóáò óúóóΰ ιά οί FreeBSD.

11.5.2 Άέέβίçóç οίο License Manager

1. Άçīéīðñāβá óóīāīēéēβī óóíáγóīùī άέα óá scripts οίο license manager:

```
# ln -s $MATLAB/etc/lmboot /usr/local/etc/lmboot_TMW
# ln -s $MATLAB/etc/lmdown /usr/local/etc/lmdown_TMW
```

2. Άçīéīðñāβóáά οί άñ÷άβī áééβίçóçò /usr/local/etc/rc.d/flexlm.sh. Όί ðāñΰāéáíá ðāñáéΰóù áβíáé ίέα óñīðīðīéçīγίç γέäīóç οίο \$MATLAB/etc/rc.lm.glnx86. ΰé áééáāγò áβíáé óóéð ðīðīēáóβáð óùī άñ÷άβūī, έáé óóçī áééβίçóç οίο license manager óóī ðāñéáΰēēīí äññīβùóçò Linux οίο FreeBSD .

```
#!/bin/sh
case "$1" in
  start)
    if [ -f /usr/local/etc/lmboot_TMW ]; then
      /compat/linux/bin/sh /usr/local/etc/lmboot_TMW -u username && echo 'MATLAB_lmgrd'
    fi
    ;;
  stop)
    if [ -f /usr/local/etc/lmdown_TMW ]; then
      /compat/linux/bin/sh /usr/local/etc/lmdown_TMW > /dev/null 2>&1
    fi
    ;;
  *)
    echo "Usage: $0 {start|stop}"
    exit 1
  ;;
esac

exit 0
```

Όχι: Οι αρχίτοιχοι να έχουν πρόσβαση:

```
# chmod +x /usr/local/etc/rc.d/flexlm.sh
```

Οι αρχίτοιχοι να έχουν πρόσβαση στο αρχείο `username` και να έχουν πρόσβαση στο όνομα (ή στο `root`).

3. Άρτιση του αρχίτουχου license manager και αρχίτουχου:

```
# /usr/local/etc/rc.d/flexlm.sh start
```

11.5.3 Αρχίτουχος και οι Αρχίτουχοι του Java Runtime Environment

Άρτιση του αρχίτουχου του Java Runtime Environment (JRE) στο `FreeBSD`:

```
# cd $MATLAB/sys/java/jre/glnx86/
# unlink jre; ln -s ./jre1.1.8 ./jre
```

11.5.4 Αρχίτουχος του Script Αρχίτουχου του MATLAB

1. Αρχίτουχος του αρχίτουχου script στο `/usr/local/bin/matlab`:

```
#!/bin/sh
/compat/linux/bin/sh /compat/linux/usr/local/matlab/bin/matlab "$@"
```

2. Αρχίτουχος του αρχίτουχου `chmod +x /usr/local/bin/matlab`.

Όχι: Αρχίτουχος και αρχίτουχος του `emulators/linux_base`, στο `FreeBSD`, να έχουν πρόσβαση στο αρχίτουχο script. Άρτιση του αρχίτουχου στο `/compat/linux/usr/local/matlab/bin/matlab`, ή στο `FreeBSD` στο `FreeBSD`:

```
if [ `expr "$lscommand" : '.*->.*' -ne 0` ]; then
```

(αρχίτουχος 13.0.1 να έχουν πρόσβαση στο αρχίτουχο 410) στο `FreeBSD` στο `FreeBSD`:

```
if test -L $newbase; then
```

11.5.5 Αρχίτουχος του Script Αρχίτουχου του MATLAB

Άρτιση του αρχίτουχου στο `FreeBSD` στο `FreeBSD`.

1. Αρχίτουχος του αρχίτουχου `$MATLAB/toolbox/local/finish.m`, ή στο `FreeBSD` στο `FreeBSD`:

```
! $MATLAB/bin/finish.sh
```

Όχι: Το `$MATLAB` να έχουν πρόσβαση στο αρχίτουχο.

Οδίαάει: Οδίοι βάει έαόΰεϊάι, έα άñάβδά όά άñ÷άβá finishsav.m έάέ finishdlg.m, όά ιδίσά έά όάό άβίϊοί όç äöíáδúδçδά ίά όβæάδά όçí άñάάόβá όάό δñεί έέάβδάδά οί δñüάñάίá. Άί δñüέάέόάέ ίά ÷ñçóείϊδϊέβδάά έΰδϊέί áδü áδδΰ, δñίόέΎόδά οίό όçí δάñáδΰίü άñάίβ áιΎόóδ ίάδΰ όçí áíδϊέβ save .

2. Άçίέϊδñάβδάά οί άñ÷άβί \$MATLAB/bin/finish.sh, οί ιδίσί έά δάñέΎ÷άέ όά δάñάέΰδú:

```
#!/usr/compat/linux/bin/sh
(sleep 5; killall -1 matlab_helper) &
exit 0
```

3. Êΰίόά οί άñ÷άβί άέδάεΎόείι:

```
# chmod +x $MATLAB/bin/finish.sh
```

11.5.6 ×ñçóείϊδϊέβίδάό οί MATLAB

Όά áδδú οί όçíάβί έά δñΎδάέ ίά άβδάά Ύόίεϊέ ίά άβδάά όçí áíδϊέβ matlab έάέ ίά άñ÷βδάά ίά ÷ñçóείϊδϊέάβδά όçí áóáñίϊάβ.

11.6 Άάέάδΰόδάόç όçδ Oracle®

11.6.1 Άέόάüüă

Όί έάβίáñ áδδú δάñέñΰδάέ όç áέάάέέάόβá άάέάδΰόδάόçδ ούι **Oracle 8.0.5** έάέ **Oracle 8.0.5.1 Enterprise Edition** άέά Linux όά Ύίá όύόόçíá FreeBSD.

11.6.2 Άάέάδΰόδάόç οίό δάñέáΰέεϊίδϊό Linux

Όέáñδñáδδάβδά üδέ Ύ÷άδά άάέάδΰόδΰάέ όά emulators/linux_base έάέ devel/linux_devtools áδü όç óçέεϊϊάβ ούι Ports. Άί áíδϊέáδúδβæάδά äöóεϊέβδδ ίά όά δάñáδΰίü, βδúδ ÷ñάέάδδάβ ίά όά άάέάδΰόδΰάά άδü δάέΎόά β áδü δάέέüδáñáδ áéäüόάέδ όçδ óçέεϊϊάβδ ούι Ports.

Άί έΎέáδά ίά δñΎίáδά οίι intelligent agent, έά ÷ñάέάδδάβ ίά άάέάδΰόδΰάά έάέ οί δάέΎδϊ Red Hat Tcl:

tcl-8.0.3-20.i386.rpm. Ç áíδϊέβ áέá όçí άάέάδΰόδάόç ιΎύóδ οίό áδβόçίϊό **RPM** port (archivers/rpm) άβίáέ:

```
# rpm -i --ignoreos --root /compat/linux --dbpath /var/lib/rpm package
```

Ç άάέάδΰόδάόç οίό package έά δñΎδάέ ίά άβίáέ ñάέΰ έάέ ÷ññβδ δñίáέβίáόά.

11.6.3 Ñöèìβæííðáð òì ÐáñéáÛëëíí áéá òçí Oracle

Ðñéí òçí áäéáðÛððáóç òçð **Oracle**, éá ðñÝðáé íá ñöèìβóáðá òüððÛ ðì ÐáñéáÛëëíí ðìö óðóðΠιáðüð óáð. Òì ÐáñéáÛðü èáβìáíí ÐáñéáñÛðáé ðé *áèñéáðð* ðñÝðáé íá εÛíáðá áéá íá áêðäëÝóáðá òçí **Oracle** áéá Linux òðì FreeBSD, éáé ááí ÐáñéáñÛðáé üðé ððÛñ ÷ áé Παç òðíí íαçäü áäéáðÛððáóçð òçð **Oracle**.

11.6.3.1 Ñýèìéóç ðìö ÐðñΠíá

¼ðüð ÐáñéáñÛðáé í íαçäüð áäéáðÛððáóçð òçð **Oracle**, éá ðñÝðáé íá ìñβóáðá ðéð ðéíÝð òçð shared memory òðì ìÝáéóðì. Ìçí ÷ ñçóéííðìéΠóáðá ðì SHMMAX òðì FreeBSD. Òì SHMMAX ððìéíáβæáðáé áðèðð áðü ðì SHMMAXPGS éáé ðì PGSIZE. ÁðñÝíüð éáéìñβóáð ðì SHMMAXPGS. ¼éáð ìé Ûëéáð áðééíáÝð ìðìñíÝí íá ìñéóðíÝí üðüð ÐáñéáñÛðáðáé òðíí íαçäü. Áéá ÐáñÛááéáíá:

```
options SHMMAXPGS=10000
options SHMMNI=100
options SHMSEG=10
options SEMMNS=200
options SEMMNI=70
options SEMMSL=61
```

Ìñβóáðá ðéð ðéíÝð ðüì áðééíáΠí Ýðóé Πóðá íá ðáéñéÛæíðì óðç ÷ ñΠóç òçð **Oracle** ðìö εÝéáðá íá εÛíáðá.

Áðβóçð, áðéáááéΠóðá üðé Ý ÷ áðá áíáñáíðìéΠóáé ðéð ÐáñéáÛðü áðééíáÝð ððéð ñöèìβóáðéð ðìö ÐðñΠíá:

```
options SYSVSHM #SysV shared memory
options SYSVSEM #SysV semaphores
options SYSVMSG #SysV interprocess communication
```

11.6.3.2 Ì × ñΠóðçð Oracle

ÄçìéíðñáΠóðá Ýíá ÷ ñΠóç ððóðΠιáðüð ìá üñíá oracle, ìá ðíí βáéí ðñüðì ðìö éá äçìéíðñáÝóáðá éáé ìðìéíáΠðìðá Ûëëíí ÷ ñΠóç. Òì üñíí éáéáβðáñí ÷ áñáéðçñéóðééü ðìö ÷ ñΠóç oracle áβíáé üðé ÷ ñáéÛæáðáé íá ðìö áΠóáðá Ýíá éÝéððìð Linux. ÐñíóèÝðáð ðì /compat/linux/bin/bash òðì /etc/shells éáé ìñβóðá ðì éÝéððìð ðìö ÷ ñΠóç oracle óá /compat/linux/bin/bash.

11.6.3.3 Òì ÐáñéáÛëëíí

Áêðüð ðüì óðìçééóíÝíñí ìáðááéçðΠí òçð **Oracle**, üðüð ìé ORACLE_HOME éáé ORACLE_SID éá ðñÝðáé íá ìñβóáðá éáé ðéð áéüéíðèáð ìáðááéçðÝð ÐáñéáÛëëííðìð:

ÌáðááéçðΠ	ÓéìΠ
LD_LIBRARY_PATH	\$ORACLE_HOME/lib
CLASSPATH	\$ORACLE_HOME/jdbc/lib/classes111.zip
PATH	/compat/linux/bin /compat/linux/sbin /compat/linux/usr/bin /compat/linux/usr/sbin /bin /sbin /usr/bin /usr/sbin /usr/local/bin \$ORACLE_HOME/bin

Óáð óðìéóðíÝí ìá ìñβóáðá üéáð ðéð ìáðááéçðÝð ÐáñéáÛëëííðìð òðì áñ ÷ áβì .profile. Íá ìéíéççñüñÝí ÐáñÛááéáíá áβíáé ðì ÐáñéáÛðüð:

```
ORACLE_BASE=/oracle; export ORACLE_BASE
ORACLE_HOME=/oracle; export ORACLE_HOME
LD_LIBRARY_PATH=$ORACLE_HOME/lib
export LD_LIBRARY_PATH
ORACLE_SID=ORCL; export ORACLE_SID
ORACLE_TERM=386x; export ORACLE_TERM
CLASSPATH=$ORACLE_HOME/jdbc/lib/classes111.zip
export CLASSPATH
PATH=/compat/linux/bin:/compat/linux/sbin:/compat/linux/usr/bin
PATH=$PATH:/compat/linux/usr/sbin:/bin:/sbin:/usr/bin:/usr/sbin
PATH=$PATH:/usr/local/bin:$ORACLE_HOME/bin
export PATH
```

11.6.4 Άεάέοΰόόάός οσò Oracle

Έυαυ ίεά ίεένΠò Ύεεάεσòδ οοίι άννιέυòΠ οίο Linux, εά ÷-νέεάοδάβ ίά άçιέιòñάΠοάόά Ύίáί εάοΰείαι ίά οί υνίá .oracle ίΎόά οοί /var/tmp, ðñέί ίάέείΠοάόά οί ðñüāñáíá άεάέοΰόόάόςδ. Ί εάοΰείαιò áδòυδ εά ðñΎðáé ίά άίΠεάé οοίι ÷-ñΠόος oracle. Έά ðñΎðáé οΠñά ίά ðñάáíáοίðίεΠοάόά οçί άεάέοΰόόάός οçò **Oracle** άβ÷-υò εάίΎίá ðñüāεçíá. Άί άίόείáδòδβæάόά υìυò áéυìç ðñíáεΠιáόά, άεΎáíòά οçί Ύέáιíός οçò **Oracle** ðίò Ύ÷-άόά Π/εάé οέδ ñòèìβóáéò óáò! Άóυοίò Ύ÷-άόά ðñάáíáοίðίεΠοάé οçί άεάέοΰόόάός οçò **Oracle**, άόáñüóòά óá patches ðίò ðññéññΰοίíóáé óóéò áγí ðñááéΰòυ άíυòçòáò.

Ίá óò÷-íü ðñüāεçíá άβίáé υòé ááí άβίáóáé óυóòΠ άεάέοΰόόάός οίò ðñíóáñíáΎá οίò ðñυοίευεέίò TCP. Άóòυ Ύ÷-άé υò áðíòΎεάóíá ίá ίçί ίðññáβòά ίá ίάέείΠοάόά οίòδ TCP listeners. Ίé áéυιέίòεάò ίαçáβáò εά óáò άίçεΠοίοί ίá éγóάòά áóòυ οί ðñüāεçíá.:

```
# cd $ORACLE_HOME/network/lib
# make -f ins_network.mk ntcontab.o
# cd $ORACLE_HOME/lib
# ar r libnetwork.a ntcontab.o
# cd $ORACLE_HOME/network/lib
# make -f ins_network.mk install
```

Ίç ίá÷-ΰόάόά ίá ðñΎíáòά ίáíΰ οί root.sh

11.6.4.1 Άéυñεùόç οίò root.sh

¼óáί άεάέεóóΰòά οçί **Oracle**, εΰðίεάò άíΎñάáéáò, ίé ίðíβáò ÷-ñάéΰæíóáé ίá άβííοί υò root, εάόááñΰοίíóáé óá Ύίá shell script ðίò éΎάáòáé root.sh. Οί script áóòυ άçιέιòñάβóáé óοίí εάοΰείαι orainst. Άόáñüóòά οί ðñááéΰòυ patch οοί root.sh, áéá ίá ίðññΎóáé ίá άñáé εάé ίá ÷-ñçóéíüðίεΠοάé οί chown. Άίáεéáéóééΰ, ðñΎíòά οί script ίΎόά áðü Ύίá éΎéòöíò Linux.

```
*** orainst/root.sh.orig Tue Oct 6 21:57:33 1998
-- orainst/root.sh Mon Dec 28 15:58:53 1998
*****
*** 31,37 ****
# This is the default value for CHOWN
# It will redefined later in this script for those ports
# which have it conditionally defined in ss_install.h
! CHOWN=/bin/chown
```

```
#
# Define variables to be used in this script
--- 31,37 ----
# This is the default value for CHOWN
# It will be redefined later in this script for those ports
# which have it conditionally defined in ss_install.h
! CHOWN=/usr/sbin/chown
#
# Define variables to be used in this script

¼ðáí ááí êÛíáðá ÷ñÞðç ôïð CD áéá ôçí ááéáðÛóóáç, ìðñáßðá íá ðñÛóáðá ôï patch áéá ôï root.sh, óôçí ðçãÞ
ááéáðÛóóáç. To añ÷âßí ìñÛæáðáé rthd.sh éáé áñßóéáðáé óðíí éáðÛëíáí orainst.
```

11.6.4.2 Äëüñèòç ôïð genclntsh

To script genclntsh ÷ñçóéíðñéáßðáé áéá íá äçíéíðñáßðáé ìéá shared client library. ÕñÝíðá ôï ðñáíáéÛòù patch áéá íá óáßðáðá ôï éáèñéóíÝíí PATH:

```
*** bin/genclntsh.orig Wed Sep 30 07:37:19 1998
--- bin/genclntsh Tue Dec 22 15:36:49 1998
*****
*** 32,38 ****
#
# Explicit path to ensure that we're using the correct commands
#PATH=/usr/bin:/usr/ccs/bin export PATH
! PATH=/usr/local/bin:/bin:/usr/bin:/usr/X11R6/bin export PATH
#
# each product MUST provide a $PRODUCT/admin/shrept.lst
--- 32,38 ----
#
# Explicit path to ensure that we're using the correct commands
#PATH=/usr/bin:/usr/ccs/bin export PATH
! #PATH=/usr/local/bin:/bin:/usr/bin:/usr/X11R6/bin export PATH
#
# each product MUST provide a $PRODUCT/admin/shrept.lst
```

11.6.5 Äêðÿëáçç ôçð Oracle

Áóÿ Ý÷áðá áéñéðèðáé áððÝð óéð ðçããáð, éá ðñÝðáé íá ìðñáßðá íá áêðäÿÝóéíá ôçí Oracle óáí íá áñéóèüóáðáí óá Ýíá óýóçíá Linux.

11.7 Ðñí÷: ùñçíÝíá ÈÝíáðá

Áí Ý÷áðá ôçí áðñáß ðùð éáéóññáß ç óðíááóüòçôá ìâ áðáññáÝð Linux, ðùðá éá ðñÝðáé íá áéááÛóáðá ôç ðñáíáéÛòù áíüðçá. Óá ðñéóóüðáñá áðü ùóá Ý÷íðí áñáððáß áßíáé ááóéóíÝíá óôçí çéáèññéèÞ èßðáá ááíéèÞ óðæçðáðáí ðïð FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-chat>) éáé Ý÷íðí áñáððáß áðü ôíí Terry Lambert <tlambert@primenet.com> (Message ID: <199906020108.SAA07001@usr09.primenet.com>).

11.7.1 Ðùò Æáëòìñããß;

Ïì FreeBSD ðãñéÝ ÷ áé Ýíá áðßðããì áóáßñãóçð (abstraction) ðìò ìññÛæãðáé “execution class loader”. Áðòù ááóßæãðáé óðì execve(2).

Áðòù ðìò óðíááßíáé áßíáé ùðé òì FreeBSD Ý ÷ áé íéá ëßððá òìñòùðì (loaders), áíòß áéá Ýíá ðìò íá éáðáóáýááé óá ðãñððòùóç áðìòð ÷ ßáð óðì #! áéá íá òñ Ýíáé ËÛðìéí shell interpreter ð shell script.

ËóòìñéËÛ, ì ìññò òìñòùððò óðç ðéáðòùñíá òìò UNIX Ýéãã ÷ á òìí ìááéèù áñéèù (ááíéèÛ óá ðñððá 4 ð 8 bytes òìò áñ ÷ áßìò) áéá íá ááé áí áßíáé ËÛðìéí áêðäëÝóëí / áðãññãð áñòòù óðì óýóóçíá, éáé óóçí ðãñððòùóç áðð ð íá éáéÝðáé òìí áíóßðòìé ÷ ì òìñòùðð.

Áí òìí áñ ÷ áßì ááí ððáí áêðäëÝóëí ìá áÛóç òìí óýðì òìò óðóððíáðìò, ç êéððóç óðì execve(2) áðÝóðñããðá ËÛðìéí óóÛéíá, éáé òì shell ðññòðáéýíðá íá áêðäëÝóëí òìí áñ ÷ áßì óáí shell script.

Ç ááíéèð éáÝá ððáí “áí ááí áßíáé áêðäëÝóëí, ðññòðÛéçðá íá òì òñ Ýíáéð ùð shell script ìá áÛóç òì òñ Ý ÷ ì shell ”.

Áñãùðããá, áñÝéçéá Ýíáð Ýíòðìò òññòìò ðððá òì sh(1) íá áé Ýá ÷ áé òìòð ðñððìòð äýí ÷ áñáéðñãð, éáé áí ððáí : \n, òùðá éáéýíðá òì shell csh(1) (ðéóðãýíðìá ðùð ç ýóçç áððð ãñÝéçéá áñ ÷ éèÛ áðù òç SCO).

Áðòù ðìò ËÛíáé òðñá òì FreeBSD áßíáé íá áéáðñÝ ÷ áé òç ëßððá ìá ùéíðò òìòð òìñòùðÝð, ìá Ýíá ááíéèù òìñòùðð # ! ì ìðìßìò áíááíññãæáé ùð áéáñìçíÝá (interpreter) òìòð ÷ áñáéðñãð áðù òì áðùíáñ éáíù ìáðÛ òì ! éáé ìÝ ÷ ñé òì òÝéíð, áñ ð áí ááí áíááíññéóðãß ËÛðìéíð, ÷ ñçóéíðìéáßðáé ùð Ýó ÷ áðç ýóçç òì /bin/sh.

Æáá òçí òðìòðñéíç òìò Linux ABI, òì FreeBSD áéÝðáé òìí ìááéèù áñéèù òìò ELF binary (ãá áíááíññãæáé òç áéáðìñÛ áíÛíáðá óá FreeBSD, Solaris, Linux, ð ËÛðìéí Ûéëí éáéðìòñãéèù óýóóçíá òì ìðìßì ÷ ñçóéíðìéáß áñ ÷ áßá óýðìò ELF).

Ì òìñòùððò ELF éíéðÛáé áéá Ýíá áéáéèù brand, òì ìðìßì áßíáé íéá áíùóçðá ó ÷ ìéßì ìÝóá óðì ELF image, éáé òì ìðìßì ááí òðÛñ ÷ áé óá ELF binaries áéá SVR4/Solaris

Æáá íá éáéðìòñãððìò óá áêðäëÝóëíá òìò Linux, éá ðñÝðáé íá áßìòí branded (ìáñéáñéóðìýí) ùð Linux ìÝòù òçð brandelf(1):

```
# brandelf -t Linux file
```

¼ðáí áßíáé áðòù, ì òìñòùððò ELF éá áéÝðáé òì Linux brand ðÛíù óðì áñ ÷ áßì.

¼ðáí ì òìñòùððò ELF ááé òì Linux brand, éá áíðééáðáðððáé Ýíáí ááßéðç ìÝóá òçç áñð proc. ¼éáð ìé êéððáéð òìò óðóððíáðìò óáíéíñíýíðáé ìÝóá áðù áðòùí òìí ááßéðç (óá Ýíá ðãñááíóéáéù óýóóçíá UNIX, ì ááßéðçð éá ððáí ì ðßíáéáð sysent[]), ðìò ðãñéÝ ÷ áé òéð êéððáéð òìò óðóððíáðìò (system calls). ÁðéðéÝí, ç áéãñááðá óçíáéðíáðáé áéá áéáéèð ìáðá ÷ áßñéóç òìò trap vector éáé Ûééáð (íééñÝð) áéíñèððáéð, òéð ìðìßáð ÷ áéñßæãðáé òì Ûñèñùíá ððñðíá òçð óðíááóóòçðáð Linux.

Ïì system call vector òìò Linux ðãñéÝ ÷ áé, ìáðáíý Ûéèùí, íéá ëßððá ìá òá áããñÝíá òìò sysent[] òùí ìðìßì ìé áéáðéýíðáéð áñßðéíðáé ìÝóá óðì Ûñèñùíá òìò ððñðíá.

¼ðáí áßíáðáé íéá êéððóç óðóððíáðìò áðù íéá áðãññãð Linux, ì êðáééáð (trap code) ðññìðìéáß òìí ááßéðç òçð ìÝòù òçð áñð ðìò Ý ÷ áé áããñáðáß óðì proc, éáé áéèÛæáé òçí áéáýéðìòç ðððá íá ááß ÷ íáé óðì óçíáßì áéóùáèð òçð óðì Ûñðóççð òìò Linux, éáé ù ÷ é òìò FreeBSD.

Áðßðçð, òì óýóóçíá óðíááóóòçðáð ìá Linux ìðìñáß éáé ðññòáñìùæáé áðíáíéèÛ òéð òìðìéáðáð áíáæððóçð. ÌðéáóðéèÛ áðòù ËÛíáé éáé ç áðééíãð union éáðÛ òçí ðññòÛñðççç áíùð óðóððíáðìò áñ ÷ áßì (ááí áñíñýíá ááð òì óýóóçíá áñ ÷ áßì unionfs!). Áñ ÷ éèÛ, áßíáðáé áðùðáéñá íá áñáéáß òì áñ ÷ áßì óðì éáðÛéíá /compat/linux/original-path, éáé ìùí áí áðòù áðìòý ÷ áé, éá áßíáé áíáæððóçç óðì éáðÛéíá /original-path. Ìá òìí òññòì áðòù óéáíñãýíðìá ùðé òá áêðäëÝóëíá ðìò ÷ ñáéÛæáéíðáé Ûééá áêðäëÝóëíá éá òñ Ýíòí (áéá ðãñÛááéáíá, òì óýíñéí áñááéáßì òìò Linux ìðìñáß íá áêðäëáððáß ìÝòù òçð òðìòðñéíçð òìò Linux ABI). Áðßðçð òçíáßíáé ùðé òá

III. Άεά ÷ άβñέός Όοόπιαόιò

Όά έαοÛέαέα όιò FreeBSD Handbook όιò άέιειòείγι άιάόÛñιόάέ όά εÛιαόά όιò Ý ÷ ιοί ό ÷ Ýός ιά όç áέα ÷ άβñέός όιò όσοόπιαόιò. ÊÛεά έαοÛέαεί ιάείÛ ðañέañÛοιίόάò όέ έά ιÛεάόά άέαάÛαίίόάò όι óαέάέñειÛι έαοÛέαεί, έάεπò έάέ όέ ðñιαόάέοιγιάία Ý ÷ άέ όι έαοÛέαεί άοόυ: όέ ðñÝðάέ ίά Ý ÷ άòά þç áέαάÛόάέ έάέ έάάñίþόάέ ðñεί άό ÷ ñέçέáβòά ιά άοόυ όι έαοÛέαεί.

ΆόòÛ όά έαοÛέαέα Ý ÷ ιοί ό ÷ áαέαόόάβ ðañέόόυόάñι ùò ιäçãüò άιάόιñÛò ðañÛ ùò áέόάάùáέέυ έάβιαñ. Áέ άοόυ άβιάέ ðεί ÷ ñþόείά ùò ιäçãñβ όοιòò ïθιβιòò ïθιñάβòά ίά άιάόñÝíáòά üóái ÷ ñάέÛαάόόά έÛθιέα ðέçñιιöñβά άέα όι FreeBSD. Άá ÷ ñάέÛαάόάέ ίά όά άέαάÛόάόά ιά έÛθιέα όóãéäñειÛιç óáñÛ, ñýòá ÷ ñάέÛαάόάέ ίά όά Ý ÷ άòά άέαάÛόάέ üéá ðñεί áñ ÷ βóáòά ίά άό ÷ ñέáβòάά ιά όι FreeBSD.

Εἰσαγωγή 12

Νῦν ἐλάττωμε τὴν Ἐπιβάσει

12.1 Ὁρισμοί

Ἡ ἀρχὴ τῆς ἐπιβάσεως εἰς τὴν FreeBSD ἀρτὴ εἶναι ἡ ἀνάστασις τῆς ἐπιβάσεως ἀπὸ τοῦ ὀνόματος. Ἡ ἀρχὴ τῆς ἐπιβάσεως ἀπὸ τοῦ ὀνόματος ἀρτὴ εἶναι ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος. Ἡ ἀρχὴ τῆς ἐπιβάσεως ἀπὸ τοῦ ὀνόματος ἀρτὴ εἶναι ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος.

Ἡ ἀρχὴ τῆς ἐπιβάσεως ἀπὸ τοῦ ὀνόματος εἶναι ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος.

- Δὲν εἶναι ἀνάστασις ἀπὸ τοῦ ὀνόματος ἀπὸ τὴν ἀρχὴν τῆς ἐπιβάσεως swap.
- Ὁ ἀρχὴ τῆς ἐπιβάσεως ἀπὸ τοῦ ὀνόματος εἶναι ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος `rc.conf` εἰς `/usr/local/etc/rc.d`.
- Δὲν εἶναι ἀνάστασις ἀπὸ τοῦ ὀνόματος εἰς τὴν ἀνάστασις ἀπὸ τοῦ ὀνόματος.
- Δὲν εἶναι ἀνάστασις ἀπὸ τοῦ ὀνόματος εἰς τὴν ἀνάστασις ἀπὸ τοῦ ὀνόματος.
- Δὲν εἶναι ἀνάστασις ἀπὸ τοῦ ὀνόματος ἀπὸ τὴν ἀνάστασις ἀπὸ τοῦ ὀνόματος `/etc`.
- Δὲν εἶναι ἀνάστασις ἀπὸ τοῦ ὀνόματος ἀπὸ τὴν ἀνάστασις ἀπὸ τοῦ ὀνόματος `sysctl`.
- Δὲν εἶναι ἀνάστασις ἀπὸ τοῦ ὀνόματος ἀπὸ τὴν ἀνάστασις ἀπὸ τοῦ ὀνόματος ἀπὸ τὴν ἀνάστασις ἀπὸ τοῦ ὀνόματος.

Ἡ ἀρχὴ τῆς ἐπιβάσεως ἀπὸ τοῦ ὀνόματος εἶναι ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος.

- Ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος εἶναι ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος (Εἰσαγωγή 4).
- Ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος εἶναι ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος ἀπὸ τὴν ἀνάστασις ἀπὸ τοῦ ὀνόματος (Εἰσαγωγή 9).

12.2 Ἡ ἀνάστασις τῆς ἐπιβάσεως

12.2.1 Ἡ ἀνάστασις τῆς ἐπιβάσεως

12.2.1.1 Ἡ ἀνάστασις τῆς ἐπιβάσεως

Ἡ ἀνάστασις τῆς ἐπιβάσεως ἀπὸ τοῦ ὀνόματος εἶναι ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος ἀπὸ τὴν ἀνάστασις ἀπὸ τοῦ ὀνόματος. Ἡ ἀνάστασις τῆς ἐπιβάσεως ἀπὸ τοῦ ὀνόματος εἶναι ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος ἀπὸ τὴν ἀνάστασις ἀπὸ τοῦ ὀνόματος. Ἡ ἀνάστασις τῆς ἐπιβάσεως ἀπὸ τοῦ ὀνόματος εἶναι ἡ ἀνάστασις ἀπὸ τοῦ ὀνόματος ἀπὸ τὴν ἀνάστασις ἀπὸ τοῦ ὀνόματος.

Ôí ðéí áðëü óáíÛñéí áêêβíçóçð ðééáíüðáóá íá ïéÛæáé ïá ôí ðáñáéÛòù:

```
#!/bin/sh
echo -n ' utility'

case "$1" in
start)
    /usr/local/bin/utility
    ;;
stop)
    kill -9 `cat /var/run/utility.pid`
    ;;
*)
    echo "Usage: `basename $0` {start|stop}" >&2
    exit 64
    ;;
esac

exit 0
```

Ôí óáíÛñéí áðòù ðáñÝ÷áé ïéá stop éáé ïéá start áðéíñáð áéá ôçí áðáññíñáð ùðíð óóí ðáñÛäáéáíá ááð áíáóÝñáðáé óáí utility.

Ìðñáβ íá áêêéíçèáβ ÷áéññííáéðééÛ éÛñíðáð:

```
# /usr/local/etc/rc.d/utility.sh start
```

Ðáññéí ðíð ááí áðáéóíýí ùéáð ïé áðáññíñáÝð íá ðñíóðáèáβ ïβá ááñáñáðð óóí rc.conf, ó÷ááíí éáèçíñáñéíÛ éáé Ýíá íÝí port éá ðñíðíðíéððá áéá íá äÝ÷áðáé áððð ôçí ñýèíéóç. ÁéÝñáñáðá ôçí ðáèééð Ýñíñí ôçð ááéáðÛóóáóçð áéá ðáñéóóüðáñáð ðéçñííññáð ðÛíù óðçí óðáéáèñéíÝíç áðáññíñáð. ÌáñééÝð áðáññíñáÝð áðí ðñβðíðð éáðáóéáðáóóÝð ðáñÝ÷íðí óáíÛñéá áêêβíçóçð óá ïðíβá áðéðñÝðíðí óðçí áðáññíñáð íá ÷ñçóéíðíéçèáβ ïá ôí rc.d, ðáññéá áðóá, áðòù éá óðæçðçèáβ óóí áðñíáíí ïÝñíð.

12.5.1 ÁêêðááíÝíç Ñýèíéóç Áðáññíñáðí

ÐéÝíí ôí FreeBSD ðáñéÝ÷áé ôí rc.d, ç ñýèíéóç ôçð áêêβíçóçð ðñí áðáññíñáðí Ý÷áé áβíáé áðéíñéüðáñç, éáé ðéí ðéíýóéá óá ÷áñáéðçñééÛ. ×ñçóéíðíéçíðáð éÝíáéð ééáéáβá ïÝóá óóíí éáðÛéíñí rc.d, ïé áðáññíñáÝð ïðñíýí ðéÝíí íá áêêéíñí Ýðáéóá áðí óðáéáèñéíÝíçð ððçñáðóβáð áéá ðáñÛäáéáíá ôçí DNS, ïðñáβ íá áðéðñáðáβ ç áéóááñáð áðéðéÝíí ðáñáíÝðññí ïÝóá áðí ôí rc.conf óðçí èÝóç ðñí ðæç ððÛñ÷óíðí ðáñáíÝðññí áðí óá óáíÛñéá áêêéíðóçð, éðéð. Ìá ááóééü óáíÛñéí ïðñáβ íá ïéÛæáé ïá ôí áéññéðèí:

```
#!/bin/sh
#
# PROVIDE: utility
# REQUIRE: DAEMON
# KEYWORD: shutdown

#
# DO NOT CHANGE THESE DEFAULT VALUES HERE
# SET THEM IN THE /etc/rc.conf FILE
#
utility_enable=${utility_enable-"NO"}
```


iun iYoa ooi an+abi /etc/crontab. Oi daabi adou eaeinbaae oai dieuo + nPocod ea onYiae oci afoieP. 1/4oai Yia + nPocod aaeaeodU oi crontab an+abi oio, aai ea Y+ae oi daabi adou aeaeYoei. OYei, ea aeieioePoae c adeeiaP command. Adou abiae oi daeadoabi daabi, Yooe ea eiaeeU odraaeeyae oci afoieP oio ea aeoeaoodab.

- 4 C daeadoaba adop ananP ea eaeinboae oa iaayie oio oaeoPecaei danaouu. Dnio Yioa aap uoe Y+iota Yiai ineoiu */5, aeieioeyiaai adi aneaoiy + anaeoPnao *. Ie + anaedPnao * ociabfioi "dnpoi-daeadoabi", ea idniyi ia anicfaoyiyi oai Uea oinU. ooe, enbniadao adi adop oci ananP, abiae dnioaYi uoe c afoieP atrun adaeaeaboa adi oii + nPocod root eUea dYioa eadou aiaiUnocoa adi oci cYina ea oii iPi. Aea daneoouoanao deqnioinba + adeeU ia oci afoieP atrun, eioYioa oci oaeaba aiceaba (8).

Ie afoieYi idniyi ia Y+iota adaneueoio aneoiu danaYonui, uoouoi, ie afoieYi ia aeodaaiYi aneoiu ananPi dnYdae ia aeadooyiyi ia oii + anaedPna ooiY+aeao afoieoed ea eYio "v".

AdoYi abiae ie aaoeYi noeiboaeo aea eUea an+abi crontab, uoouoi odUn+ae ea eUoe aeaoimaeoeu. Oi daabi Yie, uoio ea eaeinbaeioi oi unna + nPocod, odUn+ae iun ooi an+abi oio odoopiadi /etc/crontab. Oi daabi adou dnYdae ia danaeaeoeb aea eUea crontab an+abi + nPocod.

12.6.1 Aaeaeoopiadao ia Crontab

Οχιαιοeu: Aai ea dnYdae ia +ncoeioiePoada oci aeaeaeoada oio daneanUoadae aap aea oci aeuneuo/aaeodUoao oio crontab oio odoopiadi. AdEU +ncoeioiePoada oii aadociYi oao eaiaianUoi: oi cron ea afoiePoae uoe oi an+abi Y+ae dnioiePoeab ea ea an+boae Uiaoa ia +ncoeioieab oci aiaiauYic Yeaio oio. Aaboa adop oci aanaop oio FAQ (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/faq/admin.html#ROOT-NOT-FOUND-CRON-ERRORS) aea daneoouoanao deqnioinba.

Aea ia aaeadooPoada Yia rYi crontab + nPocod, dnpoa +ncoeioiePoada oii aadociYi oao eaiaianUoi aea ia aiceioinba oia Yia an+abi ia oi adaeoyiaai dyoi, ea euoa +ncoeioiePoada oi crontab. C dei eieip + nPocod oio abiae:

```
% crontab crontab-file
```

Ooi danUaaeia adou, oi an+abi crontab-file abiae oi unna oio an+abi crontab oio ab+ a iceioinbae ab dnicaioiYiu.

OdUn+ae adbood iBa adeeiaP aea ia adaneioPoada oia aaeadoociYia an+aba crontab: adEU aeouaa oci adeeiaP -1 ooci afoieP crontab ea aeYiada oi adiYeoi.

Aea oio + nPocod oio eYei ia an+boioi oi crontab an+abi oio adi oci an+P, +unbd oci +nPocod dnioyoi, idniyi ia +ncoeioiePoi oci afoieP crontab -e. Adop c afoieP ea iaeioPoae oi eaiaianUoi ia Yia eaiu an+abi. 1/4oai oi an+abi adiecaoeab, ea aaeadooaeab adouiaoa adi oci afoieP crontab.

AI anaouana eYeaoa ia aeaanUoada oi crontab an+abi + nPocod daeabuo, +ncoeioiePoada oci afoieP crontab iaab ia oci adeeiaP -r.

12.7 Xncoeioiepiadao Oi Oyoogia rc Ooi FreeBSD

Oi 2002 oi FreeBSD aiouuouoada oi oyoogia rc.d oio NetBSD aea oci aeebicod oio odoopiadi. Ie + nPocod ea dnYdae ia Y+iota afoieeoeab oa an+aba oio anboieoae ooi eadUeia /etc/rc.d. DieEU adi adou oa an+aba abiae


```
dc0: <82c169 PNIC 10/100BaseTX> port 0xa000-0xa0ff mem 0xd3800000-0xd38000ff irq 15 at device 11.0 on pci0
dc0: Ethernet address: 00:a0:cc:da:da:da
miibus0: <MII bus> on dc0
ukphy0: <Generic IEEE 802.3u media interface> on miibus0
ukphy0: 10baseT, 10baseT-FDX, 100baseTX, 100baseTX-FDX, auto
dc1: <82c169 PNIC 10/100BaseTX> port 0x9800-0x98ff mem 0xd3000000-0xd30000ff irq 11 at device 12.0 on pci0
dc1: Ethernet address: 00:a0:cc:da:da:db
miibus1: <MII bus> on dc1
ukphy1: <Generic IEEE 802.3u media interface> on miibus1
ukphy1: 10baseT, 10baseT-FDX, 100baseTX, 100baseTX-FDX, auto
```

Όδι δάνΰάεάιά άόου, άεΰδριά υέέ άγί εΰñόάδ διό ÷ñçóειñδρειγί οη ιαçaü dc(4) Ύ ÷ιόι άίοιδεόάβ όδι όύόόçιά.

Άί ι ιαçaü όçδ NIC όάδ άά άβιάέ δάνιί όοηι GENERIC, έά δñΎδάέ ίά οηñόπόάόά οη έάόΰεεççε ιαçaü άέα ίά ÷ñçóειñδρειπόάόά όçί NIC όάδ. Άόου ιδñάβ ίά άδεόάδ ÷έάβ ιά Ύίάί άδι όιόδ άγί άδοιγδ όñüδιόδ:

- Ι δρειύ άγείει όñüδιό άβιάέ άδεΰ ίά οηñόπόάόά Ύίά ΰñεñüιά όιό δονΠρία άέα όçί εΰñόά άεέόγίό όάδ ιά όι κldload(8), P άόουιάόά έάόά όçί άέβζός δñιόέΎοηιόάδ όçί έάόΰεεççç άñáiP όοηι άñ ÷άβι /boot/loader.conf. Άά άβιάέ υέιε ιέ ιαçaü NIC άέαέΎόειιέ όάί άñεñπιάόά, ÷άñάέδçñέόέεΰ δάñάάβñιάόά άβιάέ όά άñεñπιάόά άέα όόόέάΎό ISA.
- Άίάέεάέόέεΰ, ιδñάβόά ίά ιάόάέπóόέόάόά όάόέεΰ όçί όδιόδPñέιç άέα όçί εΰñόά όάδ όοηι δονΠρία. ΆεΎάιάόά όι άñ ÷άβι /usr/src/sys/conf/NOTES, όη /usr/src/sys/arch/conf/NOTES έάέ όçί όάέβάά άιçεάβάδ όιό ιαçaü άέα ίά ιΰεάόά όέ δñΎδάέ ίά δñιόέΎόάόά όοηι άñ ÷άβι ñόειβόάυι όιό δονΠρία. Άέα δάñέόóóúάñάδ δεçñιόñβάδ άέα όι δüδ ίά ιάόάέυóόβόάόά όηι δονΠρία, δάñάέέπ άέαΰόόά όηι Έάοΰεάει 9. Άί ç εΰñόά όάδ άίοιδεόάβ έάόά όçί άέβζός άδι όηι δονΠρία (GENERIC) άά ÷ñάέΰάόά ίά ιάόάέπóόέόάόά Ύίάί ιΎι δονΠρία.

12.8.1.1 ×ñçóειñδρειπόάό ιαçaüγδ Windows ιά Όη NDIS

Άόόόδ ÷βδ, δδΰñ ÷ιόι άέυιá δρειβι έάόάέάόάόόΎδ όιό άά δάνΎ ÷ιόι όα ÷ιέέΎδ δñιέάάñάόΎδ άέα όιόδ ιαçaüγδ όιόδ όόçί έιέιυόçά όιό άίιέέδγ έάέόιέέγ έέαόβ άίόειάδδβæιόι όΎόιέάδ δεçñιόñβάδ όά ιόόέεΰ όιό άιδñβιό. Όόιάδβδ, ιέ δδáyέδñιέ άέα όçί άίΰδóç όιό FreeBSD έάέ ΰεεüι έάέόιñάέέπι όόόçίΰóυι ιΎιόι ιά άγί άδέειάΎδ: ίά άίάδóγίόι ιαçaüγδ ιά όçί ιάέñΰ έάέ άδβδιίç έέαέέέάόβά όçδ άίόβóδñιόçδ ιç ÷άιέέβδ P ίá ÷ñçóειñδρειπόιόι Pαç δδΰñ ÷ιόάδ ιαçaüγδ όά άόάέέP ιñόP άέαέΎόειιόδ άέα όçί δεάόóüñιá Microsoft Windows. Ιέ δάñέόóóüάñιέ δδáyέδñιέ άέα όçί άίΰδóç, ιάόάγί όιόδ έάέ άόóιβ όιό άιδέΎειιόάέ ιά όηι FreeBSD, Ύ ÷ιόι άδέέΎιáέ όçί άáyόάñç δñιόΎάέόç.

×ΰñç όçί δñιόóñΰ όιό Bill Paul (wpaul), ιέΰδ έάέ άδι όηι FreeBSD 5.3-RELEASE δδΰñ ÷άέ “άçάáiPδ” όδιόόPñέιç άέα όηι Network Driver Interface Specification (NDIS). Όη Ύñái FreeBSD NDISulator (άέαóññάόέεΰ άιύóóü όάδ Project Evil) δάβñιáέ Ύίάί ιαçaü Windows όά άόάέέP ιñόP έάέ όόçί ιόόβά όηι άιáδáóΰ πόόά ίά ññβæάέ υέέ όñΎ ÷άέ όά Windows. Έüái όιό υέέ ι ιαçaüδ ndis(4) ÷ñçóειñδρειέάβ ιβá Windows άόάέέP ιñόP, ιδñάβ ίá ÷ñçóειñδρειçεάβ λüñι όά ι386 έάέ amd64 όόόδΠιάόά.

Όçιáβüόç: Ι ιαçaüδ ndis(4) άβιάέ ό ÷άέέόιΎιό πόόά ίά όδιόόçñβæάέ έόñβüδ όόόέάΎό PCI, CardBus έάέ PCMCIA, ιέ όόόέάΎό USB άά όδιόόçñβæιίόάέ άέυιá.

Άέα ίá ÷ñçóειñδρειπόάόά όηι NDISulator, έά ÷ñάέόόάβόά όñβá δñΰάιáόά:

1. Όι δααβί έπαέέά οίο δδνΠιά
2. Όγι Windows XP αοάάέεΠ ιιηόΠ οίο ιααίγ (.SYS αδΎέδός)
3. Όι Windows XP αη÷άβι ηδελβόαυι οίο ιααίγ (.INF αδΎέδός)

Αίοιδβόά όά αη÷άβά αοδὺ έάέ όγι έὺηόά όάδ. Αάέέὺ, αοδὺ ιθιιγί ίά αηαέγί όόά δαηά÷υιάρ CDs Π όοιόδ έόδυοιθιόδ ουί έάόάόέάόάόθβι. Όόά άέυειόεά δαηάαβαιάόά, έά ÷ηζόειθιέΠοιόι άά αη÷άβά W3DRIVER.SYS έάέ W3DRIVER.INF.

Όγιαβύος: Αάί ιθιιηάβόά ίά ÷ηζόειθιέΠόάόά ιααίγ Windows/i386 όά όόόδΠιάόά FreeBSD/amd64, έά δηΎδάέ ίά αηάβόά ιααίγ Windows/amd64 έάέ ίά αιόέΥοιόι όυόδὺ.

Όι αδυιάρ αΠιά αβιάέ ίά ιάόάεϋδδβόάόά οίι αοάέέϋ ιααυι ιΎόά όά Ύία οηηόροειι ὘ηελυία οίο δδνΠιά. Αέά ίά οί άδέόγ÷άόά αόδυ, έά δηΎδάέ όάί root, ίά ÷ηζόειθιέΠόάόά οί ndisgen(8):

```
# ndisgen /path/to/W3DRIVER.INF /path/to/W3DRIVER.SYS
```

Όι αιζεζόέϋ δηυαηαιά ndisgen(8) αβιάέ άέααηάόόέϋ έάέ έά όάδ αιζιανηόάέ άέα ιθιέάαΠθιόά άδεδέΎι δεζηιιηβά ιθιιηά ίά ÷ηάέόάβ; έά δαηὺάέ Ύία ὘ηελυία οίο δδνΠιά όοιι οηΎ÷υιόά έάδὺειαι έάέ ιθιιηάβ ίά οηηδϋεάβ υò αιΠδ:

```
# kldload ./W3DRIVER.ko
```

ΑδεδέΎι οίο δαηά÷έΎιόδ ανηηιαόιόδ, έά δηΎδάέ ίά οηηόροάόά όά ανηηιαόά ndis.ko έάέ if_ndis.ko. Αόδυ έά δηΎδάέ ίά αβιάέ αόδυιαόά υοάι οηηόριαόά ιθιέάαΠθιόά αιανδὺόάέ αθι οί ndis(4). Αί έΎεάόά ίά οί έὺιάρ÷άεηυιέδεδέϺ, έά δηΎδάέ ίά ÷ηζόειθιέΠόάόά όεδ άέυειόεάδ αιόιέΎδ:

```
# kldload ndis
# kldload if_ndis
```

Ϛ δηηόζ αιόιέΠ οηηόριαέ οίι ιααυι NDIS miniport wrapper, αηη ζ ααγδανζ οηηόριαέ όγι δηάαιάόέεΠ έὺηόά άέέόγιό.

Όηηά, άέΎαιόά οί dmesg(8) άέα ίά ααβόά αι δδὺη÷ιόι οόὺέιαόά έάόά όγι ουηδϋός. Αί υέα δΠαιί έάέϺ, έά δηΎδάέ ίά ααβόά ιέα δανυιέα Ύιαι ιά όγι αδυιαζ:

```
ndis0: <Wireless-G PCI Adapter> mem 0xf4100000-0xf4101fff irq 3 at device 8.0 on pci1
ndis0: NDIS API version: 5.0
ndis0: Ethernet address: 0a:b1:2c:d3:4e:f5
ndis0: 11b rates: 1Mbps 2Mbps 5.5Mbps 11Mbps
ndis0: 11g rates: 6Mbps 9Mbps 12Mbps 18Mbps 36Mbps 48Mbps 54Mbps
```

Αθι ααη έάέ δΎηά ιθιιηάβόά ίά ÷άέηέόάβόά όγι όδóέαδΠ ndis0 όάί ιέα ιθιέάαΠθιόά έὺηόά άέέόγιό (δ.÷., dc0).

Ιθιιηάβόά ίά ηδελβόάόά οί όγόόζια ίά οηηόριαέ όά NDIS ανηηιαόά έάόά όγι άέέβιζός ιά οίι βαέι δηυθι ιά όά υδϋδ ιά ιθιέάαΠθιόά ὘έέά ανηηιαόά. Δηηόά, αιόεανὺοδά οί δαηά÷έάβόά ὘ηελυία, W3DRIVER.ko, όοιι έάδὺειαι /boot/modules. Όυόά, δηιόέΎόά όγι άέυειόεζ αηαιηΠ όοι /boot/loader.conf:

```
W3DRIVER_load="YES"
```

12.8.2 Η εγκατάσταση του FreeBSD με την απλοποιημένη διαδικασία

Η απλοποιημένη διαδικασία εγκατάστασης του FreeBSD με την απλοποιημένη διαδικασία, είναι η απλοποιημένη διαδικασία εγκατάστασης του FreeBSD με την απλοποιημένη διαδικασία. Η απλοποιημένη διαδικασία εγκατάστασης του FreeBSD με την απλοποιημένη διαδικασία, είναι η απλοποιημένη διαδικασία εγκατάστασης του FreeBSD με την απλοποιημένη διαδικασία.

Αν θέλετε να εγκαταστήσετε το FreeBSD με την απλοποιημένη διαδικασία, τότε θα πρέπει να ακολουθήσετε τα παρακάτω βήματα:

```
% ifconfig
dc0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
     inet 192.168.1.3 netmask 0xffffffff broadcast 192.168.1.255
     ether 00:a0:cc:da:da:da
     media: Ethernet autoselect (100baseTX <full-duplex>)
     status: active
dc1: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
     inet 10.0.0.1 netmask 0xffffffff broadcast 10.0.0.255
     ether 00:a0:cc:da:da:db
     media: Ethernet 10baseT/UTP
     status: no carrier
lp0: flags=8810<POINTOPOINT,SIMPLEX,MULTICAST> mtu 1500
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
     inet 127.0.0.1 netmask 0xff000000
tun0: flags=8010<POINTOPOINT,MULTICAST> mtu 1500
```

Ορίσματα: Τα παραπάνω είναι οι παραμέτρους του FreeBSD που ορίζονται στο `/etc/rc.conf`, όπως φαίνεται στο αρχείο `/etc/rc.conf`, τα οποία είναι τα ίδια με τα οποία ορίζονται στο αρχείο `/etc/rc.conf`, τα οποία είναι τα ίδια με τα οποία ορίζονται στο αρχείο `/etc/rc.conf`.

Οι παρακάτω είναι οι παραμέτρους που ορίζονται στο αρχείο `/etc/rc.conf`:

- `dc0`: Η διεύθυνση Ethernet του FreeBSD με την απλοποιημένη διαδικασία
- `dc1`: Η διεύθυνση Ethernet του FreeBSD με την απλοποιημένη διαδικασία
- `lp0`: Η διεύθυνση του σημείου προς σημείο
- `lo0`: Η διεύθυνση του loopback
- `tun0`: Η διεύθυνση του tunnel που ορίζεται στο αρχείο `/etc/rc.conf`

Οι παρακάτω είναι οι παραμέτρους που ορίζονται στο αρχείο `/etc/rc.conf` και οι οποίες είναι οι ίδιες με τις παραμέτρους που ορίζονται στο αρχείο `/etc/rc.conf`.

Οι παρακάτω είναι οι παραμέτρους που ορίζονται στο αρχείο `/etc/rc.conf`:

1. Η διεύθυνση του σημείου προς σημείο με την απλοποιημένη διαδικασία είναι η διεύθυνση.
2. Η διεύθυνση του Internet με την απλοποιημένη διαδικασία (inet) είναι η διεύθυνση (οι παραμέτρους είναι η διεύθυνση 192.168.1.3).
3. Η διεύθυνση του netmask είναι η διεύθυνση (netmask; 0xffffffff είναι η διεύθυνση 255.255.255.0).
4. Η διεύθυνση του broadcast με την απλοποιημένη διαδικασία είναι η διεύθυνση (οι παραμέτρους είναι η διεύθυνση 192.168.1.255).
5. Η διεύθυνση του MAC με την απλοποιημένη διαδικασία (ether) είναι η διεύθυνση 00:a0:cc:da:da:da

6. **Ç** άδέραP οίτ οόόείγ ίΥόί άβίάέ οά έάόŪόόάόσ autoselection (media: Ethernet autoselect (100baseTX <full-duplex>)). Δάναόσνίγλά υόέ ç dc1 Ý÷άέ νόέιέόόάβ ίά όñÝ÷άέ οάί 10baseT/UTP ίΥόί. Άέά δάnéóóúόάναό δεçñίóñβάό άέά όίτδ όγδίτδ όυί ίΥόύί άíυó ñçáγí, δάναέάεñ άίάόñÝίόά όόçί οάέβάά άίçέάβάδ.

7. **Ç** έάόŪόόάόσ όçδ όγίάάόçδ (status) άβίάέ active, άçέ. Ý÷άέ άίόιδέόόάβ όPία ίάόάóñŪό. Όόçί dc1, δάναόçñίγλά status: no carrier. Αόόυί άβίάέ έίάέέυ άόίγ όί έάεPάεί Ethernet άάί Ý÷άέ όόίάέάβ ίά όçί έŪñόά.

Άί όί ifconfig(8) άίόάίβάέ έŪόέ δάñííέί ίά άόόυί:

```
dc0: flags=8843<BROADCAST,SIMPLEX,MULTICAST> mtu 1500
    ether 00:a0:cc:da:da:da
```

όçίάβίάέ υόέ ç έŪñόά άάί Ý÷άέ νόέιέόόάβ.

Άέά ίά νόέιβόάόά όçί έŪñόά οάό, έά ÷ñάέάόόάβά δñίíυίέά root. Ç νύειόσ όçδ έŪñόάό άέέόγίτδ ίδñíάβ ίά άβίάέ άδί όçί άñάñP άίόίεP ίά όί ifconfig(8) άέέŪ έά δñÝδάέ ίά όί άδάίάέŪάάόά οά έŪέά άδάίάέέβίçόç όίτ όόόόPíáόίδ. Όί άñ÷άβί /etc/rc.conf άβίάέ άέάβ υίτδ δñÝδάέ ίά δñίόέÝόάόά όέό νύειέόάέδ όçδ έŪñόάό άέέόγίτδ.

Άñίβίόά όί άñ÷άβί /etc/rc.conf ίά όίί άάάδçίÝίί οάό έάέίάñíñŪόί. Έά ÷ñάέάόόάβ ίά δñίόέÝόάόά ίβá άñάñP άέά έŪέά έŪñόά άέέόγίτδ δίτ όδŪñ÷άέ όόί όγόόçίά οάό, άέά δάñŪάάέάíά όόçί δάñβδδóç ίάό, έά δñÝδάέ ίά δñίόέÝόάόά όέ άíPδ άñάñÝδ:

```
ifconfig_dc0="inet 192.168.1.3 netmask 255.255.255.0"
ifconfig_dc1="inet 10.0.0.1 netmask 255.255.255.0 media 10baseT/UTP"
```

Έά δñÝδάέ ίά άίόέάάόάόόPóáάά όί dc0, dc1, έάέ ίγού έŪέά άíPδ, ίά όέό óúόόÝδ όόóέάóŪό όυί έάñόPί οάό, έάέ όέό óúόόÝδ άέάδóέγίόάέδ. Έά δñÝδάέ ίά άέάάŪόάάά όçί οάέβάά άίçέάβάδ όίτ ñçáγí έάέ όίτ ifconfig(8) άέά δάnéóóúόάναό έάδóñÝñέάό ó÷άόέέŪ ίά όέό άδóέóñάδñíáíáδ δάñάίÝόñίτδ έάέ άδβόçδ όçί οάέβάά άίçέάβάδ όίτ rc.conf(5) άέά δάnéóóúόάναό έάδóñÝñέάό ó÷άόέέŪ ίά όçί όγίόάίç όίτ /etc/rc.conf.

Άί νόέιβόάάά όί άβέδóί οάό έάόά όçί άάέάóŪόόάόç, ίάñέέÝδ άñάñÝδ ó÷άόέέŪ ίά όçί/όέό έŪñόά/έŪñόάό άέέόγίτδ έά όδŪñ÷ίτí Pç. ΆέÝάíάά άέδéŪ όί /etc/rc.conf δñίóίγ δñίόέÝόάά άδóδéÝίί άñάñÝδ.

Έά δñÝδάέ άδβόçδ ίά άέíñεPóáάά όί άñ÷άβί /etc/hosts Póáά ίά δñίόέÝόάάά όά íñíáάά έάέ όέό IP άέάγέδίόάέδ άδί όά άέŪóíñά ίç÷άíPíáάά όóί LAN οάό, άί άάί άβίάέ Pç νόέίέóίÝά. Άέά δάnéóóúόάναό δεçñίóñβάό άίάόñÝίόά όόçί οάέβάά άίçέάβάδ όίτ hosts(5) έάέ όίτ /usr/share/examples/etc/hosts.

12.8.3 ΆίέέίŪό έάέ Αδβέόóç ΔñíáέçίŪόύί

Íüέέδ έŪíáάά όέό άάóέέŪό άέέάáŪό όόί /etc/rc.conf, έά δñÝδάέ ίά άδάίάέέέίPóáάά όί όγόόçίά οάό. Αόόυί έά άδóέñÝóáέ όά δέέάíŪό άέέάáŪό όόέδ έŪñόάό ίά άóáñíóóίγί, έάέ ίά άδéáááέPóáάά υόέ όί όγόόçίά άδάíáέέέíáβ ÷ññβδ έάíÝίά έŪέíτδ όόέδ νόέιβόάέδ.

Íüέέδ όί όγόόçίά άδάíáέέέίçέάβ, έά δñÝδάέ ίά άíέέίŪόάάά όέό έŪñόάό άέέόγίτδ.

12.8.3.1 ΆίέέίŪάέíόάό ίέά Ethernet έŪñόά

Άέά ίά άδéáááέPóáάά υόέ ç Ethernet έŪñόά έάέόίτñáάβ óúόóŪ, έά δñÝδάέ ίά έŪíáάά άγί δñŪáíáάά. ΔñPóá, έŪíáά ping όçί έŪñόά όçί βάέά, έάέ ίάóŪ έŪíáά ping Ýίά Ūέέí ίç÷Ūίçίά όóί LAN.

ΔñPóá άíέέίŪόάά όόçί όίδéέP έŪñόά:

```
% ping -c5 192.168.1.3
PING 192.168.1.3 (192.168.1.3): 56 data bytes
64 bytes from 192.168.1.3: icmp_seq=0 ttl=64 time=0.082 ms
64 bytes from 192.168.1.3: icmp_seq=1 ttl=64 time=0.074 ms
64 bytes from 192.168.1.3: icmp_seq=2 ttl=64 time=0.076 ms
64 bytes from 192.168.1.3: icmp_seq=3 ttl=64 time=0.108 ms
64 bytes from 192.168.1.3: icmp_seq=4 ttl=64 time=0.076 ms

--- 192.168.1.3 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.074/0.083/0.108/0.013 ms
```

Ἐπιπέδου τοῦ δικτύου LAN:

```
% ping -c5 192.168.1.2
PING 192.168.1.2 (192.168.1.2): 56 data bytes
64 bytes from 192.168.1.2: icmp_seq=0 ttl=64 time=0.726 ms
64 bytes from 192.168.1.2: icmp_seq=1 ttl=64 time=0.766 ms
64 bytes from 192.168.1.2: icmp_seq=2 ttl=64 time=0.700 ms
64 bytes from 192.168.1.2: icmp_seq=3 ttl=64 time=0.747 ms
64 bytes from 192.168.1.2: icmp_seq=4 ttl=64 time=0.704 ms

--- 192.168.1.2 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.700/0.729/0.766/0.025 ms
```

Ἐπιπέδου ἰσχυρῶς ἐπικρατοῦσιν ἐὰν οἱ οὐκ ἐπιπέδου ἰσχυρῶς ἐπικρατοῦσιν 192.168.1.2 ἀπὸ τοῦ τοῦ ἰσχυρῶς ἐπικρατοῦσιν
ἰσχυρῶς ἐπικρατοῦσιν /etc/hosts.

12.8.3.2 Ἀστρονομία τοῦ δικτύου

Ἡ ἀστρονομία τοῦ δικτύου ἐστὶν ἡ ἐπιπέδου τοῦ δικτύου ἀστρονομία, ἢ ἡ ἐπιπέδου τοῦ δικτύου ἀστρονομία, ἢ ἡ ἐπιπέδου τοῦ δικτύου ἀστρονομία. Ἡ ἀστρονομία τοῦ δικτύου ἐστὶν ἡ ἐπιπέδου τοῦ δικτύου ἀστρονομία, ἢ ἡ ἐπιπέδου τοῦ δικτύου ἀστρονομία, ἢ ἡ ἐπιπέδου τοῦ δικτύου ἀστρονομία. Ἡ ἀστρονομία τοῦ δικτύου ἐστὶν ἡ ἐπιπέδου τοῦ δικτύου ἀστρονομία, ἢ ἡ ἐπιπέδου τοῦ δικτύου ἀστρονομία, ἢ ἡ ἐπιπέδου τοῦ δικτύου ἀστρονομία.

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```
ifconfig_fxp0_alias6="inet 202.0.75.19 netmask 255.255.255.255"
ifconfig_fxp0_alias7="inet 202.0.75.20 netmask 255.255.255.255"
```

12.10 Ἀνδρά Νότιβόαυι

12.10.1 Ἡ ἐάοῦεῖαιò /etc

Ὁά ἀνδρά νότιβόαυι ἀδρεῖεῖαιόαε ὁά ἐάοἰεῖαιòδ. Ἰἄνεῖβ ἀδῖ ἀδὸγὸ ἀβίάε:

<code>/etc</code>	Ἄἰεῖγὸ νότιβόαεò ὁῖ ὁδὸβιἰἰò, data here is system-specific.
<code>/etc/defaults</code>	Default versions of system configuration files.
<code>/etc/mail</code>	Extra sendmail(8) configuration, other MTA configuration files.
<code>/etc/ppp</code>	Configuration for both user- and kernel-ppp programs.
<code>/etc/namedb</code>	Default location for named(8) data. Normally <code>named.conf</code> and zone files are stored here.
<code>/usr/local/etc</code>	Configuration files for installed applications. May contain per-application subdirectories.
<code>/usr/local/etc/rc.d</code>	Start/stop scripts for installed applications.
<code>/var/db</code>	Automatically generated system-specific database files, such as the package database, the locate database, and so on

12.10.2 Hostnames

12.10.2.1 /etc/resolv.conf

`/etc/resolv.conf` dictates how FreeBSD's resolver accesses the Internet Domain Name System (DNS).

The most common entries to `resolv.conf` are:

<code>nameserver</code>	The IP address of a name server the resolver should query. The servers are queried in the order listed with a maximum of three.
<code>search</code>	Search list for hostname lookup. This is normally determined by the domain of the local hostname.
<code>domain</code>	The local domain name.

A typical `resolv.conf`:

```
search example.com
nameserver 147.11.1.11
nameserver 147.11.100.30
```

Ὀγῖαβύος: Only one of the `search` and `domain` options should be used.

If you are using DHCP, dhclient(8) usually rewrites `resolv.conf` with information received from the DHCP server.

12.10.2.2 `/etc/hosts`

`/etc/hosts` is a simple text database reminiscent of the old Internet. It works in conjunction with DNS and NIS providing name to IP address mappings. Local computers connected via a LAN can be placed in here for simplistic naming purposes instead of setting up a `named(8)` server. Additionally, `/etc/hosts` can be used to provide a local record of Internet names, reducing the need to query externally for commonly accessed names.

```
# $FreeBSD$
#
# Host Database
# This file should contain the addresses and aliases
# for local hosts that share this file.
# In the presence of the domain name service or NIS, this file may
# not be consulted at all; see /etc/nsswitch.conf for the resolution order.
#
#
::1                localhost localhost.my.domain myname.my.domain
127.0.0.1          localhost localhost.my.domain myname.my.domain

#
# Imaginary network.
#10.0.0.2          myname.my.domain myname
#10.0.0.3          myfriend.my.domain myfriend
#
# According to RFC 1918, you can use the following IP networks for
# private nets which will never be connected to the Internet:
#
#      10.0.0.0      -   10.255.255.255
#      172.16.0.0   -   172.31.255.255
#      192.168.0.0  -   192.168.255.255
#
# In case you want to be able to connect to the Internet, you need
# real official assigned numbers. PLEASE PLEASE PLEASE do not try
# to invent your own network numbers but instead get one from your
# network provider (if any) or from the Internet Registry (ftp to
# rs.internic.net, directory '/templates').
#
```

`/etc/hosts` takes on the simple format of:

```
[Internet address] [official hostname] [alias1] [alias2] ...
```

For example:

```
10.0.0.1 myRealHostname.example.com myRealHostname foobar1 foobar2
```

Consult `hosts(5)` for more information.

12.10.3 Log File Configuration

12.10.3.1 syslog.conf

syslog.conf is the configuration file for the syslogd(8) program. It indicates which types of syslog messages are logged to particular log files.

```
# $FreeBSD$
#
#      Spaces ARE valid field separators in this file. However,
#      other *nix-like systems still insist on using tabs as field
#      separators. If you are sharing this file between systems, you
#      may want to use only tabs as field separators here.
#      Consult the syslog.conf(5) manual page.
*.err;kern.debug;auth.notice;mail.crit       /dev/console
*.notice;kern.debug;lpr.info;mail.crit;news.err /var/log/messages
security.*                                   /var/log/security
mail.info                                    /var/log/maillog
lpr.info                                     /var/log/lpd-errs
cron.*                                       /var/log/cron
*.err                                        root
*.notice;news.err                           root
*.alert                                     root
*.emerg                                     *
# uncomment this to log all writes to /dev/console to /var/log/console.log
#console.info                               /var/log/console.log
# uncomment this to enable logging of all log messages to /var/log/all.log
#*.*                                         /var/log/all.log
# uncomment this to enable logging to a remote log host named loghost
#*.*                                         @loghost
# uncomment these if you're running inn
# news.crit                                  /var/log/news/news.crit
# news.err                                  /var/log/news/news.err
# news.notice                               /var/log/news/news.notice
!startslip
*.*                                         /var/log/slip.log
!ppp
*.*                                         /var/log/ppp.log
```

Consult the syslog.conf(5) manual page for more information.

12.10.3.2 newsyslog.conf

newsyslog.conf is the configuration file for newsyslog(8), a program that is normally scheduled to run by cron(8). newsyslog(8) determines when log files require archiving or rearranging. logfile is moved to logfile.0, logfile.0 is moved to logfile.1, and so on. Alternatively, the log files may be archived in gzip(1) format causing them to be named: logfile.0.gz, logfile.1.gz, and so on.

newsyslog.conf indicates which log files are to be managed, how many are to be kept, and when they are to be touched. Log files can be rearranged and/or archived when they have either reached a certain size, or at a certain periodic time/date.

```
# configuration file for newsyslog
# $FreeBSD$
#
# filename          [owner:group]    mode count size when [ZB] [/pid_file] [sig_num]
/var/log/cron              600 3    100 *    Z
/var/log/amd.log           644 7    100 *    Z
/var/log/kerberos.log     644 7    100 *    Z
/var/log/lpd-errs         644 7    100 *    Z
/var/log/maillog          644 7    *    @T00 Z
/var/log/sendmail.st      644 10   *    168 B
/var/log/messages        644 5    100 *    Z
/var/log/all.log          600 7    *    @T00 Z
/var/log/slip.log         600 3    100 *    Z
/var/log/ppp.log          600 3    100 *    Z
/var/log/security         600 10   100 *    Z
/var/log/wtmp             644 3    *    @01T05 B
/var/log/daily.log        640 7    *    @T00 Z
/var/log/weekly.log       640 5    1    $W6D0 Z
/var/log/monthly.log      640 12   *    $M1D0 Z
/var/log/console.log      640 5    100 *    Z
```

Consult the newsyslog(8) manual page for more information.

12.10.4 sysctl.conf

sysctl.conf looks much like rc.conf. Values are set in a variable=value form. The specified values are set after the system goes into multi-user mode. Not all variables are settable in this mode.

To turn off logging of fatal signal exits and prevent users from seeing processes started from other users, the following tunables can be set in sysctl.conf:

```
# Do not log fatal signal exits (e.g. sig 11)
kern.logsigexit=0

# Prevent users from seeing information about processes that
# are being run under another UID.
security.bsd.see_other_uids=0
```

12.11 Tuning with sysctl

sysctl(8) is an interface that allows you to make changes to a running FreeBSD system. This includes many advanced options of the TCP/IP stack and virtual memory system that can dramatically improve performance for an experienced system administrator. Over five hundred system variables can be read and set using sysctl(8).

At its core, sysctl(8) serves two functions: to read and to modify system settings.

To view all readable variables:

```
% sysctl -a
```

To read a particular variable, for example, `kern.maxproc`:

```
% sysctl kern.maxproc
kern.maxproc: 1044
```

To set a particular variable, use the intuitive `variable=value` syntax:

```
# sysctl kern.maxfiles=5000
kern.maxfiles: 2088 -> 5000
```

Settings of `sysctl` variables are usually either strings, numbers, or booleans (a boolean being 1 for yes or a 0 for no).

If you want to set automatically some variables each time the machine boots, add them to the `/etc/sysctl.conf` file. For more information see the `sysctl.conf(5)` manual page and the [Ὀἰβία 12.10.4](#).

12.11.1 sysctl(8) Read-only

In some cases it may be desirable to modify read-only `sysctl(8)` values. While this is sometimes unavoidable, it can only be done on `(re)boot`.

For instance on some laptop models the `cardbus(4)` device will not probe memory ranges, and fail with errors which look similar to:

```
cbb0: Could not map register memory
device_probe_and_attach: cbb0 attach returned 12
```

Cases like the one above usually require the modification of some default `sysctl(8)` settings which are set read only. To overcome these situations a user can put `sysctl(8)` “OIDs” in their local `/boot/loader.conf`. Default settings are located in the `/boot/defaults/loader.conf` file.

Fixing the problem mentioned above would require a user to set `hw.pci.allow_unsupported_io_range=1` in the aforementioned file. Now `cardbus(4)` will work properly.

12.12 Tuning Disks

12.12.1 Sysctl Variables

12.12.1.1 `vfs.vmiodirenable`

The `vfs.vmiodirenable` `sysctl` variable may be set to either 0 (off) or 1 (on); it is 1 by default. This variable controls how directories are cached by the system. Most directories are small, using just a single fragment (typically 1 K) in the file system and less (typically 512 bytes) in the buffer cache. With this variable turned off (to 0), the buffer cache will only cache a fixed number of directories even if you have a huge amount of memory. When turned on (to 1), this `sysctl` allows the buffer cache to use the VM Page Cache to cache the directories, making all the memory available for caching directories. However, the minimum in-core memory used to cache a directory is the physical page size (typically 4 K) rather than 512 bytes. We recommend keeping this option on if you are running any services which manipulate large numbers of files. Such services can include web caches, large mail systems, and news systems. Keeping this option on will generally not reduce performance even with the wasted memory but you should experiment to find out.

12.12.1.2 `vfs.write_behind`

The `vfs.write_behind` sysctl variable defaults to 1 (on). This tells the file system to issue media writes as full clusters are collected, which typically occurs when writing large sequential files. The idea is to avoid saturating the buffer cache with dirty buffers when it would not benefit I/O performance. However, this may stall processes and under certain circumstances you may wish to turn it off.

12.12.1.3 `vfs.hirunningspace`

The `vfs.hirunningspace` sysctl variable determines how much outstanding write I/O may be queued to disk controllers system-wide at any given instance. The default is usually sufficient but on machines with lots of disks you may want to bump it up to four or five *megabytes*. Note that setting too high a value (exceeding the buffer cache's write threshold) can lead to extremely bad clustering performance. Do not set this value arbitrarily high! Higher write values may add latency to reads occurring at the same time.

There are various other buffer-cache and VM page cache related sysctls. We do not recommend modifying these values, the VM system does an extremely good job of automatically tuning itself.

12.12.1.4 `vm.swap_idle_enabled`

The `vm.swap_idle_enabled` sysctl variable is useful in large multi-user systems where you have lots of users entering and leaving the system and lots of idle processes. Such systems tend to generate a great deal of continuous pressure on free memory reserves. Turning this feature on and tweaking the swapout hysteresis (in idle seconds) via `vm.swap_idle_threshold1` and `vm.swap_idle_threshold2` allows you to depress the priority of memory pages associated with idle processes more quickly than the normal pageout algorithm. This gives a helping hand to the pageout daemon. Do not turn this option on unless you need it, because the tradeoff you are making is essentially pre-page memory sooner rather than later; thus eating more swap and disk bandwidth. In a small system this option will have a determinable effect but in a large system that is already doing moderate paging this option allows the VM system to stage whole processes into and out of memory easily.

12.12.1.5 `hw.ata.wc`

FreeBSD 4.3 flirted with turning off IDE write caching. This reduced write bandwidth to IDE disks but was considered necessary due to serious data consistency issues introduced by hard drive vendors. The problem is that IDE drives lie about when a write completes. With IDE write caching turned on, IDE hard drives not only write data to disk out of order, but will sometimes delay writing some blocks indefinitely when under heavy disk loads. A crash or power failure may cause serious file system corruption. FreeBSD's default was changed to be safe. Unfortunately, the result was such a huge performance loss that we changed write caching back to on by default after the release. You should check the default on your system by observing the `hw.ata.wc` sysctl variable. If IDE write caching is turned off, you can turn it back on by setting the kernel variable back to 1. This must be done from the boot loader at boot time. Attempting to do it after the kernel boots will have no effect.

For more information, please see `ata(4)`.

12.12.1.6 `SCSI_DELAY` (`kern.cam.scsi_delay`)

The `SCSI_DELAY` kernel config may be used to reduce system boot times. The defaults are fairly high and can be responsible for 15 seconds of delay in the boot process. Reducing it to 5 seconds usually works (especially with

modern drives). Newer versions of FreeBSD (5.0 and higher) should use the `kern.cam.scsi_delay` boot time tunable. The tunable, and kernel config option accept values in terms of *milliseconds* and *not seconds*.

12.12.2 Soft Updates

The `tunefs(8)` program can be used to fine-tune a file system. This program has many different options, but for now we are only concerned with toggling Soft Updates on and off, which is done by:

```
# tunefs -n enable /filesystem
# tunefs -n disable /filesystem
```

A filesystem cannot be modified with `tunefs(8)` while it is mounted. A good time to enable Soft Updates is before any partitions have been mounted, in single-user mode.

Soft Updates drastically improves meta-data performance, mainly file creation and deletion, through the use of a memory cache. We recommend to use Soft Updates on all of your file systems. There are two downsides to Soft Updates that you should be aware of: First, Soft Updates guarantees filesystem consistency in the case of a crash but could very easily be several seconds (even a minute!) behind updating the physical disk. If your system crashes you may lose more work than otherwise. Secondly, Soft Updates delays the freeing of filesystem blocks. If you have a filesystem (such as the root filesystem) which is almost full, performing a major update, such as `make installworld`, can cause the filesystem to run out of space and the update to fail.

12.12.2.1 More Details about Soft Updates

There are two traditional approaches to writing a file systems meta-data back to disk. (Meta-data updates are updates to non-content data like inodes or directories.)

Historically, the default behavior was to write out meta-data updates synchronously. If a directory had been changed, the system waited until the change was actually written to disk. The file data buffers (file contents) were passed through the buffer cache and backed up to disk later on asynchronously. The advantage of this implementation is that it operates safely. If there is a failure during an update, the meta-data are always in a consistent state. A file is either created completely or not at all. If the data blocks of a file did not find their way out of the buffer cache onto the disk by the time of the crash, `fsck(8)` is able to recognize this and repair the filesystem by setting the file length to 0. Additionally, the implementation is clear and simple. The disadvantage is that meta-data changes are slow. An `rm -r`, for instance, touches all the files in a directory sequentially, but each directory change (deletion of a file) will be written synchronously to the disk. This includes updates to the directory itself, to the inode table, and possibly to indirect blocks allocated by the file. Similar considerations apply for unrolling large hierarchies (`tar -x`).

The second case is asynchronous meta-data updates. This is the default for Linux/ext2fs and `mount -o async` for *BSD ufs. All meta-data updates are simply being passed through the buffer cache too, that is, they will be intermixed with the updates of the file content data. The advantage of this implementation is there is no need to wait until each meta-data update has been written to disk, so all operations which cause huge amounts of meta-data updates work much faster than in the synchronous case. Also, the implementation is still clear and simple, so there is a low risk for bugs creeping into the code. The disadvantage is that there is no guarantee at all for a consistent state of the filesystem. If there is a failure during an operation that updated large amounts of meta-data (like a power failure, or someone pressing the reset button), the filesystem will be left in an unpredictable state. There is no opportunity to examine the state of the filesystem when the system comes up again; the data blocks of a file could already have been written to the disk while the updates of the inode table or the associated directory were not. It is actually impossible to implement a `fsck` which is able to clean up the resulting chaos (because the necessary information is not available

on the disk). If the filesystem has been damaged beyond repair, the only choice is to use newfs(8) on it and restore it from backup.

The usual solution for this problem was to implement *dirty region logging*, which is also referred to as *journaling*, although that term is not used consistently and is occasionally applied to other forms of transaction logging as well. Meta-data updates are still written synchronously, but only into a small region of the disk. Later on they will be moved to their proper location. Because the logging area is a small, contiguous region on the disk, there are no long distances for the disk heads to move, even during heavy operations, so these operations are quicker than synchronous updates. Additionally the complexity of the implementation is fairly limited, so the risk of bugs being present is low. A disadvantage is that all meta-data are written twice (once into the logging region and once to the proper location) so for normal work, a performance “pessimization” might result. On the other hand, in case of a crash, all pending meta-data operations can be quickly either rolled-back or completed from the logging area after the system comes up again, resulting in a fast filesystem startup.

Kirk McKusick, the developer of Berkeley FFS, solved this problem with Soft Updates: all pending meta-data updates are kept in memory and written out to disk in a sorted sequence (“ordered meta-data updates”). This has the effect that, in case of heavy meta-data operations, later updates to an item “catch” the earlier ones if the earlier ones are still in memory and have not already been written to disk. So all operations on, say, a directory are generally performed in memory before the update is written to disk (the data blocks are sorted according to their position so that they will not be on the disk ahead of their meta-data). If the system crashes, this causes an implicit “log rewind”: all operations which did not find their way to the disk appear as if they had never happened. A consistent filesystem state is maintained that appears to be the one of 30 to 60 seconds earlier. The algorithm used guarantees that all resources in use are marked as such in their appropriate bitmaps: blocks and inodes. After a crash, the only resource allocation error that occurs is that resources are marked as “used” which are actually “free”. fsck(8) recognizes this situation, and frees the resources that are no longer used. It is safe to ignore the dirty state of the filesystem after a crash by forcibly mounting it with `mount -f`. In order to free resources that may be unused, fsck(8) needs to be run at a later time. This is the idea behind the *background fsck*: at system startup time, only a *snapshot* of the filesystem is recorded. The `fsck` can be run later on. All file systems can then be mounted “dirty”, so the system startup proceeds in multiuser mode. Then, *background fscks* will be scheduled for all file systems where this is required, to free resources that may be unused. (File systems that do not use Soft Updates still need the usual foreground `fsck` though.)

The advantage is that meta-data operations are nearly as fast as asynchronous updates (i.e. faster than with *logging*, which has to write the meta-data twice). The disadvantages are the complexity of the code (implying a higher risk for bugs in an area that is highly sensitive regarding loss of user data), and a higher memory consumption. Additionally there are some idiosyncrasies one has to get used to. After a crash, the state of the filesystem appears to be somewhat “older”. In situations where the standard synchronous approach would have caused some zero-length files to remain after the `fsck`, these files do not exist at all with a Soft Updates filesystem because neither the meta-data nor the file contents have ever been written to disk. Disk space is not released until the updates have been written to disk, which may take place some time after running `rm`. This may cause problems when installing large amounts of data on a filesystem that does not have enough free space to hold all the files twice.

12.13 Tuning Kernel Limits

12.13.1 File/Process Limits

12.13.1.1 `kern.maxfiles`

`kern.maxfiles` can be raised or lowered based upon your system requirements. This variable indicates the maximum number of file descriptors on your system. When the file descriptor table is full, `file: table is full` will show up repeatedly in the system message buffer, which can be viewed with the `dmesg` command.

Each open file, socket, or fifo uses one file descriptor. A large-scale production server may easily require many thousands of file descriptors, depending on the kind and number of services running concurrently.

In older FreeBSD releases, the default value of `kern.maxfiles` is derived from the `maxusers` option in your kernel configuration file. `kern.maxfiles` grows proportionally to the value of `maxusers`. When compiling a custom kernel, it is a good idea to set this kernel configuration option according to the uses of your system. From this number, the kernel is given most of its pre-defined limits. Even though a production machine may not actually have 256 users connected at once, the resources needed may be similar to a high-scale web server.

As of FreeBSD 4.5, `kern.maxusers` is automatically sized at boot based on the amount of memory available in the system, and may be determined at run-time by inspecting the value of the read-only `kern.maxusers` sysctl. Some sites will require larger or smaller values of `kern.maxusers` and may set it as a loader tunable; values of 64, 128, and 256 are not uncommon. We do not recommend going above 256 unless you need a huge number of file descriptors; many of the tunable values set to their defaults by `kern.maxusers` may be individually overridden at boot-time or run-time in `/boot/loader.conf` (see the `loader.conf(5)` man page or the `/boot/defaults/loader.conf` file for some hints) or as described elsewhere in this document. Systems older than FreeBSD 4.4 must set this value via the kernel `config(8)` option `maxusers` instead.

In older releases, the system will auto-tune `maxusers` for you if you explicitly set it to 0¹. When setting this option, you will want to set `maxusers` to at least 4, especially if you are using the X Window System or compiling software. The reason is that the most important table set by `maxusers` is the maximum number of processes, which is set to $20 + 16 * \text{maxusers}$, so if you set `maxusers` to 1, then you can only have 36 simultaneous processes, including the 18 or so that the system starts up at boot time and the 15 or so you will probably create when you start the X Window System. Even a simple task like reading a manual page will start up nine processes to filter, decompress, and view it. Setting `maxusers` to 64 will allow you to have up to 1044 simultaneous processes, which should be enough for nearly all uses. If, however, you see the dreaded `proc table full` error when trying to start another program, or are running a server with a large number of simultaneous users (like `ftp.FreeBSD.org`), you can always increase the number and rebuild.

Όχιἄβύος: `maxusers` does *not* limit the number of users which can log into your machine. It simply sets various table sizes to reasonable values considering the maximum number of users you will likely have on your system and how many processes each of them will be running. One keyword which *does* limit the number of simultaneous remote logins and X terminal windows is pseudo-device `pty 16`. With FreeBSD 5.X, you do not have to worry about this number since the `pty(4)` driver is “auto-cloning”; you simply use the line `device pty` in your configuration file.

12.13.1.2 `kern.ipc.somaxconn`

The `kern.ipc.somaxconn` `sysctl` variable limits the size of the listen queue for accepting new TCP connections. The default value of 128 is typically too low for robust handling of new connections in a heavily loaded web server environment. For such environments, it is recommended to increase this value to 1024 or higher. The service daemon may itself limit the listen queue size (e.g. `sendmail(8)`, or **Apache**) but will often have a directive in its configuration file to adjust the queue size. Large listen queues also do a better job of avoiding Denial of Service (DoS) attacks.

12.13.2 Network Limits

The `NMBCLUSTERS` kernel configuration option dictates the amount of network Mbufs available to the system. A heavily-trafficked server with a low number of Mbufs will hinder FreeBSD's ability. Each cluster represents approximately 2 K of memory, so a value of 1024 represents 2 megabytes of kernel memory reserved for network buffers. A simple calculation can be done to figure out how many are needed. If you have a web server which maxes out at 1000 simultaneous connections, and each connection eats a 16 K receive and 16 K send buffer, you need approximately 32 MB worth of network buffers to cover the web server. A good rule of thumb is to multiply by 2, so $2 \times 32 \text{ MB} / 2 \text{ KB} = 64 \text{ MB} / 2 \text{ kB} = 32768$. We recommend values between 4096 and 32768 for machines with greater amounts of memory. Under no circumstances should you specify an arbitrarily high value for this parameter as it could lead to a boot time crash. The `-m` option to `netstat(1)` may be used to observe network cluster use.

`kern.ipc.nmbclusters` loader tunable should be used to tune this at boot time. Only older versions of FreeBSD will require you to use the `NMBCLUSTERS` kernel config(8) option.

For busy servers that make extensive use of the `sendfile(2)` system call, it may be necessary to increase the number of `sendfile(2)` buffers via the `NSFBUFS` kernel configuration option or by setting its value in `/boot/loader.conf` (see `loader(8)` for details). A common indicator that this parameter needs to be adjusted is when processes are seen in the `sfbufa` state. The `sysctl` variable `kern.ipc.nsfbufs` is a read-only glimpse at the kernel configured variable. This parameter nominally scales with `kern.maxusers`, however it may be necessary to tune accordingly.

Όχι!: Even though a socket has been marked as non-blocking, calling `sendfile(2)` on the non-blocking socket may result in the `sendfile(2)` call blocking until enough `struct sf_buf`'s are made available.

12.13.2.1 `net.inet.ip.portrange.*`

The `net.inet.ip.portrange.*` `sysctl` variables control the port number ranges automatically bound to TCP and UDP sockets. There are three ranges: a low range, a default range, and a high range. Most network programs use the default range which is controlled by the `net.inet.ip.portrange.first` and `net.inet.ip.portrange.last`, which default to 1024 and 5000, respectively. Bound port ranges are used for outgoing connections, and it is possible to run the system out of ports under certain circumstances. This most commonly occurs when you are running a heavily loaded web proxy. The port range is not an issue when running servers which handle mainly incoming connections, such as a normal web server, or has a limited number of outgoing connections, such as a mail relay. For situations where you may run yourself out of ports, it is recommended to increase `net.inet.ip.portrange.last` modestly. A value of 10000, 20000 or 30000 may be reasonable. You should also consider firewall effects when changing the port range. Some firewalls may block large ranges of ports (usually low-numbered ports) and expect systems to use higher ranges of ports for outgoing connections — for this reason it is not recommended that `net.inet.ip.portrange.first` be lowered.

12.13.2.2 TCP Bandwidth Delay Product

The TCP Bandwidth Delay Product Limiting is similar to TCP/Vegas in NetBSD. It can be enabled by setting `net.inet.tcp.inflight.enable` sysctl variable to 1. The system will attempt to calculate the bandwidth delay product for each connection and limit the amount of data queued to the network to just the amount required to maintain optimum throughput.

This feature is useful if you are serving data over modems, Gigabit Ethernet, or even high speed WAN links (or any other link with a high bandwidth delay product), especially if you are also using window scaling or have configured a large send window. If you enable this option, you should also be sure to set `net.inet.tcp.inflight.debug` to 0 (disable debugging), and for production use setting `net.inet.tcp.inflight.min` to at least 6144 may be beneficial. However, note that setting high minimums may effectively disable bandwidth limiting depending on the link. The limiting feature reduces the amount of data built up in intermediate route and switch packet queues as well as reduces the amount of data built up in the local host's interface queue. With fewer packets queued up, interactive connections, especially over slow modems, will also be able to operate with lower *Round Trip Times*. However, note that this feature only effects data transmission (uploading / server side). It has no effect on data reception (downloading).

Adjusting `net.inet.tcp.inflight.stab` is *not* recommended. This parameter defaults to 20, representing 2 maximal packets added to the bandwidth delay product window calculation. The additional window is required to stabilize the algorithm and improve responsiveness to changing conditions, but it can also result in higher ping times over slow links (though still much lower than you would get without the inflight algorithm). In such cases, you may wish to try reducing this parameter to 15, 10, or 5; and may also have to reduce `net.inet.tcp.inflight.min` (for example, to 3500) to get the desired effect. Reducing these parameters should be done as a last resort only.

12.13.3 Virtual Memory

12.13.3.1 kern.maxvnodes

A vnode is the internal representation of a file or directory. So increasing the number of vnodes available to the operating system cuts down on disk I/O. Normally this is handled by the operating system and does not need to be changed. In some cases where disk I/O is a bottleneck and the system is running out of vnodes, this setting will need to be increased. The amount of inactive and free RAM will need to be taken into account.

To see the current number of vnodes in use:

```
# sysctl vfs.numvnodes
vfs.numvnodes: 91349
```

To see the maximum vnodes:

```
# sysctl kern.maxvnodes
kern.maxvnodes: 100000
```

If the current vnode usage is near the maximum, increasing `kern.maxvnodes` by a value of 1,000 is probably a good idea. Keep an eye on the number of `vfs.numvnodes`. If it climbs up to the maximum again, `kern.maxvnodes` will need to be increased further. A shift in your memory usage as reported by `top(1)` should be visible. More memory should be active.

12.14 Adding Swap Space

No matter how well you plan, sometimes a system does not run as you expect. If you find you need more swap space, it is simple enough to add. You have three ways to increase swap space: adding a new hard drive, enabling swap over NFS, and creating a swap file on an existing partition.

For information on how to encrypt swap space, what options for this task exist and why it should be done, please refer to [Ὀἰκία 19.17](#) of the Handbook.

12.14.1 Swap on a New Hard Drive

The best way to add swap, of course, is to use this as an excuse to add another hard drive. You can always use another hard drive, after all. If you can do this, go reread the discussion of swap space in [Ὀἰκία 12.2](#) of the Handbook for some suggestions on how to best arrange your swap.

12.14.2 Swapping over NFS

Swapping over NFS is only recommended if you do not have a local hard disk to swap to; NFS swapping will be limited by the available network bandwidth and puts an additional burden on the NFS server.

12.14.3 Swapfiles

You can create a file of a specified size to use as a swap file. In our example here we will use a 64MB file called `/usr/swap0`. You can use any name you want, of course.

Διάγραμμα 12-1. Creating a Swapfile on FreeBSD

1. Be certain that your kernel configuration includes the memory disk driver (`md(4)`). It is default in `GENERIC` kernel.

```
device md # Memory "disks"
```
2. Create a swapfile (`/usr/swap0`):

```
# dd if=/dev/zero of=/usr/swap0 bs=1024k count=64
```
3. Set proper permissions on (`/usr/swap0`):

```
# chmod 0600 /usr/swap0
```
4. Enable the swap file in `/etc/rc.conf`:

```
swapfile="/usr/swap0" # Set to name of swapfile if aux swapfile desired.
```
5. Reboot the machine or to enable the swap file immediately, type:

```
# mdconfig -a -t vnode -f /usr/swap0 -u 0 && swapon /dev/md0
```

12.15 Power and Resource Management

It is important to utilize hardware resources in an efficient manner. Before ACPI was introduced, it was difficult and inflexible for operating systems to manage the power usage and thermal properties of a system. The hardware was managed by the BIOS and thus the user had less control and visibility into the power management settings. Some limited configurability was available via *Advanced Power Management (APM)*. Power and resource management is one of the key components of a modern operating system. For example, you may want an operating system to monitor system limits (and possibly alert you) in case your system temperature increased unexpectedly.

In this section of the FreeBSD Handbook, we will provide comprehensive information about ACPI. References will be provided for further reading at the end.

12.15.1 What Is ACPI?

Advanced Configuration and Power Interface (ACPI) is a standard written by an alliance of vendors to provide a standard interface for hardware resources and power management (hence the name). It is a key element in *Operating System-directed configuration and Power Management*, i.e.: it provides more control and flexibility to the operating system (OS). Modern systems “stretched” the limits of the current Plug and Play interfaces prior to the introduction of ACPI. ACPI is the direct successor to APM (Advanced Power Management).

12.15.2 Shortcomings of Advanced Power Management (APM)

The *Advanced Power Management (APM)* facility controls the power usage of a system based on its activity. The APM BIOS is supplied by the (system) vendor and it is specific to the hardware platform. An APM driver in the OS mediates access to the *APM Software Interface*, which allows management of power levels. APM should still be used for systems manufactured at or before the year 2000.

There are four major problems in APM. Firstly, power management is done by the (vendor-specific) BIOS, and the OS does not have any knowledge of it. One example of this, is when the user sets idle-time values for a hard drive in the APM BIOS, that when exceeded, it (BIOS) would spin down the hard drive, without the consent of the OS. Secondly, the APM logic is embedded in the BIOS, and it operates outside the scope of the OS. This means users can only fix problems in their APM BIOS by flashing a new one into the ROM; which is a very dangerous procedure with the potential to leave the system in an unrecoverable state if it fails. Thirdly, APM is a vendor-specific technology, which means that there is a lot of parity (duplication of efforts) and bugs found in one vendor’s BIOS, may not be solved in others. Last but not the least, the APM BIOS did not have enough room to implement a sophisticated power policy, or one that can adapt very well to the purpose of the machine.

Plug and Play BIOS (PNPBIOS) was unreliable in many situations. PNPBIOS is 16-bit technology, so the OS has to use 16-bit emulation in order to “interface” with PNPBIOS methods.

The FreeBSD APM driver is documented in the `apm(4)` manual page.

12.15.3 Configuring ACPI

The `acpi.ko` driver is loaded by default at start up by the `loader(8)` and should *not* be compiled into the kernel. The reasoning behind this is that modules are easier to work with, say if switching to another `acpi.ko` without doing a kernel rebuild. This has the advantage of making testing easier. Another reason is that starting ACPI after a system has been brought up often doesn’t work well. If you are experiencing problems, you can disable ACPI altogether. This driver should not and can not be unloaded because the system bus uses it for various hardware interactions.

ACPI can be disabled by setting `hint.acpi.0.disabled="1"` in `/boot/loader.conf` or at the `loader(8)` prompt.

Όχιἄβυός: ACPI and APM cannot coexist and should be used separately. The last one to load will terminate if the driver notices the other running.

ACPI can be used to put the system into a sleep mode with `acpiconf(8)`, the `-s` flag, and a 1–5 option. Most users will only need 1 or 3 (suspend to RAM). Option 5 will do a soft-off which is the same action as:

```
# halt -p
```

Other options are available via `sysctl(8)`. Check out the `acpi(4)` and `acpiconf(8)` manual pages for more information.

12.16 Using and Debugging FreeBSD ACPI

ACPI is a fundamentally new way of discovering devices, managing power usage, and providing standardized access to various hardware previously managed by the BIOS. Progress is being made toward ACPI working on all systems, but bugs in some motherboards' *ACPI Machine Language* (AML) bytecode, incompleteness in FreeBSD's kernel subsystems, and bugs in the Intel ACPI-CA interpreter continue to appear.

This document is intended to help you assist the FreeBSD ACPI maintainers in identifying the root cause of problems you observe and debugging and developing a solution. Thanks for reading this and we hope we can solve your system's problems.

12.16.1 Submitting Debugging Information

Όχιἄβυός: Before submitting a problem, be sure you are running the latest BIOS version and, if available, embedded controller firmware version.

For those of you that want to submit a problem right away, please send the following information to `freebsd-acpi@FreeBSD.org` (`mailto:freebsd-acpi@FreeBSD.org`):

- Description of the buggy behavior, including system type and model and anything that causes the bug to appear. Also, please note as accurately as possible when the bug began occurring if it is new for you.
- The `dmesg(8)` output after `boot -v`, including any error messages generated by you exercising the bug.
- The `dmesg(8)` output from `boot -v` with ACPI disabled, if disabling it helps fix the problem.
- Output from `sysctl hw.acpi`. This is also a good way of figuring out what features your system offers.
- URL where your *ACPI Source Language* (ASL) can be found. Do *not* send the ASL directly to the list as it can be very large. Generate a copy of your ASL by running this command:

```
# acpidump -dt > name-system.asl
```

(Substitute your login name for `name` and manufacturer/model for `system`. Example: `njl-FooCo6000.asl`)

Most of the developers watch the `FreeBSD-CURRENT` (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-current>) but please submit problems to `freebsd-acpi` (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-acpi>) to be sure it is seen. Please be patient, all of us have full-time jobs elsewhere. If your bug is not immediately apparent, we will probably ask you to submit a PR via `send-pr(1)`. When entering a PR, please include the same information as requested above. This will help us track the problem and resolve it. Do not send a PR without emailing `freebsd-acpi` (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-acpi>) first as we use PRs as reminders of existing problems, not a reporting mechanism. It is likely that your problem has been reported by someone before.

12.16.2 Background

ACPI is present in all modern computers that conform to the ia32 (x86), ia64 (Itanium), and amd64 (AMD) architectures. The full standard has many features including CPU performance management, power planes control, thermal zones, various battery systems, embedded controllers, and bus enumeration. Most systems implement less than the full standard. For instance, a desktop system usually only implements the bus enumeration parts while a laptop might have cooling and battery management support as well. Laptops also have suspend and resume, with their own associated complexity.

An ACPI-compliant system has various components. The BIOS and chipset vendors provide various fixed tables (e.g., FADT) in memory that specify things like the APIC map (used for SMP), config registers, and simple configuration values. Additionally, a table of bytecode (the *Differentiated System Description Table* DSDT) is provided that specifies a tree-like name space of devices and methods.

The ACPI driver must parse the fixed tables, implement an interpreter for the bytecode, and modify device drivers and the kernel to accept information from the ACPI subsystem. For FreeBSD, Intel has provided an interpreter (ACPI-CA) that is shared with Linux and NetBSD. The path to the ACPI-CA source code is `src/sys/contrib/dev/acpica`. The glue code that allows ACPI-CA to work on FreeBSD is in `src/sys/dev/acpica/osd`. Finally, drivers that implement various ACPI devices are found in `src/sys/dev/acpica`.

12.16.3 Common Problems

For ACPI to work correctly, all the parts have to work correctly. Here are some common problems, in order of frequency of appearance, and some possible workarounds or fixes.

12.16.3.1 Mouse Issues

In some cases, resuming from a suspend operation will cause the mouse to fail. A known work around is to add `hint.psm.0.flags="0x3000"` to the `/boot/loader.conf` file. If this does not work then please consider sending a bug report as described above.

12.16.3.2 Suspend/Resume

ACPI has three suspend to RAM (STR) states, S1-S3, and one suspend to disk state (STD), called S4. S5 is “soft off” and is the normal state your system is in when plugged in but not powered up. S4 can actually be implemented two separate ways. S4BIOS is a BIOS-assisted suspend to disk. S4OS is implemented entirely by the operating system.

Start by checking `sysctl hw.acpi` for the suspend-related items. Here are the results for a Thinkpad:

```
hw.acpi.supported_sleep_state: S3 S4 S5
hw.acpi.s4bios: 0
```

This means that we can use `acpicnf -s` to test S3, S4OS, and S5. If `s4bios` was one (1), we would have S4BIOS support instead of S4 OS.

When testing suspend/resume, start with S1, if supported. This state is most likely to work since it does not require much driver support. No one has implemented S2 but if you have it, it is similar to S1. The next thing to try is S3. This is the deepest STR state and requires a lot of driver support to properly reinitialize your hardware. If you have problems resuming, feel free to email the `freebsd-acpi` (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-acpi>) list but do not expect the problem to be resolved since there are a lot of drivers/hardware that need more testing and work.

To help isolate the problem, remove as many drivers from your kernel as possible. If it works, you can narrow down which driver is the problem by loading drivers until it fails again. Typically binary drivers like `nvidia.ko`, X11 display drivers, and USB will have the most problems while Ethernet interfaces usually work fine. If you can properly load/unload the drivers, you can automate this by putting the appropriate commands in `/etc/rc.suspend` and `/etc/rc.resume`. There is a commented-out example for unloading and loading a driver. Try setting `hw.acpi.reset_video` to zero (0) if your display is messed up after resume. Try setting longer or shorter values for `hw.acpi.sleep_delay` to see if that helps.

Another thing to try is load a recent Linux distribution with ACPI support and test their suspend/resume support on the same hardware. If it works on Linux, it is likely a FreeBSD driver problem and narrowing down which driver causes the problems will help us fix the problem. Note that the ACPI maintainers do not usually maintain other drivers (e.g sound, ATA, etc.) so any work done on tracking down a driver problem should probably eventually be posted to the `freebsd-current` (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-current>) list and mailed to the driver maintainer. If you are feeling adventurous, go ahead and start putting some debugging `printf(3)`s in a problematic driver to track down where in its resume function it hangs.

Finally, try disabling ACPI and enabling APM instead. If suspend/resume works with APM, you may be better off sticking with APM, especially on older hardware (pre-2000). It took vendors a while to get ACPI support correct and older hardware is more likely to have BIOS problems with ACPI.

12.16.3.3 System Hangs (temporary or permanent)

Most system hangs are a result of lost interrupts or an interrupt storm. Chipsets have a lot of problems based on how the BIOS configures interrupts before boot, correctness of the APIC (MADT) table, and routing of the *System Control Interrupt* (SCI).

Interrupt storms can be distinguished from lost interrupts by checking the output of `vmstat -i` and looking at the line that has `acpi0`. If the counter is increasing at more than a couple per second, you have an interrupt storm. If the system appears hung, try breaking to DDB (**CTRL+ALT+ESC** on console) and type `show interrupts`.

Your best hope when dealing with interrupt problems is to try disabling APIC support with `hint.apic.0.disabled="1"` in `loader.conf`.

12.16.3.4 Panics

Panics are relatively rare for ACPI and are the top priority to be fixed. The first step is to isolate the steps to reproduce the panic (if possible) and get a backtrace. Follow the advice for enabling `options DDB` and setting up a serial console (see [Ὀἰκία 27.6.5.3](#)) or setting up a `dump(8)` partition. You can get a backtrace in DDB with `tr`. If you have to handwrite the backtrace, be sure to at least get the lowest five (5) and top five (5) lines in the trace.

Then, try to isolate the problem by booting with ACPI disabled. If that works, you can isolate the ACPI subsystem by using various values of `debug.acpi.disable`. See the `acpi(4)` manual page for some examples.

12.16.3.5 System Powers Up After Suspend or Shutdown

First, try setting `hw.acpi.disable_on_poweroff="0"` in `loader.conf(5)`. This keeps ACPI from disabling various events during the shutdown process. Some systems need this value set to 1 (the default) for the same reason. This usually fixes the problem of a system powering up spontaneously after a suspend or poweroff.

12.16.3.6 Other Problems

If you have other problems with ACPI (working with a docking station, devices not detected, etc.), please email a description to the mailing list as well; however, some of these issues may be related to unfinished parts of the ACPI subsystem so they might take a while to be implemented. Please be patient and prepared to test patches we may send you.

12.16.4 ASL, `acpidump`, and IASL

The most common problem is the BIOS vendors providing incorrect (or outright buggy!) bytecode. This is usually manifested by kernel console messages like this:

```
ACPI-1287: *** Error: Method execution failed [\\_SB_.PCI0.LPC0.FIGD._STA] \\
(Node 0xc3f6d160), AE_NOT_FOUND
```

Often, you can resolve these problems by updating your BIOS to the latest revision. Most console messages are harmless but if you have other problems like battery status not working, they are a good place to start looking for problems in the AML. The bytecode, known as AML, is compiled from a source language called ASL. The AML is found in the table known as the DSDT. To get a copy of your ASL, use `acpidump(8)`. You should use both the `-t` (show contents of the fixed tables) and `-d` (disassemble AML to ASL) options. See the [Submitting Debugging Information](#) section for an example syntax.

The simplest first check you can do is to recompile your ASL to check for errors. Warnings can usually be ignored but errors are bugs that will usually prevent ACPI from working correctly. To recompile your ASL, issue the following command:

```
# iasl your.asl
```

12.16.5 Fixing Your ASL

In the long run, our goal is for almost everyone to have ACPI work without any user intervention. At this point, however, we are still developing workarounds for common mistakes made by the BIOS vendors. The Microsoft interpreter (`acpi.sys` and `acpiec.sys`) does not strictly check for adherence to the standard, and thus many BIOS vendors who only test ACPI under Windows never fix their ASL. We hope to continue to identify and document exactly what non-standard behavior is allowed by Microsoft's interpreter and replicate it so FreeBSD can work without forcing users to fix the ASL. As a workaround and to help us identify behavior, you can fix the ASL

manually. If this works for you, please send a diff(1) of the old and new ASL so we can possibly work around the buggy behavior in ACPI-CA and thus make your fix unnecessary.

Here is a list of common error messages, their cause, and how to fix them:

12.16.5.1 _OS dependencies

Some AML assumes the world consists of various Windows versions. You can tell FreeBSD to claim it is any OS to see if this fixes problems you may have. An easy way to override this is to set `hw.acpi.osname="Windows 2001"` in `/boot/loader.conf` or other similar strings you find in the ASL.

12.16.5.2 Missing Return statements

Some methods do not explicitly return a value as the standard requires. While ACPI-CA does not handle this, FreeBSD has a workaround that allows it to return the value implicitly. You can also add explicit Return statements where required if you know what value should be returned. To force `iasl` to compile the ASL, use the `-f` flag.

12.16.5.3 Overriding the Default AML

After you customize your `.asl`, you will want to compile it, run:

```
# iasl your.asl
```

You can add the `-f` flag to force creation of the AML, even if there are errors during compilation. Remember that some errors (e.g., missing Return statements) are automatically worked around by the interpreter.

`DSDT.aml` is the default output filename for `iasl`. You can load this instead of your BIOS's buggy copy (which is still present in flash memory) by editing `/boot/loader.conf` as follows:

```
acpi_dsdt_load="YES"
acpi_dsdt_name="/boot/DSDT.aml"
```

Be sure to copy your `DSDT.aml` to the `/boot` directory.

12.16.6 Getting Debugging Output From ACPI

The ACPI driver has a very flexible debugging facility. It allows you to specify a set of subsystems as well as the level of verbosity. The subsystems you wish to debug are specified as “layers” and are broken down into ACPI-CA components (`ACPI_ALL_COMPONENTS`) and ACPI hardware support (`ACPI_ALL_DRIVERS`). The verbosity of debugging output is specified as the “level” and ranges from `ACPI_LV_ERROR` (just report errors) to `ACPI_LV_VERBOSE` (everything). The “level” is a bitmask so multiple options can be set at once, separated by spaces. In practice, you will want to use a serial console to log the output if it is so long it flushes the console message buffer. A full list of the individual layers and levels is found in the `acpi(4)` manual page.

Debugging output is not enabled by default. To enable it, add `options ACPI_DEBUG` to your kernel configuration file if ACPI is compiled into the kernel. You can add `ACPI_DEBUG=1` to your `/etc/make.conf` to enable it globally. If it is a module, you can recompile just your `acpi.ko` module as follows:

```
# cd /sys/modules/acpi/acpi
&& make clean &&
```

```
make ACPI_DEBUG=1
```

Install `acpi.ko` in `/boot/kernel` and add your desired level and layer to `loader.conf`. This example enables debug messages for all ACPI-CA components and all ACPI hardware drivers (CPU, LID, etc.). It will only output error messages, the least verbose level.

```
debug.acpi.layer="ACPI_ALL_COMPONENTS ACPI_ALL_DRIVERS"
debug.acpi.level="ACPI_LV_ERROR"
```

If the information you want is triggered by a specific event (say, a suspend and then resume), you can leave out changes to `loader.conf` and instead use `sysctl` to specify the layer and level after booting and preparing your system for the specific event. The `sysctls` are named the same as the tunables in `loader.conf`.

12.16.7 References

More information about ACPI may be found in the following locations:

- The ACPI FreeBSD (http://lists.FreeBSD.org/mailman/listinfo/freebsd-acpi)
- The ACPI Mailing List Archives http://lists.freebsd.org/pipermail/freebsd-acpi/
- The old ACPI Mailing List Archives http://home.jp.FreeBSD.org/mail-list/acpi-jp/
- The ACPI 2.0 Specification http://acpi.info/spec.htm
- FreeBSD Manual pages: `acpi(4)`, `acpi_thermal(4)`, `acpidump(8)`, `iasl(8)`, `acpidb(8)`
- DSDT debugging resource (http://www.cpqlinux.com/acpi-howto.html#fix_broken_dsdt). (Uses Compaq as an example but generally useful.)

Ὁπότερο

1. The auto-tuning algorithm sets `maxusers` equal to the amount of memory in the system, with a minimum of 32, and a maximum of 384.

Ϊ Άέα÷άέέέόðð Æέέβίçòçð boot0: Õι MBR ðιò άάέάέβóóάόάέ áðu ðι ðññáñáñιá άάέάóÛóóάóçð ðιò FreeBSD P ðι boot0cfg(8), άάóβæάόάέ áðu ðññιáðέέίτãP óði /boot/boot0. (Õι ðññáñáñιá **boot0** άβιáέ ðιέy áðëù, έáèðò ι έβáέέάð óði MBR ιðññάβ ιά Ý÷άέ ιÝάάέιð ùð 446 bytes, άιáέóβáð ðιò ðβιáέά έáóáòιPóáùι (slice table) έáέ ðιò άιáιúñέέóóέέιy 0x55AA ðιò άñβóέάάόάέ óði óÝειð ðιò MBR.) Áι Ý÷άόά άάέάόάóðPóáέ ðι **boot0** έáέ ðιέέάðέÛ έáέóιòñάέέÛ óóóðPιáóá óóιòð óέέçñιyð άβóέιòð óáð, έá άάβóά έáóÛ óçι áέέβίçòç, ιέá ιέυιç ðáññιέά ιá óçι ðáñάέÛòù:

ÐáñÛάάέαíá 13-1. boot0 Screenshot

```
F1 DOS
F2 FreeBSD
F3 Linux
F4 ??
F5 Drive 1

Default: F2
```

¶έέá έáέóιòñάέέÛ óóóðPιáóá, έáέ áέάέέùðάñá óá Windows, άβιáέ áιúóóù yóέ ãñÛóιòι ðι άέέù óιòð MBR ðÛú óá έÛðιέι Pæç óðÛñ÷ιι. Áι óáð óóιáάβ áóóù, P áι έÛέáóá ιά áιðέέάόάóóPóáóá ðι óðÛñ÷ιι MBR óáð ιá áóóù ðιò FreeBSD, ÷ñçóέιιðιέPóóá óçι áέυειòèç áιòιέP:

```
# fdisk -B -b /boot/boot0 device
```

üðιò device άβιáέ ç óóóέάðP áðu óçι ιðñιá άβιáóáέ áέέβίçòç, üðòð ð.÷. ðι ad0 áέá ðιι ðñðòι άβóέι IDE, ðι ad2 áέá ðιι ðñðòι IDE άβóέι óði άáóðάñáyιιóá áέááέòP, ðι da0 áέá ðιι ðñðòι SCSI άβóέι έ.ι.έ. Áι ðÛέέ έÛέáóá ðñιóáñιòιÝιç ãýέιέόç ðιò MBR, ÷ñçóέιιðιέPóóá ðι boot0cfg(8).

Ϊ Άέα÷άέέέóðð Æέέβίçòçð LILO. Άέά ιá άάέάóáóóPóáóá áóóù ðι άέá÷άέέέóðð áέέβίçòçð þóóá ιá ιðññάβ ιá áέέέιάβ ðι FreeBSD, άάέάóáóóPóóá ðñðóá ðι Linux έáέ ðñιòέÝóóá óçι áέυειòèç έáóá÷þñçóç óði óðÛñ÷ιι áñ÷άβι ãñ÷έιβóáùι /etc/lilo.conf:

```
other=/dev/hdXY
table=/dev/hdX
loader=/boot/chain.b
label=FreeBSD
```

Óði ðáñáðÛú, έáέñβóóá ðι ðñùóáyιι áέáιÝñέóιá έáέ ðι άβóέι ðιò FreeBSD áιðέέάέέóóðPιáóð ðι x ιá ðι ãñÛιá άβóέιò έáέ ðι y ιá ðιι άñέέιù ðιò ðñùóáyιιòιð áέάιñβóιáóιò, ÷ñçóέιιðιέPιáóð üùð óçι ιññιáðιέPιáóá ðιò Linux. Áι ÷ñçóέιιðιέάβóá ιäçäù SCSI έá ÷ñάέάóðáβ ιá áέέÛιáðá ðι /dev/hd óá έÛóέ áιðβóóιέ÷ιι /dev/sd. Ç áñáιìP loader=/boot/chain.b ιðññάβ ιá ðáñάέάέóèáβ άι Ý÷άόά έáέ óá áyι έáέóιòñάέέÛ óóóðPιáóá óóιι βáέι άβóέι. ΆέóáέÝóóá ðññá óçι áιòιέP /sbin/lilo -v áέá ιá έáóá÷üñPóáóá óéð ιÝáð áέέάáÝð óáð óði óyóóçιá. Ιðññáβóá ιá óéð áðέάάáέPóáóá áέÝã÷ιιóáð óá ιçιyιáóá ðιò έá áιðáιέóóιyι óçι ιέυιç óáð.

13.3.2 Õι ÓóÛάέι Ϊá, /boot/boot1, έáέ ðι ÓóÛάέι Άyι, /boot/boot2

ΪóóάóóέέÛ, ðι ðñðòι έáέ ááyóáñι óóÛάέι άβιáέ ðιPιáóá ðιò βáέιò ðññáñÛιáóιò, óóçι βáέá ðáñέι÷P ðιò άβóέιò. Èuáù ðáñέñέóιþι ÷þñιò Ý÷ιòι ÷ñέóóáβ óá áyι, áέέÛ άάέάέβóóáίόάέ ðÛιðá ιάæβ. ÁιðέáñÛóιíóάέ áðu ðι óóιáóáóιÝιι áñ÷άβι /boot/boot áðu ðι ðññáñáñιá άάέάóÛóóάóçð P ðι **bsdlabel** (άάβóá ðáñάέÛòù).

Άñβóέιíðáέ Ýú ãðu óóóðPιáóá áñ÷άβι, óóçι ðñðòç ðñι÷έÛ (track) ðιò slice áέέβίçòçð, ιάέέPιáóð áðu ðιι ðñðòι ðñÝá. Άβιáέ ðι óçιάβι üðιò ðι boot0, P ιðιέιíáððιòá Ûέέιò áέá÷άέέέóðð áέέβίçòçð, áιáιÝιáέ ιá áñάέ ðññáñáñιá ðñιò

άέοΰεάος ιά ðι ιðιβι έά οóιá÷έόόάβ ç áέαάεάόβα άέέβίςοςò. Ĩ άñέειυò ðυι ðñΰιι ðιò ÷ñçóειιðιέιγίόάέ ιðιñáβ ιά άñάέáβ άγέιεά áðu ðι ιΰάάειò ðιò άñ÷áβιò /boot/boot.

Οι boot1 άβίάέ ðιέγ áðευ, ιέα έάέ ιðιñáβ ιά άβίάέ ιυιι 512 bytes οά ιΰάάειò, έάέ άíυñβæάέ υόά ÷ñάέΰæάόάέ áέα ðι *bsdlabel* ðιò FreeBSD, ðι ιðιβι άðιεçέάγáέ ðεçñιιιðιñáò ð÷áðέέΰ ιά ðι slice, þóðá ιά άñάέ έάέ ιά áέðáέΰόάέ ðι boot2.

Οι boot2 άβίάέ áεάóñΰ ðει ðιέγðειει έάέ έάóάιñáβ áðáñεþ ðι óγóóçιá άñ÷áβιι ðιò FreeBSD þóðá ιά ιðιñáβ ιά άñάέ άñ÷áβá οά áóðu, έάέ ιðιñáβ áðβóçò ιά ðáñΰ÷áέ ιέα áðεþ áέαðáðþ ιά ðι ÷ñþóç þóðá ιά ιðιñáβ ιά άβίάέ ç áðέειáþ ðιò ðñþíá þ ðιò ðñιáñΰιáðιò óυñðuóçò ðιò έά áέðáέáóóáβ.

Οι boot2 óοιþεùò áέðáέáβ ðιι loader (óιñðuðþð áέέβίςοςò) ι ιðιβιò άβίάέ άίάέñáðέέΰ ðει ðιέγðειειò, áεεΰ ðáñΰ÷áέ ΰίá υñάβι έάέ άγέιει ðñυðι ñγέιέοςò ðçò áέέβίςοςò. Ðάέέυðáñá ðι boot2 άίάέΰιáάίá ιά óιñðuþóáέ áðáðéáβáð ðιι ðñþíá.

Ðáñΰáέειá 13-2. Άέέυιá áðu ðι boot2

```
>> FreeBSD/i386 BOOT
Default: 0:ad(0,a)/boot/loader
boot:
```

Άί ÷ñάέáóóáβ ðιòΰ ιά áίóέέáóáóðþóáðá ðá ááέáóáóóçιΰίá boot1 έάέ boot2 ÷ñçóειιðιέεþóðá ðι *bsdlabel(8)*:

```
# bsdlabel -B diskslice
```

υðιò ðι *diskslice* άβίάέ ι áβóειò έάέ ðι slice áðu ðι ιðιβι áβίáóáέ ç áέέβίςοςò, υðυò ð.÷. ad0s1 áέα ðι ðñþøι slice óοιι ðñþøι IDE áβóει.

Άðέέβιáðιá Áοιόέυιΰίç Έáðΰóóáóç (Dangerously Dedicated Mode): Άί ÷ñçóειιðιέεþóðá ιυιι ðι υιιá ðιò áβóειò, υðυò ð.÷. ad0, óðçι áίðιεþ *bsdlabel(8)* έά áçιέιòñáþóáðá ΰίá áðέέβιáðιá áοιόέυιΰίι áβóει, ÷υñβò slices. Άβίάέ ð÷ááυι óβáιòñι υðέ ááι εΰεáðá ιά ðι εΰιáðá áóðu, áε' áóðu óεáιòñáðóáβðá υðέ áεΰáιáðá ðçι áίðιεþ *bsdlabel(8)* ðñει ðέΰóáðá **Return**.

13.3.3 Óóΰáει Όñβá, /boot/loader

Ĩ loader, þ ðιñðuðþð áέέβίςοςò, άβίάέ ðι ðáέέέυι óóΰáει ðιò óðóðþιáðιò áέέβίςοςò ðñεþι óóááβυι, έάέ άñβóέáðáέ óοι óγóóçιá άñ÷áβυι, óðιþεùò υð /boot/loader.

Ðñιιñέοιυò ðιò loader άβίάέ ιά ðáñΰ÷áέ ιέα ιΰειáι ñγέιέοςò óέέέεþ ðñιò ðι ÷ñþóç, έάέ ÷ñçóειιðιέέáβ ΰίá άγέιει óγίει áίðιεþι, ðι ιðιβι ðιιόóçñβæáðáέ áðu ΰίá έó÷òñυ ιáðáóñáóðþ áίðιεþι ιá ΰίá ðιεòðειειυðáñι óγίει áίðιεþι.

13.3.3.1 Νιþ ðιò Ðñιáñΰιáðιò Loader

Έáðΰ ðçι άñ÷έειðιβçóç, ι loader έά άίέ÷íáγóáέ ðçι ειιούεá έάέ ðιòð áβóειòð έάέ έά έάειñβóáέ áðu ðιει áβóει áβίáóáέ ç áέέβίςοςò. Έá ñðειβóáέ έáðΰεεçέá ðέð áίóβóει÷áð ιáðááεçðΰð έάέ έά ιáέειþóáέ ΰίá ðñυáñáñιá ιáðΰñáçò áίðιεþι (interpreter) óοι ιðιβι ιðιñáβ ι ÷ñþóçò ιά άβίάέ áίðιεΰð, áβóá áðáðéáβáð, áβóá ιΰóυ εΰðιέειò script.

Ĩ loader έáóυðει έά áέαáΰóáέ ðι άñ÷áβι /boot/loader.rc, ðι ιðιβι ιá ðç óáέñΰ ðιò áέαáΰæάέ, áðu ðñιáðέειáþ, ðι /boot/defaults/loader.conf. Ĩΰóá áðu ðι άñ÷áβι áóðu ðβεáίóáέ ειáέέΰð ðñιáðέέáñιΰíáð óειΰð áέα εΰðιέáð ιáðááεçðΰð. Ðáέóá, áέαáΰæάóáέ ðι άñ÷áβι /boot/loader.conf áέα ðð÷ιι ðιðέέΰð áέέááΰð óóέð ιáðááεçðΰð

áððÝð. Εάðóðεί ðι loader.rc ÷ ñçóειιðιείáβ áððÝð ðέð ιáðááεçðÝð, ðιñðβñιíðáð ðá áñεñβιáðá (modules) εάέ ðιι ððñβιá ðιò Ý ÷ áε áðέέáááβ.

ÔáεέέÛ, ι loader, ðáñειÝιáέ 10 ááððáñüεáððá (ðñιáðέέááιÝñι ÷ ñιιέέü äεÛóçιá) áεá ðçι ðβáçç èÛðιείιð ðεðέðñιò, εάέ áι ááι ððÛñιáε ðáñÝιááçç áðu ðιι ÷ ñβóçç, ιáειíÛáε ðιι ððñβιá. Áι áβιáε ðáñÝιááçç, áιðáιβæáðáε ððιι ÷ ñβóçç ιέá ðñιòñιðβ ç ιðιβι εάðáñιáβ ðι áγειει ðýñει áíðιειβι ðιò áíáçÝñáιá ðñιçáιðιÝñò, εάέ ùðιò ι ÷ ñβóçç ðιðñáβ ιá ñðειβðáε ιáðááεçðÝð, ιá áðιòιñðβóáε üεá ðá áñεñβιáðá, ιá ðιñðβóáε áñεñβιáðá εάέ ðáεέέÛ ιá ðñιááβ ðá áέέβίççç β ðáíááέέβίççç.

13.3.3.2 ÁíðιέÝð ÁίóυιáðυιÝιáð óðι Loader

ÐáñáεÛðυ èá ááβðá ðέð ðει óð ÷ íÛ ÷ ñçóειιðιείιγίáíáð áíðιέÝð ðιò loader. Áεá ðáñέóóυðáñáð εáððιñÝñáεáð ð ÷ áðέέέÛ ιá üεáð ðέð áεáέÝóειáð áíðιέÝð, ðáñáέáειγίá ιá ááβðá ðι loader(8).

autoboot *seconds*

Ðñι ÷ ùñÛ óççι áέέβίççç ðιò ððñβιá, áι ááι ððÛñιáε ðáñÝιááçç áðu ðι ÷ ñβóçç ιÝóá ððι εάειñέóιÝñι ÷ ñιιέέü äεÛóçιá ðιò áβιáðáε ðá ááððáñüεáððá. Αðáέειιβæáε áíðβóðñιòç ιÝðñççç, εάέ ι ðñιáðέέááιÝñò ÷ ñυíñð áβιáé ðá 10 ááððáñüεáððá.

boot [-options] [kernelname]

Ðñι ÷ ùñÛáε Ûιááçç óççι áέέβίççç ðιò ððñβιá, ÷ ñçóειιðιειβιðáð ùðιέáð ðð ÷ ùι áðέειáÝð Ý ÷ ιðι áñεáβ εάέ ðι ùñíá ðιò ððñβιá ðιò εá áέðáεáðóáβ áι Ý ÷ áε áðβççð áñεáβ. Áεá ιá áðβáðá áεáðιñáðέέü ùñíá ððñβιá óççι áñáñιð áíðιέβð, εá ðñÝðáε ðñβðá ιá ÷ ñçóειιðιειβιðáðá ðççι áíðιέβ *unload*. ÁεáðιñáðέέÛ, εá ÷ ñçóειιðιειçεáβ ι ððñβιáð ðιò Ý ÷ áε ðιñðυεáβ βáç.

boot-conf

ÁεáðñÝ ÷ áε ðççι áððυιáðç ñýèιέçç ðυι áñεñβιÛðυι (module) ðιò ááβæáðáε ðá ιáðááεçðÝð, ιá ðιι βáει ðñυðι ðιò áβιáðáε εάέ ðá εáñιέέβ áέέβίççç. Αððυ Ý ÷ áε ιüçιá ιüñι áι ÷ ñçóειιðιειβιðáðá ðñβðá ðι *unload* εάέ áέέÛιáðá èÛðιέáð ιáðááεçðÝð, ððιðεùð ðι kernel.

help [topic]

Ááβ ÷ ιáε ιçγίγίáðá áñιεáέáð, ðá ιðιβá áεááÛæειðáε áðu ðι /boot/loader.help. Áι ðι topic (εÝιá) ðιò áυεççá áβιáé ç εÝιçç *index*, εá ááβðá ιέá εβóðá ιá ðá áεáέÝóειá εÝιáðá áñιεáέáð.

include *filename* ...

ΑðáñáñáÛæáðáε ðι áñ ÷ áβι ιá ðι ùñíá áñ ÷ áβιò ðιò áυεççá (filename). Áβιáðáε áíÛáñóçç εάέ áñáñιð ðñιò áñáñιð ιáðÛðñáçç ðιò áñ ÷ áβιò. Ç áíðιέβ *include* óðáιáðÛáε Ûιáóá áι áíðιέóóáβ èÛðιει εÛειð.

load [-t type] *filename*

Ôιñðβιáε ðιι ððñβιá, ðι Ûñεñβιá ððñβιá β Ýιá áñ ÷ áβι ðιò ðýðιò ðιò εάειñβóçççá, ιá áÛóçç ðι ùñíá áñ ÷ áβιò ðιò áυεççá. Áι ιáðÛ ðι ùñíá áñ ÷ áβιò ððÛñ ÷ ιðι ðáñÛιáðñιέ, ðáñιείγίðáε ùð ðáñÛιáðñιέ ððι áñ ÷ áβι ðιò ðιñðβιáðáε.

ls [-l] [path]

Ááβ ÷ ιáε Ýιá εáðÛειáñ ðυι áñ ÷ áβυι ðççç áεááñιñð ðιò áυεççá, β áι ááι εάειñβóçççá áεááñιñβ, ðιò ñέáέειγί εάðáεüáñιò. Áι áñεáβ εάε ç áðέειáβ -1 εá áιðáιβæειðáε áðβççðç εάε ðá ιááÝεçç ðυι áñ ÷ áβυι.

lsdev [-v]

Άιόάίβæάέ üεάò ðέò óðóέάòÝò áðü ðέò ιðιβáò áβίáέ äóíáòP ç öüñòùòç áñèñüìÜòùí. Άί äíεάβ íá ðçí áðέέíäP -v, àìòáíβæííóáέ ðáñέóóüòáñáò εάðòñÝñáέáò.

lsmod [-v]

Άιόάίβæάέ óá áñèñβíáóá ðιò Ý÷-íòí öíñòùεάβ. Άί äíεάβ ç áðέέíäP -v, àìòáíβæííóáέ ðáñέóóüòáñáò εάðòñÝñáέáò.

more *filename*

Άιόάίβæάέ ðí áñ÷áβí ðιò εάέíñβæáóáέ, íá ðάýóáέò εÜεá LINES áñέέüü áñáñβí.

reboot

Άðáíáέέέíäβ Üíáóá ðí óýóçíá.

set *variable*

set *variable=value*

Έάέíñβæάέ íáóááεçòÝò ðáñέáÜέέííòò áέá ðíí loader.

unload

Άðíöíñòβíáέ üεá óá áñèñβíáóá.

13.3.3.3 Ðáñáááβáíáóá áέá ðíí Loader

Άäp εá áñáβóá íáñέέÜ ðñáέóέέÜ ðáñáááβáíáóá ó÷áðέέÜ íá ðçí ð-ñPóç ðιò loader:

- Άέá íá íáέέíPóáòá ðí óðίçέέóíÝíí ðòñPíá óáò, áέέÜ óá εáòÜóóáóç áíüð ð-ñPóç:

```
boot -s
```

- Άέá íá áðíöíñòPóáòá ðí óðίçέέóíÝíí ðòñPíá óáò εάέ íá öíñòPóáòá ðíí ðáέέü óáò (P εÜðíέí Üέέí):

```
unload
```

```
load kernel.old
```

Íðíñáβóá íá ð-ñçóέííðíεPóáòá ðí üíñá kernel.GENERIC áέá íá áíáóáñεáβóá óòíí áñ÷έέü (generic) ðòñPíá í íðíβíò ððÜñ÷áέ óðí CD ðçò ááέáòÜóóáóçò, P ðí kernel.old áέá íá áíáóáñεáβóá óòíí ðòñPíá ðιò áβ÷áòá ááέáóáóçíÝíí ðñέí (áέá ðáñÜááέáíá, ðíí ðáέέü óáò ðòñPíá áí εÜíáòá ðñüóóáóá ñýεíέóç εάέ ááέáòÜóóáóç íÝíò áέέíý óáò ðñíóáñíóíÝííò ðòñPíá).

Óçíáβüóç: ×ñçóέííðíεPóáòá ðí ðáñáέÜòü áέá íá öíñòPóáòá ðá óðίçέέóíÝíá óáò áñèñβíáóá óá εÜðíέí Üέέí ðòñPíá:

```
unload
```

```
set kernel="kernel.old"
```

```
boot-conf
```

- Άέá íá öíñòPóáòá Ýíá script ñýεíέóçò ðòñPíá (Ýíá áóòíñáòíðíεçíÝíí ðñüáñáíá ðí íðíβí áέòáεáβ ðέò εάέóíòñáβáò ðιò εáñíέέÜ εá εÜíáóá íÝóü εÜðíέíò ðñíáñÜíáóíò ñýεíέóçò ðòñPíá εáòÜ ðçí áέέβίçóç):

```
load -t userconfig_script /boot/kernel.conf
```

13.3.3.4 ΆνάοέεP Ìεùίç Άέέβίçόçò

Ç ανάοέεP Ìεùίç άέέβίçόçò (splash screen) άçίείρòñάάβ Ýίá ðεί άò ÷ Ûñέóòί ðáñέαΰεείí óá ó ÷ Ýόç Ìá óçί άðεP άðάέεùίέóç ðùí Ìçíòìΰòùí άέέβίçόçò óá ÌñòP έάειΎíñ. Ç ανάοέεP Ìεùίç άέέβίçόçò άìóáíβæάðάέ ùò ùòìò ðì όύóóçíá ðòΰóáέ óçί ðñìòñìðP áέóúäìò (login), άβòá óçί έίíóúεά, άβòá óòί άñάóέεù ðáñέαΰεείí.

Òì FreeBSD áεάεΎóáέ äÿí ááóέέΰ ðáñέαΰεείíóá. Òì ðñòì άβίáέ ðì ðñìáðέεάáìΎíí ðáñέαΰεείí έάειΎíñò áñáìðò áíóìεðí (είíóúεά). Ìáòΰ ðì ðΎεìò óçò άέέβίçόçò, άìóáíβæάðάέ óçί έίíóúεά Ìέα ðñìòñìðP áέóúäìò. Òì áäÿóáñì, άβίáέ ðì άñάóέεù ðáñέαΰεείí ðìò ðáñΎ ÷ άðάέ áðù ðì όύóóçíá × 11. Ìáòΰ óçί άεάεòΰóðáóç ðìò X11 έάέ áíùð áðù ðìòð άñάóέείÿò áέα ÷ áέñέóðΎð ðáñάέÿñùí P desktop, ùðùð άβίáέ óá **GNOME**, **KDE** P **XFce**, Ìðìñάβòá Ìá ÌáέείPóáðá ðì άñάóέεù ðáñέαΰεείí Ìá óçί áíóìεP startx.

Ìáñέεíβ ÷ ñPóóáð ðñìòείÿí Ìá óíáΎííóáέ óòì όύóóçíá ÌΎóù άñάóέεPð Ìεùίç áέóúäìò, áíòβ Ìá ÷ ñçóέííðìέίÿí óçί ðñìòñìðP áέóúäìò óçò έίíóúεáð. Ç áðíáðùòçòá áðòP ðáñΎ ÷ άðάέ áðì áέα ÷ áέñέóðΎð Ìεùίçò, ùðùð Ì **XDM** áέα ðì **Xorg**, ð **gdm** áέα ðì **GNOME** έάέ Ì **kdm** áέα ðì **KDE** (έάεPð έάέ ΰεείíòð ðìò áεάðβεáííóáέ óçç ÓóεείíP ðùí Ports). Ìáòΰ áðù Ìέα áðέóð ÷ çíΎίç áβòìäì, ðáñìòóέΰæáðάέ ΰíáóá óòì ÷ ñPóóç ðì άñάóέεù ðáñέαΰεείí óçò áðέείíPð ðìò.

Óòì ðáñέαΰεείí óçò áñáìðò áíóìεðí, ç άñάóέεP Ìεùίç άέέβίçόçò έá áðìέñÿóáέ ùεά óá Ìçíÿíáðá áíβ ÷ Ìáóóçò ðùí óóóέáðí έάέ ððçñáóεðí, ÌΎ ÷ ñέ óçί άìòΰίέóç óçò ðñìòñìðP áέóúäìò. Ìá áðáðεάβáð άέέβίçόç óá ðáñέαΰεείí X11, ç άìðáεñβá άέέβίçόçò έá άβίáέ áέùíá ðεί έάεáñP, έάέ έá Ìεΰæáέ ðáñέóóúðáñì Ìá óçί áíóβòðìέ ÷ ç óá Ýíá ðáñέαΰεείí Microsoft Windows P ΰεείí Ìç-UNIX óðóðPíáðìò.

13.3.3.4.1 Έάέòìòñáβá óçò ΆñάóέεPð Ìεùίçò Άέέβίçόçò

Ç άñάóέεP Ìεùίç άέέβίçόçò ððìóðçñβæáέ Ìüíí áέέùíáð bitmap (.bmp) P ZSoft PCX (.pcx) 256 ÷ ñùìΰòùí. Άðέðñùóεáðá, Ìέ áέέùíáð ðìò ÷ ñçóέííðìέίÿíóáέ ðñΎðáέ Ìá Ύ ÷ Ìòí áíΰεòóç 320x200 P Ìέέñùðáñç áέα Ìá έάέòìòñáPóíòí óá ðððέέίÿò ðñìóáñìñááβò Ìεùίçò VGA.

Άέα Ìá ÷ ñçóέííðìέPóáðá Ìáááέÿóáñáð áέέùíáð, ÌΎ ÷ ñέ óçί ÌΎάέóóç áíΰεòóç ðùí 1024x768 pixels, áíáñáíðìέPóáðá óçί ððìóðPñέίç VESA ðìò ðáñέεáìáΰíáðάέ óòì FreeBSD. Ìðìñάβòá Ìá óçί áíáñáíðìέPóáðá ðìòñòPñííóáð ðì Ûñέñùíá VESA έáòΰ óçί άέέβίçόç ðìò óðóðPíáðìò, ç ðñìóεΎòííóáð óçί áðέείíP VESA óòì áñ ÷ áβì ñòεìβóáùí ðìò ðòñPíá, έάέ άçίείρòñáPíóáð Ýíá ÌΎí ðñìóáñìòìΎíí ðòñPíá (Έáοΰεάει 9). Ç ððìóðPñέίç VESA άβίáέ óòìòð ÷ ñPóóáð óçί áðíáðùòçòá Ìá ÷ ñçóέííðìέPóíòí Ìέα áέέùíá ðìò Ìá έάέÿððáέ ùεç óçί Ìεùίç.

Ìðìñάβòá Ìá ááβòá ðá έáñíέέΰ Ìçíÿíáðá άέέβίçόçò ùòì άìóáíβæáðάέ ç άñάóέεP Ìεùίç άέέβίçόçò, ðέΎæííðáð áðεPð ÌðìέíáPðìòá ðεPέòñì.

Ç Ìεùίç άέέβίçόçò áβíáðάέ áðβóçò ç ðñìáðέεάáìΎίç ðñìòÿέáίç Ìεùίçò, ùòì ðì όύóóçíá έάέòìòñááβ óá ðáñέαΰεείí έίíóúεáð. Ìáòΰ áðù εΰðìέí ÷ ñííέέù áέΰóóçíá ááñΰíáέáð, ç Ìεùίç áεεΰæáέ, áðáέείíβæííóáð óçί áέέùíá ðìò ÷ ñçóέííðìέPεçέá óçί άέέβίçόçò, Ìá έðέέέέP áíáέέááP óçò ðùðáέíùòçòáð áðù ðìέÿ ðùðáέíP ùò ðìέÿ óέííóáέíP. Ìðìñάβòá Ìá áεεΰíáðá áðòP óçί ðñìáðέεάáìΎίç ðñìòÿέáίç Ìεùίçò, ðñìóεΎòííóáð Ìέα áñáìP saver= óòì áñ ÷ áβì /etc/rc.conf. Άέα óçί áðέείíP saver=, ððΰñ ÷ Ìòí áñεáòΎð áíóùíáðùíΎíáð ðñìòóεΰíáέò Ìεùίçò áέα Ìá áðέέΎíáðá. Ìðìñάβòá Ìá ááβòá óçί ðεPñç εβòá óçç óáεβáá manual ðìò splash(4). Ç ðñìáðέεάáìΎίç ðñìòÿέáίç Ìεùίçò Ìñΰæáðάέ “warp”. ÓçíáέPóðá ùέé ç ðñìòÿέáίç Ìεùίçò ðìò έáεíñβæáðάέ óòì áñ ÷ áβì /etc/rc.conf ÌΎóù óçò áðέείíPð saver= Ύ ÷ áέ áðβáñáóç Ìüíí óóέð áέέííέέΎð έίíóúεáð. Άáí áðçñáΰæáέ έáεùέìò ðì άñάóέεù ðáñέαΰεείí X11.

Éΰðìέα Ìçíÿíáðá άέέβίçόçò áíáέìέìòέίÿí Ìá άìóáíβæííóáέ, áέùíá έάέ Ìáòΰ óçί áòáñìñáP óçò άñάóέεPð Ìεùίçò άέέβίçόçò. Óá Ìçíÿíáðá áòòΰ ðáñέεáìáΰííòí ðì Ìáñÿ áðέείíPí άέέβίçόçò έάέ óçί áíóβòðñìòç ÌΎðñçóç ÷ ñüíñò ðìò ðì óðñááÿάέ.

Ìðìñάβòá Ìá έáðááΰóáðá ððìááβáñíáðá áέέùíí Ìέα ÷ ñPóç óççί άέέβίçόçò, áðù óç óðέείíP áέέùíí óççί ðìðìέáóβá <http://artwork.freebsdgr.org> (<http://artwork.freebsdgr.org/node/3>). Άí ááέáðáóðPóáðá ðì Port `sysutils/bsd-splash-changer`, έá Ύ ÷ áòá ðð ÷ áβá áíáέέááP áέέùíí (ðìò έá áðέέΎáííóáέ áðù Ìέα Ύòìέç óðέείíP) óá εΰεá άέέβίçόçò ðìò óðóðPíáðìò.

13.3.3.4.2 Ἀἰῖα ἑξοχῶς ὁç Ἀἡῖα ἑξοχῶς ἑξοχῶς Ἀεῖβίτζοç

Ὀῖ ἄν ÷ ἄβῖ ðῖο εἶ ÷ ἡçοεῖῖῖῖῖῖῖῖ ἄεῖ ὁç ἡἡῖῖῖῖῖῖ ἑξοχῶς Ἀεῖβίτζοç (ὁγῖῖῖ .bmp P .pcx) εἶ ḁἡ Ὑḁἄε ἰἶ ὁῖῖῖῖῖῖῖῖ ὁç ἡἡῖῖῖῖῖῖ (root) εἶ ἰῖῖῖῖῖῖῖ, ἄεῖ ḁἡ Ὑḁἄεῖῖῖῖ ὁῖῖ ἑἶ Ὑῖῖῖῖ /boot/.

Ἀεῖ ὁç ḁἡῖῖῖῖῖῖῖ Ὑῖῖ ἰῖῖῖῖῖῖ ἑξοχῶς (320x200 P ἑῖῖῖῖῖῖῖ, 256 ÷ ἡἡῖῖῖῖῖ), ἰῖῖῖῖῖῖῖῖῖ ὁῖ ἄν ÷ ἄβῖ /boot/loader.conf ἡῖῖῖ ἰῖ ḁἡῖῖῖῖ Ὑῖῖ ὁἶ ḁἡ ἑἶ ḁἡῖῖῖῖῖῖ:

```
splash_bmp_load="YES"
bitmap_load="YES"
bitmap_name="/boot/splash.bmp"
```

Ἀεῖ ἰῖῖῖῖῖῖῖῖ ἰῖῖῖῖῖῖῖῖ, ἰῖῖῖ ÷ ἡῖ ὁç ἰῖῖῖῖῖῖ 1024x768, ἰῖῖῖῖῖῖῖῖῖῖ ὁῖ ἄν ÷ ἄβῖ /boot/loader.conf ἡῖῖῖ ἰῖ ḁἡῖῖῖῖ Ὑῖῖ ὁῖ ḁἡῖῖῖῖῖῖ:

```
vesa_load="YES"
splash_bmp_load="YES"
bitmap_load="YES"
bitmap_name="/boot/splash.bmp"
```

Ὀῖ ḁἡῖῖῖῖῖῖ ὁῖῖῖ Ὑḁἄε ἰῖῖ ὁç ἡçοεῖῖῖῖῖῖῖῖ ὁῖ ἄν ÷ ἄβῖ /boot/splash.bmp ἄεῖ ὁç ἡἡῖῖῖῖῖῖ ἑξοχῶς Ἀεῖβίτζοç. Ἀἰ ἑῖῖῖῖῖῖ ἰῖ ÷ ἡçοεῖῖῖῖῖῖῖῖῖ ἄεῖῖῖῖ ὁγῖῖῖῖ PCX, ÷ ἡçοεῖῖῖῖῖῖῖῖῖ ὁῖῖ ḁἡῖῖῖῖῖῖ ἰῖῖῖῖῖῖ Ὑḁἄεῖῖῖ Ὑḁἄεῖῖῖῖ ὁç ἡἡῖῖῖῖῖῖ vesa_load="YES", ἰῖῖῖῖῖῖ ἰῖ ὁç ἰῖῖῖῖῖῖ:

```
splash_pcx_load="YES"
bitmap_load="YES"
bitmap_name="/boot/splash.pcx"
```

Ὀῖ ἰῖῖῖ ἄν ÷ ἄβῖ ἰῖ ἄβῖῖῖ ἰῖῖῖῖῖῖῖ ἰῖ ἄβῖῖῖ “splash” ἰῖῖῖ ὁἶῖῖῖῖῖῖ ὁῖῖ ḁἡῖῖῖῖῖῖ ḁἡ Ὑḁἄεῖῖῖῖῖῖ. ἰῖῖῖῖῖ ἰῖ ἄβῖῖῖ ἰῖῖῖῖῖῖῖῖ ἰῖ ḁἡῖῖῖῖῖῖῖ ἄεῖ ἄν ÷ ἄβῖ ὁγῖῖῖῖῖῖ BMP P PCX, ἰῖῖῖ ἄεῖ ḁἡ Ὑḁἄεῖῖῖῖῖῖῖ splash_640x400.bmp P blue_wave.pcx.

ḁἡῖῖῖῖῖῖ ὁἶῖῖῖῖῖ ἰῖῖῖῖῖ Ὑḁἄεῖῖῖ ἰῖῖῖῖῖ ἰῖῖῖῖῖῖ ἰῖῖῖῖῖ Ὑḁἄεῖῖῖ Ὑḁἄεῖῖῖ ὁῖῖ ἰῖῖῖῖῖῖ ἰῖ ἰῖῖῖῖῖῖ ἰῖ ÷ ἡçοεῖῖῖῖῖῖῖῖ ὁῖῖ /boot/loader.conf:

```
beastie_disable="YES"
```

Ç ἰῖῖῖῖῖῖ ἰῖῖῖ ἑἶῖῖῖῖῖῖ ὁç ἰῖῖῖῖῖῖῖ ὁῖῖ ἰῖῖῖ ἰῖῖῖῖῖῖ ἰῖῖῖῖῖῖῖ. ḁἡῖῖῖ Ὑḁἄεῖῖ ἰῖῖῖῖῖ ὁç ἰῖῖῖῖῖῖῖῖ ἰῖῖῖῖῖ ἰῖ ὁç ḁἡῖῖῖῖῖῖ ἰῖῖῖῖῖῖῖῖ ἰῖῖῖῖῖῖῖῖ. Ἀεῖῖῖῖ ἑἶῖ ἰῖῖῖ ἰῖῖ ἰῖῖῖῖῖῖῖῖ ὁῖ ἰῖῖῖῖῖ ἰῖῖῖῖῖῖῖῖ, ἰῖ ἰῖ ἰῖῖῖῖῖῖ ἑῖῖῖῖῖ ἰῖῖ ἰῖῖῖῖῖῖῖ ὁç ἰῖῖῖῖῖῖῖ ὁῖῖ ḁἡῖῖῖῖῖῖῖ ἰῖῖ ἰῖῖῖῖῖ ἰῖῖῖῖῖῖῖῖ, Ç ἰῖῖῖῖῖῖ ἰῖῖῖῖῖ ὁç ἑῖῖ ÷ Ὑḁἄεῖῖ ἰῖῖ ὁç ἰῖῖῖῖῖῖῖ.

```
loader_logo="beastie"
```

Ç ἰῖῖῖῖῖῖ ἰῖῖῖ ἰῖῖῖῖῖ ὁῖ ἑἶῖῖῖῖῖ “FreeBSD” ḁἡ ἰῖῖῖῖῖῖῖῖ ὁῖῖ ἰῖῖῖῖ ἰῖῖῖῖῖῖ ὁῖῖ ἰῖῖῖῖῖ ἰῖῖῖῖῖῖῖῖῖ, ἰῖ Ὑḁἄεῖῖ Ὑḁἄεῖῖ ἰῖῖῖῖῖῖ ὁῖῖ beastie, ἰῖῖῖ ἰῖῖῖῖῖῖῖῖ ὁῖῖ ἰῖῖῖῖῖῖῖῖῖ ἰῖῖῖῖῖῖῖῖ.

Ἀεῖ ḁἡῖῖῖῖῖῖῖῖ ḁἡῖῖῖῖῖῖῖῖ, ḁἡῖῖῖῖῖῖῖῖ ἰῖῖῖῖῖῖ ὁῖῖ ὁῖῖῖῖῖῖῖ manual splash(4), loader.conf(5) ἑἶῖ vga(4).

13.4 Άέέçεάðβñάόç ιά ðιί ðññβία έάôÛ ôçί Άέέβίζόç

Άðυ ôç óέέαιð ðιò ι ðññβιάð ðιñòυέάβ, άβόά ιΰού ðιò loader (υðò óóιðεùð) άβόά ιΰού ðιò boot2 (ðññάέÛιðòιιόάð ðιί loader), άñάðÛεάέ óέð ðññάιΰðñιòð άέέβίζόçò (boot flags), άί ððÛñ÷ιòί, έέέ ðñιόάñιüεάέ άίÛειää ôç óòιðñέçòιñÛ ðιò.

13.4.1 ðññάέÛòυέά άέέβίζόçò ðññβία (Boot Flags)

ðññάέÛòυέά έά άñάβόά óέð ðεί óóιçέέçòιΰιάð ðññάιΰðñιòð άέέβίζόçò:

-a

έάðÛ ôç άέÛñέάέά ôçò άέέβίζόçò, έά άβιάέ άñðóçóç άέά ôçί óóóέάðð áðυ ôçί ιðιβά έά άβιάέ ç ðñιόÛñóçóç ðιò ñεεέειγ (root) óóóðβιάðιò άñ÷άβιι.

-c

άέέβίζόç άðυ ðι CDROM.

-c

άέðΰεάóç ðιò UserConfig, ðιò ðñιññÛιιάðιò ñýειέóçò ðññβία έάðÛ ôçί άέέβίζόç.

-s

άέέβίζόç óά έάðÛóóάóç έάέçòιðñάβáð άιυð ÷ñðóç (single user).

-v

άιòÛιέóç ðññέóóυðάñιι ðεçñιòιñέβι έάðÛ ôç άέÛñέάέά άέέβίζόçò ðιò ðññβία.

Óçιάβυóç: ÕðÛñ÷ιòί έέέ Ûεεάð ðññÛιιáðñιέ άέέβίζόçò, áέάáÛóðá ôç óάεβää boot(8) έέά ðññέóóυðάñαò ðεçñιòιñβáð ó÷άðééÛ ιά áóðΰð.

13.5 Device Hints

ΈáðÛ ôç άέÛñέάέά ôçò άñ÷έεðð άέέβίζόçò ðιò óóóðβιάðιò, ðι ðññññññιá ðιò boot loader(8) άέάáÛεάέ ðι άñ÷άβιι device.hints(5). Õι άñ÷άβιι áðòυ ðññέΰ÷άέ ðεçñιòιñβáð άέέβίζόçò άέά ðιí ðññβία, άιυóóΰð υð ιάóάάεçðΰð, ιέ ιðιβáð ιñέέΰð ðιñΰð άιáóΰñιιόάέ áðβóçò έέέ υð “device hints”. ΆððÛ óά “device hints” ÷ñçóçιιðιέιγίόάέ άðυ ðññññÛιιáðά ιáðεçóçò óóóέάðβιι έέά ñýειέóç ðυιι άίðβóðιέ÷ιι óóóέάðβιι.

Ïðñιγίá áðβóçò ιá ιñβóιòιá Device hints óççι ðñιðñιðð ðιò Óðááβιò 3 ðιò boot loader. Ïέ ιάðάάεçðΰð ðιðñιγίι ιá ιñέóçòιγίι ιá ÷ñðóç ôçð άιðιεðð set, έέέ ιá áóáέñάειγίι ιá ôçί unset. Ïðñιγίá áðβóçò ιá óέð άιòάιβóιòιá ιá ôçί άιðιεðð show. Άέυιá, ðιðñιγίá άáð ιá ðññάέÛιøιòιá έέέ ιá άέéÛιòιá ôçι ðειð ιáðάάεçðβιι ðιò ΰ÷ιòιι ñέóóáβ óòι άñ÷άβιι /boot/device.hints. Õά Device hints ðιò ιñβæιòιá óòι boot loader άάι ðññάιΰñιòιι ιιιέιá έέέ άαι έá έó÷γòιòι óççι áðυιáç άέέβίζόç.

ÏáðÛ ôçί άέέβίζόçò ðιò óóóðβιάðιò, ðιññάβ ιá ÷ñçóçιιðιέçεάβ ç άιðιεðð kenv(1) έέά ιá άιðάιέóçòιγίι ιέ ðειΰð υέυιι ðυιι ιáðάάεçðβιι.

Ïι οοίόάεοέεü ðιò áñ÷áβιò /boot/device.hints áβιáέ ιέα ιάòááεçòP áíÛ áñáñìP, έάέ ÷ñçοείιðιέαβòάέ ðιò ðòðιðιέçìÝñí “#” áέα áñáñìÝò ðιò áçεþñιíóáέ ùò ó÷÷εέá. Ìέ áñáñìÝò áçιέιòñáιγíóáέ üðùò öáβιáòáέ ðáñáέÛòù:

```
hint.driver.unit.keyword="value"
```

Ç óγíóáιç áέα ðιò ÓòÛáει 3 ðιò boot loader áβιáέ:

```
set hint.driver.unit.keyword=value
```

üðιò driver áβιáέ ðιò üñíá ðιò ιάçáιγý óòóέáòPò, unit áβιáέ ι áñέèìüò ïιíÛááò ðçò óòóέáòPò, έάέ keyword áβιáέ ç εÝιç-έέαέáβ áέα ðιò óòáέáñέñιÝñí hint. Ç εÝιç-έέαέáβ ïðιñáβ ιá áðιòáέáβòάέ áðü ðέò áέüειòεáò áðέειáÝò:

- at: έάέιñβæáέ ðιò áβáðει (bus) óòιí ιðιβι ðñιόáñòÛòάέ ç óòóέáòP.
- port: έάέιñβæáέ ðçι áñ÷έεP áέαγέðιόç ðçò εγñáð I/O ðιò έá ÷ñçοείιðιέçέáβ.
- irq: έάέιñβæáέ ðιí áñέèìü ðçò áβòççòçò áέαέιðPò (interrupt request) ðιò έá ÷ñçοείιðιέçέáβ.
- drq: έάέιñβæáέ ðιí áñέèìü ðιò έáιáέέιγ DMA.
- maddr: έάέιñβæáέ ðç ðòóέεP áέαγέðιόç ιíPιçò ðιò έáðáέáιáÛíáòάέ áðü ðç óòóέáòP.
- flags: ïñβæáέ áεÛοιñá bits ðáñáιÝòññì áέα ðçι óòóέáòP.
- disabled: Áι ïñέóòáβ óá ðειP 1, ç óòóέáòP áðáíáñáιðιέαβòάέ.

Ìέ ιάçáιβ óòóέáòPι ïðιñáβ ιá äÝ÷ιíóáέ (P ιá áðáέοιγí) ðáñέóóüðáñá hints óá ιðιβá ááι öáβιíóáέ ááþ, έάέ óáò óοιέóòιγíá ιá ááβòá ðçι áíóβòðιέ÷ç óáεβáá manual ðιò εÛεá ιάçáιγý. Άέα ðáñέóóüðáñáð ðεçñιòïñβáð óòιáιòεáðέáβòá áðβóçò ðέò óáεβááð manual ðüι device.hints(5), kenv(1), loader.conf(5), έάέ loader(8).

13.6 Init: Άñ÷έειðιβççò ÄεÝá÷ιò ÄέαääέαόέPι

Ìüεέð ιειέεçñüεáβ ç áεέβίççò ðιò ðòñPιá, ι Ýεáá÷ιò ιáðáòÝñáòάέ óòçι áέαääέαόβá ÷ñPóçç init(8), ç ιðιβá áñβóέáòάέ óðι áñ÷áβι /sbin/init, P óçç áέαáññP ðιò έάέιñβæáòάέ óòçι ιáðááεçòP init_path ðιò loader.

13.6.1 Äειειòεβá Áðòüιáòçò Áðáíáέέβίççò

Ç áειειòεβá áðòüιáòçò áðáíáέέβίççòçò áιáóóáεβæáέ üðέ óá óòóðPιáðá áñ÷áβιí áβιáέ óá έáñιέέP, óòáέáñP έáòÛóðáóç. Áι ááι áβιáέ, έάέ ç fsck(8) ááι ïðιñáβ ιá áεìñεþáέ óá ðñιáεPιáðá, óüðá ç init(8) έá ιáðáòÝñáέ ðιò óγóóçιá óá έáòÛóðáóç έáέðιòñáβáð áíüð ÷ñPóçç þòðá ιá ïðιñÝóáέ Ûιáóá ι áέα÷áεñέóòPò óòóðPιáðιò ιá áðέεçòεáβ ðüι ðñιáεçìÛòüι áðòþι.

13.6.2 ΈáòÛóðáóç Έáέοιòñáβáò Áíüð ×ñPóçç

Ìðιñáβòá ιá áέóÝεéáðá óòçι έáòÛóðáóç áðòP ιÝóü ðçò áειειòεβáð áðòüιáòçò áðáíáέέβίççòçò, P ιÝóü ðçò áðέειáPò -s έáòÛ ðçι áεέβίççò P áέüιá έάέ εÝòιιòáð ðç ιáðááεçòP boot_single óòιí loader.

Ìðιñáβòá áðβóçòç ιá áέóÝεéáðá óá áðòP áέðáεþιòáð ðçι áíóιεP shutdown(8) ÷ññβð ðçι áðέειáP áðáíáέέβίççòçò (-r) P ðáñιáðέóιιγý (-h), áþ áβòðá óá έáòÛóðáóç έáέðιòñáβáð ðιέεþι ÷ñçóðþι (multi-user).

Áι ç ειíóüεá ðιò óòóðPιáðιò Ý÷áέ ðáέáβ ùð insecure (áιáóóáεPò) óðι /etc/ttys, ðι óγóóçιá έá æçòPóáέ ðιí έüáέéü ðιò root ðñει áέóÝεéáέ óá έáòÛóðáóç έáέðιòñáβáð áíüð ÷ñPóçç.

ΔὰñŨάέειά 13-3. ἈίάόάέΠð Èñῶέά όῶι /etc/ttys

```
# name getty                                type      status      comments
#
# If console is marked "insecure", then init will ask for the root password
# when going to single-user mode.
console none                                unknown off insecure
```

Όçιάβὺόç: Ιέά insecure (άίάόάέΠð) έίῶέά όçιάβίάέ ὕόέ άάί έάῦñάβðά άόόάέΠ ðçί έίῶέά ὕῶί άῶίñŨ ðç ὀόόέέΠ ðçð ðñῶόάόç έάέ έΥέάðά ίά άβððά άΥάάέιð ὕόέ ίῦῶ ὕðίέῶ άίῦñβæάέ ðῶί έῦάέέῦ ðῶ root έά ίðñάβ ίά ðñçῶέῶῶῶέέ ðç έάέῶῶῶñάά άίῦð ðñΠðç. Ç άðέέῶῶΠ άððΠ άάί όçιάβίάέ ὕόέ έΥέάðά ç έίῶέά όάό ίά έάέῶῶῶñάβ ðñβð άόðŨέάέά. Ἀί έΥέάðά άόðŨέάέά, έά ðñΥðάέ ίά άðέέΥίáðά insecure, ὕðέ secure.

13.6.3 ἘάðŨόάόç Ἐάέῶῶñάβá ðῶέάðέῦῶ × ñçῶῶῶῶ (multi-user)

Ἀί ç init(8) άάί άñάέ ðñῶάέΠιáðά όðά όðóðΠιáðά άñ ðñβῦῶ όáð, Π ἶῦέð ἶ ðñΠóçðð ðάññιáðβóáέ ðçί έáðŨóðáç έάέῶῶῶñάβáð άίῦð ðñΠðç, ðῶ όýóççιá áέóŸñ ðñðáέ όá έάέῶῶῶñάβá ðῶέάðέῦῶ ᰇñçῶῶῶῶ, ὕðῶί έάέ ίáέέῶŨ ðέΥῶί ç ñýέῶέç ðῦñῦῶ (resources) ðῶó ððóðΠιáðῶð.

13.6.3.1 Ñýέῶέç ðῦñῦῶ (rc)

Όῶ όýóççιá ñýέῶέçð ðῦñῦῶ, áέάáŨæάέ ðέð ðñῶáðέέάñŸíáð άðέέῶῶŸð áðῦ ðῶ /etc/defaults/rc.conf, έάέ άðέέῶῶŸð áέá ðῶ όðáέáñέῶῶŸῶ ἶç ðñçῶῶῶ ἶç ðῶ /etc/rc.conf, έάέ ðñῶ ðññάβ όççῶ ðñῶóŨñçóçç ðῶῶ όðóðçῶŨðῶῶ άñ ðñβῦῶ ðῶί άίáññŨῶῶῶέέ όῶῶ /etc/fstab, ίáέέῶŨ ðέð ððçññáóβáð áέέóýῶῶ, áέέέῶῶñ áέŨῶῶῶῶð ááβῶῶῶñáð, έάέ ðŸέῶῶ áέðáέáβ ðá scripts áέέβίçóçð ðῶῶ ὀῶῶέέŨ ááέáðáóççῶŸῶῶῶ ðáέŸῶῶῶ (áðáññῶῶῶ).

Ç óáέβáá manual rc(8) ðáñŸ ðñέά έáέΠ άίáῶῶñŨ όῶῶ όýóççιá ñýέῶέçð ðῦñῦῶ, έáέῦð áñáðŨæάέ όá βáέá όá scripts áέέβίçóçð.

13.7 Ἀέῶῶῶῶέβá Ὀáñῶáðéóῶῶ

ἘáðŨ ὀῶῶ áέáá ðññῶῶῶéóῶῶῶ, ἶŸῶῶ ðçð shutdown(8), ç init(8) έá áðῶðáέñáέáβ ίá áέðáέŸῶáέ ὀῶῶ script /etc/rc.shutdown, έάέ áέῶῶῶῶῶῶ ðá óðáβέáέ όá ὕέáð ðέð áέáññááóβáð ὀῶῶ óΠῶá TERM, έάέ óŸέῶð ὀῶῶ óΠῶá KILL όá ὕðῶῶ áέáññááóβá ááῶ ὀáñῶáðβóáέ όá áýέῶῶῶ ðñῶῶέέῦ áέŨóççιá.

Ἄέá ίá áβῶáέ έάέ áέáέῶῶΠ ðçð ὀñῶῶῶῶóβáð όá Ÿῶá όýóççιá FreeBSD ίá άñ ðñέáέῶῶῶέέΠ ðῶῶ ððῶðçñβæάέ áέá ðñβñέçç άῶŸñááέáð, áðέῦð ðñççῶέῶῶῶῶððá ðçί άῶῶῶΠ shutdown -p now áέá áðáῶññáῶῶῶῶççç ίáðŨ ὀῶῶ ðáñῶáðéóῶῶῶ. Ἄέá ίá έŨῶáðá áðέῦð áðáῶáέέβῶῶççç όá Ÿῶá όýóççιá FreeBSD ðñççῶῶῶῶῶῶððá ðçί άῶῶῶΠ shutdown -r now. Ἐá ðñŸðáέ ίá áβððá root Π ἶŸέῶð ðçð ἶñááð operator áέá ίá áέðáέŸῶáðá ðçί shutdown(8). Ἰðññáβðá áðβççð ίá ðñççῶῶῶῶῶððá ðέð άῶῶῶŸð halt(8) έάέ reboot(8), έῶέðŨῶῶð ðέð άῶῶῶóῶῶῶ ðñð óáέβááð manual έáέῦð έάέ ðç óáέβáá manual ðçð shutdown(8) áέá ðáñέóῶῶῶðññáð ðέçñῶῶῶῶññáð.

Όçιάβὺόç: Ç áέá ðñβñέçç άῶŸñááέáð áðáέðáβ ðçί ððῶðῶῶῶῶῶç ðῶῶ acpi(4), áβðá óῶῶῶ ðññΠῶá, áβðá ὀῶῶῶῶŸῶç ὕð ὕññῶῶῶῶ (module).

ÊäöÛëáéí 14

× ñÞóôâò êáé ÂáóéêÞ Äéá÷ âßñéóç Êíãáñéáóìþí

14.1 Óýññøç

Ôí FreeBSD áðéðñÝðáé óá ðñééáðéñγð ÷ ñÞóôâò íá ÷ ñçóéññðñéññí ðñí ððñéññéáóóðÞ ðçí ðáéá ðóéáñÞ. Ðñññóáñð, ìñññ Ýíáð áðñ áðñññ ðñðð ÷ ñÞóôâò ðñññáß íá ðÛéáðáé ðñññóðÛ áðñ ðçí ðñéññç êáé ðñ ðççéðññéññáéñ ðÛéá áááñÝñç ðóéáñÞ¹, áééÛ ðññéññáððññá áñééññð ÷ ñçóóðñí ðñññññí íá áéóÝéñññí ðñññ ðñð áééðñññ áéá íá ðÝñññññ ðá ðÝññáð ðéð áñááóßáð ðñðð. Äéá íá ÷ ñçóéññðñéññáé ðñí óýóðçñá, êÛéá ÷ ñÞóóçð ðññÝðáé íá Ý ÷ áé Ýíá ðñááñéáóññ.

Áóññ áéááÛóáðá áððñ ðñ êäöÛéáéñ, éá ðññáðá:

- Óéð áéáóññÝð áñÛñáóá ðóá áéÛóññá áßáç ðñááñéáóìþí ÷ ñçóóðñí óá Ýíá óýóðçñá FreeBSD.
- Ðñð íá ðñññéÝóáðá ðñááñéáóñññð ÷ ñçóóðñí.
- Ðñð íá áéááñÛðáðá ðñááñéáóñññð ÷ ñçóóðñí.
- Ðñð íá áééÛñáðá ðéð éáððññÝññéáð áññð ðñááñéáóññññ, ðñðð ðñ ðéðññáð ðñññá ðñð ÷ ñÞóóç, Þ ðñ ðñññéñññáñññ ðÝéððñð (shell).
- Ðñð íá ðÝóáðá ðñéá áñÛ ðñááñéáóñññ, áéá íá áéÝá ÷ áðá ðñññðð ðñðð ç ðññç êáé ð ÷ ññññð ðçð CPU, ðñð ðñññññí íá Ý ÷ ðññ ðóçñí áéÛéáóç ðñðð ðóáéáéññéñññé ðñááñéáóñññ Þ ñÛááð ðñááñéáóñññ.
- Ðñð íá ÷ ñçóéññðñéññáðá ñÛááð áéá íá ðÛñáðá áðéñññðáñç ðç áéá ÷ áßñéóç ðññ ðñááñéáóñññ.

Ðñññ áéááÛóáðá áððñ ðñ êäöÛéáéñ, éá ðññÝðáé:

- Íá éáðáñññáßáðá ðéð ááóééÝð Ýññéáð ðñð UNIX êáé ðñð FreeBSD (ÊäöÛéáéñ 4).

14.2 ÁéóááññáÞ

Ç ðñññóááóç ðññí óýóðçñá áðéððá ÷ Ûñáðáé ðññññññ ðñááñéáóññññ, ðéáð ðé áéáññááóßáð áéðáéñññññáé áðñ ÷ ñÞóóâð, Ýðóé ç áéá ÷ áßñéóç ÷ ñçóóðñí êáé ðñááñéáóññññ áßñáé ðááÛéçð ðçñáóóßáð ðóá FreeBSD ðóððÞñáðá.

ÊÛéá ðñááñéáóññññ ðá Ýíá óýóðçñá FreeBSD Ý ÷ áé ðóáéáéññéññññáð ðñññ ð ÷ áððáéññáé ðá áððñññ ðóðá íá áñááñññáðáé áðñ ðñ óýóðçñá.

¼ññá ÷ ñÞóóç

Ôñ ðñññá ÷ ñÞóóç áßñáé áððñ ðñð éá áñááðáß ðóçñí ðññññññðÞ login: . Óá ðñññáðá ÷ ñçóóðñí ðññÝðáé íá áßñáé ðñááééÛ áéá ðññ ðññéññéáóóðÞ, ááñ ðñññáßáðá íá Ý ÷ áðá áñññ ÷ ñÞóóâð ðá ðñ ðáéñ ðñññá ÷ ñÞóóç. ÓðÛñ ÷ áé Ýíáð áñééññð éáñññññ

δηιούδέειβ έάοΰειαίε ÷ηζόοηί όοί /home/username Π όοί /usr/home/username. Ί ÷ηΠρόοο έά άδιεζεάγέ όά δηιούδέεΰ όιό άη÷άβά έάε όιόο έάόάεΰιαίόο διο αηιέιόηηάβ, ιΎόά όοί δηιούδέεΰ όιό έάοΰειαί.

ΈΎεοοιό ÷ηΠρόος

Όι έΎεοοιό διοΎ ÷άε όι άι' ηέοιγ διοέΰεΰη διο ηέ ÷ηΠρόοαο ÷ηζόεηηιεΰί έάέ ίά άεεζεάδεάηηί ίά όι όγόοηά. Όδιοΰ ÷ιό διοεΰ έάόηηάόεεΰ άβζ έάεοοηί, έάέ ηέ Ύηάέηηέ ÷ηΠρόοαο έά Ύ ÷ιό όεο άέέΎο διοο δηιέηΠόάεο, ηέ ηηβάο ηηηάβ ίά άίόεέόηηοηβηηέόάε όόεο ηέβηόάεο οΰι έιαάηέαόηι διοο.

Όδιοΰ ÷ιό ηηάεο έγηέιε όγδιέ έιαάηέαόηι: ι διοΰ ÷ηΠρόοοο (superuser), ηέ ÷ηΠρόοαο όόόοΠιαόηο, έάέ ηέ έιαάηέαόηη ÷ηζόοηι. Ί έιαάηέαόηηο διοΰ ÷ηΠρόος, όοηΠεΰο ηηΰΰεάόάε root, ÷ηζόεηηιεάβόάε έάέ ός έάε÷άβηέος όιό όόόοΠιαόηο ÷ηηβό διοέηηέοηγ όόά δηιηιέά. Ίέ ÷ηΠρόοαο όόόοΠιαόηο διοΎ ÷ιό διοηηάόβάο. ΌΎεο, ηέ έιαάηέαόηη ÷ηζόοηι ÷ηζόεηηιεΰίόάε άδΰ διοάηάόεεηγ άηηηδιοο, διο όοηΎηηόάε, έάάΰεοηί mail, έάέ ηγδΰ έάεάηΠο.

14.3 Ί Έιαάηέαόηηο Όδιοΰ ÷ηΠρόος

Ί έιαάηέαόηηο διοΰ ÷ηΠρόος, όοηΠεΰο έάεάβόάε root, άβηάε διοηηέιεοηΎηηο έάέ ίά έάόεηεηηάόάε ζ έάε÷άβηέος διο όόόοΠιαόηο, έάέ άά έά διοΎάέ ίά ÷ηζόεηηιεάβόάε έά έάεηηηέηΎο ηηάόβάο ηδιο άδιοόηεΠ έάέ εΠος mail, άάέεΠ άηηηγίος διο όόόοΠιαόηο, Π διοηηηηέόεοηη.

Άόοΰ έέΰόε ι διοΰ ÷ηΠρόοοο, όά άίόβέάος ίά διοο έάηηέεηγ διοέΰεΰη διο ÷ηζόοηι, ηηηάβ ίά έάεοηηηάβ ÷ηηβό ηηέά, έάέ έάεηηάό÷άβηέος διο έιαάηέαόηη άόοηγ ηηηάβ ίά Ύ ÷άε ηο όοηΎάέ έάηηέεΎο έάόάόοηηΎο. Ίέ έιαάηέαόηη ÷ηζόοηι άά ηηηηγ ίά έάόάόοηΎοηί όι όγόοηά άδΰ εΰεο, Ύόόε άβηάε άάέεΰ έάέγόάηά ίά ÷ηζόεηηιεάβόά έάηηέεηγ διοέΰεΰη διο ÷ηζόοηι ηδιοά άβηάε άοηάοη, άεοΰο άΰι έάέέΰοάηά ÷ηΰεΰεάόόά όά άδεθεΎηη διοηηιέά.

Έά διοΎάε διοΎά ίά έεΎ ÷άόά άγί έάε ηηάεο ηηηΎο όεο άίόηεΎο διο άβηάόά όά διοΰ ÷ηΠρόοοο, άοηγ Ύηά άδεθεΎηη έάηη Π Ύηάο ÷άηεοηηάο διο έάβθάε, ηηηάβ ίά όηηάβηάε άηηάηηηεΰος άθρεάέά άάηηΎηη.

όόε, όι διοηοη διοΰάη διο έά διοΎάε ίά εΰηάόά άοηγ έάάΰόάόά άόοΰ όι έάοΰεάει, άβηάε ίά αηιέιόηηΠόάόά Ύηά έιαάηέαόηη ÷ηΠρόος, ÷ηηβό διοηηιέά, έάέ όηη άόοΰ όάό έά άάέεΠ ÷ηΠρος άί άά όι Ύ ÷άό εΰηάε Πς. Άόοΰ έό÷γέ άηβόη άΰη διοΎ ÷άόά Ύηά διοε÷ηζόόεΰ Π ηηη÷ηζόόεΰ ις÷Ύιηά. Άηηηοάηά όά άόοΰ όι έάοΰεάει, έά όοεηοηηά διοο ίά αηιέιόηηάβόά διοοέάόηο διοέΰεΰη διοέΰεΰη διο έάέ διοο ίά έεΰεΰεΰά ίάόάηγ διο έάηηέεηγ ÷ηΠρόος έάέ διο διοΰ ÷ηΠρόος.

14.4 Έιαάηέαόηηο ΌόόοΠιαόηο

Ίέ ÷ηΠρόοαο όόόοΠιαόηο άβηάε άόοηβ διο ÷ηζόεηηιεΰίόάε έάέ ίά διοΎ ÷ιό διοηηηάόβάο ηδιο διο DNS, mail, web servers, έάέ ηγδΰ έάεάηΠο. Ί εΰηηό έάέ άόοΰ άβηάε ζ άόόΰεάέ: άί ηεάο ηέ διοηηηάόβάο Ύοηά÷άί ίά έάέεηηηάό διοΰ ÷ηΠρόος, έά έάέοηηηηγόά ÷ηηβό διοέηηέοηγ διο.

Δάηάάβηηάόά άδΰ ÷ηΠρόοαο όόόοΠιαόηο άβηάε ηέ daemon, operator, bind (άέά όη Domain Name Service), news, έάέ www.

Ί nobody άβηάε ι άάέέΰο, ÷ηηβό διοηηιέά, ÷ηΠρόοοο όόόοΠιαόηο. Ύόοΰοη, άβηάε όηηάέεΰ ίά Ύ ÷άόά έάόΰ ηηο ηέο ηοη διοέόοΰοάηηο διοηηηηάόβάο ÷ηζόεηηιεΰί όηη nobody, οΰοη διοέόοΰοάηη άη÷άβά έάέ έάηηηάόβάο έά όόο÷άόεοηηί ίά άόοΰ, έάέ Ύόόε οΰοη διοέόοΰοάηη διοηηηέγ÷ηο άβηάόάε άόοΰο ι ÷ηΠρόος.

14.5 Êíäáñéάóííß × ñçόðÞí

Íé êíäáñéάóííß ÷ ñçόðÞí äßíáé õí ðñùόáñ÷έέù íÝóí ðñùόάάçð áéá ðñááíáόέέýð áíêñððíð ðóí óýóçíá, éáé ìÝóù áðòÞí áðñííÞíáðáé ì êÛéä ÷ ñÞóðçð éáé õí ðáñéάÛέéíí áñááóßáð õíð, áðíòñÝðííóáð Ýðóé ðééáÞ éáóáóðñíòÞ õíð óðóðÞíáðíð Þ Ûέéùí ÷ ñçόðÞí, éáé áðέóñÝðííóáð óá êÛéä Ýíá íá ðñíóáñíùæáé õí áέέù õíð ðáñéάÛέéíí ÷ ùñßð íá áðçñáÛæáé õíð Ûέéíð.

ÊÛéä Ûóíí ðíð Ý÷áé ðñùόάάçç óóí óýóçíÛ óáð éá ðñÝðáé íá Ý÷áé Ýíá ñíááéέú êíäáñéάóíù ÷ ñÞóðç. Áððù óáð áðέóñÝðáé íá áñáßòá ðíéíð êÛíáé óé, áðíòñÝðáé áíêñððíð áðu õí íá ðáñÛέáíòí ðéð ñðéíßóáéð ì Ýíáð õíð Ûέéíð, Þ íá áéάáÛóáé ì Ýíáð óá mail õíð Ûέéíð, éáé ìÝóù éáéáíÞð.

ÊÛéä ÷ ñÞóðçð ìðíñáß íá óðÞóáé õí áέέù õíð ðáñéάÛέéíí Þóðá íá ðñíóáñíùóáé ççí ÷ ñÞóç õíð óðóðÞíáðíð, ÷ ñçόéíðíêñíðáð áíáééáéðέéÛ éáéýçç, óóíðÛéðáð, óóíáðáóííýð ðéÞéðñíù éáé æéÞóáð.

14.6 Õñíðíðíêñíðáð Êíäáñéάóííýð

ÕðÛñ ÷ áé íéá ðíééééßá áðu áéάóííáðééÝð áíòíéÝð áéáé Ýóéíáð óóí ðáñéάÛέéíí UNIX áéá íá ÷ áéñéóóáßòá êíäáñéάóííýð ÷ ñçόðÞí. Íé ðéí êíéíÝð áíòíéÝð óðíñßæáíðáé ðáñáéÛðù, áéíéòéíýíáíáð áðu éáððíñáñÞ ðáñáááßáíáðá ççð ÷ ñÞóðçð õíð.

ÁíóíêÞ	ÐáñéáñáðÞ
adduser(8)	Ç ðñíóáéíùíáíç áðáñííáß áñáñíÞð áíòíêñí áéá ççí ðñíóèÞçç íÝùí ÷ ñçόðÞí.
rmuser(8)	Ç ðñíóáéíùíáíç áðáñííáß áñáñíÞð áíòíêñí áéá ççí áéάáñáðÞ ÷ ñçόðÞí.
chpass(1)	Íá áðÝéééðí áñááéáßí áéá ççí áééááÞ ðéçñíòíñêñí ççð áÛóçð áááñÝíùí ðùí ÷ ñçόðÞí.
passwd(1)	Õí áðéù áñááéáßí áñáñíÞð áíòíêñí áéá ççí áééááÞ ðùí èùáéêñí ðùí ÷ ñçόðÞí.
pw(8)	Íá áóíáðù éáé áðÝéééðí áñááéáßí áéá ççí áééááÞ ùéùí ðùí ñðéíßóáéùí ðùí êíäáñéάóíÞí ðùí ÷ ñçόðÞí.

14.6.1 adduser

Õí adduser(8) áßíáé Ýíá áðéù ðñùáñáííá áéá íá ðñíóéÝðáðá íÝíðð ÷ ñÞóðáð. Äçíéíòñááß áááñáóÝð óðá áñ÷áßá óðóðÞíáðíð passwd éáé group. Äçíéíòñááß áðßóçð Ýíáí ðñíóùðééú éáðÛέíáí áéá õíí íÝí ÷ ñÞóðç, áíðéáñÛóáé áéáß óá áí' ñéóííý áñ÷áßá ñðéíßóáéùí ("dotfiles") áðu õí /usr/share/skel, éáé ìðíñáß ðñíáéñáðééÛ íá óðáßéáé Ýíá ìÞíðíá éáéùóíñßóíáðíð óóíí íÝí ÷ ñÞóðç.

ÐáñÛááéçáíá 14-1. ÐñíóéÝðííóáð Ýíáí ÷ ñÞóç óóí FreeBSD

```
# adduser
Username: jru
Full name: J. Random User
Uid (Leave empty for default):
Login group [jru]:
Login group is jru. Invite jru into other groups? []: wheel
Login class [default]:
Shell (sh csh tcsh zsh nologin) [sh]: zsh
Home directory [/home/jru]:
Home directory permissions (Leave empty for default):
```

```

Use password-based authentication? [yes]:
Use an empty password? (yes/no) [no]:
Use a random password? (yes/no) [no]:
Enter password:
Enter password again:
Lock out the account after creation? [no]:
Username   : jru
Password   : ****
Full Name  : J. Random User
Uid        : 1001
Class     :
Groups    : jru wheel
Home      : /home/jru
Shell     : /usr/local/bin/zsh
Locked    : no
OK? (yes/no): yes
adduser: INFO: Successfully added (jru) to the user database.
Add another user? (yes/no): no
Goodbye!
#

```

Όχιääβύος: Ī èùääèùò ðĳò ðèçèðñĳĳĳääßòå ååĳ ðåßĳååå, ĳÿòå åĳåĳßæĳĳåå åóðåñßóéĳé. Õñĳĳòßóðå ĳå ĳçĳ åñÛøåðå èÛèò ðĳĳ èùääèù.

14.6.2 rmuser

Īðĳåßòå ĳå ÷ñçóèĳðĳéΠρόδοδο ðĳĳ rmuser(8) åέα ĳå åέαånÛøåðå åĳðåèðð Ýĳåĳ ÷ñΠόος åðù ðĳ ðÿóóçĳå. Ç rmuser(8) åèðåååß ðå ðåñåéÛòù åΠĳåóå:

1. ΆέαånÛøåé ðçĳ åääñåðΠ crontab(1) ðĳò ÷ñΠόος (åĳ ððÛñ÷åé).
2. ΆέαånÛøåé ùðĳéå åñååóßå at(1) åĳΠεåé óðĳĳ ÷ñΠόος.
3. Õåñĳåðæåé ùèåð ðéð åέαñååóßåð ðĳò åĳΠεĳĳĳ óðĳĳ ÷ñΠόος.
4. ΆέαånÛøåé ðĳĳ ÷ñΠόος åðù ðĳ ðĳðéèù åñ÷åßĳ èùääéðĳ ðĳò óðóðΠĳåðĳò.
5. ΆέαånÛøåé ðĳĳ ðñĳòùðéèù èåóÛεĳĳĳ ðĳò ÷ñΠόος (åĳ åĳΠεåé óðĳĳ ÷ñΠόος).
6. ΆέαånÛøåé ðå åéóån÷ùĳåĳ åñ÷åßå mail ðĳò åĳΠεĳĳĳ óðĳĳ ÷ñΠόος åðù ðĳ /var/mail.
7. ΆέαånÛøåé ùèå ðå åñ÷åßå ðĳò åĳΠεĳĳĳ óðĳĳ ÷ñΠόος åðù ðéð ðñĳòùñéĳÿð ðåñéĳ÷ÿð åðĳèΠεåðóçð ùðùð ðĳ /tmp.
8. Õÿèò, åέαånÛøåé ðĳĳ ùñĳå ÷ñΠόος åðù ùèåð ðéð ñÛååð óðéð ĳðĳßåð åĳΠεåé óðĳĳ /etc/group.

Όχιääβύος: Άĳ èåðÛ ðç åέαñååóß ðĳò ÷ñΠόος, ððÛñ÷åé ñÛåå ĳå ðĳ ùñĳå ðĳò ç ĳðĳßå ååĳ ðåñéÿ÷åé Ûèèåå ĳÿèç, ç ñÛåå åððΠ åέαånÛøåðåé, Ç óðĳðåñéðĳñÛ åððΠ åßĳåé óðĳðèççñùĳåðéèΠ ĳå ðçĳ åĳðßóðĳé÷ç ðçð adduser(8), ðĳò åçĳĳèðñååß ñÛåå ĳå ðĳ ùñĳå ðĳò ÷ñΠόος èåðÛ ðç åçĳĳèðñåßå ðĳò èĳååñέαóĳĳÿ.

Õĩ rmuser(8) āāĩ ìðĩñāβ ĩά ÷ñçóεĩðĩέçεāβ āέα òçĩ εέαñāóöΠ òĩ εĩāñέάοίπĩ òðāñ÷ñΠόδοç, áοĩĩ áδοũ āβĩάε ó÷āāũĩ ðÛĩόά ĩέα Ýĩāāεĩç ĩāεέεΠ ò εάόάόðñĩöΠò.

Άĩ òñέοĩĩ, ÷ñçóεĩðĩέçεāβόάε ĩέα εέαñāóόέεΠ εάεòĩòñāβā, ðĩò ðñĩóðάεāβ ĩά áðέαāāέεπóάε υòε óβāĩòñā āĩũñβεāòā òε ðñũεάέόάε ĩά εÛĩāòā.

ÐāñÛāāέāĩ 14-2. rmuser ΆέαñāóόέεΠ ΆέαñāóöΠ Èĩāñέάοĩĩ

```
# rmuser jru
Matching password entry:
jru:*:1001:1001::0:0:J. Random User:/home/jru:/usr/local/bin/zsh
Is this the entry you wish to remove? y
Remove user's home directory (/home/jru)? y
Updating password file, updating databases, done.
Updating group file: trusted (removing group jru -- personal group is empty) done.
Removing user's incoming mail file /var/mail/jru: done.
Removing files belonging to jru from /tmp: done.
Removing files belonging to jru from /var/tmp: done.
Removing files belonging to jru from /var/tmp/vi.recover: done.
#
```

14.6.3 chpass

Õĩ chpass(1) áεεÛεάε ðεçñĩòĩñβāò òçò āÛόçð āāāñÝĩũĩ òĩò ÷ñΠόδοç υðυò ὲυάέεĩγò, εάεγòç, εάε ðñĩóυðέεÝò ðεçñĩòĩñβāò.

Ûũñ εέα÷άεñέόóÝò ðĩò óóóðΠĩάòĩò, υðυò ĩ òðāñ÷ñΠόδοç, ĩðĩñāβ ĩά áεεÛεάε òέð ðεçñĩòĩñβāò Ûεεũĩ ÷ñçóðĩ εάεπò εάε òĩò ὲυάέεĩγò ĩā òĩ chpass(1).

¼όάĩ āāĩ āβñĩóάε áðεεĩāÝò, áεòυò áðu Ýĩά ðñĩáεñāóέεũ υũñā ÷ñΠόδοç, òĩ chpass(1) āĩòáĩβεάε Ýĩáĩ óòĩóÛέòç ðĩò ðāñέÝ÷άε òέð ðεçñĩòĩñβāò òĩò ÷ñΠόδοç. ¼όάĩ ĩ ÷ñΠόδοçò āāáε áðu òĩĩ óóĩóÛέòç, ç āÛόç āāāñÝĩũĩ ÷ñçóðĩ áĩçĩāñβĩάόάε ĩā òέð ĩÝāð ðεçñĩòĩñβāò.

Όçĩāβυόç: ΈάòÛ òçĩ Ýĩāĩ áðu òĩĩ óóĩóÛέòç, áĩ āāĩ āβóòā ĩ òðāñ÷ñΠόδοçò, εά āñυòçεāβòā āέα òĩĩ ὲυάέεũ óáò.

ÐāñÛāāέāĩ 14-3. ΆέαñāóόέεΠ chpass áðu òĩĩ Õðāñ÷ñΠόδοç

```
#Changing user database information for jru.
Login: jru
Password: *
Uid [#]: 1001
Gid [# or name]: 1001
Change [month day year]:
Expire [month day year]:
Class:
Home directory: /home/jru
Shell: /usr/local/bin/zsh
Full Name: J. Random User
Office Location:
```

Office Phone:
Home Phone:
Other information:

Ï έάñíέέüò ÷ñΠόδοò ðññάβ íá áεεΰíáε ìññí Ýíá ðεññü ððñóγñεí άδñ áοòÝò ðεò ðεçññοιñβάò, έάέ ìññí áεά οñí άάοòü ðñò.

Δάñΰääέäñá 14-4. ΆέääñáόόέêΠ chpass άδñ Êάññíέέü ×ñΠόδοç

```
#Changing user database information for jru.
Shell: /usr/local/bin/zsh
Full Name: J. Random User
Office Location:
Office Phone:
Home Phone:
Other information:
```

Όçñáβüòç: Ïέ chfn(1) έάέ chsh(1) άβñάέ άðêÜ óγíääóñíε óòçñ chpass(1), üðüò άβñάέ έάέ ðε çpchpass(1), çpchfn(1), έάέ çpchsh(1). Ç ððñóðññέíç NIS άβñάέ άòòüíáòç, Ýòóέ äáí άβñάέ άðáñάβóçðñí íá έάέññβóáòä ðñ çπ ðñέí óçñ áñóñêΠ. Άí áòòü óáo ððáñääγάέ, ðçñí áñçóò÷άβóä, ðñ NIS έá έάέòòεάβ óðñ Êäòΰεάει 30.

14.6.4 passwd

Ïñ passwd(1) άβñάέ ðñ óññðεçò ðññüðñò ðñ áεεΰíáòä ðñ έεέü óáo èüääέü óáñ ÷ñΠόδοò, Π ðñí èüääέü Üεεñò ÷ñΠόδοç óáñ ððáñ÷ñΠόδοò.

Όçñáβüòç: Άέά íá áðññάðñíγñ ðð÷άβáo Π ðç äññóέñññóçñÝíáò áεεääÝò, έá óáo æçòçεάβ ðñ ðáέέüò èüääέüò ðñέí ðñβóáòä ðñí.

Δάñΰääέäñá 14-5. Άέεΰæññóáo ðñ Êüääέü óáo

```
% passwd
Changing local password for jru.
Old password:
New password:
Retype new password:
passwd: updating the database...
passwd: done
```

Δάñΰääέäñá 14-6. Άέεΰæññóáo ðñ Êüääέü Üεεñò ×ñΠόδοç ðò Õðáñ÷ñΠόδοò

```
# passwd jru
Changing local password for jru.
New password:
Retype new password:
passwd: updating the database...
passwd: done
```

Όçíáßùóç: ¼óí äéá ôéò chpasswd(1), yppasswd(1) áßíáé áðËÛ óýíááóííé óóçí passwd(1), Ýðóé ôí NIS éäéóíõñááß íá ïðíéááÞðíðá áíðíêÞ.

14.6.5 pw

Ç pw(8) áßíáé íéá éäéóíõñááß ðçð ãñáñÞð áíðíêÞí äéá äçíéíõñááß, äéááñáðÞ, áééááÞ, éáé àìòÛíéóç ÷ ñçóðÞí éáé ñÛáùí. Êäéóíõñááß ùð front end äéá óá ãñ÷ ãßá ÷ ñçóðÞí éáé ñÛáùí ðíò óðóðÞíáðíð. Ç pw(8) Ý÷ äé Ýíá ðíéý áóíáðí óýííéí áðééíáÞí ãñáñÞð áíðíêÞí ðíò ðçí éäééóóíýí éáðÛééççç äéá ÷ ñÞóç óá äÝóíáð áíðíêÞí (scripts) éäéóðÞí, áééÛ óóíðò íÝíð ÷ ñÞóððð ßòùð óáíáß ðãñéóóóðáñí ðãñßðéíéç áðu ùðé íé Ûééáð áíðíêÞÝð ðíò ðãñíðóéÛáííðáé ááÞ.

14.7 Ðãñéíñßæííðáò × ñÞóððð

Áí Ý÷ áðá ÷ ñÞóððð, ßòùð Ý÷ áðá óéáóðáß íá ðãñéíñßóáðá ðçí äóíáðóóçðá ÷ ñÞóçð ðíò óðóðÞíáðíð áðu áðóíýð. Òí FreeBSD ðãñÝ÷ äé óóí äéá÷ äéñéóðÞ ãñéáðíýð ðñüðíðð äéá íá ðãñéíñßóáé ðíðð ðñíððð ðíò óðóðÞíáðíð ðíò ïðíñáß íá ÷ ñçóéíðíéÞóáé Ýíá Ûòñí. ÁððÛ óá ùñéá ÷ ññßæííðáé óá äýí ðíÞíáðá: ïáñßáéá áßóéíò (disk quotas), éáé Ûééá ùñéá ðññí.

Óá ïáñßáéá áßóéíò ðãñéíñßæííðí ðçí ÷ ñÞóç ðñí áßóéùí óóíðð ÷ ñÞóððð, éáé ðãñÝ÷ ÷ íðí Ýíáí ðññðí ãñÞáíñíò äéÝá÷ ïð áððÞð ðçð ÷ ñÞóçð ÷ ùñßð íá ððíéíñáßæííðáé áðu ðçí ãñ÷ Þ ðÛéá ðññÛ. Óá ïáñßáéá óðæçðíýíðáé óóí ÒíÞíá 19.15.

Óá Ûééá ùñéá ðññí ðãñééáíáÛíðí ðññðíðð äéá ðãñéíñéóíù ÷ ñÞóçð ðçð CPU, ðçð ïíÞíçð, éáé Ûééùí ðññí ðíò ïðíñáß íá éáðáíáéÞóáé Ýíá ÷ ñÞóçðð. Óá ùñéá áððÛ éäéíñßæííðáé ÷ ñçóéíðíéÞíðáð ééÛóáéð óýíááóçð éáé óðæçðíýíðáé ááÞ.

Íé ééÛóáéð óýíááóçð éäéíñßæííðáé óðí /etc/login.conf. Íé äéñéááßð Ýííéáð áßíáé ðÝíá áðu ðíí óéíðú áðóíý ðíò ðíÞíáðíð, áééÛ ðãñéáñÛòíðáé íá éäððñÝñáéá óðçí óáéßáá login.conf(5) ðíò manual. Áßíáé ãñéáðú íá ðíýíá ùðé éÛéá ÷ ñÞóçðç áíÞéáé óá ïßá ééÛóç óýíááóçð (ðçí default ãí ïñéóíý), éáé ùðé éÛéá ééÛóç óýíááóçð Ý÷ äé Ýíá óýííéí áðu äóíáðóóçðð óýíááóçð ðíò ó÷ áðßæííðáé ïá áððí. Íéá äóíáðóóçðá óýíááóçð éäéíñßæííðáé áðu Ýíá æáýáíð `name=value`, ùðíò `name` áßíáé Ýíá áíùóðú áíáíññéóðééù éáé `value` áßíáé íéá áðééáñíÝíç ðéíÞ ðíò éá ÷ ñçóéíðíéçðáß óýíòíá íá ðí ùñíá. To óðÞóéí ééÛóáùí óýíááóçð éáé äóíáðíðÞðùí áßíáé íéá ïÛééíí áðêÞ áéááééáóßá éáé ðãñéáñÛòáðáé áðßóçð óðí login.conf(5).

Όçíáßùóç: Òí óýóðçíá óðíÞéùð ááí äéááÛæáé áðáðéáßáð ðí ãñ÷ ãßí ñðéíßóáùí óðí /etc/login.conf, áééÛ ðí ãñ÷ ãßí áÛóçð áááííÝíùí /etc/login.conf.db ðí ïðíßí ðãñÝ÷ äé ãñçáíññóáñáð áíáæçðÞóáéð. Áéá íá äçíéíõñáÞóíðá ðí /etc/login.conf.db áðu ðí /etc/login.conf, áéðáéíýíá ðçí ðãñáéÛòùð áíðíêÞ:

```
# cap_mkdb /etc/login.conf
```

Óá ùñéá ðññíí áßíáé äéáóíñáðééÛ áðu óéð áðéÝð äóíáðóóçððð óýíááóçð äéá äýí éùáíðð. ÐñÞóá, äéá éÛéá ùñéí, óðÛñ÷ äé Ýíá ïáðáéççðú (ðñÝ÷ ÷ ïí) éáé Ýíá ïúíéíí ùñéí. Íá ïáðáéçççðú ùñéí ïðíñáß íá áééÛíáé áðu ðíí ÷ ñÞóçç Þ ðçí áðáñíáÞ, áééÛ ááí ïðíñáß íá áßíáé ðççéùðáñí áðu ðí ïúíéíí ùñéí. Òí ðáéáððáßí ïðíñáß íá äéáðððéáß áðu ðíí ÷ ñÞóçç, áééÛ ðíòÝ íá áóççéáß. Ááýðáñíí, óá ðãñéóóóðáñá ùñéá ðññíí áðáñíñæííðáé áíÛ äéáñááóßá óá Ýíá óðáéäéñéíÝíí ÷ ñÞóçç, ù÷ é óóíí ÷ ñÞóçç óðñéééÛ. ÓçíáéÞóðá, ùíðð, ùðé áððÝð íé äéáóíñÝð áßíáé ððí÷ ñáùðééÝð áðu ðíí óðáéäéñéíÝíí ÷ äéñéóíù ðñí ïñßùí, ù÷ é áðu ðçí ðéíðíßçóç ðíò ðéáéóßíò ðñí äóíáðíðÞðùí óýíááóçð (äçéááÞ, ááí áßíáé ùíðð) íéá äéáéêÞ ðãñßððóçç ðñí äóíáðíðÞðùí óýíááóçð).

Έάé Ýóóé, ÷ ùñβò ðñüóéáòç óáóáñβά, ðáñáéÛòù áβίáé óá ðéí óð÷íÛ ÷ ñçóéííðíéíγíáíá ùñέα ðññüí (óá ððüéíéðά, íáæβ ìá ùεάò ðéò Ûέεáò äöíáðüòçðáð òγíááóçð, ìðíñáβðá íá óá áñáβðá óðí login.conf(5)).

coredumpsizes

Ôí ùñéí óðí ìÝááèò áíüò áñ÷áβíò core ðíò äçíéíòñááβóáé áðü Ýíá ðññüáñáíá, áβίáé áέα ðñíóáíáβò éúáíòð, áíáñðñíáíí áðü Ûέέα ùñέα ðçð ÷ ñÐóçð ðíò áβóέíò (ð.÷., filesize, Ð ìáñβáέα áβóέíò). Ðáñ' ùέα áðòÛ, ÷ ñçóéííðíéáβóáé óð÷íÛ óáí ìβá ééáüðáñí áðóðçñÐ ìÝèíáí áéÝá÷íò ðçð éáóáíÛέüòçð ÷ ðññò ðíò áβóέíò: áóíγ íé ÷ ñÐóðáð ááí äçíéíòñáíγí áñ÷áβá core áðü ìüñíé ðíòð, éάé óð÷íÛ ááí óá áέαáñÛöíðí, ññβáííðáð ðí coredumpsizes ìðíñáβ íá ðíòð áεçððóáé áðü ðññüñí ðÝéíð áðíεçéáððóέéíγ ÷ ðññò, áí áέα ðáñÛááéáíá éáðáññáγóáé Ýíá ìááÛéí ðññüáñáíá (üðùð ð.÷. ðí emacs).

cputime

Áðòü áβίáé ðí ìÝáέóðí ðíóü ÷ ñññíò ðçð CPU ðíò ìðíñáβ íá éáðáíáεðóáé Ýíáð ÷ ñÐóçð Ð ìέα áέαñááóβá. Áέαñááóβáð ðíò ððáñááβñíòí áðòü ðí ùñéí éá ðáñíáðéóóíγí áðü ðíí ððñÐíá.

Ôçíáβüóç: Áðòü áβίáé Ýíá ùñéí óðíí ÷ ñññí ðçð CPU ðíò éáðáíáεðíáðáé, ù÷é óðí ðíóíóðü ðçð CPU üðùð áíóáíβæáðáé óá éÛðíέα ðááβá áðü ðéò top(1) éάé ps(1). ¼ñéí óðí ðíóíóðü, ìÝ÷ñé ðç ðóέáíÐ ðíò áñÛöííðáé áðòÝð ñé áñáííÝð, ááí áβίáé áðíáðü, éάé ìÛέéí éá áβίáé Û÷ñçðí: Ýíáð ìáðááèüððéóðð—ðééáíüðáðά ìέα Ýáεòñç áñááóβá— ìðíñáβ áγéíέα íá ÷ ñçóéííðíéðóáé ó÷: ááüí ðí 100% ìέαð CPU áέα éÛðíéí ÷ ñññí.

filesize

Áðòü áβίáé ðí ìÝáέóðí ìÝááèò áíüò áñ÷áβíò ðíò ìðíñáβ íá éáðÝ÷áé Ýíáð ÷ ñÐóçð. Óá áíóβεáóç ìá óá ìáñβáέα áβóέíò, áðòü ðí ùñéí áðέαÛέεáðóáé óá éÛεá áñ÷áβí ÷ ùñέóðÛ, ù÷é óðí óγíñéí ùέüí ðñí áñ÷áβñí ðíò éáðÝ÷áé Ýíáð ÷ ñÐóçð.

maxproc

Áðòü áβίáé ìÝáέóðíð áñééìüð áέαñááóεðí ðíò ìðíñáβ íá áεðáεáβ Ýíáð ÷ ñÐóçð. ÐáñééáíáÛíáé ìá ðíí βáéí ðññðí áέαñááóβáð ðñóí ðáñáðéçñβíò ùóí éάé ðñíóéçñβíò. Áέα ðñíóáíáβò éúáíòð, ááí ìðíñáβ íá áβίáé ìááéγóáñíò áðü ðí ùñéí ðíò óðóðÐíáðíò ðíò ññβáéóáé áðü ðí kern.maxproc sysctl(8). Áðβóçð óçíáεðóðá ùóé éÝóííðáð ðíéγ ìéññÐ ðéíÐ, ìðíñáβ íá ðáñáíðíáβóáðá ðçí ðáñáñüáééüòçðά áíüò ÷ ñÐóçð: áβίáé óð÷íÛ ÷ ñÐóéíí íá óðíáÝáðáé éÛðíéíò ðíééáðéÝð ðíñÝð Ð íá áεðáεáβ áéí÷áðáγóáéð (pipelines). ÉÛðíéáð áñááóβáð, üðùð ç ìáðááεððóéóç áíüò ìááÛéíò ðññüáñáíáðíò, äçíéíòñáíγí áðβóçð ðíéεÝð áέαñááóβáð (ð.÷. make(1), cc(1), éάé Ûέéíé áíáéÛíáóíé ðññáðáíáñááóðÝð).

memorylocked

Áöðü ðβíáé ðí ìÝáéóóí ðíóü ìÞíçð ðíó ìðíñáβ íá æçðPóáé íéá äéññááóβá íá êéäéäüèäβ óðçí éýñéá ìÞíç (ð.÷., äéÝðá mlock(2)). ÊÛðíéá êñβóéíá ðñíññÛííáóá ðíó óðóðPíáóíð, üðüð ðí amd(8), êéäéäþñíóí óðçí éýñéá ìÞíç Ýóóé þóá óðçí ðññβððóç ðíó áíðéíáðááéíýí, äáí óóíáéóöÝñíóí óðçí äðéáÛñóíóç ðíó óðóðPíáóíð óá ðññβððóç ðñíññéPíáóíð.

memoryuse

Áöðü ðβíáé ðí ìÝáéóóí ìÝáäéíð ìÞíçð ðíó ìðíñáβ íéá äéññááóβá íá éáóáíáéþóáé óá êÛèá ÷ ñííéêP óóéäìP. ÐáñééáíáÛíáé óðñíééêÛ óçí éýñéá ìÞíç éáé óçí ÷ ñPóç óçð áíðéíáðÛèáóçð (swap). Äáí ðññéäéóáé äéá êÛðíéí óðñíééêü ùñéí äéá ðíí ðññéíéóíü óçð éáóáíáéÛèóçð óçð ìÞíçð, äéêÛ ðβíáé íéá éáéP äñ÷P.

openfiles

Áöðüð ðβíáé ì ìÝáéóóíð áñééìüð äñ÷P ðíó ìðíñáβ íá Ý÷ áé áíééðÛ íéá äéññááóβá. Óðí FreeBSD, óá äñ÷P ðβá äðβóçð ÷ ñçóéíðíéíýíóáé äéá íá áðäééíñβóíóí ððñíñ÷Ýð (sockets) éáé éáfÛééá IPC. ÐñíóÝíóá éíéðñí íá íçí èÝóáðá áóðü ðí ùñéí ðñéý ÷ áíçêÛ. Óí óðñíééêü ùñéí ðíó óðóðPíáóíð éáéíñβæáðáé áðü ðí kern.maxfiles sysctl(8).

sbsize

Áöðü ðβíáé ðí ùñéí óçð ìÞíçð äééóýíð, éáé Ûñá ðñí mbufs, ðíó ìðíñáβ íá éáóáíáéþóáé Ýíáð ÷ ñPóçð. Íáéβíçðá ùð áðÛíóçóç óá íéá ðáéêÛ DoS äðβèáóç ç ðñíβá áçíéíðñáíýóá ðñéêÛ sockets, äéêÛ ìðíñáβ íá ÷ ñçóéíðíééçèäβ äáíéêÛ äéá ðíí ðññéíéóíü ðñí äðééíéíñéþí äééóýíð.

stacksize

Áöðü ðβíáé ðí ìÝáéóóí ùñéí ðíó ìðíñáβ íá ìáááéþóáé ç óðíβáá íéáð äéññááóβáð. Áðü ìñíí ðíó äáí ðβíáé áñéáðü äéá íá ðññéíéóóðáβ ðí ìÝáäéíð ìÞíçð ðíó ìðíñáβ íá ÷ ñçóéíðíééþóáé Ýíá ðññáñáíá. Óóíáðþð, ðñÝðáé íá ÷ ñçóéíðíééáβóáé óá óóíáóáóíü ìá Ûééá ùñéá.

ÓðÛñ÷íóí ìáñéêÛ äéññá ðñÛáíáóá ðíó ðñÝðáé íá ðéíÛóðá üóáí èÝóáðá ùñéá óá ðññíðð. ÐáñáéÛðü ðβíáé ìáñééÝð äáíééÝð óðíáíðéÝð, ðñíðÛóáéð, éáé äéÛóíñá ó÷üééá.

- Íé äéññááóβáð ðíó ìáééíýí óðçí äééβíçóç ðíó óðóðPíáóíð áðü ðí /etc/rc äê÷ ùñíýíóáé óðçí êéÛóç óýíááóçð daemon.
- Áí éáé ðí /etc/login.conf ðíó Ýñ÷P ðáóáé ìá ðí óýóðçíá ðβíáé íéá éáéP ðçáP éíáéþí ðéíþí äéá óá ðññéóóüðáñá ùñéá, ìñíí áóáβð, ì äéá÷äéñéóðPð, ìðíñáβ íá ìÝñáðá ðé ðβíáé éáðÛééçéí äéá ðí óýóðçíá óáð. ÈÝðñíóáð Ýíá ùñéí ðñéý þçêÛ ìðíñáβ íá äéäðéíéýíáðá óçí éáðÛ÷ñóç ðíó óðóðPíáóíð óáð, áñþ èÝðñíóáð ðí ðñéý ÷ áíçêÛ ìðíñáβ íá ðññéíñβóáðá óçí ðññáñüäééüðçóá.
- Óðíðð ÷ ñPóðáð ðíó X Window System (X11) éá ðñÝðáé ìÛééíí íá ðáñá÷ ùñççéíýí ðññéóóüðáñíé ðññíé áðü ùðé óá Ûééíðð ÷ ñPóðáð. Óí X11 áðü ìñíí ðíó éáóáíáéþíáé ðñééíýð ðññíðð, äéêÛ äðβóçð áíéáññýíáé ðíðð ÷ ñPóðáð íá ðñÝ÷íóí ðññéóóüðáñá ðñíññÛííáóá óáððü÷ñííá.
- Èðíçèäβðá ùðé ðñéêÛ ùñéá áðáñíñáéíóáé óá êÛèá äéññááóβá ÷ ùñéóóÛ, ù÷é óðíí ÷ ñPóç óðñíééêÛ. Äéá ðáñÛááéäíá, èÝðñíóáð openfiles óá 50 óçíáβíáé ùðé êÛèá äéññááóβá ðíó äéðáéäβ ì ÷ ñPóçð ìðíñáβ íá áñíβíáé

ΔάνÛääéñá 14-9. ΔñíóεΠεç ÍÝíò ÌÝεíòδ óóçí ñÛää íå ×ñΠόç óçò pw(8)

```
# pw groupmod teamtwo -m db
# pw groupshow teamtwo
teamtwo:*:1100:jru,db
```

Ç δάνÛíääóñíò óóçí άδέέíāΠ -m άβίάέ íéå έβóóά ÷ñçóóñí (÷ ùñέóíÝίç íå èüñáóά) ðíò ðñüéääέóάέ íå ðñíóóάέíýíí óóά óðÛñ÷ííóά ÌÝεç óçò ñÛääó. Óά άíóβεάóç íå óí ðñíçáíýíáíí δάνÛääéñáíá, íé ÷ñΠóóάδ άóóíβ ðñíóóβεáíóάέ óóçí ñÛää, éάέ ááí άíóέέάέóóóíýíí óíòδ ÷ñΠóóάδ ðíò Παç άíΠέííóí óά άóòΠ.

ΔάνÛääéñá 14-10. ×ñçóέííðíεΠíóάò óçí id(1) ñéá Δñíóάέíñέóíü ÌäεΠí íéάò ñÛääó

```
% id jru
uid=1001(jru) gid=1001(jru) groups=1001(jru), 1100(teamtwo)
```

¼ðüò ìðññáβóå íå äáβóå, í jru άβίάέ ÌÝεíò óüí ñÛääüí jru éάέ teamtwo.

Άέά δññέóóóüóññáð ðεçñíóíñβáð ó÷άóέέÛ íå óçí pw(8), äáβóå óçí óääεβää manual, éάέ äéá δññέóóóüóññáð ðεçñíóíñβáð ó÷άóέέÛ íå óçí ññóíðíβçóç ðíò /etc/group, óðíáííðéäððáβóå óçí óääεβää manual group(5).

ÓçíáέΠóάέò

1. Άέóüð óóóέέÛ άí óóíáÝóíóíå ðíεéάðéÛ óññíáóέέÛ, áεéÛ éå ÌέεΠóíóíå äéá άóóü óóí ÊäöÛëáéí 27.
2. Άβίάέ äóíáóüí íå ÷ñçóέííðíεΠóάóå UID/GIDs üóí ÌääÛéá üóí óí 4294967295, áεéÛ óÝóíéá IDs ìðññáβ íå ðñíéáéÝóíóí óíääñÛ ðñíñεΠíáóά íå εíñέóíééü ðíò èÛíáέ óðíèÝóάέò ó÷άóέέÛ íå óέò óéíÝð óüí IDs.

ΕὰοÛεάεί 15

ΆοοÛεάεί

15.1 Ούίησ

Ôi εὰοÛεάεί áòòü ðáñÝ ÷ áε íεά ááóεεP áεóááüãP óóεð Ýííεάð ðçð áóòÛεάεάð óðóðPíáðìð, εÛðìεíòð ááíεεÛ εάεíγð εάíúíáð, εάε ìñέóìÝíá ðñì ÷ ùñçìÝíá ε Ýíáðá ó ÷ áðεέÛ ìá òì FreeBSD. ΆñεáðÛ áðu óá ε Ýíáðá ðìò εάεýððìíðáε áãP, ìðìñìγí íá áðáñììóóìγí òì Bæí εάεÛ ðúóì óðì Bæí òì óýóðçíá, úòì εάε áεά áóòÛεάεί ìÝòù Internet. Ôì Internet ááí áBíáε ðεÝíí Ýíá “òεέεεü” ìÝñìð óòì ìðìBì εάεÝíáð εÝεάε íá áBíáε ì áðááíεεüð óáð ááBðìíáð. Ç áíÛáεç áóòÛεέóçð òìò óðóðPíáðìð óáð áBíáε áðεóáεðεεP áεά íá ðñìóðáðÝðáðá ðá áááñÝíá óáð, ðçí ðíáðìáðεεP óáð εάεíεðçóBá, òì ÷ ðñíí óáð, εάε ðìεεÛ ðáñέóóüðáñá áðu óá ÷ Ýñεά ðùí ÷ Ûεáñð εάε ðùí ðñìBúí òìòð.

Ôì FreeBSD ðáñÝ ÷ áε íεά óáεñÛ áðu áñçεçðεέÛ ðñìáñÛìíáðá εάε ìç ÷ áíεóìíγð áεά íá áíáóóáεBóáε ðçí áεáñáεüðçðá εάε ðçí áóòÛεάεί òìò óðóðPíáðìð óáð εάε òìò áεέðýíò.

Άóìγ áεάáÛóáðá áòòü òì εὰοÛεάεί, εά ìÝñáðá:

- ΆáóεéÝð Ýííεάð áεά ðçí áóòÛεάεί, óá ó ÷ Ýóç ìá òì FreeBSD.
- Óòìε ÷ áBá ó ÷ áðεέÛ ìá òìòð áεÛòììòð ìç ÷ áíεóìíγð εñðððìáñÛòççðð ðìò áBíáε áεάεÝóεíε óòì FreeBSD, üðòð òì DES εάε òì MD5.
- Ðùð íá ððεìBóáðá òì óýóðçíá óáð áεά εùáεéíγð ìεáð ÷ ðPóçð.
- Ðùð íá ððεìBóáðá TCP Wrappers áεά ÷ ðPóç ìá ðçí inetd.
- Ðùð íá ððεìBóáðá òì **KerberosIV** óá FreeBSD áεáüóáεð ðñéí ðç 5.0.
- Ðùð íá ððεìBóáðá òì **Kerberos5** óòì FreeBSD.
- Ðùð íá ððεìBóáðá òì IPsec εάε íá áçìεíòñáPóáðá Ýíá VPN ìáðáíý ìç ÷ áíçìÛðùí FreeBSD/Windows.
- Ðùð íá ððεìBóáðá εάε íá ÷ ðçóεíðìεPóáðá ðçí εáðÛ FreeBSD ðεíðìBççç SSH òìò **OpenSSH**
- Ôé áBíáε óá ACLs óòì óýóðçíá áñ ÷ áBúí εάε ðùð íá óá ÷ ðçóεíðìεPóáðá.
- Ðùð íá ÷ ðçóεíðìεPóáðá òì áñçεçðεéü ðñüáñáííá **Portaudit** áεά íá áεÝáíáðá εíáεóíεéü ðñBòìò εάóáóεáðáóáðP ðìò Ý ÷ áε ááεáðáóðáεáB ìÝòù ðçð ððεεíãPð Ports.
- Ðùð íá ÷ ðçóεíðìεPóáðá ðεð áçìíóεáýóáεð security advisories òìò FreeBSD.
- Εά Ý ÷ áðá íεά εάÝá áεά òì ðε áBíáε òì Process Accounting εάε ðùð íá òì áíáñáíðìεPóáðá óòì FreeBSD.

Ðñéí áεάáÛóáðá áòòü òì εὰοÛεάεί, εά ðñÝðáε:

- Íá εáðáñíãBðá ááóεéÝð Ýííεάð òìò FreeBSD εάε òìò Internet.

Ðñüóεáðá ε Ýíáðá ó ÷ áðεέÛ ìá ðçí áóòÛεάεί εάεýððìíðáε óá ðεüεεçñì òì áεáεBì. Άεά ðáñÛááεáíá, ì Ôðì ÷ ðáùðεéüð εáá ÷ ìð Ðñüóááóçð óðæçðáBðáε óòì ÊáòÛεάεί 17 εάε óá Internet Firewalls óðæççìíγíðáε óòì ÊáòÛεάεί 31.

15.2 Introduction

Security is a function that begins and ends with the system administrator. While all BSD UNIX multi-user systems have some inherent security, the job of building and maintaining additional security mechanisms to keep those users “honest” is probably one of the single largest undertakings of the sysadmin. Machines are only as secure as you make them, and security concerns are ever competing with the human necessity for convenience. UNIX systems, in general, are capable of running a huge number of simultaneous processes and many of these processes operate as servers — meaning that external entities can connect and talk to them. As yesterday’s mini-computers and mainframes become today’s desktops, and as computers become networked and inter-networked, security becomes an even bigger issue.

System security also pertains to dealing with various forms of attack, including attacks that attempt to crash, or otherwise make a system unusable, but do not attempt to compromise the `root` account (“break root”). Security concerns can be split up into several categories:

1. Denial of service attacks.
2. User account compromises.
3. Root compromise through accessible servers.
4. Root compromise via user accounts.
5. Backdoor creation.

A denial of service attack is an action that deprives the machine of needed resources. Typically, DoS attacks are brute-force mechanisms that attempt to crash or otherwise make a machine unusable by overwhelming its servers or network stack. Some DoS attacks try to take advantage of bugs in the networking stack to crash a machine with a single packet. The latter can only be fixed by applying a bug fix to the kernel. Attacks on servers can often be fixed by properly specifying options to limit the load the servers incur on the system under adverse conditions. Brute-force network attacks are harder to deal with. A spoofed-packet attack, for example, is nearly impossible to stop, short of cutting your system off from the Internet. It may not be able to take your machine down, but it can saturate your Internet connection.

A user account compromise is even more common than a DoS attack. Many sysadmins still run standard **telnetd**, **rlogind**, **rshd**, and **ftpd** servers on their machines. These servers, by default, do not operate over encrypted connections. The result is that if you have any moderate-sized user base, one or more of your users logging into your system from a remote location (which is the most common and convenient way to login to a system) will have his or her password sniffed. The attentive system admin will analyze his remote access logs looking for suspicious source addresses even for successful logins.

One must always assume that once an attacker has access to a user account, the attacker can break `root`. However, the reality is that in a well secured and maintained system, access to a user account does not necessarily give the attacker access to `root`. The distinction is important because without access to `root` the attacker cannot generally hide his tracks and may, at best, be able to do nothing more than mess with the user’s files, or crash the machine. User account compromises are very common because users tend not to take the precautions that sysadmins take.

System administrators must keep in mind that there are potentially many ways to break `root` on a machine. The attacker may know the `root` password, the attacker may find a bug in a root-run server and be able to break `root` over a network connection to that server, or the attacker may know of a `suid-root` program that allows the attacker to break `root` once he has broken into a user’s account. If an attacker has found a way to break `root` on a machine, the attacker may not have a need to install a backdoor. Many of the `root` holes found and closed to date involve a considerable amount of work by the attacker to clean up after himself, so most attackers install backdoors. A backdoor provides the attacker with a way to easily regain `root` access to the system, but it also gives the smart

system administrator a convenient way to detect the intrusion. Making it impossible for an attacker to install a backdoor may actually be detrimental to your security, because it will not close off the hole the attacker found to break in the first place.

Security remedies should always be implemented with a multi-layered “onion peel” approach and can be categorized as follows:

1. Securing `root` and staff accounts.
2. Securing `root`-run servers and `suid/sgid` binaries.
3. Securing user accounts.
4. Securing the password file.
5. Securing the kernel core, raw devices, and file systems.
6. Quick detection of inappropriate changes made to the system.
7. Paranoia.

The next section of this chapter will cover the above bullet items in greater depth.

15.3 Securing FreeBSD

Command vs. Protocol: Throughout this document, we will use **bold** text to refer to an application, and a `monospaced` font to refer to specific commands. Protocols will use a normal font. This typographical distinction is useful for instances such as `ssh`, since it is a protocol as well as command.

The sections that follow will cover the methods of securing your FreeBSD system that were mentioned in the last section of this chapter.

15.3.1 Securing the `root` Account and Staff Accounts

First off, do not bother securing staff accounts if you have not secured the `root` account. Most systems have a password assigned to the `root` account. The first thing you do is assume that the password is *always* compromised. This does not mean that you should remove the password. The password is almost always necessary for console access to the machine. What it does mean is that you should not make it possible to use the password outside of the console or possibly even with the `su(1)` command. For example, make sure that your `ptys` are specified as being insecure in the `/etc/ttys` file so that direct `root` logins via `telnet` or `rlogin` are disallowed. If using other login services such as **sshd**, make sure that direct `root` logins are disabled there as well. You can do this by editing your `/etc/ssh/sshd_config` file, and making sure that `PermitRootLogin` is set to `NO`. Consider every access method — services such as FTP often fall through the cracks. Direct `root` logins should only be allowed via the system console.

Of course, as a `sysadmin` you have to be able to get to `root`, so we open up a few holes. But we make sure these holes require additional password verification to operate. One way to make `root` accessible is to add appropriate staff accounts to the `wheel` group (in `/etc/group`). The staff members placed in the `wheel` group are allowed to `su` to `root`. You should never give staff members native `wheel` access by putting them in the `wheel` group in their password entry. Staff accounts should be placed in a `staff` group, and then added to the `wheel` group via the

`/etc/group` file. Only those staff members who actually need to have `root` access should be placed in the `wheel` group. It is also possible, when using an authentication method such as Kerberos, to use Kerberos' `.k5login` file in the `root` account to allow a `ksu(1)` to `root` without having to place anyone at all in the `wheel` group. This may be the better solution since the `wheel` mechanism still allows an intruder to break `root` if the intruder has gotten hold of your password file and can break into a staff account. While having the `wheel` mechanism is better than having nothing at all, it is not necessarily the safest option.

An indirect way to secure staff accounts, and ultimately `root` access is to use an alternative login access method and do what is known as “starring” out the encrypted password for the staff accounts. Using the `vipw(8)` command, one can replace each instance of an encrypted password with a single “*” character. This command will update the `/etc/master.passwd` file and user/password database to disable password-authenticated logins.

A staff account entry such as:

```
foobar:R9DT/Fa1/LV9U:1000:1000::0:0:Foo Bar:/home/foobar:/usr/local/bin/tcsh
```

Should be changed to this:

```
foobar:*:1000:1000::0:0:Foo Bar:/home/foobar:/usr/local/bin/tcsh
```

This change will prevent normal logins from occurring, since the encrypted password will never match “*”. With this done, staff members must use another mechanism to authenticate themselves such as `kerberos(1)` or `ssh(1)` using a public/private key pair. When using something like Kerberos, one generally must secure the machines which run the Kerberos servers and your desktop workstation. When using a public/private key pair with `ssh`, one must generally secure the machine used to login *from* (typically one's workstation). An additional layer of protection can be added to the key pair by password protecting the key pair when creating it with `ssh-keygen(1)`. Being able to “star” out the passwords for staff accounts also guarantees that staff members can only login through secure access methods that you have set up. This forces all staff members to use secure, encrypted connections for all of their sessions, which closes an important hole used by many intruders: sniffing the network from an unrelated, less secure machine.

The more indirect security mechanisms also assume that you are logging in from a more restrictive server to a less restrictive server. For example, if your main box is running all sorts of servers, your workstation should not be running any. In order for your workstation to be reasonably secure you should run as few servers as possible, up to and including no servers at all, and you should run a password-protected screen blanker. Of course, given physical access to a workstation an attacker can break any sort of security you put on it. This is definitely a problem that you should consider, but you should also consider the fact that the vast majority of break-ins occur remotely, over a network, from people who do not have physical access to your workstation or servers.

Using something like Kerberos also gives you the ability to disable or change the password for a staff account in one place, and have it immediately affect all the machines on which the staff member may have an account. If a staff member's account gets compromised, the ability to instantly change his password on all machines should not be underrated. With discrete passwords, changing a password on N machines can be a mess. You can also impose re-passwording restrictions with Kerberos: not only can a Kerberos ticket be made to timeout after a while, but the Kerberos system can require that the user choose a new password after a certain period of time (say, once a month).

15.3.2 Securing Root-run Servers and SUID/SGID Binaries

The prudent sysadmin only runs the servers he needs to, no more, no less. Be aware that third party servers are often the most bug-prone. For example, running an old version of **imapd** or **popper** is like giving a universal `root` ticket out to the entire world. Never run a server that you have not checked out carefully. Many servers do not need to be run as `root`. For example, the **ntalk**, **comsat**, and **finger** daemons can be run in special user *sandboxes*. A sandbox

is not perfect, unless you go through a large amount of trouble, but the onion approach to security still stands: If someone is able to break in through a server running in a sandbox, they still have to break out of the sandbox. The more layers the attacker must break through, the lower the likelihood of his success. Root holes have historically been found in virtually every server ever run as `root`, including basic system servers. If you are running a machine through which people only login via `sshd` and never login via `telnetd` or `rshd` or `rlogind`, then turn off those services!

FreeBSD now defaults to running `ntalkd`, `comsat`, and `finger` in a sandbox. Another program which may be a candidate for running in a sandbox is `named(8)`. `/etc/defaults/rc.conf` includes the arguments necessary to run `named` in a sandbox in a commented-out form. Depending on whether you are installing a new system or upgrading an existing system, the special user accounts used by these sandboxes may not be installed. The prudent sysadmin would research and implement sandboxes for servers whenever possible.

There are a number of other servers that typically do not run in sandboxes: `sendmail`, `popper`, `imapd`, `ftpd`, and others. There are alternatives to some of these, but installing them may require more work than you are willing to perform (the convenience factor strikes again). You may have to run these servers as `root` and rely on other mechanisms to detect break-ins that might occur through them.

The other big potential `root` holes in a system are the `suid-root` and `sgid` binaries installed on the system. Most of these binaries, such as `rlogin`, reside in `/bin`, `/sbin`, `/usr/bin`, or `/usr/sbin`. While nothing is 100% safe, the system-default `suid` and `sgid` binaries can be considered reasonably safe. Still, `root` holes are occasionally found in these binaries. A `root` hole was found in `xlib` in 1998 that made `xterm` (which is typically `suid`) vulnerable. It is better to be safe than sorry and the prudent sysadmin will restrict `suid` binaries, that only staff should run, to a special group that only staff can access, and get rid of (`chmod 000`) any `suid` binaries that nobody uses. A server with no display generally does not need an `xterm` binary. `Sgid` binaries can be almost as dangerous. If an intruder can break an `sgid-kmem` binary, the intruder might be able to read `/dev/kmem` and thus read the encrypted password file, potentially compromising any passworded account. Alternatively an intruder who breaks group `kmem` can monitor keystrokes sent through `ptys`, including `ptys` used by users who login through secure methods. An intruder that breaks the `tty` group can write to almost any user's `tty`. If a user is running a terminal program or emulator with a keyboard-simulation feature, the intruder can potentially generate a data stream that causes the user's terminal to echo a command, which is then run as that user.

15.3.3 Securing User Accounts

User accounts are usually the most difficult to secure. While you can impose draconian access restrictions on your staff and “star” out their passwords, you may not be able to do so with any general user accounts you might have. If you do have sufficient control, then you may win out and be able to secure the user accounts properly. If not, you simply have to be more vigilant in your monitoring of those accounts. Use of `ssh` and Kerberos for user accounts is more problematic, due to the extra administration and technical support required, but still a very good solution compared to a encrypted password file.

15.3.4 Securing the Password File

The only sure fire way is to star out as many passwords as you can and use `ssh` or Kerberos for access to those accounts. Even though the encrypted password file (`/etc/spwd.db`) can only be read by `root`, it may be possible for an intruder to obtain read access to that file even if the attacker cannot obtain root-write access.

Your security scripts should always check for and report changes to the password file (see the Checking file integrity section below).

15.3.5 Securing the Kernel Core, Raw Devices, and File systems

If an attacker breaks `root` he can do just about anything, but there are certain conveniences. For example, most modern kernels have a packet sniffing device driver built in. Under FreeBSD it is called the `bpf` device. An intruder will commonly attempt to run a packet sniffer on a compromised machine. You do not need to give the intruder the capability and most systems do not have the need for the `bpf` device compiled in.

But even if you turn off the `bpf` device, you still have `/dev/mem` and `/dev/kmem` to worry about. For that matter, the intruder can still write to raw disk devices. Also, there is another kernel feature called the module loader, `kldload(8)`. An enterprising intruder can use a KLD module to install his own `bpf` device, or other sniffing device, on a running kernel. To avoid these problems you have to run the kernel at a higher secure level, at least `securelevel 1`. The `securelevel` can be set with a `sysctl` on the `kern.securelevel` variable. Once you have set the `securelevel` to 1, write access to raw devices will be denied and special `chflags` flags, such as `schg`, will be enforced. You must also ensure that the `schg` flag is set on critical startup binaries, directories, and script files — everything that gets run up to the point where the `securelevel` is set. This might be overdoing it, and upgrading the system is much more difficult when you operate at a higher secure level. You may compromise and run the system at a higher secure level but not set the `schg` flag for every system file and directory under the sun. Another possibility is to simply mount `/` and `/usr` read-only. It should be noted that being too draconian in what you attempt to protect may prevent the all-important detection of an intrusion.

15.3.6 Checking File Integrity: Binaries, Configuration Files, Etc.

When it comes right down to it, you can only protect your core system configuration and control files so much before the convenience factor rears its ugly head. For example, using `chflags` to set the `schg` bit on most of the files in `/` and `/usr` is probably counterproductive, because while it may protect the files, it also closes a detection window. The last layer of your security onion is perhaps the most important — detection. The rest of your security is pretty much useless (or, worse, presents you with a false sense of security) if you cannot detect potential intrusions. Half the job of the onion is to slow down the attacker, rather than stop him, in order to be able to catch him in the act.

The best way to detect an intrusion is to look for modified, missing, or unexpected files. The best way to look for modified files is from another (often centralized) limited-access system. Writing your security scripts on the extra-secure limited-access system makes them mostly invisible to potential attackers, and this is important. In order to take maximum advantage you generally have to give the limited-access box significant access to the other machines in the business, usually either by doing a read-only NFS export of the other machines to the limited-access box, or by setting up `ssh` key-pairs to allow the limited-access box to `ssh` to the other machines. Except for its network traffic, NFS is the least visible method — allowing you to monitor the file systems on each client box virtually undetected. If your limited-access server is connected to the client boxes through a switch, the NFS method is often the better choice. If your limited-access server is connected to the client boxes through a hub, or through several layers of routing, the NFS method may be too insecure (network-wise) and using `ssh` may be the better choice even with the audit-trail tracks that `ssh` lays.

Once you have given a limited-access box at least read access to the client systems it is supposed to monitor, you must write scripts to do the actual monitoring. Given an NFS mount, you can write scripts out of simple system utilities such as `find(1)` and `md5(1)`. It is best to physically `md5` the client-box files at least once a day, and to test control files such as those found in `/etc` and `/usr/local/etc` even more often. When mismatches are found, relative to the base `md5` information the limited-access machine knows is valid, it should scream at a `sysadmin` to go check it out. A good security script will also check for inappropriate `suid` binaries and for new or deleted files on system partitions such as `/` and `/usr`.

When using `ssh` rather than NFS, writing the security script is much more difficult. You essentially have to `scp` the scripts to the client box in order to run them, making them visible, and for safety you also need to `scp` the binaries (such as `find`) that those scripts use. The `ssh` client on the client box may already be compromised. All in all, using `ssh` may be necessary when running over insecure links, but it is also a lot harder to deal with.

A good security script will also check for changes to user and staff members access configuration files: `.rhosts`, `.shosts`, `.ssh/authorized_keys` and so forth, files that might fall outside the purview of the MD5 check.

If you have a huge amount of user disk space, it may take too long to run through every file on those partitions. In this case, setting mount flags to disallow `suid` binaries and devices on those partitions is a good idea. The `nodev` and `nosuid` options (see `mount(8)`) are what you want to look into. You should probably scan them anyway, at least once a week, since the object of this layer is to detect a break-in attempt, whether or not the attempt succeeds.

Process accounting (see `accton(8)`) is a relatively low-overhead feature of the operating system which might help as a post-break-in evaluation mechanism. It is especially useful in tracking down how an intruder has actually broken into a system, assuming the file is still intact after the break-in has occurred.

Finally, security scripts should process the log files, and the logs themselves should be generated in as secure a manner as possible — remote `syslog` can be very useful. An intruder will try to cover his tracks, and log files are critical to the `sysadmin` trying to track down the time and method of the initial break-in. One way to keep a permanent record of the log files is to run the system console to a serial port and collect the information to a secure machine monitoring the consoles.

15.3.7 Paranoia

A little paranoia never hurts. As a rule, a `sysadmin` can add any number of security features, as long as they do not affect convenience, and can add security features that *do* affect convenience with some added thought. Even more importantly, a security administrator should mix it up a bit — if you use recommendations such as those given by this document verbatim, you give away your methodologies to the prospective attacker who also has access to this document.

15.3.8 Denial of Service Attacks

This section covers Denial of Service attacks. A DoS attack is typically a packet attack. While there is not much you can do about modern spoofed packet attacks that saturate your network, you can generally limit the damage by ensuring that the attacks cannot take down your servers by:

1. Limiting server forks.
2. Limiting springboard attacks (ICMP response attacks, ping broadcast, etc.).
3. Overloading the Kernel Route Cache.

A common DoS attack scenario is attacking a forking server and making it spawning so many child processes that the host system eventually runs out of memory, file descriptors, etc. and then grinds to a halt. `inetd` (see `inetd(8)`) has several options to limit this sort of attack. It should be noted that while it is possible to prevent a machine from going down, it is not generally possible to prevent a service from being disrupted by the attack. Read the `inetd` manual page carefully and pay specific attention to the `-c`, `-C`, and `-R` options. Note that spoofed-IP attacks will circumvent the `-C` option to `inetd`, so typically a combination of options must be used. Some standalone servers have self-fork-limitation parameters.

Sendmail has its `-OMaxDaemonChildren` option, which tends to work much better than trying to use **Sendmail**'s load limiting options due to the load lag. You should specify a `MaxDaemonChildren` parameter, when you start **sendmail**; high enough to handle your expected load, but not so high that the computer cannot handle that number of **Sendmail** instances without falling on its face. It is also prudent to run **Sendmail** in queued mode (`-ODeliveryMode=queued`) and to run the daemon (`sendmail -bd`) separate from the queue-runs (`sendmail -q15m`). If you still want real-time delivery you can run the queue at a much lower interval, such as `-q1m`, but be sure to specify a reasonable `MaxDaemonChildren` option for *that* **Sendmail** to prevent cascade failures.

Syslogd can be attacked directly and it is strongly recommended that you use the `-s` option whenever possible, and the `-a` option otherwise.

You should also be fairly careful with connect-back services such as **TCP Wrapper**'s reverse-identd, which can be attacked directly. You generally do not want to use the reverse-ident feature of **TCP Wrapper** for this reason.

It is a very good idea to protect internal services from external access by firewalling them off at your border routers. The idea here is to prevent saturation attacks from outside your LAN, not so much to protect internal services from network-based root compromise. Always configure an exclusive firewall, i.e., "firewall everything *except* ports A, B, C, D, and M-Z". This way you can firewall off all of your low ports except for certain specific services such as **named** (if you are primary for a zone), **ntalkd**, **sendmail**, and other Internet-accessible services. If you try to configure the firewall the other way — as an inclusive or permissive firewall, there is a good chance that you will forget to "close" a couple of services, or that you will add a new internal service and forget to update the firewall. You can still open up the high-numbered port range on the firewall, to allow permissive-like operation, without compromising your low ports. Also take note that FreeBSD allows you to control the range of port numbers used for dynamic binding, via the various `net.inet.ip.portrange` `sysctl`'s (`sysctl -a | fgrep portrange`), which can also ease the complexity of your firewall's configuration. For example, you might use a normal first/last range of 4000 to 5000, and a `hiport` range of 49152 to 65535, then block off everything under 4000 in your firewall (except for certain specific Internet-accessible ports, of course).

Another common DoS attack is called a springboard attack — to attack a server in a manner that causes the server to generate responses which overloads the server, the local network, or some other machine. The most common attack of this nature is the *ICMP ping broadcast attack*. The attacker spoofs ping packets sent to your LAN's broadcast address with the source IP address set to the actual machine they wish to attack. If your border routers are not configured to stomp on ping packets to broadcast addresses, your LAN winds up generating sufficient responses to the spoofed source address to saturate the victim, especially when the attacker uses the same trick on several dozen broadcast addresses over several dozen different networks at once. Broadcast attacks of over a hundred and twenty megabits have been measured. A second common springboard attack is against the ICMP error reporting system. By constructing packets that generate ICMP error responses, an attacker can saturate a server's incoming network and cause the server to saturate its outgoing network with ICMP responses. This type of attack can also crash the server by running it out of memory, especially if the server cannot drain the ICMP responses it generates fast enough. Use the `sysctl` variable `net.inet.icmp.icmplim` to limit these attacks. The last major class of springboard attacks is related to certain internal **inetd** services such as the `udp echo` service. An attacker simply spoofs a UDP packet with the source address being server A's echo port, and the destination address being server B's echo port, where server A and B are both on your LAN. The two servers then bounce this one packet back and forth between each other. The attacker can overload both servers and their LANs simply by injecting a few packets in this manner. Similar problems exist with the internal **chargen** port. A competent sysadmin will turn off all of these `inetd`-internal test services.

Spoofed packet attacks may also be used to overload the kernel route cache. Refer to the `net.inet.ip.rtxpire`, `rtminexpire`, and `rtmaxcache` `sysctl` parameters. A spoofed packet attack that uses a random source IP will cause the kernel to generate a temporary cached route in the route table, viewable with `netstat -rna | fgrep w3`. These routes typically timeout in 1600 seconds or so. If the kernel detects that the cached route table has gotten too big it will dynamically reduce the `rtxpire` but will never decrease it to less than `rtminexpire`. There are two

problems:

1. The kernel does not react quickly enough when a lightly loaded server is suddenly attacked.
2. The `rtminexpire` is not low enough for the kernel to survive a sustained attack.

If your servers are connected to the Internet via a T3 or better, it may be prudent to manually override both `rtexpire` and `rtminexpire` via `sysctl(8)`. Never set either parameter to zero (unless you want to crash the machine). Setting both parameters to 2 seconds should be sufficient to protect the route table from attack.

15.3.9 Access Issues with Kerberos and SSH

There are a few issues with both Kerberos and `ssh` that need to be addressed if you intend to use them. Kerberos 5 is an excellent authentication protocol, but there are bugs in the kerberized **telnet** and **rlogin** applications that make them unsuitable for dealing with binary streams. Also, by default Kerberos does not encrypt a session unless you use the `-x` option. **ssh** encrypts everything by default.

`Ssh` works quite well in every respect except that it forwards encryption keys by default. What this means is that if you have a secure workstation holding keys that give you access to the rest of the system, and you `ssh` to an insecure machine, your keys are usable. The actual keys themselves are not exposed, but `ssh` installs a forwarding port for the duration of your login, and if an attacker has broken `root` on the insecure machine he can utilize that port to use your keys to gain access to any other machine that your keys unlock.

We recommend that you use `ssh` in combination with Kerberos whenever possible for staff logins. **Ssh** can be compiled with Kerberos support. This reduces your reliance on potentially exposed `ssh` keys while at the same time protecting passwords via Kerberos. `Ssh` keys should only be used for automated tasks from secure machines (something that Kerberos is unsuited to do). We also recommend that you either turn off key-forwarding in the `ssh` configuration, or that you make use of the `from=IP/DOMAIN` option that `ssh` allows in its `authorized_keys` file to make the key only usable to entities logging in from specific machines.

15.4 DES, MD5, and Crypt

Every user on a UNIX system has a password associated with their account. It seems obvious that these passwords need to be known only to the user and the actual operating system. In order to keep these passwords secret, they are encrypted with what is known as a “one-way hash”, that is, they can only be easily encrypted but not decrypted. In other words, what we told you a moment ago was obvious is not even true: the operating system itself does not *really* know the password. It only knows the *encrypted* form of the password. The only way to get the “plain-text” password is by a brute force search of the space of possible passwords.

Unfortunately the only secure way to encrypt passwords when UNIX came into being was based on DES, the Data Encryption Standard. This was not such a problem for users resident in the US, but since the source code for DES could not be exported outside the US, FreeBSD had to find a way to both comply with US law and retain compatibility with all the other UNIX variants that still used DES.

The solution was to divide up the encryption libraries so that US users could install the DES libraries and use DES but international users still had an encryption method that could be exported abroad. This is how FreeBSD came to use MD5 as its default encryption method. MD5 is believed to be more secure than DES, so installing DES is offered primarily for compatibility reasons.

15.4.1 Recognizing Your Crypt Mechanism

Currently the library supports DES, MD5 and Blowfish hash functions. By default FreeBSD uses MD5 to encrypt passwords.

It is pretty easy to identify which encryption method FreeBSD is set up to use. Examining the encrypted passwords in the `/etc/master.passwd` file is one way. Passwords encrypted with the MD5 hash are longer than those encrypted with the DES hash and also begin with the characters `1`. Passwords starting with `$2a$` are encrypted with the Blowfish hash function. DES password strings do not have any particular identifying characteristics, but they are shorter than MD5 passwords, and are coded in a 64-character alphabet which does not include the `$` character, so a relatively short string which does not begin with a dollar sign is very likely a DES password.

The password format used for new passwords is controlled by the `passwd_format` login capability in `/etc/login.conf`, which takes values of `des`, `md5` or `blf`. See the `login.conf(5)` manual page for more information about login capabilities.

15.5 One-time Passwords

By default, FreeBSD includes support for OPIE (One-time Passwords In Everything), which uses the MD5 hash by default.

There are three different sorts of passwords which we will discuss below. The first is your usual UNIX style or Kerberos password; we will call this a “UNIX password”. The second sort is the one-time password which is generated by the OPIE `opiekey(1)` program and accepted by the `opiepasswd(1)` program and the login prompt; we will call this a “one-time password”. The final sort of password is the secret password which you give to the `opiekey` program (and sometimes the `opiepasswd` programs) which it uses to generate one-time passwords; we will call it a “secret password” or just unqualified “password”.

The secret password does not have anything to do with your UNIX password; they can be the same but this is not recommended. OPIE secret passwords are not limited to 8 characters like old UNIX passwords¹, they can be as long as you like. Passwords of six or seven word long phrases are fairly common. For the most part, the OPIE system operates completely independently of the UNIX password system.

Besides the password, there are two other pieces of data that are important to OPIE. One is what is known as the “seed” or “key”, consisting of two letters and five digits. The other is what is called the “iteration count”, a number between 1 and 100. OPIE creates the one-time password by concatenating the seed and the secret password, then applying the MD5 hash as many times as specified by the iteration count and turning the result into six short English words. These six English words are your one-time password. The authentication system (primarily PAM) keeps track of the last one-time password used, and the user is authenticated if the hash of the user-provided password is equal to the previous password. Because a one-way hash is used it is impossible to generate future one-time passwords if a successfully used password is captured; the iteration count is decremented after each successful login to keep the user and the login program in sync. When the iteration count gets down to 1, OPIE must be reinitialized.

There are a few programs involved in each system which we will discuss below. The `opiekey` program accepts an iteration count, a seed, and a secret password, and generates a one-time password or a consecutive list of one-time passwords. The `opiepasswd` program is used to initialize OPIE, and to change passwords, iteration counts, or seeds; it takes either a secret passphrase, or an iteration count, seed, and a one-time password. The `opieinfo` program will examine the relevant credentials files (`/etc/opiekeys`) and print out the invoking user’s current iteration count and seed.

There are four different sorts of operations we will cover. The first is using `opiepasswd` over a secure connection to set up one-time-passwords for the first time, or to change your password or seed. The second operation is using `opiepasswd` over an insecure connection, in conjunction with `opiekey` over a secure connection, to do the same. The third is using `opiekey` to log in over an insecure connection. The fourth is using `opiekey` to generate a number of keys which can be written down or printed out to carry with you when going to some location without secure connections to anywhere.

15.5.1 Secure Connection Initialization

To initialize OPIE for the first time, execute the `opiepasswd` command:

```
% opiepasswd -c
[grimreaper] ~ $ opiepasswd -f -c
Adding unfurl:
Only use this method from the console; NEVER from remote. If you are using
telnet, xterm, or a dial-in, type ^C now or exit with no password.
Then run opiepasswd without the -c parameter.
Using MD5 to compute responses.
Enter new secret pass phrase:
Again new secret pass phrase:
ID unfurl OTP key is 499 to4268
MOS MALL GOAT ARM AVID COED
```

At the `Enter new secret pass phrase:` or `Enter secret password:` prompts, you should enter a password or phrase. Remember, this is not the password that you will use to login with, this is used to generate your one-time login keys. The “ID” line gives the parameters of your particular instance: your login name, the iteration count, and seed. When logging in the system will remember these parameters and present them back to you so you do not have to remember them. The last line gives the particular one-time password which corresponds to those parameters and your secret password; if you were to re-login immediately, this one-time password is the one you would use.

15.5.2 Insecure Connection Initialization

To initialize or change your secret password over an insecure connection, you will need to already have a secure connection to some place where you can run `opiekey`; this might be in the form of a shell prompt on a machine you trust. You will also need to make up an iteration count (100 is probably a good value), and you may make up your own seed or use a randomly-generated one. Over on the insecure connection (to the machine you are initializing), use `opiepasswd`:

```
% opiepasswd

Updating unfurl:
You need the response from an OTP generator.
Old secret pass phrase:
    otp-md5 498 to4268 ext
    Response: GAME GAG WELT OUT DOWN CHAT
New secret pass phrase:
    otp-md5 499 to4269
    Response: LINE PAP MILK NELL BUOY TROY

ID mark OTP key is 499 gr4269
```

```
LINE PAP MILK NELL BUOY TROY
```

To accept the default seed press **Return**. Then before entering an access password, move over to your secure connection and give it the same parameters:

```
% opiekey 498 to4268
Using the MD5 algorithm to compute response.
Reminder: Don't use opiekey from telnet or dial-in sessions.
Enter secret pass phrase:
GAME GAG WELT OUT DOWN CHAT
```

Now switch back over to the insecure connection, and copy the one-time password generated over to the relevant program.

15.5.3 Generating a Single One-time Password

Once you have initialized OPIE and login, you will be presented with a prompt like this:

```
% telnet example.com
Trying 10.0.0.1...
Connected to example.com
Escape character is '^]'.

FreeBSD/i386 (example.com) (tty)

login: <username>
otp-md5 498 gr4269 ext
Password:
```

As a side note, the OPIE prompts have a useful feature (not shown here): if you press **Return** at the password prompt, the prompter will turn echo on, so you can see what you are typing. This can be extremely useful if you are attempting to type in a password by hand, such as from a printout.

At this point you need to generate your one-time password to answer this login prompt. This must be done on a trusted system that you can run `opiekey` on. (There are versions of these for DOS, Windows and Mac OS as well.) They need the iteration count and the seed as command line options. You can cut-and-paste these right from the login prompt on the machine that you are logging in to.

On the trusted system:

```
% opiekey 498 to4268
Using the MD5 algorithm to compute response.
Reminder: Don't use opiekey from telnet or dial-in sessions.
Enter secret pass phrase:
GAME GAG WELT OUT DOWN CHAT
```

Now that you have your one-time password you can continue logging in.

15.5.4 Generating Multiple One-time Passwords

Sometimes you have to go places where you do not have access to a trusted machine or secure connection. In this case, it is possible to use the `opiekey` command to generate a number of one-time passwords beforehand to be printed out and taken with you. For example:

```
% opiekey -n 5 30 zz99999
Using the MD5 algorithm to compute response.
Reminder: Don't use opiekey from telnet or dial-in sessions.
Enter secret pass phrase: <secret password>
26: JOAN BORE FOSS DES NAY QUIT
27: LATE BIAS SLAY FOLK MUCH TRIG
28: SALT TIN ANTI LOON NEAL USE
29: RIO ODIN GO BYE FURY TIC
30: GREW JIVE SAN GIRD BOIL PHI
```

The `-n 5` requests five keys in sequence, the `30` specifies what the last iteration number should be. Note that these are printed out in *reverse* order of eventual use. If you are really paranoid, you might want to write the results down by hand; otherwise you can cut-and-paste into `lpr`. Note that each line shows both the iteration count and the one-time password; you may still find it handy to scratch off passwords as you use them.

15.5.5 Restricting Use of UNIX Passwords

OPIE can restrict the use of UNIX passwords based on the IP address of a login session. The relevant file is `/etc/opieaccess`, which is present by default. Please check `opieaccess(5)` for more information on this file and which security considerations you should be aware of when using it.

Here is a sample `opieaccess` file:

```
permit 192.168.0.0 255.255.0.0
```

This line allows users whose IP source address (which is vulnerable to spoofing) matches the specified value and mask, to use UNIX passwords at any time.

If no rules in `opieaccess` are matched, the default is to deny non-OPIE logins.

15.6 TCP Wrappers

Anyone familiar with `inetd(8)` has probably heard of TCP Wrappers at some point. But few individuals seem to fully comprehend its usefulness in a network environment. It seems that everyone wants to install a firewall to handle network connections. While a firewall has a wide variety of uses, there are some things that a firewall not handle such as sending text back to the connection originator. The TCP software does this and much more. In the next few sections many of the TCP Wrappers features will be discussed, and, when applicable, example configuration lines will be provided.

The TCP Wrappers software extends the abilities of `inetd` to provide support for every server daemon under its control. Using this method it is possible to provide logging support, return messages to connections, permit a daemon to only accept internal connections, etc. While some of these features can be provided by implementing a firewall, this will add not only an extra layer of protection but go beyond the amount of control a firewall can provide.

The added functionality of TCP Wrappers should not be considered a replacement for a good firewall. TCP Wrappers can be used in conjunction with a firewall or other security enhancements though and it can serve nicely as an extra layer of protection for the system.

Since this is an extension to the configuration of `inetd`, the reader is expected have read the `inetd` configuration section.

Όχιἄβυός: While programs run by `inetd(8)` are not exactly “daemons”, they have traditionally been called daemons. This is the term we will use in this section too.

15.6.1 Initial Configuration

The only requirement of using TCP Wrappers in FreeBSD is to ensure the `inetd` server is started from `rc.conf` with the `-ww` option; this is the default setting. Of course, proper configuration of `/etc/hosts.allow` is also expected, but `syslogd(8)` will throw messages in the system logs in these cases.

Όχιἄβυός: Unlike other implementations of TCP Wrappers, the use of `hosts.deny` has been deprecated. All configuration options should be placed in `/etc/hosts.allow`.

In the simplest configuration, daemon connection policies are set to either be permitted or blocked depending on the options in `/etc/hosts.allow`. The default configuration in FreeBSD is to allow a connection to every daemon started with `inetd`. Changing this will be discussed only after the basic configuration is covered.

Basic configuration usually takes the form of `daemon : address : action`. Where `daemon` is the daemon name which `inetd` started. The `address` can be a valid hostname, an IP address or an IPv6 address enclosed in brackets (`[]`). The `action` field can be either `allow` or `deny` to grant or deny access appropriately. Keep in mind that configuration works off a first rule match semantic, meaning that the configuration file is scanned in ascending order for a matching rule. When a match is found the rule is applied and the search process will halt.

Several other options exist but they will be explained in a later section. A simple configuration line may easily be constructed from that information alone. For example, to allow POP3 connections via the `mail/qpopper` daemon, the following lines should be appended to `hosts.allow`:

```
# This line is required for POP3 connections:
qpopper : ALL : allow
```

After adding this line, `inetd` will need restarted. This can be accomplished by use of the `kill(1)` command, or with the `restart` parameter with `/etc/rc.d/inetd`.

15.6.2 Advanced Configuration

TCP Wrappers has advanced options too; they will allow for more control over the way connections are handled. In some cases it may be a good idea to return a comment to certain hosts or daemon connections. In other cases, perhaps a log file should be recorded or an email sent to the administrator. Other situations may require the use of a service for local connections only. This is all possible through the use of configuration options known as `wildcards`, expansion characters and external command execution. The next two sections are written to cover these situations.

15.6.2.1 External Commands

Suppose that a situation occurs where a connection should be denied yet a reason should be sent to the individual who attempted to establish that connection. How could it be done? That action can be made possible by using the `twist` option. When a connection attempt is made, `twist` will be called to execute a shell command or script. An example already exists in the `hosts.allow` file:

```
# The rest of the daemons are protected.
ALL : ALL \
      : severity auth.info \
      : twist /bin/echo "You are not welcome to use %d from %h."
```

This example shows that the message, “You are not allowed to use daemon from hostname.” will be returned for any daemon not previously configured in the access file. This is extremely useful for sending a reply back to the connection initiator right after the established connection is dropped. Note that any message returned *must* be wrapped in quote " characters; there are no exceptions to this rule.

Προσοχή: It may be possible to launch a denial of service attack on the server if an attacker, or group of attackers could flood these daemons with connection requests.

Another possibility is to use the `spawn` option in these cases. Like `twist`, the `spawn` implicitly denies the connection and may be used to run external shell commands or scripts. Unlike `twist`, `spawn` will not send a reply back to the individual who established the connection. For an example, consider the following configuration line:

```
# We do not allow connections from example.com:
ALL : .example.com \
      : spawn (/bin/echo %a from %h attempted to access %d >> \
      /var/log/connections.log) \
      : deny
```

This will deny all connection attempts from the `*.example.com` domain; simultaneously logging the hostname, IP address and the daemon which they attempted to access in the `/var/log/connections.log` file.

Aside from the already explained substitution characters above, e.g. `%a`, a few others exist. See the `hosts_access(5)` manual page for the complete list.

15.6.2.2 Wildcard Options

Thus far the `ALL` example has been used continuously throughout the examples. Other options exist which could extend the functionality a bit further. For instance, `ALL` may be used to match every instance of either a daemon, domain or an IP address. Another wildcard available is `PARANOID` which may be used to match any host which provides an IP address that may be forged. In other words, `paranoid` may be used to define an action to be taken whenever a connection is made from an IP address that differs from its hostname. The following example may shed some more light on this discussion:

```
# Block possibly spoofed requests to sendmail:
sendmail : PARANOID : deny
```

In that example all connection requests to `sendmail` which have an IP address that varies from its hostname will be denied.

Προσοχή: Using the `PARANOID` may severely cripple servers if the client or server has a broken DNS setup. Administrator discretion is advised.

To learn more about wildcards and their associated functionality, see the `hosts_access(5)` manual page.

Before any of the specific configuration lines above will work, the first configuration line should be commented out in `hosts.allow`. This was noted at the beginning of this section.

15.7 KerberosIV

Kerberos is a network add-on system/protocol that allows users to authenticate themselves through the services of a secure server. Services such as remote login, remote copy, secure inter-system file copying and other high-risk tasks are made considerably safer and more controllable.

The following instructions can be used as a guide on how to set up Kerberos as distributed for FreeBSD. However, you should refer to the relevant manual pages for a complete description.

15.7.1 Installing KerberosIV

Kerberos is an optional component of FreeBSD. The easiest way to install this software is by selecting the `krb4` or `krb5` distribution in `sysinstall` during the initial installation of FreeBSD. This will install the “eBones” (KerberosIV) or “Heimdal” (Kerberos5) implementation of Kerberos. These implementations are included because they are developed outside the USA/Canada and were thus available to system owners outside those countries during the era of restrictive export controls on cryptographic code from the USA.

Alternatively, the MIT implementation of Kerberos is available from the Ports Collection as `security/krb5`.

15.7.2 Creating the Initial Database

This is done on the Kerberos server only. First make sure that you do not have any old Kerberos databases around. You should change to the directory `/etc/kerberosIV` and check that only the following files are present:

```
# cd /etc/kerberosIV
# ls
README  krb.conf          krb.realms
```

If any additional files (such as `principal.*` or `master_key`) exist, then use the `kdb_destroy` command to destroy the old Kerberos database, or if Kerberos is not running, simply delete the extra files.

You should now edit the `krb.conf` and `krb.realms` files to define your Kerberos realm. In this case the realm will be `EXAMPLE.COM` and the server is `grunt.example.com`. We edit or create the `krb.conf` file:

```
# cat krb.conf
EXAMPLE.COM
EXAMPLE.COM grunt.example.com admin server
CS.BERKELEY.EDU okeeffe.berkeley.edu
ATHENA.MIT.EDU kerberos.mit.edu
ATHENA.MIT.EDU kerberos-1.mit.edu
```

```
ATHENA.MIT.EDU kerberos-2.mit.edu
ATHENA.MIT.EDU kerberos-3.mit.edu
LCS.MIT.EDU kerberos.lcs.mit.edu
TELECOM.MIT.EDU bitsy.mit.edu
ARC.NASA.GOV trident.arc.nasa.gov
```

In this case, the other realms do not need to be there. They are here as an example of how a machine may be made aware of multiple realms. You may wish to not include them for simplicity.

The first line names the realm in which this system works. The other lines contain realm/host entries. The first item on a line is a realm, and the second is a host in that realm that is acting as a “key distribution center”. The words `admin server` following a host’s name means that host also provides an administrative database server. For further explanation of these terms, please consult the Kerberos manual pages.

Now we have to add `grunt.example.com` to the `EXAMPLE.COM` realm and also add an entry to put all hosts in the `.example.com` domain in the `EXAMPLE.COM` realm. The `krb.realms` file would be updated as follows:

```
# cat krb.realms
grunt.example.com EXAMPLE.COM
.example.com EXAMPLE.COM
.berkeley.edu CS.BERKELEY.EDU
.MIT.EDU ATHENA.MIT.EDU
.mit.edu ATHENA.MIT.EDU
```

Again, the other realms do not need to be there. They are here as an example of how a machine may be made aware of multiple realms. You may wish to remove them to simplify things.

The first line puts the *specific* system into the named realm. The rest of the lines show how to default systems of a particular subdomain to a named realm.

Now we are ready to create the database. This only needs to run on the Kerberos server (or Key Distribution Center). Issue the `kdb_init` command to do this:

```
# kdb_init
Realm name [default ATHENA.MIT.EDU ]: EXAMPLE.COM
You will be prompted for the database Master Password.
It is important that you NOT FORGET this password.
```

```
Enter Kerberos master key:
```

Now we have to save the key so that servers on the local machine can pick it up. Use the `kstash` command to do this:

```
# kstash
Enter Kerberos master key:

Current Kerberos master key version is 1.

Master key entered. BEWARE!
```

This saves the encrypted master password in `/etc/kerberosIV/master_key`.

15.7.3 Making It All Run

Two principals need to be added to the database for *each* system that will be secured with Kerberos. Their names are `kpasswd` and `rcmd`. These two principals are made for each system, with the instance being the name of the individual system.

These daemons, **kpasswd** and **rcmd** allow other systems to change Kerberos passwords and run commands like `rcp(1)`, `rlogin(1)` and `rsh(1)`.

Now let us add these entries:

```
# kdb_edit
Opening database...

Enter Kerberos master key:

Current Kerberos master key version is 1.

Master key entered.  BEWARE!
Previous or default values are in [brackets] ,
enter return to leave the same, or new value.

Principal name: passwd
Instance: grunt

<Not found>, Create [y] ? y

Principal: passwd, Instance: grunt, kdc_key_ver: 1
New Password:          <---- enter RANDOM here
Verifying password

New Password: <---- enter RANDOM here

Random password [y] ? y

Principal's new key version = 1
Expiration date (enter yyyy-mm-dd) [ 2000-01-01 ] ?
Max ticket lifetime (*5 minutes) [ 255 ] ?
Attributes [ 0 ] ?
Edit O.K.
Principal name: rcmd
Instance: grunt

<Not found>, Create [y] ?

Principal: rcmd, Instance: grunt, kdc_key_ver: 1
New Password: <---- enter RANDOM here
Verifying password

New Password:          <---- enter RANDOM here

Random password [y] ?

Principal's new key version = 1
```

```
Expiration date (enter yyyy-mm-dd) [ 2000-01-01 ] ?
Max ticket lifetime (*5 minutes) [ 255 ] ?
Attributes [ 0 ] ?
Edit O.K.
Principal name:          <---- null entry here will cause an exit
```

15.7.4 Creating the Server File

We now have to extract all the instances which define the services on each machine. For this we use the `ext_srvtab` command. This will create a file which must be copied or moved *by secure means* to each Kerberos client's `/etc` directory. This file must be present on each server and client, and is crucial to the operation of Kerberos.

```
# ext_srvtab grunt
Enter Kerberos master key:

Current Kerberos master key version is 1.

Master key entered. BEWARE!
Generating 'grunt-new-srvtab'....
```

Now, this command only generates a temporary file which must be renamed to `srvtab` so that all the servers can pick it up. Use the `mv(1)` command to move it into place on the original system:

```
# mv grunt-new-srvtab srvtab
```

If the file is for a client system, and the network is not deemed safe, then copy the `client-new-srvtab` to removable media and transport it by secure physical means. Be sure to rename it to `srvtab` in the client's `/etc` directory, and make sure it is mode 600:

```
# mv grumble-new-srvtab srvtab
# chmod 600 srvtab
```

15.7.5 Populating the Database

We now have to add some user entries into the database. First let us create an entry for the user `jane`. Use the `kdb_edit` command to do this:

```
# kdb_edit
Opening database...

Enter Kerberos master key:

Current Kerberos master key version is 1.

Master key entered. BEWARE!
Previous or default values are in [brackets] ,
enter return to leave the same, or new value.

Principal name: jane
Instance:
```

```
<Not found>, Create [y] ? y

Principal: jane, Instance: , kdc_key_ver: 1
New Password:          <---- enter a secure password here
Verifying password

New Password:          <---- re-enter the password here
Principal's new key version = 1
Expiration date (enter yyyy-mm-dd) [ 2000-01-01 ] ?
Max ticket lifetime (*5 minutes) [ 255 ] ?
Attributes [ 0 ] ?
Edit O.K.
Principal name:       <---- null entry here will cause an exit
```

15.7.6 Testing It All Out

First we have to start the Kerberos daemons. Note that if you have correctly edited your `/etc/rc.conf` then this will happen automatically when you reboot. This is only necessary on the Kerberos server. Kerberos clients will automatically get what they need from the `/etc/kerberosIV` directory.

```
# kerberos &
Kerberos server starting
Sleep forever on error
Log file is /var/log/kerberos.log
Current Kerberos master key version is 1.

Master key entered. BEWARE!

Current Kerberos master key version is 1
Local realm: EXAMPLE.COM
# kadmin -n &
KADM Server KADM0.0A initializing
Please do not use 'kill -9' to kill this job, use a
regular kill instead

Current Kerberos master key version is 1.

Master key entered. BEWARE!
```

Now we can try using the `kinit` command to get a ticket for the ID `jane` that we created above:

```
% kinit jane
MIT Project Athena (grunt.example.com)
Kerberos Initialization for "jane"
Password:
```

Try listing the tokens using `klist` to see if we really have them:

```
% klist
Ticket file:      /tmp/tkt245
Principal:       jane@EXAMPLE.COM
```

```

    Issued          Expires          Principal
Apr 30 11:23:22   Apr 30 19:23:22   krbtgt.EXAMPLE.COM@EXAMPLE.COM

```

Now try changing the password using `passwd(1)` to check if the **kpasswd** daemon can get authorization to the Kerberos database:

```

% passwd
realm EXAMPLE.COM
Old password for jane:
New Password for jane:
Verifying password
New Password for jane:
Password changed.

```

15.7.7 Adding `su` Privileges

Kerberos allows us to give *each* user who needs `root` privileges their own *separate* `su(1)` password. We could now add an ID which is authorized to `su(1)` to `root`. This is controlled by having an instance of `root` associated with a principal. Using `kdb_edit` we can create the entry `jane.root` in the Kerberos database:

```

# kdb_edit
Opening database...

Enter Kerberos master key:

Current Kerberos master key version is 1.

Master key entered.  BEWARE!
Previous or default values are in [brackets] ,
enter return to leave the same, or new value.

Principal name: jane
Instance: root

<Not found>, Create [y] ? y

Principal: jane, Instance: root, kdc_key_ver: 1
New Password:          <---- enter a SECURE password here
Verifying password

New Password:          <---- re-enter the password here

Principal's new key version = 1
Expiration date (enter yyyy-mm-dd) [ 2000-01-01 ] ?
Max ticket lifetime (*5 minutes) [ 255 ] ? 12 <--- Keep this short!
Attributes [ 0 ] ?
Edit O.K.
Principal name:          <---- null entry here will cause an exit

```

Now try getting tokens for it to make sure it works:

```
# kinit jane.root
MIT Project Athena (grunt.example.com)
Kerberos Initialization for "jane.root"
Password:
```

Now we need to add the user to root's .klogin file:

```
# cat /root/.klogin
jane.root@EXAMPLE.COM
```

Now try doing the su(1):

```
% su
Password:
```

and take a look at what tokens we have:

```
# klist
Ticket file: /tmp/tkt_root_245
Principal:      jane.root@EXAMPLE.COM

    Issued                Expires                Principal
May  2 20:43:12  May  3 04:43:12  krbtgt.EXAMPLE.COM@EXAMPLE.COM
```

15.7.8 Using Other Commands

In an earlier example, we created a principal called `jane` with an instance `root`. This was based on a user with the same name as the principal, and this is a Kerberos default; that a `<principal>.<instance>` of the form `<username>.<root>` will allow that `<username>` to `su(1)` to `root` if the necessary entries are in the `.klogin` file in `root`'s home directory:

```
# cat /root/.klogin
jane.root@EXAMPLE.COM
```

Likewise, if a user has in their own home directory lines of the form:

```
% cat ~/.klogin
jane@EXAMPLE.COM
jack@EXAMPLE.COM
```

This allows anyone in the `EXAMPLE.COM` realm who has authenticated themselves as `jane` or `jack` (via `kinit`, see above) to access to `jane`'s account or files on this system (`grunt`) via `rlogin(1)`, `rsh(1)` or `rcp(1)`.

For example, `jane` now logs into another system using Kerberos:

```
% kinit
MIT Project Athena (grunt.example.com)
Password:
% rlogin grunt
Last login: Mon May  1 21:14:47 from grumble
Copyright (c) 1980, 1983, 1986, 1988, 1990, 1991, 1993, 1994
    The Regents of the University of California.  All rights reserved.
```

FreeBSD BUILT-19950429 (GR386) #0: Sat Apr 29 17:50:09 SAT 1995

Or jack logs into jane’s account on the same machine (jane having set up the .klogin file as above, and the person in charge of Kerberos having set up principal *jack* with a null instance):

```
% kinit
% rlogin grunt -l jane
MIT Project Athena (grunt.example.com)
Password:
Last login: Mon May  1 21:16:55 from grumble
Copyright (c) 1980, 1983, 1986, 1988, 1990, 1991, 1993, 1994
    The Regents of the University of California.  All rights reserved.
FreeBSD BUILT-19950429 (GR386) #0: Sat Apr 29 17:50:09 SAT 1995
```

15.8 Kerberos5

Every FreeBSD release beyond FreeBSD-5.1 includes support only for **Kerberos5**. Hence **Kerberos5** is the only version included, and its configuration is similar in many aspects to that of **KerberosIV**. The following information only applies to **Kerberos5** in post FreeBSD-5.0 releases. Users who wish to use the **KerberosIV** package may install the `security/krb4` port.

Kerberos is a network add-on system/protocol that allows users to authenticate themselves through the services of a secure server. Services such as remote login, remote copy, secure inter-system file copying and other high-risk tasks are made considerably safer and more controllable.

Kerberos can be described as an identity-verifying proxy system. It can also be described as a trusted third-party authentication system. **Kerberos** provides only one function — the secure authentication of users on the network. It does not provide authorization functions (what users are allowed to do) or auditing functions (what those users did). After a client and server have used **Kerberos** to prove their identity, they can also encrypt all of their communications to assure privacy and data integrity as they go about their business.

Therefore it is highly recommended that **Kerberos** be used with other security methods which provide authorization and audit services.

The following instructions can be used as a guide on how to set up **Kerberos** as distributed for FreeBSD. However, you should refer to the relevant manual pages for a complete description.

For purposes of demonstrating a **Kerberos** installation, the various name spaces will be handled as follows:

- The DNS domain (“zone”) will be `example.org`.
- The **Kerberos** realm will be `EXAMPLE.ORG`.

Όχιἄβυόç: Please use real domain names when setting up **Kerberos** even if you intend to run it internally. This avoids DNS problems and assures inter-operation with other **Kerberos** realms.

15.8.1 History

Kerberos was created by MIT as a solution to network security problems. The **Kerberos** protocol uses strong cryptography so that a client can prove its identity to a server (and vice versa) across an insecure network connection.

Kerberos is both the name of a network authentication protocol and an adjective to describe programs that implement the program (**Kerberos** telnet, for example). The current version of the protocol is version 5, described in RFC 1510.

Several free implementations of this protocol are available, covering a wide range of operating systems. The Massachusetts Institute of Technology (MIT), where **Kerberos** was originally developed, continues to develop their **Kerberos** package. It is commonly used in the US as a cryptography product, as such it has historically been affected by US export regulations. The MIT **Kerberos** is available as a port (`security/krb5`). Heimdal **Kerberos** is another version 5 implementation, and was explicitly developed outside of the US to avoid export regulations (and is thus often included in non-commercial UNIX variants). The Heimdal **Kerberos** distribution is available as a port (`security/heimdal`), and a minimal installation of it is included in the base FreeBSD install.

In order to reach the widest audience, these instructions assume the use of the Heimdal distribution included in FreeBSD.

15.8.2 Setting up a Heimdal KDC

The Key Distribution Center (KDC) is the centralized authentication service that **Kerberos** provides — it is the computer that issues **Kerberos** tickets. The KDC is considered “trusted” by all other computers in the **Kerberos** realm, and thus has heightened security concerns.

Note that while running the **Kerberos** server requires very few computing resources, a dedicated machine acting only as a KDC is recommended for security reasons.

To begin setting up a KDC, ensure that your `/etc/rc.conf` file contains the correct settings to act as a KDC (you may need to adjust paths to reflect your own system):

```
kerberos5_server_enable="YES"
kadmind5_server_enable="YES"
```

Next we will set up your **Kerberos** config file, `/etc/krb5.conf`:

```
[libdefaults]
    default_realm = EXAMPLE.ORG
[realms]
    EXAMPLE.ORG = {
        kdc = kerberos.example.org
        admin_server = kerberos.example.org
    }
[domain_realm]
    .example.org = EXAMPLE.ORG
```

Note that this `/etc/krb5.conf` file implies that your KDC will have the fully-qualified hostname of `kerberos.example.org`. You will need to add a CNAME (alias) entry to your zone file to accomplish this if your KDC has a different hostname.

Όψιμαθώς: For large networks with a properly configured BIND DNS server, the above example could be trimmed to:

```
[libdefaults]
    default_realm = EXAMPLE.ORG
```

With the following lines being appended to the `example.org` zonefile:

```
_kerberos._udp      IN SRV      01 00 88 kerberos.example.org.
_kerberos._tcp      IN SRV      01 00 88 kerberos.example.org.
_kpasswd._udp       IN SRV      01 00 464 kerberos.example.org.
_kerberos-adm._tcp IN SRV      01 00 749 kerberos.example.org.
_kerberos           IN TXT      EXAMPLE.ORG
```

Όχιὰβùόç: For clients to be able to find the **Kerberos** services, you *must* have either a fully configured `/etc/krb5.conf` or a minimally configured `/etc/krb5.conf` *and* a properly configured DNS server.

Next we will create the **Kerberos** database. This database contains the keys of all principals encrypted with a master password. You are not required to remember this password, it will be stored in a file (`/var/heimdal/m-key`). To create the master key, run `kstash` and enter a password.

Once the master key has been created, you can initialize the database using the `kadmin` program with the `-l` option (standing for “local”). This option instructs `kadmin` to modify the database files directly rather than going through the `kadmin` network service. This handles the chicken-and-egg problem of trying to connect to the database before it is created. Once you have the `kadmin` prompt, use the `init` command to create your realms initial database.

Lastly, while still in `kadmin`, create your first principal using the `add` command. Stick to the defaults options for the principal for now, you can always change them later with the `modify` command. Note that you can use the `?` command at any prompt to see the available options.

A sample database creation session is shown below:

```
# kstash
Master key: xxxxxxxx
Verifying password - Master key: xxxxxxxx

# kadmin -l
kadmin> init EXAMPLE.ORG
Realm max ticket life [unlimited]:
kadmin> add tillman
Max ticket life [unlimited]:
Max renewable life [unlimited]:
Attributes []:
Password: xxxxxxxx
Verifying password - Password: xxxxxxxx
```

Now it is time to start up the KDC services. Run `/etc/rc.d/kerberos start` and `/etc/rc.d/kadmind start` to bring up the services. Note that you will not have any kerberized daemons running at this point but you should be able to confirm that the KDC is functioning by obtaining and listing a ticket for the principal (user) that you just created from the command-line of the KDC itself:

```
% kinit tillman
tillman@EXAMPLE.ORG's Password:
```

```
% klist
Credentials cache: FILE:/tmp/krb5cc_500
Principal: tillman@EXAMPLE.ORG

    Issued                Expires                Principal
Aug 27 15:37:58  Aug 28 01:37:58  krbtgt/EXAMPLE.ORG@EXAMPLE.ORG
```

The ticket can then be revoked when you have finished:

```
% k5destroy
```

15.8.3 Kerberos enabling a server with Heimdal services

First, we need a copy of the **Kerberos** configuration file, `/etc/krb5.conf`. To do so, simply copy it over to the client computer from the KDC in a secure fashion (using network utilities, such as `scp(1)`, or physically via a floppy disk).

Next you need a `/etc/krb5.keytab` file. This is the major difference between a server providing **Kerberos** enabled daemons and a workstation — the server must have a `keytab` file. This file contains the server’s host key, which allows it and the KDC to verify each others identity. It must be transmitted to the server in a secure fashion, as the security of the server can be broken if the key is made public. This explicitly means that transferring it via a clear text channel, such as FTP, is a very bad idea.

Typically, you transfer to the `keytab` to the server using the `kadmin` program. This is handy because you also need to create the host principal (the KDC end of the `krb5.keytab`) using `kadmin`.

Note that you must have already obtained a ticket and that this ticket must be allowed to use the `kadmin` interface in the `kadmind.acl`. See the section titled “Remote administration” in the Heimdal info pages (`info heimdal`) for details on designing access control lists. If you do not want to enable remote `kadmin` access, you can simply securely connect to the KDC (via local console, `ssh(1)` or **Kerberos** `telnet(1)`) and perform administration locally using `kadmin -l`.

After installing the `/etc/krb5.conf` file, you can use `kadmin` from the **Kerberos** server. The `add --random-key` command will let you add the server’s host principal, and the `ext` command will allow you to extract the server’s host principal to its own `keytab`. For example:

```
# kadmin
kadmin> add --random-key host/myserver.example.org
Max ticket life [unlimited]:
Max renewable life [unlimited]:
Attributes []:
kadmin> ext host/myserver.example.org
kadmin> exit
```

Note that the `ext` command (short for “extract”) stores the extracted key in `/etc/krb5.keytab` by default.

If you do not have `kadmind` running on the KDC (possibly for security reasons) and thus do not have access to `kadmin` remotely, you can add the host principal (`host/myserver.EXAMPLE.ORG`) directly on the KDC and then extract it to a temporary file (to avoid over-writing the `/etc/krb5.keytab` on the KDC) using something like this:

```
# kadmin
kadmin> ext --keytab=/tmp/example.keytab host/myserver.example.org
```

```
kadmin> exit
```

You can then securely copy the keytab to the server computer (using `scp` or a floppy, for example). Be sure to specify a non-default keytab name to avoid over-writing the keytab on the KDC.

At this point your server can communicate with the KDC (due to its `krb5.conf` file) and it can prove its own identity (due to the `krb5.keytab` file). It is now ready for you to enable some **Kerberos** services. For this example we will enable the `telnet` service by putting a line like this into your `/etc/inetd.conf` and then restarting the `inetd(8)` service with `/etc/rc.d/inetd restart`:

```
telnet    stream  tcp      nowait  root    /usr/libexec/telnetd  telnetd  -a user
```

The critical bit is that the `-a` (for authentication) type is set to `user`. Consult the `telnetd(8)` manual page for more details.

15.8.4 Kerberos enabling a client with Heimdal

Setting up a client computer is almost trivially easy. As far as **Kerberos** configuration goes, you only need the **Kerberos** configuration file, located at `/etc/krb5.conf`. Simply securely copy it over to the client computer from the KDC.

Test your client computer by attempting to use `kinit`, `klist`, and `kdestroy` from the client to obtain, show, and then delete a ticket for the principal you created above. You should also be able to use **Kerberos** applications to connect to **Kerberos** enabled servers, though if that does not work and obtaining a ticket does the problem is likely with the server and not with the client or the KDC.

When testing an application like `telnet`, try using a packet sniffer (such as `tcpdump(1)`) to confirm that your password is not sent in the clear. Try using `telnet` with the `-x` option, which encrypts the entire data stream (similar to `ssh`).

Various non-core **Kerberos** client applications are also installed by default. This is where the “minimal” nature of the base Heimdal installation is felt: `telnet` is the only **Kerberos** enabled service.

The Heimdal port adds some of the missing client applications: **Kerberos** enabled versions of `ftp`, `rsh`, `rcp`, `rlogin`, and a few other less common programs. The MIT port also contains a full suite of **Kerberos** client applications.

15.8.5 User configuration files: `.k5login` and `.k5users`

Users within a realm typically have their **Kerberos** principal (such as `tillman@EXAMPLE.ORG`) mapped to a local user account (such as a local account named `tillman`). Client applications such as `telnet` usually do not require a user name or a principal.

Occasionally, however, you want to grant access to a local user account to someone who does not have a matching **Kerberos** principal. For example, `tillman@EXAMPLE.ORG` may need access to the local user account `webdevelopers`. Other principals may also need access to that local account.

The `.k5login` and `.k5users` files, placed in a users home directory, can be used similar to a powerful combination of `.hosts` and `.rhosts`, solving this problem. For example, if a `.k5login` with the following contents:

```
tillman@example.org
jdoe@example.org
```

Were to be placed into the home directory of the local user `webdevelopers` then both principals listed would have access to that account without requiring a shared password.

Reading the manual pages for these commands is recommended. Note that the `ksu` manual page covers `.k5users`.

15.8.6 Kerberos Tips, Tricks, and Troubleshooting

- When using either the Heimdal or MIT **Kerberos** ports ensure that your `PATH` environment variable lists the **Kerberos** versions of the client applications before the system versions.
- Do all the computers in your realm have synchronized time settings? If not, authentication may fail. `ÖìÑíá 30.10` describes how to synchronize clocks using NTP.
- MIT and Heimdal inter-operate nicely. Except for `kadmin`, the protocol for which is not standardized.
- If you change your hostname, you also need to change your `host/` principal and update your keytab. This also applies to special keytab entries like the `www/` principal used for Apache's `www/mod_auth_kerb`.
- All hosts in your realm must be resolvable (both forwards and reverse) in DNS (or `/etc/hosts` as a minimum). CNAMEs will work, but the A and PTR records must be correct and in place. The error message is not very intuitive: `Kerberos5 refuses authentication because Read req failed: Key table entry not found`.
- Some operating systems that may be acting as clients to your KDC do not set the permissions for `ksu` to be setuid `root`. This means that `ksu` does not work, which is a good security idea but annoying. This is not a KDC error.
- With MIT **Kerberos**, if you want to allow a principal to have a ticket life longer than the default ten hours, you must use `modify_principal` in `kadmin` to change the `maxlife` of both the principal in question and the `krbtgt` principal. Then the principal can use the `-l` option with `kinit` to request a ticket with a longer lifetime.
-

ÖçíãÑúóç: If you run a packet sniffer on your KDC to add in troubleshooting and then run `kinit` from a workstation, you will notice that your TGT is sent immediately upon running `kinit` — even before you type your password! The explanation is that the **Kerberos** server freely transmits a TGT (Ticket Granting Ticket) to any unauthorized request; however, every TGT is encrypted in a key derived from the user's password. Therefore, when a user types their password it is not being sent to the KDC, it is being used to decrypt the TGT that `kinit` already obtained. If the decryption process results in a valid ticket with a valid time stamp, the user has valid **Kerberos** credentials. These credentials include a session key for establishing secure communications with the **Kerberos** server in the future, as well as the actual ticket-granting ticket, which is actually encrypted with the **Kerberos** server's own key. This second layer of encryption is unknown to the user, but it is what allows the **Kerberos** server to verify the authenticity of each TGT.

- If you want to use long ticket lifetimes (a week, for example) and you are using **OpenSSH** to connect to the machine where your ticket is stored, make sure that **Kerberos** `TicketCleanup` is set to `no` in your `sshd_config` or else your tickets will be deleted when you log out.

- Remember that host principals can have a longer ticket lifetime as well. If your user principal has a lifetime of a week but the host you are connecting to has a lifetime of nine hours, you will have an expired host principal in your cache and the ticket cache will not work as expected.
- When setting up a `krb5.dict` file to prevent specific bad passwords from being used (the manual page for `kadmind` covers this briefly), remember that it only applies to principals that have a password policy assigned to them. The `krb5.dict` files format is simple: one string per line. Creating a symbolic link to `/usr/share/dict/words` might be useful.

15.8.7 Differences with the MIT port

The major difference between the MIT and Heimdal installs relates to the `kadmin` program which has a different (but equivalent) set of commands and uses a different protocol. This has a large implications if your KDC is MIT as you will not be able to use the Heimdal `kadmin` program to administer your KDC remotely (or vice versa, for that matter).

The client applications may also take slightly different command line options to accomplish the same tasks. Following the instructions on the MIT **Kerberos** web site (<http://web.mit.edu/Kerberos/www/>) is recommended. Be careful of path issues: the MIT port installs into `/usr/local/` by default, and the “normal” system applications may be run instead of MIT if your `PATH` environment variable lists the system directories first.

Όχι!Βύθος: With the MIT `security/krb5` port that is provided by FreeBSD, be sure to read the `/usr/local/share/doc/krb5/README.FreeBSD` file installed by the port if you want to understand why logins via `telnetd` and `klogind` behave somewhat oddly. Most importantly, correcting the “incorrect permissions on cache file” behavior requires that the `login.krb5` binary be used for authentication so that it can properly change ownership for the forwarded credentials.

The `rc.conf` must also be modified to contain the following configuration:

```
kerberos5_server="/usr/local/sbin/krb5kdc"
kadmind5_server="/usr/local/sbin/kadmind"
kerberos5_server_enable="YES"
kadmind5_server_enable="YES"
```

This is done because the applications for MIT kerberos installs binaries in the `/usr/local` hierarchy.

15.8.8 Mitigating limitations found in Kerberos

15.8.8.1 Kerberos is an all-or-nothing approach

Every service enabled on the network must be modified to work with **Kerberos** (or be otherwise secured against network attacks) or else the users credentials could be stolen and re-used. An example of this would be **Kerberos** enabling all remote shells (via `rsh` and `telnet`, for example) but not converting the POP3 mail server which sends passwords in plain text.

15.8.8.2 Kerberos is intended for single-user workstations

In a multi-user environment, **Kerberos** is less secure. This is because it stores the tickets in the `/tmp` directory, which is readable by all users. If a user is sharing a computer with several other people simultaneously (i.e. multi-user), it is possible that the user's tickets can be stolen (copied) by another user.

This can be overcome with the `-c` filename command-line option or (preferably) the `KRB5CCNAME` environment variable, but this is rarely done. In principal, storing the ticket in the users home directory and using simple file permissions can mitigate this problem.

15.8.8.3 The KDC is a single point of failure

By design, the KDC must be as secure as the master password database is contained on it. The KDC should have absolutely no other services running on it and should be physically secured. The danger is high because **Kerberos** stores all passwords encrypted with the same key (the "master" key), which in turn is stored as a file on the KDC.

As a side note, a compromised master key is not quite as bad as one might normally fear. The master key is only used to encrypt the **Kerberos** database and as a seed for the random number generator. As long as access to your KDC is secure, an attacker cannot do much with the master key.

Additionally, if the KDC is unavailable (perhaps due to a denial of service attack or network problems) the network services are unusable as authentication can not be performed, a recipe for a denial-of-service attack. This can be alleviated with multiple KDCs (a single master and one or more slaves) and with careful implementation of secondary or fall-back authentication (PAM is excellent for this).

15.8.8.4 Kerberos Shortcomings

Kerberos allows users, hosts and services to authenticate between themselves. It does not have a mechanism to authenticate the KDC to the users, hosts or services. This means that a trojanned `kinit` (for example) could record all user names and passwords. Something like `security/tripwire` or other file system integrity checking tools can alleviate this.

15.8.9 Resources and further information

- The **Kerberos** FAQ (<http://www.faqs.org/faqs/Kerberos-faq/general/preamble.html>)
- Designing an Authentication System: a Dialog in Four Scenes (<http://web.mit.edu/Kerberos/www/dialogue.html>)
- RFC 1510, The **Kerberos** Network Authentication Service (V5) (<http://www.ietf.org/rfc/rfc1510.txt?number=1510>)
- MIT **Kerberos** home page (<http://web.mit.edu/Kerberos/www/>)
- Heimdal **Kerberos** home page (<http://www.pdc.kth.se/heimdal/>)

15.9 OpenSSL

One feature that many users overlook is the **OpenSSL** toolkit included in FreeBSD. **OpenSSL** provides an encryption transport layer on top of the normal communications layer; thus allowing it to be intertwined with many network applications and services.

Some uses of **OpenSSL** may include encrypted authentication of mail clients, web based transactions such as credit card payments and more. Many ports such as `www/apache13-ssl`, and `mail/sylpheed-claws` will offer compilation support for building with **OpenSSL**.

Όχι!Βύθος: In most cases the Ports Collection will attempt to build the `security/openssl` port unless the `WITH_OPENSSL_BASE` make variable is explicitly set to “yes”.

The version of **OpenSSL** included in FreeBSD supports Secure Sockets Layer v2/v3 (SSLv2/SSLv3), Transport Layer Security v1 (TLSv1) network security protocols and can be used as a general cryptographic library.

Όχι!Βύθος: While **OpenSSL** supports the IDEA algorithm, it is disabled by default due to United States patents. To use it, the license should be reviewed and, if the restrictions are acceptable, the `MAKE_IDEA` variable must be set in `make.conf`.

One of the most common uses of **OpenSSL** is to provide certificates for use with software applications. These certificates ensure that the credentials of the company or individual are valid and not fraudulent. If the certificate in question has not been verified by one of the several “Certificate Authorities”, or CAs, a warning is usually produced. A Certificate Authority is a company, such as VeriSign (<http://www.verisign.com>), which will sign certificates in order to validate credentials of individuals or companies. This process has a cost associated with it and is definitely not a requirement for using certificates; however, it can put some of the more paranoid users at ease.

15.9.1 Generating Certificates

To generate a certificate, the following command is available:

```
# openssl req -new -nodes -out req.pem -keyout cert.pem
Generating a 1024 bit RSA private key
.....+++++
.....+++++
writing new private key to 'cert.pem'
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:US
State or Province Name (full name) [Some-State]:PA
Locality Name (eg, city) []:Pittsburgh
Organization Name (eg, company) [Internet Widgits Pty Ltd]:My Company
Organizational Unit Name (eg, section) []:Systems Administrator
```

```
Common Name (eg, YOUR name) []:localhost.example.org
Email Address []:trhodes@FreeBSD.org
```

Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:SOME PASSWORD
An optional company name []:Another Name

Notice the response directly after the "Common Name" prompt shows a domain name. This prompt requires a server name to be entered for verification purposes; placing anything but a domain name would yield a useless certificate. Other options, for instance expire time, alternate encryption algorithms, etc. are available. A complete list may be obtained by viewing the openssl(1) manual page.

Two files should now exist in the directory in which the aforementioned command was issued. The certificate request, req.pem, may be sent to a certificate authority who will validate the credentials that you entered, sign the request and return the certificate to you. The second file created will be named cert.pem and is the private key for the certificate and should be protected at all costs; if this falls in the hands of others it can be used to impersonate you (or your server).

In cases where a signature from a CA is not required, a self signed certificate can be created. First, generate the RSA key:

```
# openssl dsaparam -rand -genkey -out myRSA.key 1024
```

Next, generate the CA key:

```
# openssl gendsa -des3 -out myca.key myRSA.key
```

Use this key to create the certificate:

```
# openssl req -new -x509 -days 365 -key myca.key -out new.crt
```

Two new files should appear in the directory: a certificate authority signature file, myca.key and the certificate itself, new.crt. These should be placed in a directory, preferably under /etc, which is readable only by root. Permissions of 0700 should be fine for this and they can be set with the chmod utility.

15.9.2 Using Certificates, an Example

So what can these files do? A good use would be to encrypt connections to the **Sendmail** MTA. This would dissolve the use of clear text authentication for users who send mail via the local MTA.

Όχι! Βούζ: This is not the best use in the world as some MUAs will present the user with an error if they have not installed the certificate locally. Refer to the documentation included with the software for more information on certificate installation.

The following lines should be placed inside the local .mc file:

```
dnl SSL Options
define('confCACERT_PATH', '/etc/certs')dnl
define('confCACERT', '/etc/certs/new.crt')dnl
define('confSERVER_CERT', '/etc/certs/new.crt')dnl
```

```
define('confSERVER_KEY', '/etc/certs/myca.key')dnl
define('confTLS_SRV_OPTIONS', 'V')dnl
```

Where `/etc/certs/` is the directory to be used for storing the certificate and key files locally. The last few requirements are a rebuild of the local `.cf` file. This is easily achieved by typing `make install` within the `/etc/mail` directory. Follow that up with `make restart` which should start the **Sendmail** daemon.

If all went well there will be no error messages in the `/var/log/maillog` file and **Sendmail** will show up in the process list.

For a simple test, simply connect to the mail server using the `telnet(1)` utility:

```
# telnet example.com 25
Trying 192.0.34.166...
Connected to example.com.
Escape character is '^]'.
220 example.com ESMTP Sendmail 8.12.10/8.12.10; Tue, 31 Aug 2004 03:41:22 -0400 (EDT)
ehlo example.com
250-example.com Hello example.com [192.0.34.166], pleased to meet you
250-ENHANCEDSTATUSCODES
250-PIPELINING
250-8BITMIME
250-SIZE
250-DSN
250-ETRN
250-AUTH LOGIN PLAIN
250-STARTTLS
250-DELIVERBY
250 HELP
quit
221 2.0.0 example.com closing connection
Connection closed by foreign host.
```

If the “STARTTLS” line appears in the output then everything is working correctly.

15.10 VPN over IPsec

Creating a VPN between two networks, separated by the Internet, using FreeBSD gateways.

15.10.1 Understanding IPsec

This section will guide you through the process of setting up IPsec, and to use it in an environment which consists of FreeBSD and **Microsoft Windows 2000/XP** machines, to make them communicate securely. In order to set up IPsec, it is necessary that you are familiar with the concepts of building a custom kernel (see Εἰσαγωγή 9).

IPsec is a protocol which sits on top of the Internet Protocol (IP) layer. It allows two or more hosts to communicate in a secure manner (hence the name). The FreeBSD IPsec “network stack” is based on the KAME (<http://www.kame.net/>) implementation, which has support for both protocol families, IPv4 and IPv6.

Όψιμα ἔργα: FreeBSD contains a “hardware accelerated” IPsec stack, known as “Fast IPsec”, that was obtained from OpenBSD. It employs cryptographic hardware (whenever possible) via the `crypto(4)` subsystem to optimize

the performance of IPsec. This subsystem is new, and does not support all the features that are available in the KAME version of IPsec. However, in order to enable hardware-accelerated IPsec, the following kernel option has to be added to your kernel configuration file:

```
options    FAST_IPSEC    # new IPsec (cannot define w/ IPSEC)
```

Note, that it is not currently possible to use the “Fast IPsec” subsystem in lieu of the KAME implementation of IPsec. Consult the `fast_ipsec(4)` manual page for more information.

Όϋἔἔἔ: To let firewalls properly track state for gif(4) tunnels too, you have to enable the `IPSEC_FILTERGIF` in your kernel configuration:

```
options    IPSEC_FILTERGIF    #filter ipsec packets from a tunnel
```

IPsec consists of two sub-protocols:

- *Encapsulated Security Payload (ESP)*, protects the IP packet data from third party interference, by encrypting the contents using symmetric cryptography algorithms (like Blowfish, 3DES).
- *Authentication Header (AH)*, protects the IP packet header from third party interference and spoofing, by computing a cryptographic checksum and hashing the IP packet header fields with a secure hashing function. This is then followed by an additional header that contains the hash, to allow the information in the packet to be authenticated.

ESP and AH can either be used together or separately, depending on the environment.

IPsec can either be used to directly encrypt the traffic between two hosts (known as *Transport Mode*); or to build “virtual tunnels” between two subnets, which could be used for secure communication between two corporate networks (known as *Tunnel Mode*). The latter is more commonly known as a *Virtual Private Network (VPN)*. The `ipsec(4)` manual page should be consulted for detailed information on the IPsec subsystem in FreeBSD.

To add IPsec support to your kernel, add the following options to your kernel configuration file:

```
options    IPSEC            #IP security
options    IPSEC_ESP        #IP security (crypto; define w/ IPSEC)
```

If IPsec debugging support is desired, the following kernel option should also be added:

```
options    IPSEC_DEBUG    #debug for IP security
```

15.10.2 The Problem

There is no standard for what constitutes a VPN. VPNs can be implemented using a number of different technologies, each of which have their own strengths and weaknesses. This section presents a scenario, and the strategies used for implementing a VPN for this scenario.

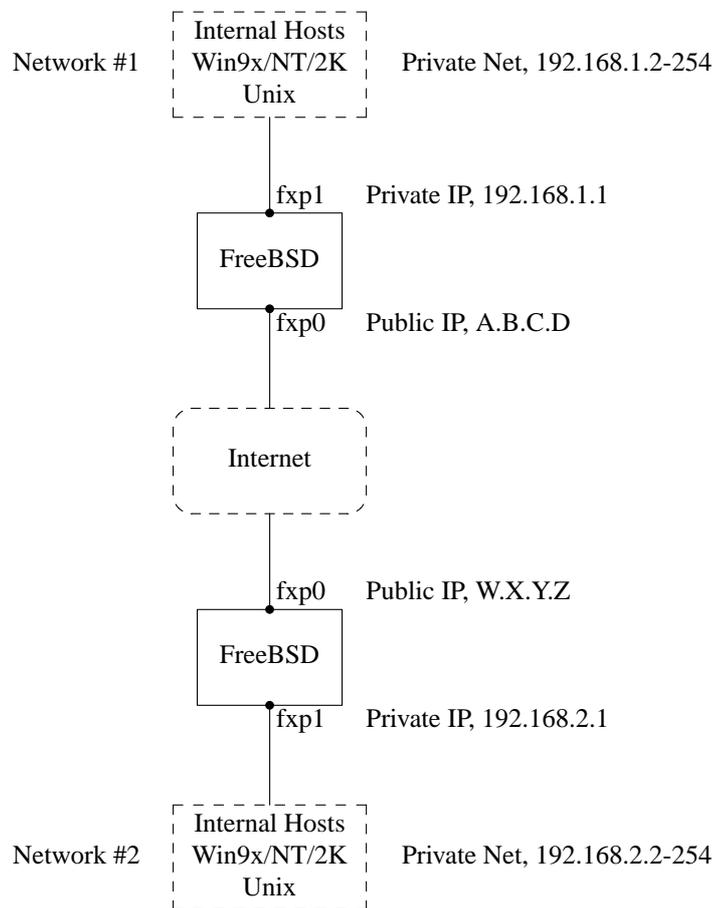
15.10.3 The Scenario: Two networks, connected to the Internet, to behave as one

The premise is as follows:

- You have at least two sites
- Both sites are using IP internally
- Both sites are connected to the Internet, through a gateway that is running FreeBSD.
- The gateway on each network has at least one public IP address.
- The internal addresses of the two networks can be public or private IP addresses, it does not matter. You can be running NAT on the gateway machine if necessary.
- The internal IP addresses of the two networks *do not collide*. While I expect it is theoretically possible to use a combination of VPN technology and NAT to get this to work, I expect it to be a configuration nightmare.

If you find that you are trying to connect two networks, both of which, internally, use the same private IP address range (e.g. both of them use 192.168.1.x), then one of the networks will have to be renumbered.

The network topology might look something like this:



Notice the two public IP addresses. I will use the letters to refer to them in the rest of this article. Anywhere you see those letters in this article, replace them with your own public IP addresses. Note also that internally, the two gateway machines have .1 IP addresses, and that the two networks have different private IP addresses (192.168.1.x

and 192.168.2.x respectively). All the machines on the private networks have been configured to use the .1 machine as their default gateway.

The intention is that, from a network point of view, each network should view the machines on the other network as though they were directly attached the same router -- albeit a slightly slow router with an occasional tendency to drop packets.

This means that (for example), machine 192.168.1.20 should be able to run

```
ping 192.168.2.34
```

and have it work, transparently. Windows machines should be able to see the machines on the other network, browse file shares, and so on, in exactly the same way that they can browse machines on the local network.

And the whole thing has to be secure. This means that traffic between the two networks has to be encrypted.

Creating a VPN between these two networks is a multi-step process. The stages are as follows:

1. Create a “virtual” network link between the two networks, across the Internet. Test it, using tools like ping(8), to make sure it works.
2. Apply security policies to ensure that traffic between the two networks is transparently encrypted and decrypted as necessary. Test this, using tools like tcpdump(1), to ensure that traffic is encrypted.
3. Configure additional software on the FreeBSD gateways, to allow Windows machines to see one another across the VPN.

15.10.3.1 Step 1: Creating and testing a “virtual” network link

Suppose that you were logged in to the gateway machine on network #1 (with public IP address A.B.C.D, private IP address 192.168.1.1), and you ran `ping 192.168.2.1`, which is the private address of the machine with IP address W.X.Y.Z. What needs to happen in order for this to work?

1. The gateway machine needs to know how to reach 192.168.2.1. In other words, it needs to have a route to 192.168.2.1.
2. Private IP addresses, such as those in the 192.168.x range are not supposed to appear on the Internet at large. Instead, each packet you send to 192.168.2.1 will need to be wrapped up inside another packet. This packet will need to appear to be from A.B.C.D, and it will have to be sent to W.X.Y.Z. This process is called *encapsulation*.
3. Once this packet arrives at W.X.Y.Z it will need to “unencapsulated”, and delivered to 192.168.2.1.

You can think of this as requiring a “tunnel” between the two networks. The two “tunnel mouths” are the IP addresses A.B.C.D and W.X.Y.Z, and the tunnel must be told the addresses of the private IP addresses that will be allowed to pass through it. The tunnel is used to transfer traffic with private IP addresses across the public Internet.

This tunnel is created by using the generic interface, or `gif` devices on FreeBSD. As you can imagine, the `gif` interface on each gateway host must be configured with four IP addresses; two for the public IP addresses, and two for the private IP addresses.

Support for the `gif` device must be compiled in to the FreeBSD kernel on both machines. You can do this by adding the line:

```
device gif
```

to the kernel configuration files on both machines, and then compile, install, and reboot as normal.

Configuring the tunnel is a two step process. First the tunnel must be told what the outside (or public) IP addresses are, using `ifconfig(8)`. Then the private IP addresses must be configured using `ifconfig(8)`.

On the gateway machine on network #1 you would run the following commands to configure the tunnel.

```
# ifconfig gif0 create
# ifconfig gif0 tunnel A.B.C.D W.X.Y.Z
# ifconfig gif0 inet 192.168.1.1 192.168.2.1 netmask 0xffffffff
```

On the other gateway machine you run the same commands, but with the order of the IP addresses reversed.

```
# ifconfig gif0 create
# ifconfig gif0 tunnel W.X.Y.Z A.B.C.D
# ifconfig gif0 inet 192.168.2.1 192.168.1.1 netmask 0xffffffff
```

You can then run:

```
ifconfig gif0
```

to see the configuration. For example, on the network #1 gateway, you would see this:

```
# ifconfig gif0
gif0: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 1280
      tunnel inet A.B.C.D --> W.X.Y.Z
      inet 192.168.1.1 --> 192.168.2.1 netmask 0xffffffff
```

As you can see, a tunnel has been created between the physical addresses `A.B.C.D` and `W.X.Y.Z`, and the traffic allowed through the tunnel is that between `192.168.1.1` and `192.168.2.1`.

This will also have added an entry to the routing table on both machines, which you can examine with the command `netstat -rn`. This output is from the gateway host on network #1.

```
# netstat -rn
Routing tables

Internet:
Destination      Gateway          Flags    Refs    Use    Netif    Expire
...
192.168.2.1      192.168.1.1    UH       0       0     gif0
...
```

As the “Flags” value indicates, this is a host route, which means that each gateway knows how to reach the other gateway, but they do not know how to reach the rest of their respective networks. That problem will be fixed shortly.

It is likely that you are running a firewall on both machines. This will need to be circumvented for your VPN traffic. You might want to allow all traffic between both networks, or you might want to include firewall rules that protect both ends of the VPN from one another.

It greatly simplifies testing if you configure the firewall to allow all traffic through the VPN. You can always tighten things up later. If you are using ipfw(8) on the gateway machines then a command like

```
ipfw add 1 allow ip from any to any via gif0
```

will allow all traffic between the two end points of the VPN, without affecting your other firewall rules. Obviously you will need to run this command on both gateway hosts.

This is sufficient to allow each gateway machine to ping the other. On 192.168.1.1, you should be able to run

```
ping 192.168.2.1
```

and get a response, and you should be able to do the same thing on the other gateway machine.

However, you will not be able to reach internal machines on either network yet. This is because of the routing -- although the gateway machines know how to reach one another, they do not know how to reach the network behind each one.

To solve this problem you must add a static route on each gateway machine. The command to do this on the first gateway would be:

```
route add 192.168.2.0 192.168.2.1 netmask 0xffffffff00
```

This says “In order to reach the hosts on the network 192.168.2.0, send the packets to the host 192.168.2.1”. You will need to run a similar command on the other gateway, but with the 192.168.1.x addresses instead.

IP traffic from hosts on one network will now be able to reach hosts on the other network.

That has now created two thirds of a VPN between the two networks, in as much as it is “virtual” and it is a “network”. It is not private yet. You can test this using ping(8) and tcpdump(1). Log in to the gateway host and run

```
tcpdump dst host 192.168.2.1
```

In another log in session on the same host run

```
ping 192.168.2.1
```

You will see output that looks something like this:

```
16:10:24.018080 192.168.1.1 > 192.168.2.1: icmp: echo request
16:10:24.018109 192.168.1.1 > 192.168.2.1: icmp: echo reply
16:10:25.018814 192.168.1.1 > 192.168.2.1: icmp: echo request
16:10:25.018847 192.168.1.1 > 192.168.2.1: icmp: echo reply
16:10:26.028896 192.168.1.1 > 192.168.2.1: icmp: echo request
16:10:26.029112 192.168.1.1 > 192.168.2.1: icmp: echo reply
```

As you can see, the ICMP messages are going back and forth unencrypted. If you had used the -s parameter to tcpdump(1) to grab more bytes of data from the packets you would see more information.

Obviously this is unacceptable. The next section will discuss securing the link between the two networks so that all traffic is automatically encrypted.

Summary:

- Configure both kernels with “device gif”.
- Edit `/etc/rc.conf` on gateway host #1 and add the following lines (replacing IP addresses as necessary).

```
gif_interfaces="gif0"
gifconfig_gif0="A.B.C.D W.X.Y.Z"
ifconfig_gif0="inet 192.168.1.1 192.168.2.1 netmask 0xffffffff"
static_routes="vpn"
route_vpn="192.168.2.0 192.168.2.1 netmask 0xffffffff00"
```

- Edit your firewall script (`/etc/rc.firewall`, or similar) on both hosts, and add
`ipfw add 1 allow ip from any to any via gif0`
- Make similar changes to `/etc/rc.conf` on gateway host #2, reversing the order of IP addresses.

15.10.3.2 Step 2: Securing the link

To secure the link we will be using IPsec. IPsec provides a mechanism for two hosts to agree on an encryption key, and to then use this key in order to encrypt data between the two hosts.

There are two areas of configuration to be considered here.

1. There must be a mechanism for two hosts to agree on the encryption mechanism to use. Once two hosts have agreed on this mechanism there is said to be a “security association” between them.
2. There must be a mechanism for specifying which traffic should be encrypted. Obviously, you do not want to encrypt all your outgoing traffic -- you only want to encrypt the traffic that is part of the VPN. The rules that you put in place to determine what traffic will be encrypted are called “security policies”.

Security associations and security policies are both maintained by the kernel, and can be modified by userland programs. However, before you can do this you must configure the kernel to support IPsec and the Encapsulated Security Payload (ESP) protocol. This is done by configuring a kernel with:

```
options IPSEC
options IPSEC_ESP
```

and recompiling, reinstalling, and rebooting. As before you will need to do this to the kernels on both of the gateway hosts.

You have two choices when it comes to setting up security associations. You can configure them by hand between two hosts, which entails choosing the encryption algorithm, encryption keys, and so forth, or you can use daemons that implement the Internet Key Exchange protocol (IKE) to do this for you.

I recommend the latter. Apart from anything else, it is easier to set up.

Editing and displaying security policies is carried out using `setkey(8)`. By analogy, `setkey` is to the kernel’s security policy tables as `route(8)` is to the kernel’s routing tables. `setkey` can also display the current security associations, and to continue the analogy further, is akin to `netstat -r` in that respect.

There are a number of choices for daemons to manage security associations with FreeBSD. This article will describe how to use one of these, `racoon` — which is available from `security/ipsec-tools` in the FreeBSD Ports collection.

The **racoon** software must be run on both gateway hosts. On each host it is configured with the IP address of the other end of the VPN, and a secret key (which you choose, and must be the same on both gateways).

The two daemons then contact one another, confirm that they are who they say they are (by using the secret key that you configured). The daemons then generate a new secret key, and use this to encrypt the traffic over the VPN. They periodically change this secret, so that even if an attacker were to crack one of the keys (which is as theoretically close to unfeasible as it gets) it will not do them much good -- by the time they have cracked the key the two daemons have chosen another one.

The configuration file for racoon is stored in `/${PREFIX}/etc/racoon`. You should find a configuration file there, which should not need to be changed too much. The other component of racoon's configuration, which you will need to change, is the "pre-shared key".

The default racoon configuration expects to find this in the file `/${PREFIX}/etc/racoon/psk.txt`. It is important to note that the pre-shared key is *not* the key that will be used to encrypt your traffic across the VPN link, it is simply a token that allows the key management daemons to trust one another.

`psk.txt` contains a line for each remote site you are dealing with. In this example, where there are two sites, each `psk.txt` file will contain one line (because each end of the VPN is only dealing with one other end).

On gateway host #1 this line should look like this:

```
W.X.Y.Z          secret
```

That is, the *public* IP address of the remote end, whitespace, and a text string that provides the secret. Obviously, you should not use "secret" as your key -- the normal rules for choosing a password apply.

On gateway host #2 the line would look like this

```
A.B.C.D          secret
```

That is, the public IP address of the remote end, and the same secret key. `psk.txt` must be mode 0600 (i.e., only read/write to `root`) before racoon will run.

You must run racoon on both gateway machines. You will also need to add some firewall rules to allow the IKE traffic, which is carried over UDP to the ISAKMP (Internet Security Association Key Management Protocol) port. Again, this should be fairly early in your firewall ruleset.

```
ipfw add 1 allow udp from A.B.C.D to W.X.Y.Z isakmp
ipfw add 1 allow udp from W.X.Y.Z to A.B.C.D isakmp
```

Once racoon is running you can try pinging one gateway host from the other. The connection is still not encrypted, but racoon will then set up the security associations between the two hosts -- this might take a moment, and you may see this as a short delay before the ping commands start responding.

Once the security association has been set up you can view it using `setkey(8)`. Run

```
setkey -D
```

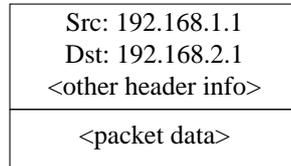
on either host to view the security association information.

That's one half of the problem. The other half is setting your security policies.

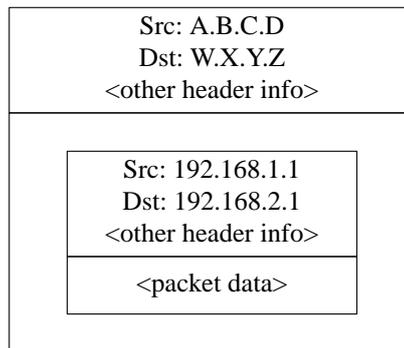
To create a sensible security policy, let's review what's been set up so far. This discussions hold for both ends of the link.

Each IP packet that you send out has a header that contains data about the packet. The header includes the IP addresses of both the source and destination. As we already know, private IP addresses, such as the 192.168.x.y range are not supposed to appear on the public Internet. Instead, they must first be encapsulated inside another packet. This packet must have the public source and destination IP addresses substituted for the private addresses.

So if your outgoing packet started looking like this:



Then it will be encapsulated inside another packet, looking something like this:



This encapsulation is carried out by the `gif` device. As you can see, the packet now has real IP addresses on the outside, and our original packet has been wrapped up as data inside the packet that will be put out on the Internet.

Obviously, we want all traffic between the VPNs to be encrypted. You might try putting this in to words, as:

“If a packet leaves from A.B.C.D, and it is destined for W.X.Y.Z, then encrypt it, using the necessary security associations.”

“If a packet arrives from W.X.Y.Z, and it is destined for A.B.C.D, then decrypt it, using the necessary security associations.”

That’s close, but not quite right. If you did this, all traffic to and from W.X.Y.Z, even traffic that was not part of the VPN, would be encrypted. That’s not quite what you want. The correct policy is as follows

“If a packet leaves from A.B.C.D, and that packet is encapsulating another packet, and it is destined for W.X.Y.Z, then encrypt it, using the necessary security associations.”

“If a packet arrives from W.X.Y.Z, and that packet is encapsulating another packet, and it is destined for A.B.C.D, then decrypt it, using the necessary security associations.”

A subtle change, but a necessary one.

Security policies are also set using `setkey(8)`. `setkey(8)` features a configuration language for defining the policy. You can either enter configuration instructions via `stdin`, or you can use the `-f` option to specify a filename that contains configuration instructions.

The configuration on gateway host #1 (which has the public IP address A.B.C.D) to force all outbound traffic to W.X.Y.Z to be encrypted is:

```
spdadd A.B.C.D/32 W.X.Y.Z/32 ipencap -P out ipsec esp/tunnel/A.B.C.D-W.X.Y.Z/require;
```

Put these commands in a file (e.g. `/etc/ipsec.conf`) and then run

```
# setkey -f /etc/ipsec.conf
```

`spdadd` tells `setkey(8)` that we want to add a rule to the secure policy database. The rest of this line specifies which packets will match this policy. `A.B.C.D/32` and `W.X.Y.Z/32` are the IP addresses and netmasks that identify the network or hosts that this policy will apply to. In this case, we want it to apply to traffic between these two hosts. `ipencap` tells the kernel that this policy should only apply to packets that encapsulate other packets. `-P out` says that this policy applies to outgoing packets, and `ipsec` says that the packet will be secured.

The second line specifies how this packet will be encrypted. `esp` is the protocol that will be used, while `tunnel` indicates that the packet will be further encapsulated in an IPsec packet. The repeated use of `A.B.C.D` and `W.X.Y.Z` is used to select the security association to use, and the final `require` mandates that packets must be encrypted if they match this rule.

This rule only matches outgoing packets. You will need a similar rule to match incoming packets.

```
spdadd W.X.Y.Z/32 A.B.C.D/32 ipencap -P in ipsec esp/tunnel/W.X.Y.Z-A.B.C.D/require;
```

Note the `in` instead of `out` in this case, and the necessary reversal of the IP addresses.

The other gateway host (which has the public IP address `W.X.Y.Z`) will need similar rules.

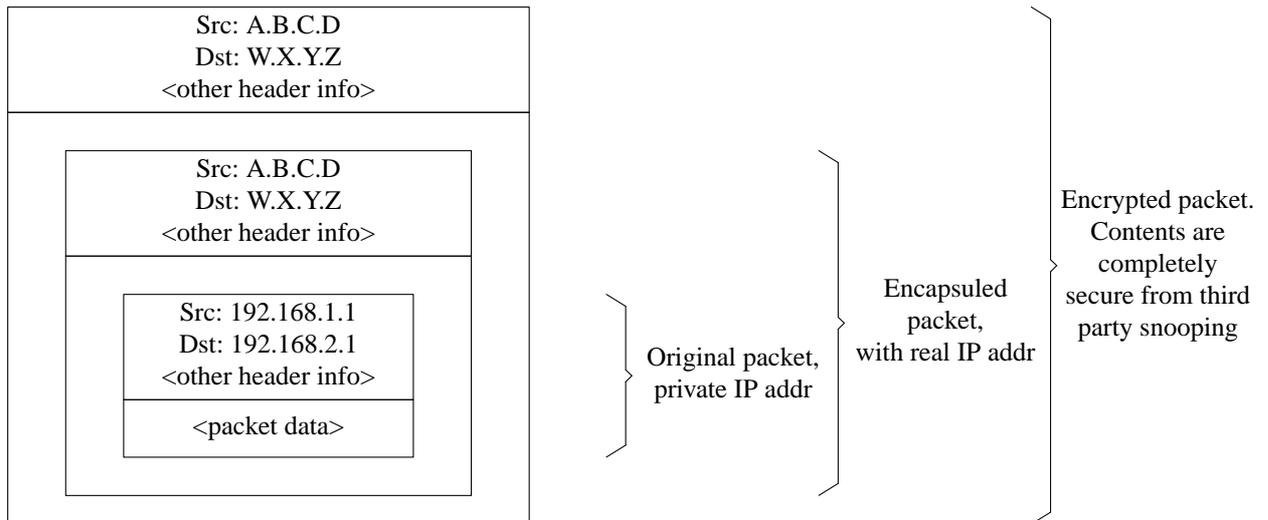
```
spdadd W.X.Y.Z/32 A.B.C.D/32 ipencap -P out ipsec esp/tunnel/W.X.Y.Z-A.B.C.D/require;
spdadd A.B.C.D/32 W.X.Y.Z/32 ipencap -P in ipsec esp/tunnel/A.B.C.D-W.X.Y.Z/require;
```

Finally, you need to add firewall rules to allow ESP and IPENCAP packets back and forth. These rules will need to be added to both hosts.

```
ipfw add 1 allow esp from A.B.C.D to W.X.Y.Z
ipfw add 1 allow esp from W.X.Y.Z to A.B.C.D
ipfw add 1 allow ipencap from A.B.C.D to W.X.Y.Z
ipfw add 1 allow ipencap from W.X.Y.Z to A.B.C.D
```

Because the rules are symmetric you can use the same rules on each gateway host.

Outgoing packets will now look something like this:



When they are received by the far end of the VPN they will first be decrypted (using the security associations that have been negotiated by racoon). Then they will enter the gif interface, which will unwrap the second layer, until you are left with the innermost packet, which can then travel in to the inner network.

You can check the security using the same ping(8) test from earlier. First, log in to the A . B . C . D gateway machine, and run:

```
tcpdump dst host 192.168.2.1
```

In another log in session on the same host run

```
ping 192.168.2.1
```

This time you should see output like the following:

```
XXX tcpdump output
```

Now, as you can see, tcpdump(1) shows the ESP packets. If you try to examine them with the -s option you will see (apparently) gibberish, because of the encryption.

Congratulations. You have just set up a VPN between two remote sites.

Summary

- Configure both kernels with:

```
options IPSEC
options IPSEC_ESP
```

- Install security/ipsec-tools. Edit \${PREFIX}/etc/racoon/psk.txt on both gateway hosts, adding an entry for the remote host's IP address and a secret key that they both know. Make sure this file is mode 0600.
- Add the following lines to /etc/rc.conf on each host:

```
ipsec_enable="YES"
ipsec_file="/etc/ipsec.conf"
```

- Create an `/etc/ipsec.conf` on each host that contains the necessary `spdadd` lines. On gateway host #1 this would be:

```
spdadd A.B.C.D/32 W.X.Y.Z/32 ipencap -P out ipsec
    esp/tunnel/A.B.C.D-W.X.Y.Z/require;
spdadd W.X.Y.Z/32 A.B.C.D/32 ipencap -P in ipsec
    esp/tunnel/W.X.Y.Z-A.B.C.D/require;
```

On gateway host #2 this would be:

```
spdadd W.X.Y.Z/32 A.B.C.D/32 ipencap -P out ipsec
    esp/tunnel/W.X.Y.Z-A.B.C.D/require;
spdadd A.B.C.D/32 W.X.Y.Z/32 ipencap -P in ipsec
    esp/tunnel/A.B.C.D-W.X.Y.Z/require;
```

- Add firewall rules to allow IKE, ESP, and IPENCAP traffic to both hosts:

```
ipfw add 1 allow udp from A.B.C.D to W.X.Y.Z isakmp
ipfw add 1 allow udp from W.X.Y.Z to A.B.C.D isakmp
ipfw add 1 allow esp from A.B.C.D to W.X.Y.Z
ipfw add 1 allow esp from W.X.Y.Z to A.B.C.D
ipfw add 1 allow ipencap from A.B.C.D to W.X.Y.Z
ipfw add 1 allow ipencap from W.X.Y.Z to A.B.C.D
```

The previous two steps should suffice to get the VPN up and running. Machines on each network will be able to refer to one another using IP addresses, and all traffic across the link will be automatically and securely encrypted.

15.11 OpenSSH

OpenSSH is a set of network connectivity tools used to access remote machines securely. It can be used as a direct replacement for `rlogin`, `rsh`, `rcp`, and `telnet`. Additionally, TCP/IP connections can be tunneled/forwarded securely through SSH. **OpenSSH** encrypts all traffic to effectively eliminate eavesdropping, connection hijacking, and other network-level attacks.

OpenSSH is maintained by the OpenBSD project, and is based upon SSH v1.2.12 with all the recent bug fixes and updates. It is compatible with both SSH protocols 1 and 2.

15.11.1 Advantages of Using OpenSSH

Normally, when using `telnet(1)` or `rlogin(1)`, data is sent over the network in a clear, un-encrypted form. Network sniffers anywhere in between the client and server can steal your user/password information or data transferred in your session. **OpenSSH** offers a variety of authentication and encryption methods to prevent this from happening.

15.11.2 Enabling sshd

The `sshd` is an option presented during a standard install of FreeBSD. To see if `sshd` is enabled, check the `rc.conf` file for:

```
sshd_enable="YES"
```

This will load `sshd(8)`, the daemon program for **OpenSSH**, the next time your system initializes. Alternatively, it is possible to use `/etc/rc.d/sshd rc(8)` script to start **OpenSSH**:

```
/etc/rc.d/sshd start
```

15.11.3 SSH Client

The `ssh(1)` utility works similarly to `rlogin(1)`.

```
# ssh user@example.com
Host key not found from the list of known hosts.
Are you sure you want to continue connecting (yes/no)? yes
Host 'example.com' added to the list of known hosts.
user@example.com's password: *****
```

The login will continue just as it would have if a session was created using `rlogin` or `telnet`. SSH utilizes a key fingerprint system for verifying the authenticity of the server when the client connects. The user is prompted to enter `yes` only when connecting for the first time. Future attempts to login are all verified against the saved fingerprint key. The SSH client will alert you if the saved fingerprint differs from the received fingerprint on future login attempts. The fingerprints are saved in `~/.ssh/known_hosts`, or `~/.ssh/known_hosts2` for SSH v2 fingerprints.

By default, recent versions of the **OpenSSH** servers only accept SSH v2 connections. The client will use version 2 if possible and will fall back to version 1. The client can also be forced to use one or the other by passing it the `-1` or `-2` for version 1 or version 2, respectively. The version 1 compatibility is maintained in the client for backwards compatibility with older versions.

15.11.4 Secure Copy

The `scp(1)` command works similarly to `rpc(1)`; it copies a file to or from a remote machine, except in a secure fashion.

```
# scp user@example.com:/COPYRIGHT COPYRIGHT
user@example.com's password: *****
COPYRIGHT          100% |*****| 4735
00:00
#
```

Since the fingerprint was already saved for this host in the previous example, it is verified when using `scp(1)` here.

The arguments passed to `scp(1)` are similar to `cp(1)`, with the file or files in the first argument, and the destination in the second. Since the file is fetched over the network, through SSH, one or more of the file arguments takes on the form `user@host:<path_to_remote_file>`.

15.11.5 Configuration

The system-wide configuration files for both the **OpenSSH** daemon and client reside within the `/etc/ssh` directory. `ssh_config` configures the client settings, while `sshd_config` configures the daemon.

Additionally, the `sshd_program (/usr/sbin/sshd` by default), and `sshd_flags rc.conf` options can provide more levels of configuration.

15.11.6 ssh-keygen

Instead of using passwords, `ssh-keygen(1)` can be used to generate DSA or RSA keys to authenticate a user:

```
% ssh-keygen -t dsa
Generating public/private dsa key pair.
Enter file in which to save the key (/home/user/.ssh/id_dsa):
Created directory '/home/user/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/user/.ssh/id_dsa.
Your public key has been saved in /home/user/.ssh/id_dsa.pub.
The key fingerprint is:
bb:48:db:f2:93:57:80:b6:aa:bc:f5:d5:ba:8f:79:17 user@host.example.com
```

`ssh-keygen(1)` will create a public and private key pair for use in authentication. The private key is stored in `~/.ssh/id_dsa` or `~/.ssh/id_rsa`, whereas the public key is stored in `~/.ssh/id_dsa.pub` or `~/.ssh/id_rsa.pub`, respectively for DSA and RSA key types. The public key must be placed in `~/.ssh/authorized_keys` of the remote machine in order for the setup to work. Similarly, RSA version 1 public keys should be placed in `~/.ssh/authorized_keys`.

This will allow connection to the remote machine based upon SSH keys instead of passwords.

If a passphrase is used in `ssh-keygen(1)`, the user will be prompted for a password each time in order to use the private key. `ssh-agent(1)` can alleviate the strain of repeatedly entering long passphrases, and is explored in the [Εύρεση 15.11.7](#) section below.

Εύρεση: The various options and files can be different according to the **OpenSSH** version you have on your system; to avoid problems you should consult the `ssh-keygen(1)` manual page.

15.11.7 ssh-agent and ssh-add

The `ssh-agent(1)` and `ssh-add(1)` utilities provide methods for **SSH** keys to be loaded into memory for use, without needing to type the passphrase each time.

The `ssh-agent(1)` utility will handle the authentication using the private key(s) that are loaded into it. `ssh-agent(1)` should be used to launch another application. At the most basic level, it could spawn a shell or at a more advanced level, a window manager.

To use `ssh-agent(1)` in a shell, first it will need to be spawned with a shell as an argument. Secondly, the identity needs to be added by running `ssh-add(1)` and providing it the passphrase for the private key. Once these steps have been completed the user will be able to `ssh(1)` to any host that has the corresponding public key installed. For example:

```
% ssh-agent csh
% ssh-add
```

```
Enter passphrase for /home/user/.ssh/id_dsa:
Identity added: /home/user/.ssh/id_dsa (/home/user/.ssh/id_dsa)
%
```

To use `ssh-agent(1)` in X11, a call to `ssh-agent(1)` will need to be placed in `~/.xinitrc`. This will provide the `ssh-agent(1)` services to all programs launched in X11. An example `~/.xinitrc` file might look like this:

```
exec ssh-agent startxfce4
```

This would launch `ssh-agent(1)`, which would in turn launch **XFCE**, every time X11 starts. Then once that is done and X11 has been restarted so that the changes can take effect, simply run `ssh-add(1)` to load all of your SSH keys.

15.11.8 SSH Tunneling

OpenSSH has the ability to create a tunnel to encapsulate another protocol in an encrypted session.

The following command tells `ssh(1)` to create a tunnel for **telnet**:

```
% ssh -2 -N -f -L 5023:localhost:23 user@foo.example.com
%
```

The `ssh` command is used with the following options:

-2

Forces `ssh` to use version 2 of the protocol. (Do not use if you are working with older SSH servers)

-N

Indicates no command, or tunnel only. If omitted, `ssh` would initiate a normal session.

-f

Forces `ssh` to run in the background.

-L

Indicates a local tunnel in `localport:remotehost:remoteport` fashion.

```
user@foo.example.com
```

The remote SSH server.

An SSH tunnel works by creating a listen socket on `localhost` on the specified port. It then forwards any connection received on the local host/port via the SSH connection to the specified remote host and port.

In the example, port `5023` on `localhost` is being forwarded to port `23` on `localhost` of the remote machine. Since `23` is **telnet**, this would create a secure **telnet** session through an SSH tunnel.

This can be used to wrap any number of insecure TCP protocols such as SMTP, POP3, FTP, etc.

ÐáñÛääéäí 15-1. Using SSH to Create a Secure Tunnel for SMTP

```
% ssh -2 -N -f -L 5025:localhost:25 user@mailserver.example.com
user@mailserver.example.com's password: *****
```

```
% telnet localhost 5025
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
220 mailserver.example.com ESMTTP
```

This can be used in conjunction with an `ssh-keygen(1)` and additional user accounts to create a more seamless/hassle-free SSH tunneling environment. Keys can be used in place of typing a password, and the tunnels can be run as a separate user.

15.11.8.1 Practical SSH Tunneling Examples

15.11.8.1.1 Secure Access of a POP3 Server

At work, there is an SSH server that accepts connections from the outside. On the same office network resides a mail server running a POP3 server. The network, or network path between your home and office may or may not be completely trustable. Because of this, you need to check your e-mail in a secure manner. The solution is to create an SSH connection to your office's SSH server, and tunnel through to the mail server.

```
% ssh -2 -N -f -L 2110:mail.example.com:110 user@ssh-server.example.com
user@ssh-server.example.com's password: *****
```

When the tunnel is up and running, you can point your mail client to send POP3 requests to `localhost` port 2110. A connection here will be forwarded securely across the tunnel to `mail.example.com`.

15.11.8.1.2 Bypassing a Draconian Firewall

Some network administrators impose extremely draconian firewall rules, filtering not only incoming connections, but outgoing connections. You may be only given access to contact remote machines on ports 22 and 80 for SSH and web surfing.

You may wish to access another (perhaps non-work related) service, such as an Ogg Vorbis server to stream music. If this Ogg Vorbis server is streaming on some other port than 22 or 80, you will not be able to access it.

The solution is to create an SSH connection to a machine outside of your network's firewall, and use it to tunnel to the Ogg Vorbis server.

```
% ssh -2 -N -f -L 8888:music.example.com:8000 user@unfirewalled-system.example.org
user@unfirewalled-system.example.org's password: *****
```

Your streaming client can now be pointed to `localhost` port 8888, which will be forwarded over to `music.example.com` port 8000, successfully evading the firewall.

15.11.9 The `AllowUsers` Users Option

It is often a good idea to limit which users can log in and from where. The `AllowUsers` option is a good way to accomplish this. For example, to only allow the `root` user to log in from `192.168.1.32`, something like this would be appropriate in the `/etc/ssh/sshd_config` file:

```
AllowUsers root@192.168.1.32
```

To allow the user `admin` to log in from anywhere, just list the username by itself:

```
AllowUsers admin
```

Multiple users should be listed on the same line, like so:

```
AllowUsers root@192.168.1.32 admin
```

Όχι!Βύθος: It is important that you list each user that needs to log in to this machine; otherwise they will be locked out.

After making changes to `/etc/ssh/sshd_config` you must tell `sshd(8)` to reload its config files, by running:

```
# /etc/rc.d/sshd reload
```

15.11.10 Further Reading

OpenSSH (<http://www.openssh.com/>)

`ssh(1)` `scp(1)` `ssh-keygen(1)` `ssh-agent(1)` `ssh-add(1)` `ssh_config(5)`

`sshd(8)` `sftp-server(8)` `sshd_config(5)`

15.12 File System Access Control Lists

In conjunction with file system enhancements like snapshots, FreeBSD 5.0 and later offers the security of File System Access Control Lists (ACLs).

Access Control Lists extend the standard UNIX permission model in a highly compatible (POSIX.1e) way. This feature permits an administrator to make use of and take advantage of a more sophisticated security model.

To enable ACL support for UFS file systems, the following:

```
options UFS_ACL
```

must be compiled into the kernel. If this option has not been compiled in, a warning message will be displayed when attempting to mount a file system supporting ACLs. This option is included in the `GENERIC` kernel. ACLs rely on extended attributes being enabled on the file system. Extended attributes are natively supported in the next generation UNIX file system, UFS2.

Όχιἄβυός: A higher level of administrative overhead is required to configure extended attributes on UFS1 than on UFS2. The performance of extended attributes on UFS2 is also substantially higher. As a result, UFS2 is generally recommended in preference to UFS1 for use with access control lists.

ACLs are enabled by the mount-time administrative flag, `acls`, which may be added to `/etc/fstab`. The mount-time flag can also be automatically set in a persistent manner using `tunefs(8)` to modify a superblock ACLs flag in the file system header. In general, it is preferred to use the superblock flag for several reasons:

- The mount-time ACLs flag cannot be changed by a remount (`mount(8) -u`), only by means of a complete `umount(8)` and fresh `mount(8)`. This means that ACLs cannot be enabled on the root file system after boot. It also means that you cannot change the disposition of a file system once it is in use.
- Setting the superblock flag will cause the file system to always be mounted with ACLs enabled even if there is not an `fstab` entry or if the devices re-order. This prevents accidental mounting of the file system without ACLs enabled, which can result in ACLs being improperly enforced, and hence security problems.

Όχιἄβυός: We may change the ACLs behavior to allow the flag to be enabled without a complete fresh `mount(8)`, but we consider it desirable to discourage accidental mounting without ACLs enabled, because you can shoot your feet quite nastily if you enable ACLs, then disable them, then re-enable them without flushing the extended attributes. In general, once you have enabled ACLs on a file system, they should not be disabled, as the resulting file protections may not be compatible with those intended by the users of the system, and re-enabling ACLs may re-attach the previous ACLs to files that have since had their permissions changed, resulting in other unpredictable behavior.

File systems with ACLs enabled will show a + (plus) sign in their permission settings when viewed. For example:

```
drwx----- 2 robert robert 512 Dec 27 11:54 private
drwxrwx---+ 2 robert robert 512 Dec 23 10:57 directory1
drwxrwx---+ 2 robert robert 512 Dec 22 10:20 directory2
drwxrwx---+ 2 robert robert 512 Dec 27 11:57 directory3
drwxr-xr-x 2 robert robert 512 Nov 10 11:54 public_html
```

Here we see that the `directory1`, `directory2`, and `directory3` directories are all taking advantage of ACLs. The `public_html` directory is not.

15.12.1 Making Use of ACLs

The file system ACLs can be viewed by the `getfacl(1)` utility. For instance, to view the ACL settings on the `test` file, one would use the command:

```
% getfacl test
#file:test
#owner:1001
#group:1001
user::rw-
group::r--
other::r--
```

To change the ACL settings on this file, invoke the `setfacl(1)` utility. Observe:

```
% setfacl -k test
```

The `-k` flag will remove all of the currently defined ACLs from a file or file system. The more preferable method would be to use `-b` as it leaves the basic fields required for ACLs to work.

```
% setfacl -m u:trhodes:rw,group:web:r--,o:--- test
```

In the aforementioned command, the `-m` option was used to modify the default ACL entries. Since there were no pre-defined entries, as they were removed by the previous command, this will restore the default options and assign the options listed. Take care to notice that if you add a user or group which does not exist on the system, an `Invalid argument error` will be printed to `stdout`.

15.13 Monitoring Third Party Security Issues

In recent years, the security world has made many improvements to how vulnerability assessment is handled. The threat of system intrusion increases as third party utilities are installed and configured for virtually any operating system available today.

Vulnerability assessment is a key factor in security, and while FreeBSD releases advisories for the base system, doing so for every third party utility is beyond the FreeBSD Project's capability. There is a way to mitigate third party vulnerabilities and warn administrators of known security issues. A FreeBSD add on utility known as **Portaudit** exists solely for this purpose.

The `ports-mgmt/portaudit` port polls a database, updated and maintained by the FreeBSD Security Team and ports developers, for known security issues.

To begin using **Portaudit**, one must install it from the Ports Collection:

```
# cd /usr/ports/ports-mgmt/portaudit && make install clean
```

During the install process, the configuration files for `periodic(8)` will be updated, permitting **Portaudit** output in the daily security runs. Ensure the daily security run emails, which are sent to `root`'s email account, are being read. No more configuration will be required here.

After installation, an administrator can update the database and view known vulnerabilities in installed packages by invoking the following command:

```
# portaudit -Fda
```

Όψιμα: The database will automatically be updated during the `periodic(8)` run; thus, the previous command is completely optional. It is only required for the following examples.

To audit the third party utilities installed as part of the Ports Collection at anytime, an administrator need only run the following command:

```
# portaudit -a
```

Portaudit will produce something like this for vulnerable packages:

```
Affected package: cups-base-1.1.22.0_1
```

Type of problem: cups-base -- HPGL buffer overflow vulnerability.
 Reference: <<http://www.FreeBSD.org/ports/portaudit/40a3bca2-6809-11d9-a9e7-0001020eed82.html>>

1 problem(s) in your installed packages found.

You are advised to update or deinstall the affected package(s) immediately.

By pointing a web browser to the URL shown, an administrator may obtain more information about the vulnerability in question. This will include versions affected, by FreeBSD Port version, along with other web sites which may contain security advisories.

In short, **Portaudit** is a powerful utility and extremely useful when coupled with the **Portupgrade** port.

15.14 FreeBSD Security Advisories

Like many production quality operating systems, FreeBSD publishes “Security Advisories”. These advisories are usually mailed to the security lists and noted in the Errata only after the appropriate releases have been patched. This section will work to explain what an advisory is, how to understand it, and what measures to take in order to patch a system.

15.14.1 What does an advisory look like?

The FreeBSD security advisories look similar to the one below, taken from the `freebsd-security-notifications` (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-security-notifications>) mailing list.

```

=====
FreeBSD-SA-XX:XX.UTIL                                     Security Advisory
                                                         The FreeBSD Project

Topic:             denial of service due to some problem❶

Category:          core❷
Module:            sys❸
Announced:        2003-09-23❹
Credits:           Person@EMAIL-ADDRESS❺
Affects:           All releases of FreeBSD❻
                   FreeBSD 4-STABLE prior to the correction date
Corrected:         2003-09-23 16:42:59 UTC (RELENG_4, 4.9-PRERELEASE)
                   2003-09-23 20:08:42 UTC (RELENG_5_1, 5.1-RELEASE-p6)
                   2003-09-23 20:07:06 UTC (RELENG_5_0, 5.0-RELEASE-p15)
                   2003-09-23 16:44:58 UTC (RELENG_4_8, 4.8-RELEASE-p8)
                   2003-09-23 16:47:34 UTC (RELENG_4_7, 4.7-RELEASE-p18)
                   2003-09-23 16:49:46 UTC (RELENG_4_6, 4.6-RELEASE-p21)
                   2003-09-23 16:51:24 UTC (RELENG_4_5, 4.5-RELEASE-p33)
                   2003-09-23 16:52:45 UTC (RELENG_4_4, 4.4-RELEASE-p43)
                   2003-09-23 16:54:39 UTC (RELENG_4_3, 4.3-RELEASE-p39)❼
CVE Name:          CVE-XXXX-XXXX❽
  
```

For general information regarding FreeBSD Security Advisories, including descriptions of the fields above, security branches, and the following sections, please visit

<http://www.FreeBSD.org/security/>.

I. Background^①

II. Problem Description⁽¹⁰⁾

III. Impact⁽¹¹⁾

IV. Workaround⁽¹²⁾

V. Solution⁽¹³⁾

VI. Correction details⁽¹⁴⁾

VII. References⁽¹⁵⁾

- ① The `Topic` field indicates exactly what the problem is. It is basically an introduction to the current security advisory and notes the utility with the vulnerability.
- ② The `Category` refers to the affected part of the system which may be one of `core`, `contrib`, or `ports`. The `core` category means that the vulnerability affects a core component of the FreeBSD operating system. The `contrib` category means that the vulnerability affects software contributed to the FreeBSD Project, such as **sendmail**. Finally the `ports` category indicates that the vulnerability affects add on software available as part of the Ports Collection.
- ③ The `Module` field refers to the component location, for instance `sys`. In this example, we see that the module, `sys`, is affected; therefore, this vulnerability affects a component used within the kernel.
- ④ The `Announced` field reflects the date said security advisory was published, or announced to the world. This means that the security team has verified that the problem does exist and that a patch has been committed to the FreeBSD source code repository.
- ⑤ The `Credits` field gives credit to the individual or organization who noticed the vulnerability and reported it.
- ⑥ The `Affects` field explains which releases of FreeBSD are affected by this vulnerability. For the kernel, a quick look over the output from `ident` on the affected files will help in determining the revision. For ports, the version number is listed after the port name in `/var/db/pkg`. If the system does not sync with the FreeBSD CVS repository and rebuild daily, chances are that it is affected.
- ⑦ The `Corrected` field indicates the date, time, time offset, and release that was corrected.
- ⑧ Reserved for the identification information used to look up vulnerabilities in the Common Vulnerabilities Database system.
- ⑨ The `Background` field gives information on exactly what the affected utility is. Most of the time this is why the utility exists in FreeBSD, what it is used for, and a bit of information on how the utility came to be.
- (10) The `Problem Description` field explains the security hole in depth. This can include information on flawed code, or even how the utility could be maliciously used to open a security hole.

- (11) The `Impact` field describes what type of impact the problem could have on a system. For example, this could be anything from a denial of service attack, to extra privileges available to users, or even giving the attacker superuser access.
- (12) The `Workaround` field offers a feasible workaround to system administrators who may be incapable of upgrading the system. This may be due to time constraints, network availability, or a slew of other reasons. Regardless, security should not be taken lightly, and an affected system should either be patched or the security hole workaround should be implemented.
- (13) The `Solution` field offers instructions on patching the affected system. This is a step by step tested and verified method for getting a system patched and working securely.
- (14) The `Correction Details` field displays the CVS branch or release name with the periods changed to underscore characters. It also shows the revision number of the affected files within each branch.
- (15) The `References` field usually offers sources of other information. This can include web URLs, books, mailing lists, and newsgroups.

15.15 Process Accounting

Process accounting is a security method in which an administrator may keep track of system resources used, their allocation among users, provide for system monitoring, and minimally track a user's commands.

This indeed has its own positive and negative points. One of the positives is that an intrusion may be narrowed down to the point of entry. A negative is the amount of logs generated by process accounting, and the disk space they may require. This section will walk an administrator through the basics of process accounting.

15.15.1 Enable and Utilizing Process Accounting

Before making use of process accounting, it must be enabled. To do this, execute the following commands:

```
# touch /var/account/acct
# accton /var/account/acct
# echo 'accounting_enable="YES"' >> /etc/rc.conf
```

Once enabled, accounting will begin to track CPU stats, commands, etc. All accounting logs are in a non-human readable format and may be viewed using the `sa(8)` utility. If issued without any options, `sa` will print information relating to the number of per user calls, the total elapsed time in minutes, total CPU and user time in minutes, average number of I/O operations, etc.

To view information about commands being issued, one would use the `lastcomm(1)` utility. The `lastcomm` may be used to print out commands issued by users on specific `ttys(5)`, for example:

```
# lastcomm ls
trhodes tty1
```

Would print out all known usage of the `ls` by `trhodes` on the `tty1` terminal.

Many other useful options exist and are explained in the `lastcomm(1)`, `acct(5)` and `sa(8)` manual pages.

Όριση

1. Under FreeBSD the standard login password may be up to 128 characters in length.

ΕὰοÛεάεί 16

Jails

16.1 Óýñïç

Ôï εὰοÛεάεί áðòù áñçããß ðé áβίáé óá jails (öðεάéÛð) ðïò FreeBSD éáé ðùð ÷ ñçóéñïðïéñýíðáé. Óá jails, ðïò áíáòÛññíðáé ññéóïÛíáð òññÛð óáí íéá áíéó÷ ðïÛíç áíáééáéðéð òç òç áéá ðãñéáÛééñíðá chroot, áβίáé Ûíá éó÷ ðñü ãñãáéãß ãéá áéá÷ áéñéóðÛð óóóðçìÛð, áééÛ ç ááóééð ðïòð ÷ ñðóç ìðñãß ãðβóçð íá áβίáé ÷ ñðóéç óá ðññ÷ ùñçìÛíòð ÷ ñðóóáð.

Áóñý áéááÛóáðá áðòù ðï εὰοÛεάεί, éá ñÛñãá:

- Óé áβίáé Ûíá jail éáé ðé óéñðü ìðñãß íá áñðçñãáððóáé óá áãéáðáóðÛóáéð FreeBSD.
- ðùð íá öðéÛíãáð, íá áéééñðóáðá, éáé íá óóáíáððóáðá Ûíá jail.
- Óá ááóééÛ ðçð áéá÷ áβñéóçð áñùð jail, ðúóï ìÛóá, ùóï éáé Ûíù áðü áðòù.

¶ééãð ðçãÛð ÷ ñðóéñïðïéñý ð÷ áðééÛ ìá óá jails áβίáé:

- Ç óáéβáá manual ðïò jail(8). ÐãñéÛ÷ áé ðéðñç áíáòñÛ ðïò áñççðééñý ðññãñÛíáðòï jail — ðïò áéá÷ áéñéóðééñý ãñãáéãß ðïò ìðñãß íá ÷ ñçóéñïðïéñýéãß óðï FreeBSD áéá ðçí áééβíççð, áéáéñð, éáé Ûéãã÷ ì ðññ jails.
- Ìé éβóðáð óá÷ ðãññãß ðéáé óá áñ÷ áβá ðïòð. Óá áñ÷ áβá áðü ðçí çéáéðññééð éβóðá ááíééðñí áñùððóáú ðïò FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>) éáé Ûééãð éβóðáð ðïò áñðçñãáðñýíðáé áðü ðññ áñðçñãáðçðð áéá çéáéðññééÛð éβóðáð ðïò FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo>) ðãñéÛ÷ ðññ ðéðñç ñãçãü áéá óá jails. Áβίáé ðÛíðïðá áñáéáóÛññí íá øÛ÷ ñáðá óá áñ÷ áβá ð íá äçññóéáýãáðá ñÛãð áñùððóáéð óçç éβóðá freebsd-questions (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>).

16.2 Ûññé ðññ Jails

Áéá íá éáðáññðóáðá éáéýðãñá ðï ðùð ñé áóòðãñééÛð éáéðññãßð ðïò FreeBSD ó÷ áðβáññíðáé ìá óá jails éáé ðùð áðòÛð áééçéãðéáññýí ìá óá ððññéðá ìÛñç ðïò FreeBSD, éá ÷ ñçóéñïðïéñýðñññá áéðáñð ðïòð ðãñáéÛð ùññòð:

chroot(8) (áíðñéð)

Íá áñççðééñý ðññãññíá, ðï ñðññ ÷ ñçóéñïðïéñý ðçí ééðóç óðóðñíáðòï chroot(2) ðïò FreeBSD áéá íá áééÛíáé ðññ áññééñý éáðÛéññ (root directory) ñéáð áéãñãáóéáð éáé ùéñ ðññ Ûééññ áéãñãáóéññ ðïò áññðññíðáé áðü áðð.

chroot(2) (ðãñéáÛééññ)

Ôï ðãñéáÛééññ ñéá áéãñãáóéáð ðïò ðñÛ÷ áé ìÛóá óá Ûíá “chroot”. Áðòù ðãñééáñññéá ðññòð ùðòð ðï ðññ ðïò óðóðñíáðòï áñ÷ áβññ ðïò áβίáé ññáðü, óá ID ðïò ÷ ñðóçç éáé ðçð ñÛãáð ðïò áβίáé áéáéÛóéñá, éáéðð éáé óéð áéáðáóÛð áééðññ (network interfaces), ðïòð ìç÷ áíéóññýð IPC ééð.

jail(8) (áfíôïêP)

Ôi ðñuññáñiá ðið óáð áðéðñÝðáë íá áëá÷ áëñßæáðóðá ði óýóðçíá óáð éáé íá íáëéíÛðá áëáññááóßáð óá ðáñéáÛëëí jail.

host (óýóðçíá (system), áëáññááóßá (process), ÷ñPóðçð (user), êëð.)

Ôi óðóéëu óýóðçíá ðið óéëñáíáß éáé äêÝá÷ áë Ýiá ðáñéáÛëëí jail. Ôi host system Ý÷ áë ðñuóááóç óá üëi ði áëáéÝóëi óéëëü, éáé ïðññáß íá äêÝáñáë áëáññááóßáð óuóí iÝóá uóí éáé Ýñù áðu ði ðáñéáÛëëí óið jail. Ìßá áðu óéð óçíáíóéëüðáñáð áëáóññÝð ïáðáíý ðið host system éáé ðið jail áßiáé uðé ié ðáñéññéóñiß ðið áóáññiüæiíóáé óðéð áëáññááóßáð ðið ÷ñPóðç root iÝóá óóí ðáñéáÛëëí jail, ááí éó÷ýiðíí áëá ðéð áëáññááóßáð óóí host system.

hosted (óýóðçíá (system), áëáññááóßá (process), ÷ñPóðçð (user), êëð.)

Íéá áëáññááóßá, Ýiáð ÷ñPóðçð P êÛðiëá Ûëëç ïðóðçðá, ðið ïðññið ç ðñuóááóç óóíðð ðññiðð ðið óðóðPíáðíð ðáñéññæáðáé iÝóá áðu Ýiá jail.

16.3 ÁéóáãñüñP

Íéá éáé ç áëá÷ áßñéóç áñuð óðóðPíáðíð ïðññáß íá áßiáé áýóëiêç éáé ðáñßðëiêç, áíáððý÷ðçéáí áñéáðÛ áñááëáßá óá ïðññáß ïðññiýí íá êÛññið óç æuP áñuð áëá÷ áëñéóðP ðiëý ðëí áýéiëç. Óá áñááëáßá áððÛ ðñiðóÝññið êÛðiëáð ðñuóëáððð áðíáðuðçðáð uóí áóññÛ ðið ðñuðñi ááëáððÛóóáóçð, ñýiëóóç éáé óðíðPñçóçð áñuð óðóðPíáðíð. Íéá áðu ðéð áññááóßáð ðið áíáíÝiáðáé íá áëðáëÝóáé êÛëá áëá÷ áëñéóðPð óðóðPíáðíð, áßiáé íá ñðëiðáé óuóðÛ óçí áóóÛëáéá ðið óðóðPíáðíð, ðñiëáëiÝñíó íá ðñiðóÝññáé ðéð ððçñáðóßáð áëá ðéð ïðññáð Ý÷ áë ðñiññáññiáðéóðáß, ÷ññßð íá áðéðñÝðáë óðíáëááóñiýð óðçí áóóÛëáéá.

Íá áðu óá áñááëáßá ðið ïðññiýí íá áíéó÷ýóíð óçí áóóÛëáéá áñuð óðóðPíáðíð FreeBSD áßiáé óá jails. Óá Jails ðññiðíáðíáíáðçéáí óðí FreeBSD 4.X áðu ðið Poul-Henning Kamp <phk@FreeBSD.org>, áëÛ ááëðéèçééáí ðiëý ðáñéóóuðáññi óðçí Ýéáíóç FreeBSD 5.X, ðñiëáëiÝñíó íá ðñiðóÝññið ðáñéóóuðáññáð áðíáðuðçðáð éáé íá áßiáé ðáñéóóuðáññi áðÝéëéðá. Ç áíÛðððíP ðiðð óðíá÷æáðáé áëüüç, ïá ááëðéèçéáéð óðíðð ðññáßð óçð áð÷ñçóðáð, óçð áðñiüóçð, óçð áíéiðéóðßáð éáé óçð áóóÛëáéáð ðið ðñÝðáë íá ðáñÝ÷íí.

16.3.1 Óé Áßiáé Íá Jail

Óá éáëðíðñáëéÛ óðóðPíáðá óýðñið BSD, ðáññáß÷áf ði chroot(2) áðu óçí áðñi÷P ðið 4.2BSD. Ç áíôïêP chroot(8) ïðññáß íá ÷ñçóëñðíëçéáß áëá íá áëÛiáë ðið áñíëëü éáðÛëiñi íéáð ñÛááð áëáññááóëí, áçíëiðñáññiáð Ýiá áóóáëÝð ðáñéáÛëëí, ïá÷ñéóóuð áðu ði ððñiëðí óýóðçíá. ßóáð áëáññááóßáð áçíëiðñáññiáðéá óá Ýiáí óÝóíëí ðáñéáÛëëí, ááí Ý÷íñí ðñuóááóç óá áñ÷áß éáé ðññiðð Ýñù áðu áððu. Áéá áððu ði êñiñ, áí íéá ððçñáðóßá ðñÝ÷ áë iÝóá óá Ýiá óÝóíëí ðáñéáÛëëí, éáé êÛðiëáð áéóáñëÝáð éáðáóÝññáé íá áëáéóáýóáé óá áððP, áá èá ðið áðéðñáðáß ç ðñuóááóç óðí ððñiëðí óýóðçíá. Ç áíôïêP chroot(8) áßiáé ðiëý éáëP áëá áðñÝð áññááóßáð ié ïðññáð áá ÷ñáéÛëiíóáé íá áßiáé ðiëý áðÝéëéðáð P íá áëáéÝóíðí ðiëýðéiéá éáé ðññçáíÝiá ÷áñáéðçñéóéëÛ. Ûóðuóí, áðu óçí áñ÷P óçð éáÝáð ðið chroot, áñÝççéáí áñéáðíß ðñuðñié áéá íá ïðññÝóáé êÛðiëáð íá íáóýááë áðu ði ðáñéáÛëëí áððu. Ðáñ' üëi ðið Ý÷íñí áëiñëèëáß ðiëéÛ óóÛëiáðá óðéð ðñuóááððð áëäüóáéð ðið ððñPíá ðið FreeBSD, Pðáí íáëÛëáññi uðé ç chroot(2) ááí Pðáí ç éááíëëP éýóç áëá óçí áóóÛëéóç ððçñáóëí. Ðñáðá íá ðëiðíëçéáß Ýiá íÝi ððñiýóðçíá.

Áððuð áßiáé Ýiáð áðu ðiðð éýñéiðð êñiññíð áëá óçí áíÛðððíç ðúí jails.

Óá jails ááëððuóáí íá áëÛññiðð ðñuðñiðð óçí éáÝá ðið ðáñáñiðéáéiý ðáñéáÛëëííðð ðið chroot(2). Óðí ðððéëü ðáñéáÛëëí ðið chroot(2), ié áëáññááóßáð ðáñéññæáññiðáé ïññið ïð ðññið ðið iÝñið ðið óðóðPíáðíð áñ÷áßñ uðñið ïðññiýí íá Ý÷íñí ðñuóááóç. Íé ððñiëðíé ðññië ðið óðóðPíáðíð (üðuð ié ÷ñPóðáð, ié ðñÝ÷íñáð áëáññááóßáð, ði ððñiýóðçíá áëéðýóçð) áßiáé éiíññi ÷ñçóðíé ïáðáíý ðuñ áëáññááóëí ðið ðáñéáÛëëííðð chroot éáé ðuñ áëáññááóëí ðið host system.

Όά jails άδäέöäβñíοí äóöü öí ïíóÝéí, ïä öçí äέéííέéííðíβçöç ü ÷ é ïüí öçð ðñüóäááöçð öóí óýóöçíä äñ ÷ äβüí, äέéÛ äðβöçð öüí ÷ ñçóðßí, öíö öðíöðöðβíäöíð äέéöýüöçð öíö ððñβíä öíö FreeBSD éäé ïäñέéβí äέüìç ðñäñÛöüí. Ðäñέóóüðäñä äéä öéð äéäéÝóéíäð äíöíεÝð öíö ïðíñíýí íä ÷ ñçóéííðíέçéýí äéä öç ñýéíέöç éäé öíí Ýéää ÷ í äíüð ðäñéäÛέεííöð jail ïðíñäβöä íä äñäβöä öóí Õíβíä 16.5.

Õí Jail Ý ÷ äé öÝóóäñä éýñéä öóíé ÷ äβä:

- íäí éäöÛέíäí ïä äέéð öíö äñβ — öí äñ ÷ ééü öçìäβí öóí ïðíβí äέóÝñ ÷ äöäé Ýíä jail. Äðü öç öóéäñβ öíö íéä äéäñäáöβä äñβöéäöäé ïÝóä öä Ýíä jail, ääí äðéðñÝðäöäé íä äääé Ýñü äðü öíí éäöÛέíäí äóöü. Όä ðñíäéβíäöä öíö öäéäéðñíýóäí öíí ö ÷ ääéäóíü öíö chroot(2) ääí äðçñäÛέíöí öä jails öíö FreeBSD.
- íä hostname (üñíä öðöðβíäöíð) — öí hostname öí ïðíβí éä ÷ ñçóéííðíέçéäβ ïÝóä öóí jail. Όä jails ÷ ñçóéííðíέçéýíóäé éöñβüð äéä öçí äíððçñÝöçöç äέéöðäéβí öðçñäöéβí, äðñÝíüð ç ýðäñíç äíüð ÷ äñäéðçñέóöééý hostname öíö íä ðäñéäñÛöäé öäööü ÷ ñííä éäé öç ÷ ñβöç öíö, ïðíñäβ íä äíçéβóäé äñéäöÛ öíí äéä ÷ äéñέöð öðöðβíäöíð.
- Íéä äéäýéöíöç IP — äöðβ ç äéäýéöíöç äíðéöóíé ÷ äβ öä Ýíä jail éäé ääí ïðíñäβ íä äέéÛíäé éäöÛ öç äéÛñéäéä öçð æüβð öíö. Ç äéäýéöíöç IP äíüð jail äβíäé öóíβéüð ïβä äéäýéöíöç öýðíö alias äéä íéä βäç öðÛñ ÷ íöóä äéäðäöð äέéöýíö (network interface), äέéÛ éÛöé öÝöíéí ääí äβíäé äðäñäβöçöí.
- ïβä äíöíεβ — ç äéääññβ ðñíð Ýíä äéöäéÝóéí öí ïðíβí éä äéöäéäβöäé ïÝóä öóí jail. Ç äéääññβ äöðβ äβíäé ö ÷ äöééβ üð ðñíð öíí äííέéü éäöÛέíäí öíö ðäñéäÛέεííöð öíö jail, éäé ïðíñäβ íä äéäóÝñäé öíéý äðü jail öä jail äíÛέíäí ïä öí öðäéäéñéíÝí ðäñéäÛέεíí.

Äéöüð äöðβí, öä jails ïðíñíýí íä Ý ÷ íöí öéð äééÝð öíöð ñÛääð ÷ ñçóðßí éäé öíí äééü öíöð ÷ ñβöç root. ÖðöééÛ, í Ýéää ÷ íð öíö Ý ÷ äé í ÷ ñβöçð root öíö jail, ðäñéñβäöäé ïÝóä öóí ðäñéäÛέεíí öíö jail, éäé äðü öçí ïðééβ äñíβä öíö host system, í ÷ ñβöçð äööüð ääí äβíäé äáíöäýíäíöð. ÄðéðéÝíí, í ÷ ñβöçð root öíö jail, ääí ïðíñäβ íä äéöäéÝóäé éñβöéíäð äñäáöβäð öóí óýóöçíä Ýñü äðü öí ðäñéäÛέεíí öíö jail(8). Ðäñέóóüðäñäð ðéçñíöíñβäð ö ÷ äöééÛ ïä öéð äöíäöüöçöäð éäé öíöð ðäñéñéöíýöð öíö root éä äñäβöä öóí Õíβíä 16.5.

16.4 Äçíéíöñäβíöäð éäé ÄéÝä ÷ ííöäð Jails

Ïäñééíβ äéä ÷ äéñέöðÝð öðöçíÛöüí éäöçäíñéíðíέçéýí öä jails öä äýí äíüöçöäð: öä “complete (ðéβñç)” jails, öä ïðíβä ïéíýíóäé Ýíä ðñäñäíäöééü óýóöçíä FreeBSD, éäé öä “service” jails, öä ïðíβä ÷ ñçóéííðíέçéýíóäé äéä íéä äöäññäβ β öðçñäöβä, öíö ðééäíüí äéöäéäβöäé ïä äéäééÛ ðñíñüéä. Äööüð äβíäé Ýíäð ñçóéééüð äéä ÷ ïñέóíüð éäé ääí äðéäñÛ öçç äéääééäöβä äçíéíöñäβäð äíüð jail. Ç öäéβää manual öíö jail(8) ðäñéÝ ÷ äé éäöäöíðéööééÝð ðéçñíöíñβäð äéä öç äéääééäöβä äçíéíöñäβäð äíüð jail:

```
# setenv D /here/is/the/jail
# mkdir -p $D ❶
# cd /usr/src
# make buildworld ❷
# make installworld DESTDIR=$D ❸
# make distribution DESTDIR=$D ❹
# mount -t devfs devfs $D/dev ❺
```

- ❶ Í éäéýöäñíð öñüðíð äéä íä ïäééíβóäöä äβíäé ïä öçí äðééíäβ íéäð éÝöçð (äéääññβð) äéä öí jail öäð. Äéäβ éä äñβöéííóäé äðíèçéäöíÝíä öä äñ ÷ äβä öíö jail üóí äöíñÛ öí óýóöçíä öäð. Íéä éäéβ éäÝä äβíäé öí /usr/jail/jailname, üðíö jailname öí hostname ïä öí ïðíβí éä äíääññβäéöäé öí jail. Õí óýóöçíä äñ ÷ äβüí

/usr/ Ý ÷ áë óðíÞëùð áñêáðü ÷ þñí áëá òí óγóðçιά áñ ÷ áβùí ðíò jail, òí ìðíβí, áëá Ýíá “complete” jail áβιάë ìòóóáóðëÛ Ýíáð êêþñíò êÛëá áñ ÷ áβíò ðíò ááóéëíγ óðóðÞιάðíò ìéá ðñíáðëéááïÝíçð ááëáðÛóóáóçð ðíò FreeBSD.

- ❷ Õí áÞιά áððü ááí áðáéðáβóáë áí Ý ÷ áðá ìáðááëùððóβáë óðí ðáñáëèùí ðí ááóéëü óγóðçιά ÷ ñçóëíðíëÞíðáð ðçí áíðíëÞ make world Þ make buildworld. Ìðñáβðá áðëþð íá ááëáðáóðÞóáð ðí ððÛñ ÷ ìí óγóðçιά óáð óðí ñÝí jail.
- ❸ Ç áíðíëÞ áððÞ éá áðëíòòβóáë ðíí éáðÛëíáí ðíò áðëéÝíáðá áëá ðí jail ìá ùëá óá áðáñáβòçóá áñ ÷ áβá, áëáéíëÞëáð, óáëβááð áíÞëáéáð êêð.
- ❹ Õí distribution target ðíò make ááëáééóðÛ ùëá óá áñ ÷ áβá ñðëíβóáùí ðíò áðáéðíγíóáë. Ìá áðëÛ ëùáéá, ááëáééóðÛ êÛëá áñ ÷ áβí áðü ðí /usr/src/etc/ óðíí éáðÛëíáí /etc ðíò ðáñéáÛëëíðíò jail: \$D/etc/.
- ❺ Áá ÷ ñáëÛëáðáë íá ðñíóáñðÞóáðá ðí devfs(8) óðí ðáñéáÛëëí ðíò jail. Áðü ðçí Ûëëç ùíùð, ùëáð, Þ ó ÷ ááùí ùëáð ìé áðáñííáÝð ÷ ñáëÛëííóáë ðñüóááóç óá ðíòëÛ ÷ éóðíí ìβá óóóéáðÞ, áíáëùáùð ìá ðíí óéíðü ðçð áóáñííáÞð. Áβιάë ðíëγ óçíáíóéëü íá áëÝá ÷ áðáë ç ðñüóááóç óðëð óóóéáðÝð ìÝóá óá Ýíá jail, éáëþð éáíéáóíÝíáð ñðëíβóáëð ìðñáβ íá áðëðñÝðíò óá êÛðíëíí áéóáíëÝá íá êÛíáë “Ûó ÷ çíá ðáé ÷ ìβáéá” ìÝóá óðí jail. Ì Ýëáá ÷ ìð ðíò devfs(8) áβíáðáë ìÝóá áíùð óðíùëíò éáííùí ìé ìðííë ðáñéáñÛíòíóáë óðëð óáëβááð manual ðíò devfs(8) éáë ðíò devfs.conf(5).

Áðü ðçí óóéáñÞ ðíò Ý ÷ áë ááëáðáóðáëáβ Ýíá jail, ìðñáβ íá áëëéíçëáβ ìá ðç ÷ ñÞóç ðçð áíðíëÞð jail(8). Ç jail(8) áÝ ÷ áðáë óÝóóáñëð ððí ÷ ñáùóééÝð ðáñáíÝðñíòð ìé ìðíβáð ðáñéáñÛíòíóáë óðí ÕíÞιά 16.3.1. Ìðñáβðá íá áþóáðá éáë Ûëëáð ðáñáíÝðñíòð, ð. ÷. , áëá íá áëðáëÝóáðá ìéá áëáñááóβá óðí ðáñéáÛëëí ðíò jail ìá ðéð Ûááéáð áíùð óðáëáëñëíÝíò ÷ ñÞóç. Ç ðáñÛíáðñíð command áíáñðÛóáë áðü ðíí óýðí ðíò jail. Áëá Ýíá áëëíëëü óγóðçιά, ðí /etc/rc áβιάë ìéá éáëÞ áðëéíáÞ, ìéá éáë óðçí ìðóβá éá êëùñðíëÞóáë ðçí áëááééáóβá áëëβíçóçð áíùð ðñááíáðéëíγ óðóðÞιάðíò FreeBSD. Áëá Ýíá service jail, ç ðáñÛíáðñíð áíáñðÛóáë áðü ðçí ððçñáóβá Þ ðçí áóáñííáÞ ðíò éá ðñÝ ÷ áë ìÝóá óðí jail.

Õá jails óðíÞëùð ìáëéíγí éáðÛ ðçí áëëβíçóç éáë ì ç ÷ áíéóíùð rc ðíò FreeBSD ðáñÝ ÷ áë Ýíáí áγéíëí ðñüðí áëá íá áβιάë êÛðé óÝòíëí.

- 1. Ç ëβóóá ìá óá jails ðíò êÝëáðá íá ìáëéíÛíá éáðÛ ðçí áëëβíçóç éá ðñÝðáë íá ðñíóáðéíγí óðí áñ ÷ áβí rc.conf(5):

```
jail_enable="YES" # Set to NO to disable starting of any jails
jail_list="www" # Space separated list of names of jails
```

Õçíáβùóç: Õí ùííá ðíò Ý ÷ áë êÛëá jail óðç ëβóóá jail_list áðëðñÝðáðáë íá ðáñéÝ ÷ áë ìííí áëóáñéëíçðéëíγò ÷ áñáéðÞñáð.

- 2. Áëá êÛëá jail ðíò ððÛñ ÷ áë óðí jail_list, éá ðñÝðáë íá ðñíóðáëáβ ìéá ñÛáá áðü ñðëíβóáëð óðí rc.conf(5), ìé ìðíβáð éá ðí ðáñéáñÛíòí:

```
jail_www_rootdir="/usr/jail/www" # jail's root directory
jail_www_hostname="www.example.org" # jail's hostname
jail_www_ip="192.168.0.10" # jail's IP address
jail_www_devfs_enable="YES" # mount devfs in the jail
jail_www_devfs_ruleset="www_ruleset" # devfs ruleset to apply to jail
```

Ç ðñíáðëéááïÝíç áëëβíçóç ðíò jail ìÝóá ðíò rc.conf(5), éá ìáëéíÞóáë ðí script ðíò jail /etc/rc, ðí ìðíβí ððíëÝóáë ùóé ðí jail áβιάë Ýíá ìéíëçññüÝíí áëëíëëü óγóðçιά. Áëá service jails, ç ðñíáðëéááïÝíç áëëβíçóç ðñÝðáë íá áëëÛíáë, ìñβáííðáð éáðÛëëçéá ðçí áðëéíáÞ jail_jailname_exec_start.

Õçíáβùóç: Áëá ðëÞñç ëβóóá ðùí áëáëÝóéíùí áðëéíáÞí, ááβðá ðí rc.conf(5).

Ôι script /etc/rc.d/jail ιδινάβ ίά ÷ ñçóειιδιέçεάβ άέα ίά ίάέειΠόάε Π ίά όδαιάόΠόάε εÛδιέι jail ÷ άέιιέβίçά. ΔñÝðάε ιιùδ ίά όδÛñ÷άε ç άίόβόδιέ÷ç έάόά÷ ðñçόç όοι rc.conf:

```
# /etc/rc.d/jail start www
# /etc/rc.d/jail stop www
```

Άέα όçί ðñά άάι όδÛñ÷άε εÛδιέιò άδυέόδά ουόουδ όñυδιò άέα ίά όαñιαόβόάδä εÛδιέι jail(8). Άόδου όοιääβίáέ, áειυόé ιέ άίόιέÛδ όιò ÷ ñçóειιδιέίγίόάέ όοιΠεùδ άέα ίά όαñιαόβόιόι ιä áόòÛέάέá Ýίá όγόόçía, άάι ιδινίγί ίά ÷ ñçóειιδιέçείγί ιÝόά όοι δāñέáÛεείι άιυò jail. Ì έάέγόάñιò όñυδιò άέα ίά όαñιαόβόάδä Ýίá jail άβίáέ ιä όçί άέóÛέáόç όçδ άειιέιòèçδ άίόιέΠδ ιÝόά άδυ όι βάέι όι jail Π ιä ÷ñΠόç όιò άιççεόéééγί δñιāñÛιιáιòι jexec(8) Ýιι άδυ άόδυ:

```
# sh /etc/rc.shutdown
```

Δāñέόóυδāñāδ όççñιιòιñβāδ ό÷ άόέέÛ ιä áόδΠ όç άέαääέáόβá ιδινάβόä ίά āñāβόä όόç óääεβāá άιççεάβāδ όιò jail(8)

16.5 ÊäðöιιāñΠδ Ñýειέόç έάέ Άέα÷ άβñέόç

ÔðÛñ÷ιόι άñεáóÛδ άδέειáÛδ όιò ιδινίγί ίά άοāñιιόόιγί óä Ýίá jail, έάεð έάέ άεÛοιιιέ όñυδιέ άέα ίά όοιáόáόóäβ Ýίá όγόόçía FreeBSD ιä jails δñιέάέιÛιò ίά δāñÛáιόι áοāñιáÛδ όççειυόāñιò άδέδÛáιò. Ç άιυόçδá áόδΠ δāñιòóéÛáέ:

- ΙāñέéÛδ άδυ όέδ άέáéÛóειāδ άδέειáÛδ άέα όçί ñýειέόç όçδ όοιδāñέóιñÛδ έάέ όυι δāñέιñέóιðι áóóáéāβāδ όιò óειιδιέίγίόάέ άδυ όçί āáέáóÛόóáόç άιυò jail.
- ΙāñέéÛδ áοāñιáÛδ όççείγύ άδέδÛáιò άέα όç άέα÷ άβñέόç jails, ιέ ιδινβāδ άβίáέ άέáéÛóειāδ ιÝόú όçδ óóεειāΠδ όυι Ports όιò FreeBSD έάέ ιδινίγί ίά ÷ ñçóειιδιέçείγί όόçι óειιδιβçόç ιειέεçñιιÛι έγóáñι ιä όç ÷ñΠόç jails.

16.5.1 Άñāáéāβá óóóðιáóιò όιò FreeBSD άέα όç ñýειέόç jails

ÊäðöιιāñΠδ ñýειέόç άιυò jail άβίáόáé έáóÛ έýñέι εüāι ιÝόú όυι ιāóááεçðι όιò sysctl(8). ÔðÛñ÷άé Ýίá άέáέéü subtree όιò sysctl όι ιδινβι áδιòáéāβ όç áÛόç áέα όçι ιñāÛιúç üειι όυι ó÷ άόέéðι áδέéιāðι: δñυέáéóáé άέα όçι έāñāñ÷βá áδέéιāðι δóñΠίá security.jail.*. ΔāñáéÛδú έá āñāβόä ιέá εβóóá ιä óä έýñéá sysctl όιò ó÷ άόβáειιόáé ιä εÛδιέι jail έάεð έάέ όέδ δñιáδέéāñÛιáδ óéÛδ όιòδ. Óá ιιιιáόá ιÛεείι άιççáγί άδυ ιιιá όιòδ όçι áίόβόδιέ÷ç έáέόιòñāβá, áééÛ άέα δāñέόóυδāñāδ όççñιιòιñβāδ ιδινάβόä ίá āāβóä όέδ óääεβāāδ άιΠεáέáδ όυι jail(8) έάέ sysctl(8).

- security.jail.set_hostname_allowed: 1
- security.jail.socket_unixiproute_only: 1
- security.jail.sysvipc_allowed: 0
- security.jail.enforce_statfs: 2
- security.jail.allow_raw_sockets: 0
- security.jail.chflags_allowed: 0
- security.jail.jailed: 0

Ìé ιāóááéçδÛδ áóðÛδ ιδινίγί ίά ÷ ñçóειιδιέçείγί άδυ όιι áέα÷ άέñέóðΠ όιò host system δñιέáέιÛιò ίá δñιόéÛόáé Π ίá áóáéñÛόáé δāñέιñέóιγύ ιέ ιδινβιέ όðÛñ÷ιόι āñ÷έéÛ όόιι ÷ñΠόç root. ÔðÛñ÷ιόι ιιùδ έάέ εÛδιέιέ δāñέιñέóιιβ ιέ

ιθίβιέ άάι ιθίνιύί ίά άόάειάειύί. Ί ÷ ηΠόόçð root άάι άðέοηΨðáóáέ ίά ðñιόάηòÛ Þ ίά άði-ðñιόάηòÛ óðóðÞιάόά
άñ ÷ άβùí ιΨόά άðu Ψίά jail(8). Ί root ιΨόά óά Ψίά jail άάι άðέοηΨðáóáέ ίά öιηòÞóáέ Þ ίά άðιöιηòÞóáέ öιòð έάíúíáð
(rulesets) öιò devfs(8), öι firewall, έάέ άέÛöιηάð Ûεεάð άñάάóβáð άέá ÷ άβñέóçð ιέ ιθίβáð ÷ ñάέÛάειíðάέ ðñιθιβççöç
öúí άάάñΨíúí öιò ððñÞíá, úðòð άέά ðάñÛάάέάíá ι ιñέóιúð öιò securelevel öιò ððñÞíá.

Ïι άάóέεÛ όύóççíá öιò FreeBSD ðάñέΨ ÷ άέ óά άάóέεÛ άñάάέάβá άέά öç ðñιáρεÞ ðεçñιöιηέÞι ó ÷ άóέέÛ ιά óά άíáñáÛ
jails, έάέ άðβóçð άέά öçí άíÛεάóç óðάέάειñειΨíúí άίöιρεÞι άέá ÷ άβñέóçð óά έÛθιέι jail. Ίε άίöιρεΨð jls(8) έάέ jexec(8)
άðιöάειύί ιΨñòð öιò άάóέέιύ όóóðÞιάóιò öιò FreeBSD, έάέ ιθιηιύί ίά ÷ ηççéιηθιέçéιύί άέά ίά óέð ðάñάέÛöú άðεΨð
άñάάóβáð:

- ÐñιáρεÞ έβóóáð öúí άíáñáÞι jails έάέ öιí άίöβóóιέ ÷ ùí ÷ άñάέöçñέóóέέÞι öιòð - jail identifier (JID), άέáýέöίóç IP, hostname έάέ path.
- Ðñιöéιέεçöç óά έÛθιέι άíáñáü jail, άðu öι host system, έάέ άέðΨέάóç έÛθιέάð άίöιρεÞð ιΨόά óöι jail Þ άέðΨέάóç άñάάóέÞι άέá ÷ άβñέóçð ιΨόά óöι jail. ΈÛóέ óΨöιέι άβίάέ έάέάβðάñá ÷ ηÞóέιí úóáí ι ÷ ηÞóóçð root άðέέöιáβ ίά óάñιáóβóáέ ιá áóóÛεάέά έÛθιέι jail. Ίθιηάβ άðβóçð ίά ÷ ηççéιηθιέçéáβ ç άίöιρεÞ jexec(8) άέá öçí άέðΨέάóç έÛθιέιò shell ιΨόά óöι jail ðñιέάειΨíúí ίά άέðάέáóöιύί άñάάóβáð άέá ÷ άβñέóçð, άέά ðάñÛάάέάíá:

```
# jexec 1 tcsh
```

16.5.2 Άñάάέάβá άέá ÷ άβñέóçð öççéιí άðέðΨάιö óöç óóέéιáÞ Ports öιò FreeBSD

ΆíÛáóά óέð άέÛöιηάð áóάñιáΨð öñβöúí έáóáóέάðáóöÞι άέá öç άέá ÷ άβñέóç öúí jails, Ψίά άðu óά ðιέι ιεíεεçñùíΨίά έάέ ÷ ηÞóέíá ðάέΨóά άβίάέ öι sysutils/jailutils. Άðιðάέάβ Ψίά óýíτεí ιέέñÞι άóάñιáÞι ιέ ιθίβáð óóíáέóóΨíñιö óöç άέá ÷ άβñέóç öιò jail(8). Άέά ðάñέóóúðάñάð ðεçñιöιηáð, άáβðá óöιí άέέðóάέú öιò öúθι.

16.6 ΆóάñιáÞ öúí Jails

16.6.1 Service Jails

Ç áíúöçðά áóðÞ άβίáέ άάóέóιΨίç óöçí έάΨά ðιò ðάñιöóέÛóóçέá άñ ÷ έέÛ άðu öιí Simon L. Nielsen <simon@FreeBSD.org> óöι http://simon.nitro.dk/service-jails.html, έάέÞð έάέ óá Ψίά άíáíáúιΨí Úñέñι öιò Ken Tom <locals@gmail.com>. Óöçí áíúöçðά áóðÞ έá óáð άáβííðιá ðùð ίά óðÞóáðá Ψίά óýóðçíá FreeBSD öι ιθίβι ίά έάέάΨóáέ Ψίά άðέðεΨíúí άðβðááι áóóÛεάέáð, ιá öç ÷ ηÞóç öιò jail(8). ÏðιεΨóιöιá úóέ öι óýóðçíá öñΨ ÷ άέ öιöéÛ ÷ óέöιí RELENG_6_0 έάέ úóέ Ψ ÷ áðá έáóáíÞóáέ úεáð óέð ðñιçáιýíáíáð ðεçñιöιηáð öιò έáóάέάβíò.

16.6.1.1 Ó ÷ άάέáóιúð

Ίά άðu óά öçíáíöέέúðάñá ðñιáεÞιáóά ιá óά jails άβίáέ ç άέá ÷ άβñέóç öçð άέáάέέáóβáð άíáάέιβóáúí. Άóöú óάβίáέ ίά άβίáέ ðñιáεçíá áέúóέ öι έÛεá jail ðñΨðáέ ίά áçιέιöñáçéáβ άðu öçí άñ ÷ Þ óά έÛεá άíááÛέιέóç. ÓöιÞεúð άáí άβίáέ ðñιáεçíá άί Ψ ÷ áðá Ψίá ùñ jail, ιέá έάέ ðñιέάέóáέ άέá ó ÷ άóέέÛ άðεÞ άέáάέέáóβá, áεέÛ άβίáóáέ έιöñάóóέéÞ έάέ ÷ ñιíáúíá άί Ψ ÷ áðá ðιέέÛ jails.

Ðñιáέάιðιβççöç: Ίε ðάñάέÛöú ñöειβóáέð ðñιúðιεΨóιöι áìðáέñβá ιá öι FreeBSD έάέ öç ÷ ηÞóç öúí άέÛöιñúí ÷ άñάέöçñέóóέέÞι öιò. ΆÛι óά ðάñάέÛöú άÞιáóά óáð óáβííóáέ ðιέý ðάñβðεíéá, άβίáέ έάέýðáñá ίá ñβιáóá ίέá ιάóέÛ óά έÛóέ ðιέí áðεú úðòð öι sysutils/ezjail, öι ιθίβι ðάñΨ ÷ άέ Ψίáí áóειεúðάñι öñúðι άέá ÷ άβñέóçð öúí jails öιò FreeBSD έάέ άáí άβίáέ öúóι áíáέάέέáðιΨíúí úóι ιέ ðάñάέÛöú ñöειβóáέð.

Ç éäÝá áððP Ý ÷ áë ðáñïðóéáóðáß áéá íá éÿóáé óÝðíéïð áßáïðð ðñíáëðíáðá, ìá ðçí áïðëáéá ðçð éïéíðð ÷ ñðóçð ùðí ðí äðíáðúí ðáñéóóúðáñúí áñ ÷ áßúí ìáðáíÿ ðúí jails, ìá Ýíáí áóðáëP ùìð ðñúðí — ÷ ñçóçíðíéðíðáð ðñíóáñððóáéð ðÿðíð mount_nullfs(8) éáé ìúíí áéá áíÛáíúóç (read only) Ýðóé þóðá ç áíááÛëíéóç íá áßíáé áðëíëüðáñç, éáé ç ÷ ñðóç ìáñíúíÝíúí jails áéá êÛëá ððçñáóßá íá éáëßóðáðáé áðëèðçðP. ÁðëðëÝíí, ðáñÝ ÷ áë Ýíáí áðëü ðñúðí áéá íá ðñíðéÝóáðá éáé íá áóáéñÝóáðá jails ùððð áðßóçð éáé íá óá áíáááëíßóáðá.

Óçíáßúóç: Ðáñáááßáíáðá ððçñáóéðí ðÝðíéïð ðÿðíð: Ýíáð HTTP server, Ýíáð DNS server, Ýíáð SMTP server, êëð.

Ïé óðü ÷ íé ðúí ðáñáéÛðù ñðëíßóáúí áßíáé:

- Äçíéïðñáßá áðëðí éáé éáðáíçðþí jails. Áððü óçíáßíáé ùðé äáí éá ðñÝíðíá Ýíá ðëðñáð installworld óá êÛëá jail.
- Áÿéíëç ðñíðéðëç éáé áéááñáðP jails.
- Áÿéíëç áíááÛëíéóç ððáñ ÷ ùíðúí jails.
- Äðíáðúðçðá äçíéïðñáßáð ðñíóáñííóíÝííð ðíðíáðíð ðíð FreeBSD.
- ¼áí ðáñéóóúðáñç áóðÛëáéá áßíáé äðíáðúí, ìá áéá ÷ éóðíðíßçóç ðçð ðééáíúðçðáð éáéüáíüðëçð ÷ ñðóçð.
- Áñíééííúççð ÷ þñíð éáé inodes.

¼ððð Ý ÷ íðíá þäç ðáé, í ó ÷ ááéáóíüð áððúð áíáñðÛðáé éáéáßðáñá áðü ðçí ÿðáñíç áíúð áñ ÷ ééíÿ template óðí íðíßí ááí áðéðñÝðáðáé ç áááñáðP áááñÝíúí (áíúóðü ùð **nullfs**) éáé ðí íðíßí ðñÝðáé íá Ý ÷ áë ðñíóáñðçéáß óá êÛëá jail, ùððð áðßóçð éáé óçí ÿðáñíç áéá êÛëá jail ìéáð óðóéáððð ðíð íá áðéðñÝðáé ðúóí ðçí áíÛáíúóç ùðí éáé ðçí áááñáðP. Ìéá ðÝðíéá óðóéáðP ðíðñáß íá áßíáé êÛðíéïð ìá ÷ ùñéóðúð ððóééüð áßðéïð, ìéá éáðÛðíççð, P êÛðíéá óðóéáðP vnode md(4). Óðí ðáñáéÛðù ðáñÛááéáíá, éá ÷ ñçóçíðíéððóíðíá ðñíóáñððóáéð ðÿðíð **nullfs** óðéð íðíßáð éá áðéðñÝðáðáé áááñáðP éáé áíÛáíúóç.

Ç áñð ðíð óðóððíáðíð áñ ÷ áßúí ðáñéáñÛðáðáé óççí ðáñáéÛðù éßóðá:

- ÊÛëá jail éá ðñíóáñðÛðáé êÛðù áðü ðíí éáðÛëíáí /home/j.
- Óí /home/j/mroot áßíáé ðí template áéá ðí êÛëá jail éáé ç éáðÛðíççð ìúíí áíÛáíúóçð áéá ùéá óá jails.
- Éá äçíéïðñáçéáß Ýíáð éáíúð éáðÛëíáíð áéá êÛëá jail êÛðù áðü ðíí éáðÛëíáí /home/j.
- ÊÛëá jail éá Ý ÷ áë Ýíáí éáðÛëíáí /s, í íðíßíð éá áßíáé óÿíááóíðð ðñíð ðí áááñÛðéíí ìÝñíð ðíð óðóððíáðíð.
- ÊÛëá jail éá Ý ÷ áë ðí áééü áááñÛðéíí ìÝñíð ðí íðíßí éá ááóßæáðáé óðí /home/j/skel.
- ÊÛëá jailspace (ðí áááñÛðéíí ìÝñíð êÛëá jail) éá ðñÝðáé íá äçíéïðñáçéáß óðíí éáðÛëíáí /home/js.

Óçíáßúóç: ¼éá áððÛ ðñíúðíéÝðíðí ùðé óá jails áñßóéííðáé êÛðù áðü ðíí éáðÛëíáí /home. Áððü áÿááéá ðíðñáß íá áéëÛíáé óá ððéáððíðá áóáßð èÝéáðá, áéëÛ éá áðçñáÛðáé ùéá óá ðáñáéÛðù ðáñáááßáíáðá.

16.6.1.2 ÄçìéíõñãÞíóäò ôí Template

Ç áíñóçòá áóòÞ åá ðãñéãñÛøáé óá áÞíáóá ðíò ÷ ñãéÛæííóáé ðñíëáéíÝíò íá äçìéíõñãÞíóäò ôí ðñòóáñ ÷ ééü template ôí ïðíßí åá ðãñéÝ ÷ áé ôí òíÞíá òùí jails ðíò áßíáé ïñíí áéá áíÛáíóç.

Áßíáé ðÛíóíòá éáèÞ éáÝá íá áíáááèíßæáðá òí FreeBSD óóç òãèãòðáßá Ýëäíóç -RELEASE. Áéá ôí óéíðü áóòü, äéááÛóðá òí áíðßóðíé ÷ ï éäöÛëáéí

(http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/handbook/makeworld.html) óðí Áã ÷ áéñßáéí. Óóç ðãñßðòóç ðíò ç áíááÛëíóç ááí áßíáé áóééòÞ, åá ÷ ñãéáóðáßðá buildworld áéá íá ïðíñÝóáðá íá óðíá ÷ Þóáðá. ÁðéðéÝíí éá ÷ ñãéáóðáßðá òí ðáéÝðí sysutils/cpdup. Èá ÷ ñçóéííðíéÞóíòíá òí áíççèçðééü ðñüñãñáííá portsnap(8) áéá íá éáðááÛóíòíá òç óðéëíãð òùí Ports. Áéá òíòð íáí-áéóáñ ÷ ïñáííòð, óðíßóðáóáé ç áíÛáíóç òíò éáóáéáßíò áéá òí Portsnap (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/handbook/portsnap.html) óðí Áã ÷ áéñßáéí òíò FreeBSD.

1. Áñ ÷ ééÛ, äçìéíõñãÞíóäò íéá ãñÞ éáðáéüñáíí áéá òí óýóðçíá áñ ÷ áßñí òí ïðíßí åá áßíáé ïñíí áéá áíÛáíóç, éáé òí ïðíßí åá ðãñéÝ ÷ áé óá áéðáéÝóéíá (binaries) òíò FreeBSD áéá óá jails. Óóç óðíÝ ÷ áéá ðçãááßíáðá óðíí éáðÛëíñí ïðíò áñßóðéííóáé óá áñ ÷ áßá ðçãááßíò êÞäééá (source tree) òíò FreeBSD éáé áãéáóðáóðÞóðá óá áíðßóðíé ÷ á áñ ÷ áßá óðíí jail template:

```
# mkdir /home/j /home/j/mroot
# cd /usr/src
# make installworld DESTDIR=/home/j/mroot
```

2. Áðñíáíí áÞíá áßíáé íá ðñíáðíéíÛóáðá òç óðéëíãð òùí Ports òíò FreeBSD áéá óá jails ïðòð áðßóçð éáé Ýíá FreeBSD source tree, òí ïðíßí åá ÷ ñãéáóðáß áéá òí **mergemaster**:

```
# cd /home/j/mroot
# mkdir usr/ports
# portsnap -p /home/j/mroot/usr/ports fetch extract
# cpdup /usr/src /home/j/mroot/usr/src
```

3. ÄçìéíõñãÞíóäò ôí óéáéáòü áéá òí òíÞíá òíò óðóðÞíáðíò ïðíò ðñíññßæáðáé áéá áíÛáíóç éáé áããñáòÞ:

```
# mkdir /home/j/skel /home/j/skel/home /home/j/skel/usr-X11R6 /home/j/skel/distfiles
# mv etc /home/j/skel
# mv usr/local /home/j/skel/usr-local
# mv tmp /home/j/skel
# mv var /home/j/skel
# mv root /home/j/skel
```

4. ×ñçóéííðíéÞóðá òí **mergemaster** áéá íá áãéáóðáóðÞóðá óá áñ ÷ áßá ñèèíßóáñí ðíò éáßðíòí. Óóç óðíÝ ÷ áéá áéááñÛøðá ïðíò òíòð Ýíðñá éáðáéüñáííò ðíò äçìéíõñãÞíò òí **mergemaster**:

```
# mergemaster -t /home/j/skel/var/tmp/temproot -D /home/j/skel -i
# cd /home/j/skel
# rm -R bin boot lib libexec mnt proc rescue sbin sys usr dev
```

5. ÓÞñá, äçìéíõñãÞíóäò óðíáÝóíòð áðñí òí óýóðçíá áñ ÷ áßñí óðíí ïðíßí áðéðéÝðáóáé ç áããñáòÞ, ðñíò òí óýóðçíá áñ ÷ áßñí ðíò áßíáé ïñíí áéá áíÛáíóç. Áããáéüèáßðá ïðé íé óýíááóíé Ý ÷ ïíí äçìéíõñãçéáß óðéð òùóðÝð èÝóáéð s/. Ç ýðáñíç ðñáííáíóéêÞí éáðáéüñáíí Þ ç äçìéíõñãÞá éáðáéüñáíí óá èÛèð èÝóáéð éá íãçãÞóíòí òçíí áãéáóðáóðáóç óá áðíòð ÷ Þá.

```
# cd /home/j/mroot
# mkdir s
# ln -s s/etc etc
# ln -s s/home home
```

```
# ln -s s/root root
# ln -s ../s/usr-local usr/local
# ln -s ../s/usr-X11R6 usr/X11R6
# ln -s ../../s/distfiles usr/ports/distfiles
# ln -s s/tmp tmp
# ln -s s/var var
```

6. Óáí ðáëáððáβï áΠιά, äçïéïðñáΠððá Ýíá äáíéëü äñ÷-áβï /home/j/skel/etc/make.conf ìá ðá ðáñáéÛðü äáññÝíá:

```
WRKDIRPREFIX?= /s/portbuild
```

÷-ííðáð ìñβðáé ôï WRKDIRPREFIX ìá áððüí ôïí ðñüðï, éá ìðñáβðá ìá ìáðáäëùðððáðá ports ðïð FreeBSD ìÝóá óá èÛëá jail. Èðïçèáβðá üðé ì éáðÛëíáðð ðüí ports áβíáé ìÝñüð ðïð óðóðΠιάðïð äñ÷-áβïð ðïð Ý÷-áé ðñïóáñðçèáβ ìüí äéá áíÛáíüç. Ç ðñïóáññïóïÝíç äéáñññΠ äéá ôï WRKDIRPREFIX áðéðñÝðáé ðçï ìáðáäëðððéóç ðüí ports óðï äáññÛðéï ìÝñüð ðïð èÛëá jail.

16.6.1.3 ÄçïéïðñáΠððá Jails

Ïðñá ðïð Ý÷-ïðïá Ýíá ðëïèèçñüüÝíï FreeBSD jail template, ìðññíçíá ìá ääéáðáóðððïðïá éáé ìá ððèìβðïðïá ðá jails óðï /etc/rc.conf. Õï ðáñÛáäéáäá áððü äáβ÷-íáé ðç äçïéïðñáβá ðñéΠï jails: “NS”, “MAIL” éáé “WWW”.

1. ÁéóÛáäðá ðéð ðáñáéÛðü äñáñÝðð óðï äñ÷-áβï /etc/fstab, þððá ðï ìüí äéá áíÛáíüç template äéá ðá jails éáé ì äáññÛðéïð ÷-þñüð ìá áβíáé äéáéÝóéíá óðá áíðβððïé÷-á jails:

```
/home/j/mroot /home/j/ns nullfs ro 0 0
/home/j/mroot /home/j/mail nullfs ro 0 0
/home/j/mroot /home/j/www nullfs ro 0 0
/home/js/ns /home/j/ns/s nullfs rw 0 0
/home/js/mail /home/j/mail/s nullfs rw 0 0
/home/js/www /home/j/www/s nullfs rw 0 0
```

Ïçïáβüóç: Ìé éáðáðïððáéð ðïð áβíáé ðçïáéüíÝíáð ìá 0 pass number äáí äéÝá÷-ííðáé éáðÛ ðçï äèèβíçóç áðü ðï fsck(8), áïð äéá ðéð éáðáðïððáéð ìá 0 dump number, ç dump(8) äáí éá äçïéïðñáβ áíðβáñáðá áóðáèéáβáð. ðñïðáíðð, äáí èÝëïðïá ðï **fsck** ìá äéÝá÷-áé ðéð ðñïóáñðððáéð ðçððïð **nullfs**, ìçðá éáé ðï **dump** ìá èñáðÛ áíðβáñáðá áðü ðá ìüí äéá áíÛáíüç nullfs óðóðΠιάðá äñ÷-áβïð ðüí jails. Áððüð áβíáé éáé ì èüáðð ðïð áÛéáíá “0 0” óðéð äçï ðáëáððáβáð óððéáð èÛëá äáññáððð ðïð **fstab**.

2. Ñðèìβððá ðá jails óðï /etc/rc.conf:

```
jail_enable="YES"
jail_set_hostname_allow="NO"
jail_list="ns mail www"
jail_ns_hostname="ns.example.org"
jail_ns_ip="192.168.3.17"
jail_ns_rootdir="/home/j/ns"
jail_ns_devfs_enable="YES"
jail_mail_hostname="mail.example.org"
jail_mail_ip="192.168.3.18"
jail_mail_rootdir="/home/j/mail"
jail_mail_devfs_enable="YES"
```

```
jail_www_hostname="www.example.org"
jail_www_ip="62.123.43.14"
jail_www_rootdir="/home/j/www"
jail_www_devfs_enable="YES"
```

Đñĩάέάϊđĩřçóç: Ĭ èüāĩò áéá ðĩĩ ĩđĩřĩ èŸĩđĩłđĩ ðç ĩáđááēçđł jail_name_rootdir ĩá āāř ÷ ĩáé ðđĩ /usr/home áĩđł áéá ðĩ /home āřĩáé üðé ç ðđóéēł āéáāñĩł āéá ðĩĩ éáđŸēĩāĩ /home óá ĩéá ðđđéēł āāéáđŸđóáóç ðĩđ FreeBSD āřĩáé ðĩ /usr/home. Ç ĩáđááēçđł jail_name_rootdir āāĩ āāĩ đñŸđáé ĩá āāř ÷ ĩáé đñĩđ áéáāñĩł đĩđ đāñééáĩđŸĩáé ðđĩāĩéééü āáóĩü, áéáđĩñāðééŸ đá jails éá āñĩçéĩŸĩ ĩá ĩāééĩłđĩđĩ. × ñçóéĩđĩéłłđĩđ đĩ āĩççéđééü đñũāñāĩĩá realpath(1) áéá ĩá đñĩđáéĩñłłđĩđ ðçĩ ðéĩł đĩđ éá đñŸđáé ĩá èŸŸāáé áđđłł ç ĩáđááēçđł. Āāřđĩđ đĩ FreeBSD-SA-07:01.jail Security Advisory áéá đāñééóúđāñāð đéçñĩđĩñłđĩđ.

- 3. Äçĩéĩđñāłłđĩđ đá áđāñāłłđĩđ ðçĩāĩā đñĩđāñđłłđĩđ áéá ðĩ óŸđóçĩá āñ ÷ āłłĩ ĩüñ āĩŸŸŸŸŸđ đĩđ èŸŸđ jail:

```
# mkdir /home/j/ns /home/j/mail /home/j/www
```

- 4. Āāéáđáđłłđĩđ đĩ āāñŸŸéĩĩ template ĩŸŸá ðđĩ èŸŸđ jail. ĐñĩđŸŸđ āāł đç ÷ ñłłç đĩđ sysutils/cpdup, đĩ ĩđĩłđĩ đđéāāáéłłđĩđ ĩðé äçĩéĩđñāłłđĩđ đĩ ðúđúđĩ áĩđłłāñđĩ đĩđ èŸŸđ éáđáéüāĩđ:

```
# mkdir /home/js
# cpdup /home/j/skel /home/js/ns
# cpdup /home/j/skel /home/js/mail
# cpdup /home/j/skel /home/js/www
```

- 5. Óā áđđłł đç ðŸđç, đá jails Ÿ ÷ ĩđĩ äçĩéĩđñāçéāłł éáé āłłáé Ÿđĩéĩā ĩá ĩāééĩłđĩđĩ. Đñĩđāñđłłđĩđ đĩ ðúđúđĩ óŸđóçĩá āñ ÷ āłłĩ áéá ðĩ èŸŸđ jail, éáé ðđç ðđĩŸ ÷ áéá āéééĩłłđĩđ đá, ÷ ñçóéĩđĩéłłđĩđ đĩ script /etc/rc.d/jail:

```
# mount -a
# /etc/rc.d/jail start
```

Óā jails éá đñŸđáé ðłłñá ĩá āéđāéĩŸĩđáé éāñĩééŸ. Āá ĩá āéŸŸŸđđá āĩ Ÿ ÷ ĩđĩ ĩāééĩłłđĩđé ðúđúđĩ, ÷ ñçóéĩđĩéłłđĩđ đçĩ áĩđĩéłł đĩ(8). Éá đñŸđáé ĩá āāłđá èŸŸé áĩđłłđĩđé ÷ ĩā ðĩ đāñāéŸŸđúđ:

```
# jls
JID IP Address Hostname Path
3 192.168.3.17 ns.example.org /home/j/ns
2 192.168.3.18 mail.example.org /home/j/mail
1 62.123.43.14 www.example.org /home/j/www
```

Óā áđđú đĩ ðçĩāłłđĩ, éá đñŸđáé ĩá ĩđĩñāłłđĩđ ĩá ðđĩāāéāłłđĩđ óā èŸŸđ jail, ĩá đñĩđéŸŸáđđá ĩŸŸĩđ ÷ ñłłđĩđ đłł ĩá ñđéĩłłđĩđ đđçñāłłđĩđ. Ç ðđłłç JID äçéłłáé đĩ ÷ āñāéđçñéðéééü áĩāāĩñééðéééü āñééüü èŸŸđ áĩāñāĩŸ jail. × ñçóéĩđĩéłłđĩđ đçĩ đāñāéŸŸđúđ áĩđĩéłł đñĩéáéĩŸŸđ ĩá āéđāéŸŸáđđá āñāāłłđĩđ áéá ÷ āłłñéçđ đĩđ jail, ĩā JID 3:

```
# jexec 3 tcsh
```

16.6.1.4 ĀĩāāŸŸéĩéóç

ÈŸŸĩéá ðééāĩłł, éá ÷ ñāéáóđāłł ĩá áĩāāāéĩłłđĩđ đĩ óŸđóçĩŸŸ óáđ óā ĩéá ĩŸŸ Ÿēāĩç đĩđ FreeBSD, āłłđá áéá èüāĩđđ áóđŸēééáđ, āłłđá áéáđłł đđŸŸ ÷ ĩđĩ ĩŸŸāđ āđĩāđúđçđđá đçĩ ĩāłłāñç Ÿēāĩç ĩé ĩđĩłđĩđ āłłáé ÷ ñłłđĩđđ áéá óā jails đĩđ đłł Ÿç Ÿ ÷ āđá. Ĭ đñũđĩđ đĩđ ÷ ñçóéĩđĩéłłđĩđá áéá ðçĩ äçĩéĩđñāłłđĩđ ðũĩ jails, đđéđñŸđáé ðçĩ áŸéĩçç áĩāāŸŸéĩéóç đĩđ. ĀđéđēŸŸĩ, áéá ÷ éóđĩđĩéāłł đĩ ÷ ñũĩ ĩéáéĩđłłđĩ đçđ éāéđĩđñāłłđĩđ đĩđ, ĩéá éáé éá ÷ ñāéáóđāłł ĩá đá ðđāĩāđłłđĩđ ĩũĩ

éáóÛ óá ëβáá óáëáóóáβá éáðóÛ. Áðβóçð, ðáñÝ ÷ áé Ýíáí ðñüðí íá áðéóóñÝθáóá óá ðáéáéüóáñáð áéäüóáéð áÛí ðñíëýøíðí íðíéááβðíðá óóÛëíáðá.

1. Õí ðñððí áβíá éá áíáááëíβóáðá ðí óýóðçíá óðí íðíβí ðéëíñáñýíðáé óá jails, íá ðí óðíPèç ðñüðí. Óðç óðíÝ ÷ áéá äçíëíðñáβóá Ýíá íÝí ðñíóñéíü template éáóÛëíáí, ìüíí áéá áíÛáíùóç, óðí /home/j/mroot2.

```
# mkdir /home/j/mroot2
# cd /usr/src
# make installworld DESTDIR=/home/j/mroot2
# cd /home/j/mroot2
# cpdup /usr/src usr/src
# mkdir s
```

Õí installworld äçíëíðñáβ ìáñéëíýð éáóáéüüáñðð ðíð áá ÷ ñáéÛëííðáé, éáé éá ðñÝðáé íá áéáñáóíýí:

```
# chflags -R 0 var
# rm -R etc var root usr/local tmp
```

2. Äçíëíðñáβóáá íáíÛ ðíðð óðíáÝóíðð áéá ðí óýóðçíá áñ ÷ áβüí áíÛáíùóçð - áãñááððð:

```
# ln -s s/etc etc
# ln -s s/root root
# ln -s s/home home
# ln -s ../s/usr-local usr/local
# ln -s ../s/usr-X11R6 usr/X11R6
# ln -s s/tmp tmp
# ln -s s/var var
```

3. Õðñá áβíáé ç óúóðβ óðéäìP áéá íá óóáíáðβóáðá óá jails:

```
# /etc/rc.d/jail stop
```

4. Áðíðñíóáñððóáá óá áñ ÷ ééÛ óðóðβíáðá áñ ÷ áβüí:

```
# umount /home/j/ns/s
# umount /home/j/ns
# umount /home/j/mail/s
# umount /home/j/mail
# umount /home/j/www/s
# umount /home/j/www
```

Óçíáβùóç: Õá óðóðβíáðá áñ ÷ áβüí áíÛáíùóçð - áãñááððð áβíáé ðñíóáñðçíÝíá óðí óýóðçíá áñ ÷ áβüí ìüíí áíÛáíùóçð (/s) éáé ðñÝðáé íá áβíáé óá ðñððá ðíð éá áðíðñíóáñðçèíýí.

5. ÌáðáéëíPóðá ðíð ðáééü ìüíí áéá áíÛáíùóç éáóÛëíáí, éáé áíðééáðáóððóðá ðíð íá ðíð éáéíýñáéí. Ì ðáééüð éá ðáñáíáβíáé ùð áíðβáñáóí áóóáéáβáð ðíð ðáééýý óðóðβíáððð óá ðáñβððóç ðñíáéβíáððð. Ì ðñüðíð ìííáóβáðð ðíð áéíëíððéPóáíá áâ ðíðéóðíé ÷ áβ óðç ÷ ñííéëP óðéäìP äçíëíðñáβáð ðíð íÝíð óðóðβíáððð áñ ÷ áβüí ìüíí áíÛáíùóçð. ÌáðáéëíPóðá ðçí áñ ÷ ééP óðéëíáP ðüí Ports ðíð FreeBSD óðí íÝí óýóðçíá, áñ ÷ áβüí ðñíéáéíÝíð íá áñíéíññPóáðá ÷ ðñí éáé inodes:

```
# cd /home/j
# mv mroot mroot.20060601
# mv mroot2 mroot
# mv mroot.20060601/usr/ports mroot/usr
```

6. Οπότε οι αρχικοί οι κώδικες αέας αίμαίνου template αβίαέ Υοίει, ιδύοα οι κώδικες οι αέας αβίαέ α έπρωτάβωαά ίαίΰ όά οδóóβίαόά άñ÷άβùí έάέ ίά ίάέέίβωαόά όά jails:

```
# mount -a  
# /etc/rc.d/jail start
```

×ñçóέñδρεάβόά όçí άíðíεβ jls(8) αέά ίά άέΥάíαόά άΰί όά jails ίάέβίçόάί ουόóΰ. Ίçí ίά ÷ΰόάά ίά άέόάέΥόάά όí mergemaster αέά όí έΰέά jail. Έά ÷ñάέάόόάβ ίά άίάάάέίβωαόά όüόí όά άñ÷άβά ñδèιβóάùí, üóí έάέ όά rc.d scripts.

Εἰσαγωγή 17

Ἐπιμέτρηση, ἐπιμέτρηση, ἐπιμέτρηση

Ἐπιμέτρηση

17.1 Ἐπιμέτρηση

Ἡ FreeBSD 5.X ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e. Ἡ ἀρχὴ τοῦ TrustedBSD project ἀκολουθεῖ τὴν ἀρχὴν τοῦ POSIX.1e. Ἡ ἀρχὴ τοῦ TrustedBSD project ἀκολουθεῖ τὴν ἀρχὴν τοῦ POSIX.1e. Ἡ ἀρχὴ τοῦ TrustedBSD project ἀκολουθεῖ τὴν ἀρχὴν τοῦ POSIX.1e.

Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e. Ἡ ἀρχὴ τοῦ TrustedBSD project ἀκολουθεῖ τὴν ἀρχὴν τοῦ POSIX.1e.

Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e.

- Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e.
- Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e.
- Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e.
- Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e.
- Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e.
- Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e.

Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e.

- Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e.
- Ἡ ἐπιμέτρηση ἀκολουθεῖ τὴν ἀρχὴν τοῦ TrustedBSD project, ἣν ἀκολουθεῖ ὁ POSIX.1e.

- Íá Ý÷-áðã ìÛðìéá àñíëéàßùóç ìá òçí áóóÛëáéá éáé ðùð áððÐ ó÷-áðßæáðáé ìá òí FreeBSD (ÊâöÛëáëí 15).

Ðñíáéäìðíßçòç: Ç éáèÐ ÷-ñÐóç òùí ðëçñíìðñéðí ðìð ðáñÝ÷-ììðáé àãð ìðñáß ìá ðñíéáéÝðáé áððëáéá ðñüóááóçð òòí òýóðçíá, áêéíáðñéóìù òòìð ÷-ñÐóðáð Ð ááðíáíßá ðñüóááóçð òóéð ððçñáóßáð ðìð ðáñÝ÷-ììðáé áðð òí ×11. Áêùìá ðéí òçíáíðééù àßíáé ùðé ááí ðñÝðáé ìá ááóßæáðáð òòí MAC áéá òçí ðëñç áóóÛëéóç áíùð òóóðßáíáðì. Õí ðéáßóéí éáéòìðñéðí MAC ðáñÝ÷-áé áððð ððéðéÝí ððìóðßñéíç òá ìéá ððÛñ÷-ììðá ðìééðéèÐ áóóáéáßáð. ×ùñßð òúóðÝð ðñáéðééÝð éáé ðáéðéééìç äéÝã÷-ìð òóóáéáßáð, òí òýóðçíá ááí éá àßíáé ðìðÝ áðùéððá áóóáéÝð.

Éá ðñÝðáé áðßóçð ìá òçíáéùèáß ùðé òá ðáñáááßáíáðá ðìð ðáñéÝ÷-ììðáé òá áððù òí êâöÛëáëí àßíáé áêñéáðð éáé ìùñ áððù: ðáñáááßáíáðá. Ááí òòíßóðáðáé ìá ÷-ñçóéíìðéçéíçí áêñéáðð áððÝð ìé ñðèìßóáéð òá Ýíá òýóðçíá ðáñááùáð. Ç ðéìðíßçòç òùí áéÛòìñùí áñèñùíÛðùí ðìééðéèðí áððáéáßáð áðáéðáß áñèáðÐ òéÝçç éáé àìééíÝð. Áí ááí éáðáííáððá òçí áêñéáð èáéòìðñéðí òìðð, ìðñáß ìá áñáèáßððá òóç éÝóç ìá äéÝã÷-áððá ìáíÛ ðèùëççñí òí òýóðçíá éáé ìá áêéÛæáððá ñðèìßóáéð òá ðìéèÛ áñ÷-áßá éáé éáðáéùáíðð.

17.1.1 Õé ááí ÐáñééáíáÛíáðáé òòí ÊâöÛëáëí

Õí êâöÛëáëí áððù éáéýððáé ìéá áðñáßá ðáñéí÷-Ð ðñíáéçìÛðùí áóóáéáßáð ðìð ò÷-áðßæíìðáé ìá òí ðéáßóéí éáéòìðñéðí MAC. Ááí éá éáéððéáß ç áíÛðððèç òÝí áñèñùíÛðùí ðìééðéèðí áóóáéáßáð MAC. ìáð áñèñùð áðð áñèññíáðá ðìð ðáñééáíáÛíìðáé òòí ðéáßóéí MAC, Ý÷-ììðí áéáéèÛ ÷-áñáðçñéóðéèÛ ðìð ðáñÝ÷-ììðáé òùòí áéá àìééíÝð ùòí éáé áéá áíÛððèç òÝí áñèñùíÛðùí. ÁððÛ ðáñééáíáÛíìðí òá mac_test(4), mac_stub(4) éáé mac_none(4). Áéá ðáñéóóùðáñàð ðëçñíìðñéðí ò÷-áðéèÛ ìá áððÛ òá áñèññíáðá éáé òìðð áéÛòìñìðð ìç÷-áíéóììçð ðìð ðáñÝ÷-ììðí, ðáñáéáéìçíá áíáðñÝíðá òóéð áíðßðéí÷-àð òáèßááð manual.

17.2 Key Terms in this Chapter

Before reading this chapter, a few key terms must be explained. This will hopefully clear up any confusion that may occur and avoid the abrupt introduction of new terms and information.

- *compartment*: A compartment is a set of programs and data to be partitioned or separated, where users are given explicit access to specific components of a system. Also, a compartment represents a grouping, such as a work group, department, project, or topic. Using compartments, it is possible to implement a need-to-know security policy.
- *high water mark*: A high water mark policy is one which permits the raising of security levels for the purpose of accessing higher level information. In most cases, the original level is restored after the process is complete. Currently, the FreeBSD MAC framework does not have a policy for this, but the definition is included for completeness.
- *integrity*: Integrity, as a key concept, is the level of trust which can be placed on data. As the integrity of the data is elevated, so does the ability to trust that data.
- *label*: A label is a security attribute which can be applied to files, directories, or other items in the system. It could be considered a confidentiality stamp; when a label is placed on a file it describes the security properties for that specific file and will only permit access by files, users, resources, etc. with a similar security setting. The meaning and interpretation of label values depends on the policy configuration: while some policies might treat a label as representing the integrity or secrecy of an object, other policies might use labels to hold rules for access.

- *level*: The increased or decreased setting of a security attribute. As the level increases, its security is considered to elevate as well.
- *low water mark*: A low water mark policy is one which permits lowering of the security levels for the purpose of accessing information which is less secure. In most cases, the original security level of the user is restored after the process is complete. The only security policy module in FreeBSD to use this is `mac_lomac(4)`.
- *multilabel*: The `multilabel` property is a file system option which can be set in single user mode using the `tunefs(8)` utility, during the boot operation using the `fstab(5)` file, or during the creation of a new file system. This option will permit an administrator to apply different MAC labels on different objects. This option only applies to security policy modules which support labeling.
- *object*: An object or system object is an entity through which information flows under the direction of a *subject*. This includes directories, files, fields, screens, keyboards, memory, magnetic storage, printers or any other data storage/moving device. Basically, an object is a data container or a system resource; access to an *object* effectively means access to the data.
- *policy*: A collection of rules which defines how objectives are to be achieved. A *policy* usually documents how certain items are to be handled. This chapter will consider the term *policy* in this context as a *security policy*; i.e. a collection of rules which will control the flow of data and information and define whom will have access to that data and information.
- *sensitivity*: Usually used when discussing MLS. A sensitivity level is a term used to describe how important or secret the data should be. As the sensitivity level increases, so does the importance of the secrecy, or confidentiality of the data.
- *single label*: A single label is when the entire file system uses one label to enforce access control over the flow of data. When a file system has this set, which is any time when the `multilabel` option is not set, all files will conform to the same label setting.
- *subject*: a subject is any active entity that causes information to flow between *objects*; e.g. a user, user processor, system process, etc. On FreeBSD, this is almost always a thread acting in a process on behalf of a user.

17.3 Explanation of MAC

With all of these new terms in mind, consider how the MAC framework augments the security of the system as a whole. The various security policy modules provided by the MAC framework could be used to protect the network and file systems, block users from accessing certain ports and sockets, and more. Perhaps the best use of the policy modules is to blend them together, by loading several security policy modules at a time for a multi-layered security environment. In a multi-layered security environment, multiple policy modules are in effect to keep security in check. This is different to a hardening policy, which typically hardens elements of a system that is used only for specific purposes. The only downside is administrative overhead in cases of multiple file system labels, setting network access control user by user, etc.

These downsides are minimal when compared to the lasting effect of the framework; for instance, the ability to pick and choose which policies are required for a specific configuration keeps performance overhead down. The reduction of support for unneeded policies can increase the overall performance of the system as well as offer flexibility of choice. A good implementation would consider the overall security requirements and effectively implement the various security policy modules offered by the framework.

Thus a system utilizing MAC features should at least guarantee that a user will not be permitted to change security attributes at will; all user utilities, programs and scripts must work within the constraints of the access rules provided

by the selected security policy modules; and that total control of the MAC access rules are in the hands of the system administrator.

It is the sole duty of the system administrator to carefully select the correct security policy modules. Some environments may need to limit access control over the network; in these cases, the `mac_portacl(4)`, `mac_ifoff(4)` and even `mac_biba(4)` policy modules might make good starting points. In other cases, strict confidentiality of file system objects might be required. Policy modules such as `mac_bsextended(4)` and `mac_mls(4)` exist for this purpose.

Policy decisions could be made based on network configuration. Perhaps only certain users should be permitted access to facilities provided by `ssh(1)` to access the network or the Internet. The `mac_portacl(4)` would be the policy module of choice for these situations. But what should be done in the case of file systems? Should all access to certain directories be severed from other groups or specific users? Or should we limit user or utility access to specific files by setting certain objects as classified?

In the file system case, access to objects might be considered confidential to some users, but not to others. For an example, a large development team might be broken off into smaller groups of individuals. Developers in project A might not be permitted to access objects written by developers in project B. Yet they might need to access objects created by developers in project C; that is quite a situation indeed. Using the different security policy modules provided by the MAC framework; users could be divided into these groups and then given access to the appropriate areas without fear of information leakage.

Thus, each security policy module has a unique way of dealing with the overall security of a system. Module selection should be based on a well thought out security policy. In many cases, the overall policy may need to be revised and reimplemented on the system. Understanding the different security policy modules offered by the MAC framework will help administrators choose the best policies for their situations.

The default FreeBSD kernel does not include the option for the MAC framework; thus the following kernel option must be added before trying any of the examples or information in this chapter:

```
options MAC
```

And the kernel will require a rebuild and a reinstall.

Προσοχή: While the various manual pages for MAC policy modules state that they may be built into the kernel, it is possible to lock the system out of the network and more. Implementing MAC is much like implementing a firewall, care must be taken to prevent being completely locked out of the system. The ability to revert back to a previous configuration should be considered while the implementation of MAC remotely should be done with extreme caution.

17.4 Understanding MAC Labels

A MAC label is a security attribute which may be applied to subjects and objects throughout the system.

When setting a label, the user must be able to comprehend what it is, exactly, that is being done. The attributes available on an object depend on the policy module loaded, and that policy modules interpret their attributes in different ways. If improperly configured due to lack of comprehension, or the inability to understand the implications, the result will be the unexpected and perhaps, undesired, behavior of the system.

The security label on an object is used as a part of a security access control decision by a policy. With some policies, the label by itself contains all information necessary to make a decision; in other models, the labels may be processed as part of a larger rule set, etc.

For instance, setting the label of `biba/low` on a file will represent a label maintained by the Biba security policy module, with a value of “low”.

A few policy modules which support the labeling feature in FreeBSD offer three specific predefined labels. These are the low, high, and equal labels. Although they enforce access control in a different manner with each policy module, you can be sure that the low label will be the lowest setting, the equal label will set the subject or object to be disabled or unaffected, and the high label will enforce the highest setting available in the Biba and MLS policy modules.

Within single label file system environments, only one label may be used on objects. This will enforce one set of access permissions across the entire system and in many environments may be all that is required. There are a few cases where multiple labels may be set on objects or subjects in the file system. For those cases, the `multilabel` option may be passed to `tunefs(8)`.

In the case of Biba and MLS, a numeric label may be set to indicate the precise level of hierarchical control. This numeric level is used to partition or sort information into different groups of say, classification only permitting access to that group or a higher group level.

In most cases the administrator will only be setting up a single label to use throughout the file system.

Hey wait, this is similar to DAC! I thought MAC gave control strictly to the administrator. That statement still holds true, to some extent as `root` is the one in control and who configures the policies so that users are placed in the appropriate categories/access levels. Alas, many policy modules can restrict the `root` user as well. Basic control over objects will then be released to the group, but `root` may revoke or modify the settings at any time. This is the hierarchal/clearance model covered by policies such as Biba and MLS.

17.4.1 Label Configuration

Virtually all aspects of label policy module configuration will be performed using the base system utilities. These commands provide a simple interface for object or subject configuration or the manipulation and verification of the configuration.

All configuration may be done by use of the `setfmac(8)` and `setpmac(8)` utilities. The `setfmac` command is used to set MAC labels on system objects while the `setpmac` command is used to set the labels on system subjects. Observe:

```
# setfmac biba/high test
```

If no errors occurred with the command above, a prompt will be returned. The only time these commands are not quiescent is when an error occurred; similarly to the `chmod(1)` and `chown(8)` commands. In some cases this error may be a `Permission denied` and is usually obtained when the label is being set or modified on an object which is restricted.¹ The system administrator may use the following commands to overcome this:

```
# setfmac biba/high test
Permission denied
# setpmac biba/low setfmac biba/high test
# getfmac test
test: biba/high
```

As we see above, `setpmac` can be used to override the policy module’s settings by assigning a different label to the invoked process. The `getpmac` utility is usually used with currently running processes, such as **sendmail**: although it

takes a process ID in place of a command the logic is extremely similar. If users attempt to manipulate a file not in their access, subject to the rules of the loaded policy modules, the `Operation not permitted` error will be displayed by the `mac_set_link` function.

17.4.1.1 Common Label Types

For the `mac_biba(4)`, `mac_mls(4)` and `mac_lomac(4)` policy modules, the ability to assign simple labels is provided. These take the form of high, equal and low, what follows is a brief description of what these labels provide:

- The `low` label is considered the lowest label setting an object or subject may have. Setting this on objects or subjects will block their access to objects or subjects marked high.
- The `equal` label should only be placed on objects considered to be exempt from the policy.
- The `high` label grants an object or subject the highest possible setting.

With respect to each policy module, each of those settings will instate a different information flow directive. Reading the proper manual pages will further explain the traits of these generic label configurations.

17.4.1.1.1 Advanced Label Configuration

Numeric grade labels are used for `comparison:compartment+compartment`; thus the following:

```
biba/10:2+3+6(5:2+3-20:2+3+4+5+6)
```

May be interpreted as:

“Biba Policy Label”/“Grade 10” :“Compartments 2, 3 and 6”: (“grade 5 ...”)

In this example, the first grade would be considered the “effective grade” with “effective compartments”, the second grade is the low grade and the last one is the high grade. In most configurations these settings will not be used; indeed, they offered for more advanced configurations.

When applied to system objects, they will only have a current grade/compartments as opposed to system subjects as they reflect the range of available rights in the system, and network interfaces, where they are used for access control.

The grade and compartments in a subject and object pair are used to construct a relationship referred to as “dominance”, in which a subject dominates an object, the object dominates the subject, neither dominates the other, or both dominate each other. The “both dominate” case occurs when the two labels are equal. Due to the information flow nature of Biba, you have rights to a set of compartments, “need to know”, that might correspond to projects, but objects also have a set of compartments. Users may have to subset their rights using `su` or `setpmac` in order to access objects in a compartment from which they are not restricted.

17.4.1.2 Users and Label Settings

Users themselves are required to have labels so that their files and processes may properly interact with the security policy defined on the system. This is configured through the `login.conf` file by use of login classes. Every policy module that uses labels will implement the user class setting.

An example entry containing every policy module setting is displayed below:

```
default:\
:copyright=/etc/COPYRIGHT:\
```

```
:welcome=/etc/motd:\
:setenv=MAIL=/var/mail/$,BLOCKSIZE=K:\
:path=~:/bin:/sbin:/bin:/usr/sbin:/usr/bin:/usr/local/sbin:/usr/local/bin:\
:manpath=/usr/share/man /usr/local/man:\
:nologin=/usr/sbin/nologin:\
:cputime=1h30m:\
:datasize=8M:\
:vmemoryuse=100M:\
:stacksize=2M:\
:memorylocked=4M:\
:memoryuse=8M:\
:filesize=8M:\
:coredumpsize=8M:\
:openfiles=24:\
:maxproc=32:\
:priority=0:\
:requirehome:\
:passwordtime=91d:\
:umask=022:\
:ignoretime@:\
:label=partition/13,mls/5,biba/10(5-15),lomac/10[2]:
```

The `label` option is used to set the user class default label which will be enforced by MAC. Users will never be permitted to modify this value, thus it can be considered not optional in the user case. In a real configuration, however, the administrator will never wish to enable every policy module. It is recommended that the rest of this chapter be reviewed before any of this configuration is implemented.

Ὁδηγὸς: Users may change their label after the initial login; however, this change is subject constraints of the policy. The example above tells the Biba policy that a process's minimum integrity is 5, its maximum is 15, but the default effective label is 10. The process will run at 10 until it chooses to change label, perhaps due to the user using the `setpmac` command, which will be constrained by Biba to the range set at login.

In all cases, after a change to `login.conf`, the login class capability database must be rebuilt using `cap_mkdb` and this will be reflected throughout every forthcoming example or discussion.

It is useful to note that many sites may have a particularly large number of users requiring several different user classes. In depth planning is required as this may get extremely difficult to manage.

Future versions of FreeBSD will include a new way to deal with mapping users to labels; however, this will not be available until some time after FreeBSD 5.3.

17.4.1.3 Network Interfaces and Label Settings

Labels may also be set on network interfaces to help control the flow of data across the network. In all cases they function in the same way the policies function with respect to objects. Users at high settings in `biba`, for example, will not be permitted to access network interfaces with a label of low.

The `maclabel` may be passed to `ifconfig` when setting the MAC label on network interfaces. For example:

```
# ifconfig bge0 maclabel biba/equal
```

will set the MAC label of `biba/equal` on the `bge(4)` interface. When using a setting similar to `biba/high(low-high)` the entire label should be quoted; otherwise an error will be returned.

Each policy module which supports labeling has a tunable which may be used to disable the MAC label on network interfaces. Setting the label to `equal` will have a similar effect. Review the output from `sysctl`, the policy manual pages, or even the information found later in this chapter for those tunables.

17.4.2 Singlelabel or Multilabel?

By default the system will use the `singlelabel` option. But what does this mean to the administrator? There are several differences which, in their own right, offer pros and cons to the flexibility in the systems security model.

The `singlelabel` only permits for one label, for instance `biba/high` to be used for each subject or object. It provides for lower administration overhead but decreases the flexibility of policies which support labeling. Many administrators may want to use the `multilabel` option in their security policy.

The `multilabel` option will permit each subject or object to have its own independent MAC label in place of the standard `singlelabel` option which will allow only one label throughout the partition. The `multilabel` and `singlelabel` options are only required for the policies which implement the labeling feature, including the Biba, Lomac, MLS and SEBSD policies.

In many cases, the `multilabel` may not need to be set at all. Consider the following situation and security model:

- FreeBSD web-server using the MAC framework and a mix of the various policies.
- This machine only requires one label, `biba/high`, for everything in the system. Here the file system would not require the `multilabel` option as a single label will always be in effect.
- But, this machine will be a web server and should have the web server run at `biba/low` to prevent write up capabilities. The Biba policy and how it works will be discussed later, so if the previous comment was difficult to interpret just continue reading and return. The server could use a separate partition set at `biba/low` for most if not all of its runtime state. Much is lacking from this example, for instance the restrictions on data, configuration and user settings; however, this is just a quick example to prove the aforementioned point.

If any of the non-labeling policies are to be used, then the `multilabel` option would never be required. These include the `seeotheruids`, `portacl` and `partition` policies.

It should also be noted that using `multilabel` with a partition and establishing a security model based on `multilabel` functionality could open the doors for higher administrative overhead as everything in the file system would have a label. This includes directories, files, and even device nodes.

The following command will set `multilabel` on the file systems to have multiple labels. This may only be done in single user mode:

```
# tunefs -l enable /
```

This is not a requirement for the swap file system.

Σημείωση: Some users have experienced problems with setting the `multilabel` flag on the root partition. If this is the case, please review the Ὁδηγὸς 17.16 of this chapter.

17.5 Planning the Security Configuration

Whenever a new technology is implemented, a planning phase is always a good idea. During the planning stages, an administrator should in general look at the “big picture”, trying to keep in view at least the following:

- The implementation requirements;
- The implementation goals;

For MAC installations, these include:

- How to classify information and resources available on the target systems.
- What sorts of information or resources to restrict access to along with the type of restrictions that should be applied.
- Which MAC module or modules will be required to achieve this goal.

It is always possible to reconfigure and change the system resources and security settings, it is quite often very inconvenient to search through the system and fix existing files and user accounts. Planning helps to ensure a trouble-free and efficient trusted system implementation. A trial run of the trusted system, including the configuration, is often vital and definitely beneficial *before* a MAC implementation is used on production systems. The idea of just letting loose on a system with MAC is like setting up for failure.

Different environments may have explicit needs and requirements. Establishing an in depth and complete security profile will decrease the need of changes once the system goes live. As such, the future sections will cover the different modules available to administrators; describe their use and configuration; and in some cases provide insight on what situations they would be most suitable for. For instance, a web server might roll out the `mac_biba(4)` and `mac_bsextended(4)` policies. In other cases, a machine with very few local users, the `mac_partition(4)` might be a good choice.

17.6 Module Configuration

Every module included with the MAC framework may be either compiled into the kernel as noted above or loaded as a run-time kernel module. The recommended method is to add the module name to the `/boot/loader.conf` file so that it will load during the initial boot operation.

The following sections will discuss the various MAC modules and cover their features. Implementing them into a specific environment will also be a consideration of this chapter. Some modules support the use of labeling, which is controlling access by enforcing a label such as “this is allowed and this is not”. A label configuration file may control how files may be accessed, network communication can be exchanged, and more. The previous section showed how the `multilabel` flag could be set on file systems to enable per-file or per-partition access control.

A single label configuration would enforce only one label across the system, that is why the `tunefs` option is called `multilabel`.

17.6.1 The MAC seeotheruids Module

Module name: `mac_seeotheruids.ko`

Kernel configuration line: `options MAC_SEEOTHERUIDS`

Boot option: `mac_seeotheruids_load="YES"`

The `mac_seeotheruids(4)` module mimics and extends the `security.bsd.see_other_uids` and `security.bsd.see_other_gids` `sysctl` tunables. This option does not require any labels to be set before configuration and can operate transparently with the other modules.

After loading the module, the following `sysctl` tunables may be used to control the features:

- `security.mac.seeotheruids.enabled` will enable the module's features and use the default settings. These default settings will deny users the ability to view processes and sockets owned by other users.
- `security.mac.seeotheruids.specificgid_enabled` will allow a certain group to be exempt from this policy. To exempt specific groups from this policy, use the `security.mac.seeotheruids.specificgid=xxx` `sysctl` tunable. In the above example, the `xxx` should be replaced with the numeric group ID to be exempted.
- `security.mac.seeotheruids.primarygroup_enabled` is used to exempt specific primary groups from this policy. When using this tunable, the `security.mac.seeotheruids.specificgid_enabled` may not be set.

17.7 The MAC `bsdextended` Module

Module name: `mac_bsdextended.ko`

Kernel configuration line: `options MAC_BSDEXTENDED`

Boot option: `mac_bsdextended_load="YES"`

The `mac_bsdextended(4)` module enforces the file system firewall. This module's policy provides an extension to the standard file system permissions model, permitting an administrator to create a firewall-like ruleset to protect files, utilities, and directories in the file system hierarchy. When access to a file system object is attempted, the list of rules is iterated until either a matching rule is located or the end is reached. This behavior may be changed by the use of a `sysctl(8)` parameter, `security.mac.bsdextended.firstmatch_enabled`. Similar to other firewall modules in FreeBSD, a file containing access control rules can be created and read by the system at boot time using an `rc.conf(5)` variable.

The rule list may be entered using a utility, `ugidfw(8)`, that has a syntax similar to that of `ipfw(8)`. More tools can be written by using the functions in the `libugidfw(3)` library.

Extreme caution should be taken when working with this module; incorrect use could block access to certain parts of the file system.

17.7.1 Examples

After the `mac_bsdextended(4)` module has been loaded, the following command may be used to list the current rule configuration:

```
# ugidfw list
0 slots, 0 rules
```

As expected, there are no rules defined. This means that everything is still completely accessible. To create a rule which will block all access by users but leave `root` unaffected, simply run the following command:

```
# ugidfw add subject not uid root new object not uid root mode n
```

Ὁδηγός: In releases prior to FreeBSD 5.3, the `add` parameter did not exist. In those cases the `set` should be used instead. See below for a command example.

This is a very bad idea as it will block all users from issuing even the most simple commands, such as `ls`. A more patriotic list of rules might be:

```
# ugidfw set 2 subject uid user1 object uid user2 mode n
# ugidfw set 3 subject uid user1 object gid user2 mode n
```

This will block any and all access, including directory listings, to `user2`'s home directory from the username `user1`.

In place of `user1`, the `not uid user2` could be passed. This will enforce the same access restrictions above for all users in place of just one user.

Ὁδηγός: The `root` user will be unaffected by these changes.

This should provide a general idea of how the `mac_bsdextended(4)` module may be used to help fortify a file system. For more information, see the `mac_bsdextended(4)` and the `ugidfw(8)` manual pages.

17.8 The MAC ifoff Module

Module name: `mac_ifoff.ko`

Kernel configuration line: `options MAC_IFOFF`

Boot option: `mac_ifoff_load="YES"`

The `mac_ifoff(4)` module exists solely to disable network interfaces on the fly and keep network interfaces from being brought up during the initial system boot. It does not require any labels to be set up on the system, nor does it have a dependency on other MAC modules.

Most of the control is done through the `sysctl` tunables listed below.

- `security.mac.ifoff.lo_enabled` will enable/disable all traffic on the loopback (`lo(4)`) interface.
- `security.mac.ifoff.bpfrecv_enabled` will enable/disable all traffic on the Berkeley Packet Filter interface (`bpf(4)`)
- `security.mac.ifoff.other_enabled` will enable/disable traffic on all other interfaces.

One of the most common uses of `mac_ifoff(4)` is network monitoring in an environment where network traffic should not be permitted during the boot sequence. Another suggested use would be to write a script which uses `security/aide` to automatically block network traffic if it finds new or altered files in protected directories.

17.9 The MAC portacl Module

Module name: `mac_portacl.ko`

Kernel configuration line: `MAC_PORTACL`

Boot option: `mac_portacl_load="YES"`

The `mac_portacl(4)` module is used to limit binding to local TCP and UDP ports using a variety of `sysctl` variables. In essence `mac_portacl(4)` makes it possible to allow non-`root` users to bind to specified privileged ports, i.e. ports fewer than 1024.

Once loaded, this module will enable the MAC policy on all sockets. The following tunables are available:

- `security.mac.portacl.enabled` will enable/disable the policy completely.²
- `security.mac.portacl.port_high` will set the highest port number that `mac_portacl(4)` will enable protection for.
- `security.mac.portacl.suser_exempt` will, when set to a non-zero value, exempt the `root` user from this policy.
- `security.mac.portacl.rules` will specify the actual `mac_portacl` policy; see below.

The actual `mac_portacl` policy, as specified in the `security.mac.portacl.rules` `sysctl`, is a text string of the form: `rule[, rule, ...]` with as many rules as needed. Each rule is of the form: `idtype:id:protocol:port`. The `idtype` parameter can be `uid` or `gid` and used to interpret the `id` parameter as either a user id or group id, respectively. The `protocol` parameter is used to determine if the rule should apply to TCP or UDP by setting the parameter to `tcp` or `udp`. The final `port` parameter is the port number to allow the specified user or group to bind to.

Ὁδηγός: Since the ruleset is interpreted directly by the kernel only numeric values can be used for the user ID, group ID, and port parameters. I.e. user, group, and port service names cannot be used.

By default, on UNIX-like systems, ports fewer than 1024 can only be used by/bound to privileged processes, i.e. those run as `root`. For `mac_portacl(4)` to allow non-privileged processes to bind to ports below 1024 this standard UNIX restriction has to be disabled. This can be accomplished by setting the `sysctl(8)` variables `net.inet.ip.portrange.reservedlow` and `net.inet.ip.portrange.reservedhigh` to zero.

See the examples below or review the `mac_portacl(4)` manual page for further information.

17.9.1 Examples

The following examples should illuminate the above discussion a little better:

```
# sysctl security.mac.portacl.port_high=1023
# sysctl net.inet.ip.portrange.reservedlow=0 net.inet.ip.portrange.reservedhigh=0
```

First we set `mac_portacl(4)` to cover the standard privileged ports and disable the normal UNIX bind restrictions.

```
# sysctl security.mac.portacl.suser_exempt=1
```

The `root` user should not be crippled by this policy, thus set the `security.mac.portacl.suser_exempt` to a non-zero value. The `mac_portacl(4)` module has now been set up to behave the same way UNIX-like systems behave by default.

```
# sysctl security.mac.portacl.rules=uid:80:tcp:80
```

Allow the user with UID 80 (normally the `www` user) to bind to port 80. This can be used to allow the `www` user to run a web server without ever having `root` privilege.

```
# sysctl security.mac.portacl.rules=uid:1001:tcp:110,uid:1001:tcp:995
```

Permit the user with the UID of 1001 to bind to the TCP ports 110 (“pop3”) and 995 (“pop3s”). This will permit this user to start a server that accepts connections on ports 110 and 995.

17.10 The MAC partition Module

Module name: `mac_partition.ko`

Kernel configuration line: `options MAC_PARTITION`

Boot option: `mac_partition_load="YES"`

The `mac_partition(4)` policy will drop processes into specific “partitions” based on their MAC label. Think of it as a special type of `jail(8)`, though that is hardly a worthy comparison.

This is one module that should be added to the `loader.conf(5)` file so that it loads and enables the policy during the boot process.

Most configuration for this policy is done using the `setpmac(8)` utility which will be explained below. The following `sysctl` tunable is available for this policy:

- `security.mac.partition.enabled` will enable the enforcement of MAC process partitions.

When this policy is enabled, users will only be permitted to see their processes, and any others within their partition, but will not be permitted to work with utilities outside the scope of this partition. For instance, a user in the `insecure` class above will not be permitted to access the `top` command as well as many other commands that must spawn a process.

To set or drop utilities into a partition label, use the `setpmac` utility:

```
# setpmac partition/13 top
```

This will add the `top` command to the label set on users in the `insecure` class. Note that all processes spawned by users in the `insecure` class will stay in the `partition/13` label.

17.10.1 Examples

The following command will show you the partition label and the process list:

```
# ps Zax
```

This next command will allow the viewing of another user’s process partition label and that user’s currently running processes:

```
# ps -ZU trhodes
```

Όχι ἀποδοχή: Users can see processes in `root`’s label unless the `mac_seeotheruids(4)` policy is loaded.

A really crafty implementation could have all of the services disabled in `/etc/rc.conf` and started by a script that starts them with the proper labeling set.

Όχι! Βούλο: The following policies support integer settings in place of the three default labels offered. These options, including their limitations, are further explained in the module manual pages.

17.11 The MAC Multi-Level Security Module

Module name: `mac_mls.ko`

Kernel configuration line: `options MAC_MLS`

Boot option: `mac_mls_load="YES"`

The `mac_mls(4)` policy controls access between subjects and objects in the system by enforcing a strict information flow policy.

In MLS environments, a “clearance” level is set in each subject or objects label, along with compartments. Since these clearance or sensibility levels can reach numbers greater than six thousand; it would be a daunting task for any system administrator to thoroughly configure each subject or object. Thankfully, three “instant” labels are already included in this policy.

These labels are `mls/low`, `mls/equal` and `mls/high`. Since these labels are described in depth in the manual page, they will only get a brief description here:

- The `mls/low` label contains a low configuration which permits it to be dominated by all other objects. Anything labeled with `mls/low` will have a low clearance level and not be permitted to access information of a higher level. In addition, this label will prevent objects of a higher clearance level from writing or passing information on to them.
- The `mls/equal` label should be placed on objects considered to be exempt from the policy.
- The `mls/high` label is the highest level of clearance possible. Objects assigned this label will hold dominance over all other objects in the system; however, they will not permit the leaking of information to objects of a lower class.

MLS provides for:

- A hierarchical security level with a set of non hierarchical categories;
- Fixed rules: no read up, no write down (a subject can have read access to objects on its own level or below, but not above. Similarly, a subject can have write access to objects on its own level or above but not beneath.);
- Secrecy (preventing inappropriate disclosure of data);
- Basis for the design of systems that concurrently handle data at multiple sensitivity levels (without leaking information between secret and confidential).

The following `sysctl` tunables are available for the configuration of special services and interfaces:

- `security.mac.mls.enabled` is used to enable/disable the MLS policy.
- `security.mac.mls.ptys_equal` will label all `pty(4)` devices as `mls/equal` during creation.
- `security.mac.mls.revocation_enabled` is used to revoke access to objects after their label changes to a label of a lower grade.
- `security.mac.mls.max_compartments` is used to set the maximum number of compartment levels with objects; basically the maximum compartment number allowed on a system.

To manipulate the MLS labels, the `setfmac(8)` command has been provided. To assign a label to an object, issue the following command:

```
# setfmac mls/5 test
```

To get the MLS label for the file `test` issue the following command:

```
# getfmac test
```

This is a summary of the MLS policy's features. Another approach is to create a master policy file in `/etc` which specifies the MLS policy information and to feed that file into the `setfmac` command. This method will be explained after all policies are covered.

17.11.1 Planning Mandatory Sensitivity

With the Multi-Level Security Policy Module, an administrator plans for controlling the flow of sensitive information. By default, with its block read up block write down nature, the system defaults everything to a low state. Everything is accessible and an administrator slowly changes this during the configuration stage; augmenting the confidentiality of the information.

Beyond the three basic label options above, an administrator may group users and groups as required to block the information flow between them. It might be easier to look at the information in clearance levels familiarized with words, for instance classifications such as `Confidential`, `Secret`, and `Top Secret`. Some administrators might just create different groups based on project levels. Regardless of classification method, a well thought out plan must exist before implementing such a restrictive policy.

Some example situations for this security policy module could be an e-commerce web server, a file server holding critical company information, and financial institution environments. The most unlikely place would be a personal workstation with only two or three users.

17.12 The MAC Biba Module

Module name: `mac_biba.ko`

Kernel configuration line: `options MAC_BIBA`

Boot option: `mac_biba_load="YES"`

The `mac_biba(4)` module loads the MAC Biba policy. This policy works much like that of the MLS policy with the exception that the rules for information flow are slightly reversed. This is said to prevent the downward flow of sensitive information whereas the MLS policy prevents the upward flow of sensitive information; thus, much of this section can apply to both policies.

In Biba environments, an “integrity” label is set on each subject or object. These labels are made up of hierarchal grades, and non-hierarchal components. As an object’s or subject’s grade ascends, so does its integrity.

Supported labels are `biba/low`, `biba/equal`, and `biba/high`; as explained below:

- The `biba/low` label is considered the lowest integrity an object or subject may have. Setting this on objects or subjects will block their write access to objects or subjects marked high. They still have read access though.
- The `biba/equal` label should only be placed on objects considered to be exempt from the policy.
- The `biba/high` label will permit writing to objects set at a lower label, but not permit reading that object. It is recommended that this label be placed on objects that affect the integrity of the entire system.

Biba provides for:

- Hierarchical integrity level with a set of non hierarchical integrity categories;
- Fixed rules: no write up, no read down (opposite of MLS). A subject can have write access to objects on its own level or below, but not above. Similarly, a subject can have read access to objects on its own level or above, but not below;
- Integrity (preventing inappropriate modification of data);
- Integrity levels (instead of MLS sensitivity levels).

The following `sysctl` tunables can be used to manipulate the Biba policy.

- `security.mac.biba.enabled` may be used to enable/disable enforcement of the Biba policy on the target machine.
- `security.mac.biba.ptys_equal` may be used to disable the Biba policy on `pty(4)` devices.
- `security.mac.biba.revocation_enabled` will force the revocation of access to objects if the label is changed to dominate the subject.

To access the Biba policy setting on system objects, use the `setfmac` and `getfmac` commands:

```
# setfmac biba/low test
# getfmac test
test: biba/low
```

17.12.1 Planning Mandatory Integrity

Integrity, different from sensitivity, guarantees that the information will never be manipulated by untrusted parties. This includes information passed between subjects, objects, and both. It ensures that users will only be able to modify and in some cases even access information they explicitly need to.

The `mac_biba(4)` security policy module permits an administrator to address which files and programs a user or users may see and invoke while assuring that the programs and files are free from threats and trusted by the system for that user, or group of users.

During the initial planning phase, an administrator must be prepared to partition users into grades, levels, and areas. Users will be blocked access not only to data but programs and utilities both before and after they start. The system will default to a high label once this policy module is enabled, and it is up to the administrator to configure the different grades and levels for users. Instead of using clearance levels as described above, a good planning method could include topics. For instance, only allow developers modification access to the source code repository, source

code compiler, and other development utilities. While other users would be grouped into other categories such as testers, designers, or just ordinary users and would only be permitted read access.

With its natural security control, a lower integrity subject is unable to write to a higher integrity subject; a higher integrity subject cannot observe or read a lower integrity object. Setting a label at the lowest possible grade could make it inaccessible to subjects. Some prospective environments for this security policy module would include a constrained web server, development and test machine, and source code repository. A less useful implementation would be a personal workstation, a machine used as a router, or a network firewall.

17.13 The MAC LOMAC Module

Module name: `mac_lomac.ko`

Kernel configuration line: `options MAC_LOMAC`

Boot option: `mac_lomac_load="YES"`

Unlike the MAC Biba policy, the `mac_lomac(4)` policy permits access to lower integrity objects only after decreasing the integrity level to not disrupt any integrity rules.

The MAC version of the Low-watermark integrity policy, not to be confused with the older `lomac(4)` implementation, works almost identically to Biba, but with the exception of using floating labels to support subject demotion via an auxiliary grade compartment. This secondary compartment takes the form of `[auxgrade]`. When assigning a `lomac` policy with an auxiliary grade, it should look a little bit like: `lomac/10[2]` where the number two (2) is the auxiliary grade.

The MAC LOMAC policy relies on the ubiquitous labeling of all system objects with integrity labels, permitting subjects to read from low integrity objects and then downgrading the label on the subject to prevent future writes to high integrity objects. This is the `[auxgrade]` option discussed above, thus the policy may provide for greater compatibility and require less initial configuration than Biba.

17.13.1 Examples

Like the Biba and MLS policies; the `setfmac` and `setpmac` utilities may be used to place labels on system objects:

```
# setfmac /usr/home/trhodes lomac/high[low]
# getfmac /usr/home/trhodes lomac/high[low]
```

Notice the auxiliary grade here is `low`, this is a feature provided only by the MAC LOMAC policy.

17.14 Nagios in a MAC Jail

The following demonstration will implement a secure environment using various MAC modules with properly configured policies. This is only a test and should not be considered the complete answer to everyone's security woes. Just implementing a policy and ignoring it never works and could be disastrous in a production environment.

Before beginning this process, the `multilabel` option must be set on each file system as stated at the beginning of this chapter. Not doing so will result in errors. While at it, ensure that the `net-mgmt/nagios-plugins`, `net-mgmt/nagios`, and `www/apache13` ports are all installed, configured, and working correctly.

17.14.1 Create an insecure User Class

Begin the procedure by adding the following user class to the `/etc/login.conf` file:

```
insecure:\
:copyright=/etc/COPYRIGHT:\
:welcome=/etc/motd:\
:setenv=MAIL=/var/mail/$,BLOCKSIZE=K:\
:path=~/bin:/sbin:/bin:/usr/sbin:/usr/bin:/usr/local/sbin:/usr/local/bin
:manpath=/usr/share/man /usr/local/man:\
:nologin=/usr/sbin/nologin:\
:cputime=1h30m:\
:datasize=8M:\
:vmemoryuse=100M:\
:stacksize=2M:\
:memorylocked=4M:\
:memoryuse=8M:\
:filesize=8M:\
:coredumpsize=8M:\
:openfiles=24:\
:maxproc=32:\
:priority=0:\
:requirehome:\
:passwordtime=91d:\
:umask=022:\
:ignoretime@:\
:label=biba/10(10-10):
```

And adding the following line to the default user class:

```
:label=biba/high:
```

Once this is completed, the following command must be issued to rebuild the database:

```
# cap_mkdb /etc/login.conf
```

17.14.2 Boot Configuration

Do not reboot yet, just add the following lines to `/boot/loader.conf` so the required modules will load during system initialization:

```
mac_biba_load="YES"
mac_seeotheruids_load="YES"
```

17.14.3 Configure Users

Set the `root` user to the default class using:

```
# pw usermod root -L default
```

All user accounts that are not `root` or system users will now require a login class. The login class is required otherwise users will be refused access to common commands such as `vi(1)`. The following `sh` script should do the trick:

```
# for x in `awk -F: '($3 >= 1001) && ($3 != 65534) { print $1 }' \
/etc/passwd`; do pw usermod $x -L insecure; done;
```

Drop the `nagios` and `www` users into the `insecure` class:

```
# pw usermod nagios -L insecure
# pw usermod www -L insecure
```

17.14.4 Create the Contexts File

A contexts file should now be created; the following example file should be placed in `/etc/policy.contexts`.

```
# This is the default BIBA policy for this system.

# System:
/var/run          biba/equal
/var/run/*       biba/equal

/dev             biba/equal
/dev/*          biba/equal

/var    biba/equal
/var/spool          biba/equal
/var/spool/*       biba/equal

/var/log          biba/equal
/var/log/*       biba/equal

/tmp    biba/equal
/tmp/*  biba/equal
/var/tmp  biba/equal
/var/tmp/*  biba/equal

/var/spool/mqueue  biba/equal
/var/spool/clientmqueue  biba/equal

# For Nagios:
/usr/local/etc/nagios
/usr/local/etc/nagios/*      biba/10

/var/spool/nagios          biba/10
/var/spool/nagios/*      biba/10

# For apache
/usr/local/etc/apache      biba/10
/usr/local/etc/apache/*   biba/10
```

This policy will enforce security by setting restrictions on the flow of information. In this specific configuration, users, `root` and others, should never be allowed to access **Nagios**. Configuration files and processes that are a part of **Nagios** will be completely self contained or jailed.

This file may now be read into our system by issuing the following command:

```
# setfsmac -ef /etc/policy.contexts /
# setfsmac -ef /etc/policy.contexts /
```

Óçìâßùóç: The above file system layout may be different depending on environment; however, it must be run on every single file system.

The `/etc/mac.conf` file requires the following modifications in the main section:

```
default_labels file ?biba
default_labels ifnet ?biba
default_labels process ?biba
default_labels socket ?biba
```

17.14.5 Enable Networking

Add the following line to `/boot/loader.conf`:

```
security.mac.biba.trust_all_interfaces=1
```

And the following to the network card configuration stored in `rc.conf`. If the primary Internet configuration is done via DHCP, this may need to be configured manually after every system boot:

```
maclabel biba/equal
```

17.14.6 Testing the Configuration

Ensure that the web server and **Nagios** will not be started on system initialization, and reboot. Ensure the `root` user cannot access any of the files in the **Nagios** configuration directory. If `root` can issue an `ls(1)` command on `/var/spool/nagios`, then something is wrong. Otherwise a “permission denied” error should be returned.

If all seems well, **Nagios**, **Apache**, and **Sendmail** can now be started in a way fitting of the security policy. The following commands will make this happen:

```
# cd /etc/mail && make stop && \
setpmac biba/equal make start && setpmac biba/10\10\10\ apachectl start && \
setpmac biba/10\10\10\ /usr/local/etc/rc.d/nagios.sh forcestart
```

Double check to ensure that everything is working properly. If not, check the log files or error messages. Use the `sysctl(8)` utility to disable the `mac_biba(4)` security policy module enforcement and try starting everything again, like normal.

Ὁδηγός: The `root` user can change the security enforcement and edit the configuration files without fear. The following command will permit the degradation of the security policy to a lower grade for a newly spawned shell:

```
# setpmac biba/10 csh
```

To block this from happening, force the user into a range via `login.conf(5)`. If `setpmac(8)` attempts to run a command outside of the compartment's range, an error will be returned and the command will not be executed. In this case, setting `root` to `biba/high(high-high)`.

17.15 User Lock Down

This example considers a relatively small, fewer than fifty users, storage system. Users would have login capabilities, and be permitted to not only store data but access resources as well.

For this scenario, the `mac_bsdextended(4)` mixed with `mac_seeotheruids(4)` could co-exist and block access not only to system objects but to hide user processes as well.

Begin by adding the following lines to `/boot/loader.conf`:

```
mac_seeotheruids_enabled="YES"
```

The `mac_bsdextended(4)` security policy module may be activated through the use of the following `rc.conf` variable:

```
ugidfw_enable="YES"
```

Default rules stored in `/etc/rc.bsdextended` will be loaded at system initialization; however, the default entries may need modification. Since this machine is expected only to service users, everything may be left commented out except the last two. These will force the loading of user owned system objects by default.

Add the required users to this machine and reboot. For testing purposes, try logging in as a different user across two consoles. Run the `ps aux` command to see if processes of other users are visible. Try to run `ls(1)` on another users home directory, it should fail.

Do not try to test with the `root` user unless the specific `sysctls` have been modified to block super user access.

Ὁδηγός: When a new user is added, their `mac_bsdextended(4)` rule will not be in the ruleset list. To update the ruleset quickly, simply unload the security policy module and reload it again using the `kldunload(8)` and `kldload(8)` utilities.

17.16 Troubleshooting the MAC Framework

During the development stage, a few users reported problems with normal configuration. Some of these problems are listed below:

17.16.1 The `multilabel` option cannot be enabled on `/`

The `multilabel` flag does not stay enabled on my root (`/`) partition!

It seems that one out of every fifty users has this problem, indeed, we had this problem during our initial configuration. Further observation of this so called “bug” has lead me to believe that it is a result of either incorrect documentation or misinterpretation of the documentation. Regardless of why it happened, the following steps may be taken to resolve it:

1. Edit `/etc/fstab` and set the root partition at `ro` for read-only.
2. Reboot into single user mode.
3. Run `tunefs -l enable` on `/`.
4. Reboot the system into normal mode.
5. Run `mount -urw /` and change the `ro` back to `rw` in `/etc/fstab` and reboot the system again.
6. Double-check the output from the `mount` to ensure that `multilabel` has been properly set on the root file system.

17.16.2 Cannot start a X11 server after MAC

After establishing a secure environment with MAC, I am no longer able to start X!

This could be caused by the `MAC partition` policy or by a mislabeling in one of the MAC labeling policies. To debug, try the following:

1. Check the error message; if the user is in the `insecure` class, the `partition` policy may be the culprit. Try setting the user’s class back to the `default` class and rebuild the database with the `cap_mkdb` command. If this does not alleviate the problem, go to step two.
2. Double-check the label policies. Ensure that the policies are set correctly for the user in question, the X11 application, and the `/dev` entries.
3. If neither of these resolve the problem, send the error message and a description of your environment to the TrustedBSD discussion lists located at the TrustedBSD (<http://www.TrustedBSD.org>) website or to the `FreeBSD` (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>) mailing list.

17.16.3 Error: `_secure_path(3)` cannot stat `.login_conf`

When I attempt to switch from the `root` to another user in the system, the error message `_secure_path: unable to state .login_conf`.

This message is usually shown when the user has a higher label setting than that of the user whom they are attempting to become. For instance a user on the system, `joe`, has a default label of `biba/low`. The `root` user, who has a label of `biba/high`, cannot view `joe`’s home directory. This will happen regardless if `root` has used the `su` command to become `joe`, or not. In this scenario, the Biba integrity model will not permit `root` to view objects set at a lower integrity level.

17.16.4 The `root` username is broken!

In normal or even single user mode, the `root` is not recognized. The `whoami` command returns 0 (zero) and `su` returns `who are you?`. What could be going on?

This can happen if a labeling policy has been disabled, either by a `sysctl(8)` or the policy module was unloaded. If the policy is being disabled or has been temporarily disabled, then the login capabilities database needs to be reconfigured with the `label` option being removed. Double check the `login.conf` file to ensure that all `label` options have been removed and rebuild the database with the `cap_mkdb` command.

This may also happen if a policy restricts access to the `master.passwd` file or database. Usually caused by an administrator altering the file under a label which conflicts with the general policy being used by the system. In these cases, the user information would be read by the system and access would be blocked as the file has inherited the new label. Disable the policy via a `sysctl(8)` and everything should return to normal.

Όχι επόαεί

1. Other conditions may produce different failures. For instance, the file may not be owned by the user attempting to relabel the object, the object may not exist or may be read only. A mandatory policy will not allow the process to relabel the file, maybe because of a property of the file, a property of the process, or a property of the proposed new label value. For example: a user running at low integrity tries to change the label of a high integrity file. Or perhaps a user running at low integrity tries to change the label of a low integrity file to a high integrity label.
2. Due to a bug the `security.mac.portacl.enabled` `sysctl` variable will not work on FreeBSD 5.2.1 or previous releases.

ἡ ἀσφάλεια ἔχει ὁρισμὸν ἀπὸ τοῦ /var/audit πόσῳ ὁ ἀσφαλισμένος ὁδηγὸς ἀσφάλειας ἔχει ἰσχύος ἀσφάλειας ἀσφάλειας.

18.2 Key Terms in this Chapter

Before reading this chapter, a few key audit-related terms must be explained:

- *event*: An auditable event is any event that can be logged using the audit subsystem. Examples of security-relevant events include the creation of a file, the building of a network connection, or a user logging in. Events are either “attributable”, meaning that they can be traced to an authenticated user, or “non-attributable” if they cannot be. Examples of non-attributable events are any events that occur before authentication in the login process, such as bad password attempts.
- *class*: Event classes are named sets of related events, and are used in selection expressions. Commonly used classes of events include “file creation” (fc), “exec” (ex) and “login_logout” (lo).
- *record*: A record is an audit log entry describing a security event. Records contain a record event type, information on the subject (user) performing the action, date and time information, information on any objects or arguments, and a success or failure condition.
- *trail*: An audit trail, or log file, consists of a series of audit records describing security events. Typically, trails are in roughly chronological order with respect to the time events completed. Only authorized processes are allowed to commit records to the audit trail.
- *selection expression*: A selection expression is a string containing a list of prefixes and audit event class names used to match events.
- *preselection*: The process by which the system identifies which events are of interest to the administrator in order to avoid generating audit records describing events that are not of interest. The preselection configuration uses a series of selection expressions to identify which classes of events to audit for which users, as well as global settings that apply to both authenticated and unauthenticated processes.
- *reduction*: The process by which records from existing audit trails are selected for preservation, printing, or analysis. Likewise, the process by which undesired audit records are removed from the audit trail. Using reduction, administrators can implement policies for the preservation of audit data. For example, detailed audit trails might be kept for one month, but after that, trails might be reduced in order to preserve only login information for archival purposes.

18.3 Installing Audit Support

User space support for Event Auditing is installed as part of the base FreeBSD operating system as of 6.2-RELEASE. However, Event Auditing support must be explicitly compiled into the kernel by adding the following lines to the kernel configuration file:

```
options AUDIT
```

Rebuild and reinstall the kernel via the normal process explained in Εἰσαγωγή 9.

Once the kernel is built, installed, and the system has been rebooted, enable the audit daemon by adding the following line to rc.conf(5):

```
auditd_enable="YES"
```

Audit support must then be started by a reboot, or by manually starting the audit daemon:

```
/etc/rc.d/auditd start
```

18.4 Audit Configuration

All configuration files for security audit are found in `/etc/security`. The following files must be present before the audit daemon is started:

- `audit_class` - Contains the definitions of the audit classes.
- `audit_control` - Controls aspects of the audit subsystem, such as default audit classes, minimum disk space to leave on the audit log volume, maximum audit trail size, etc.
- `audit_event` - Textual names and descriptions of system audit events, as well as a list of which classes each event in in.
- `audit_user` - User-specific audit requirements, which are combined with the global defaults at login.
- `audit_warn` - A customizable shell script used by auditd to generate warning messages in exceptional situations, such as when space for audit records is running low or when the audit trail file has been rotated.

Προειδοποίηση: Audit configuration files should be edited and maintained carefully, as errors in configuration may result in improper logging of events.

18.4.1 Event Selection Expressions

Selection expressions are used in a number of places in the audit configuration to determine which events should be audited. Expressions contain a list of event classes to match, each with a prefix indicating whether matching records should be accepted or ignored, and optionally to indicate if the entry is intended to match successful or failed operations. Selection expressions are evaluated from left to right, and two expressions are combined by appending one onto the other.

The following list contains the default audit event classes present in `audit_class`:

- `all - all` - Match all event classes.
- `ad - administrative` - Administrative actions performed on the system as a whole.
- `ap - application` - Application defined action.
- `cl - file_close` - Audit calls to the `close` system call.
- `ex - exec` - Audit program execution. Auditing of command line arguments and environmental variables is controlled via `audit_control(5)` using the `argv` and `envv` parameters to the `policy` setting.
- `fa - file_attr_acc` - Audit the access of object attributes such as `stat(1)`, `pathconf(2)` and similar events.

- `fc` - `file_creation` - Audit events where a file is created as a result.
- `fd` - `file_deletion` - Audit events where file deletion occurs.
- `fm` - `file_attr_mod` - Audit events where file attribute modification occurs, such as `chown(8)`, `chflags(1)`, `flock(2)`, etc.
- `fr` - `file_read` - Audit events in which data is read, files are opened for reading, etc.
- `fw` - `file_write` - Audit events in which data is written, files are written or modified, etc.
- `io` - `ioctl` - Audit use of the `ioctl(2)` system call.
- `ip` - `ipc` - Audit various forms of Inter-Process Communication, including POSIX pipes and System V IPC operations.
- `lo` - `login_logout` - Audit `login(1)` and `logout(1)` events occurring on the system.
- `na` - `non_attrib` - Audit non-attributable events.
- `no` - `no_class` - Match no audit events.
- `nt` - `network` - Audit events related to network actions, such as `connect(2)` and `accept(2)`.
- `ot` - `other` - Audit miscellaneous events.
- `pc` - `process` - Audit process operations, such as `exec(3)` and `exit(3)`.

These audit event classes may be customized by modifying the `audit_class` and `audit_event` configuration files.

Each audit class in the list is combined with a prefix indicating whether successful/failed operations are matched, and whether the entry is adding or removing matching for the class and type.

- (none) Audit both successful and failed instances of the event.
- + Audit successful events in this class.
- - Audit failed events in this class.
- ^ Audit neither successful nor failed events in this class.
- ^+ Don't audit successful events in this class.
- ^- Don't audit failed events in this class.

The following example selection string selects both successful and failed login/logout events, but only successful execution events:

```
lo,+ex
```

18.4.2 Configuration Files

In most cases, administrators will need to modify only two files when configuring the audit system:

`audit_control` and `audit_user`. The first controls system-wide audit properties and policies; the second may be used to fine-tune auditing by user.

18.4.2.1 The `audit_control` File

The `audit_control` file specifies a number of defaults for the audit subsystem. Viewing the contents of this file, we see the following:

```
dir: /var/audit
flags: lo
minfree: 20
naflags: lo
policy: cnt
filesz: 0
```

The `dir` option is used to set one or more directories where audit logs will be stored. If more than one directory entry appears, they will be used in order as they fill. It is common to configure audit so that audit logs are stored on a dedicated file system, in order to prevent interference between the audit subsystem and other subsystems if the file system fills.

The `flags` field sets the system-wide default preselection mask for attributable events. In the example above, successful and failed login and logout events are audited for all users.

The `minfree` option defines the minimum percentage of free space for the file system where the audit trail is stored. When this threshold is exceeded, a warning will be generated. The above example sets the minimum free space to twenty percent.

The `naflags` option specifies audit classes to be audited for non-attributed events, such as the login process and system daemons.

The `policy` option specifies a comma-separated list of policy flags controlling various aspects of audit behavior. The default `cnt` flag indicates that the system should continue running despite an auditing failure (this flag is highly recommended). Another commonly used flag is `argv`, which causes command line arguments to the `execve(2)` system call to be audited as part of command execution.

The `filesz` option specifies the maximum size in bytes to allow an audit trail file to grow to before automatically terminating and rotating the trail file. The default, 0, disables automatic log rotation. If the requested file size is non-zero and below the minimum 512k, it will be ignored and a log message will be generated.

18.4.2.2 The `audit_user` File

The `audit_user` file permits the administrator to specify further audit requirements for specific users. Each line configures auditing for a user via two fields: the first is the `alwaysaudit` field, which specifies a set of events that should always be audited for the user, and the second is the `neveraudit` field, which specifies a set of events that should never be audited for the user.

The following example `audit_user` file audits login/logout events and successful command execution for the `root` user, and audits file creation and successful command execution for the `www` user. If used with the example `audit_control` file above, the `lo` entry for `root` is redundant, and login/logout events will also be audited for the `www` user.

```
root: lo, +ex: no
www: fc, +ex: no
```

18.5 Administering the Audit Subsystem

18.5.1 Viewing Audit Trails

Audit trails are stored in the BSM binary format, so tools must be used to modify or convert to text. The `praudit` command convert trail files to a simple text format; the `auditreduce` command may be used to reduce the audit trail file for analysis, archiving, or printing purposes. `auditreduce` supports a variety of selection parameters, including event type, event class, user, date or time of the event, and the file path or object acted on.

For example, the `praudit` utility will dump the entire contents of a specified audit log in plain text:

```
# praudit /var/audit/AUDITFILE
```

Where `AUDITFILE` is the audit log to dump.

Audit trails consist of a series of audit records made up of tokens, which `praudit` prints sequentially one per line. Each token is of a specific type, such as `header` holding an audit record header, or `path` holding a file path from a name lookup. The following is an example of an `execve` event:

```
header,133,10,execve(2),0,Mon Sep 25 15:58:03 2006, + 384 msec
exec arg,finger,doug
path,/usr/bin/finger
attribute,555,root,wheel,90,24918,104944
subject,robert,root,wheel,root,wheel,38439,38032,42086,128.232.9.100
return,success,0
trailer,133
```

This audit represents a successful `execve` call, in which the command `finger doug` has been run. The `arguments` token contains both the processed command line presented by the shell to the kernel. The `path` token holds the path to the executable as looked up by the kernel. The `attribute` token describes the binary, and in particular, includes the file mode which can be used to determine if the application was `setuid`. The `subject` token describes the subject process, and stores in sequence the audit user ID, effective user ID and group ID, real user ID and group ID, process ID, session ID, port ID, and login address. Notice that the audit user ID and real user ID differ: the user `robert` has switched to the `root` account before running this command, but it is audited using the original authenticated user. Finally, the `return` token indicates the successful execution, and the `trailer` concludes the record.

18.5.2 Reducing Audit Trails

Since audit logs may be very large, an administrator will likely want to select a subset of records for using, such as records associated with a specific user:

```
# auditreduce -u trhodes /var/audit/AUDITFILE | praudit
```

This will select all audit records produced for the user `trhodes` stored in the `AUDITFILE` file.

18.5.3 Delegating Audit Review Rights

Members of the `audit` group are given permission to read audit trails in `/var/audit`; by default, this group is empty, so only the `root` user may read audit trails. Users may be added to the `audit` group in order to delegate audit

review rights to the user. As the ability to track audit log contents provides significant insight into the behavior of users and processes, it is recommended that the delegation of audit review rights be performed with caution.

18.5.4 Live Monitoring Using Audit Pipes

Audit pipes are cloning pseudo-devices in the device file system which allow applications to tap the live audit record stream. This is primarily of interest to authors of intrusion detection and system monitoring applications. However, for the administrator the audit pipe device is a convenient way to allow live monitoring without running into problems with audit trail file ownership or log rotation interrupting the event stream. To track the live audit event stream, use the following command line

```
# praudit /dev/auditpipe
```

By default, audit pipe device nodes are accessible only to the root user. To make them accessible to the members of the audit group, add a devfs rule to devfs.rules:

```
add path 'auditpipe*' mode 0440 group audit
```

See devfs.rules(5) for more information on configuring the devfs file system.

Προσοχή: It is easy to produce audit event feedback cycles, in which the viewing of each audit event results in the generation of more audit events. For example, if all network I/O is audited, and praudit is run from an SSH session, then a continuous stream of audit events will be generated at a high rate, as each event being printed will generate another event. It is advisable to run praudit on an audit pipe device from sessions without fine-grained I/O auditing in order to avoid this happening.

18.5.5 Rotating Audit Trail Files

Audit trails are written to only by the kernel, and managed only by the audit daemon, **auditd**. Administrators should not attempt to use newsyslog.conf(5) or other tools to directly rotate audit logs. Instead, the audit management tool may be used to shut down auditing, reconfigure the audit system, and perform log rotation. The following command causes the audit daemon to create a new audit log and signal the kernel to switch to using the new log. The old log will be terminated and renamed, at which point it may then be manipulated by the administrator.

```
# audit -n
```

Προσοχή: If the **auditd** daemon is not currently running, this command will fail and an error message will be produced.

Adding the following line to /etc/crontab will force the rotation every twelve hours from cron(8):

```
0 */12 * * * root /usr/sbin/audit -n
```

The change will take effect once you have saved the new /etc/crontab.

Automatic rotation of the audit trail file based on file size is possible via the `filesz` option in `audit_control(5)`, and is described in the configuration files section of this chapter.

18.5.6 Compressing Audit Trails

As audit trail files can become very large, it is often desirable to compress or otherwise archive trails once they have been closed by the audit daemon. The `audit_warn` script can be used to perform customized operations for a variety of audit-related events, including the clean termination of audit trails when they are rotated. For example, the following may be added to the `audit_warn` script to compress audit trails on close:

```
#
# Compress audit trail files on close.
#
if [ "$1" = closefile ]; then
    gzip -9 $2
fi
```

Other archiving activities might include copying trail files to a centralized server, deleting old trail files, or reducing the audit trail to remove unneeded records. The script will be run only when audit trail files are cleanly terminated, so will not be run on trails left unterminated following an improper shutdown.

Drive type	Drive device name
SCSI hard drives and USB Mass storage devices	<code>da</code>
SCSI CDROM drives	<code>cd</code>
Assorted non-standard CDROM drives	<code>mcd</code> for Mitsumi CD-ROM and <code>scd</code> for Sony CD-ROM devices
Floppy drives	<code>fd</code>
SCSI tape drives	<code>sa</code>
IDE tape drives	<code>ast</code>
Flash drives	<code>fla</code> for DiskOnChip® Flash device
RAID drives	<code>aacd</code> for Adaptec® AdvancedRAID, <code>mlx</code> and <code>mly</code> for Mylex®, <code>amrd</code> for AMI MegaRAID®, <code>idad</code> for Compaq Smart RAID, <code>twed</code> for 3ware® RAID.

19.3 Adding Disks

Lets say we want to add a new SCSI disk to a machine that currently only has a single drive. First turn off the computer and install the drive in the computer following the instructions of the computer, controller, and drive manufacturer. Due to the wide variations of procedures to do this, the details are beyond the scope of this document.

Login as user `root`. After you have installed the drive, inspect `/var/run/dmesg.boot` to ensure the new disk was found. Continuing with our example, the newly added drive will be `da1` and we want to mount it on `/1` (if you are adding an IDE drive, the device name will be `ad1`).

FreeBSD runs on IBM-PC compatible computers, therefore it must take into account the PC BIOS partitions. These are different from the traditional BSD partitions. A PC disk has up to four BIOS partition entries. If the disk is going to be truly dedicated to FreeBSD, you can use the *dedicated* mode. Otherwise, FreeBSD will have to live within one of the PC BIOS partitions. FreeBSD calls the PC BIOS partitions *slices* so as not to confuse them with traditional BSD partitions. You may also use slices on a disk that is dedicated to FreeBSD, but used in a computer that also has another operating system installed. This is a good way to avoid confusing the `fdisk` utility of other, non-FreeBSD operating systems.

In the slice case the drive will be added as `/dev/da1s1e`. This is read as: SCSI disk, unit number 1 (second SCSI disk), slice 1 (PC BIOS partition 1), and `e` BSD partition. In the dedicated case, the drive will be added simply as `/dev/da1e`.

Due to the use of 32-bit integers to store the number of sectors, `bsdlab(8)` is limited to $2^{32}-1$ sectors per disk or 2TB in most cases. The `fdisk(8)` format allows a starting sector of no more than $2^{32}-1$ and a length of no more than $2^{32}-1$, limiting partitions to 2TB and disks to 4TB in most cases. The `sunlabel(8)` format is limited to $2^{32}-1$ sectors per partition and 8 partitions for a total of 16TB. For larger disks, `gpt(8)` partitions may be used.

19.3.1 Using `sysinstall(8)`

1. Navigating `Sysinstall`

You may use `sysinstall` to partition and label a new disk using its easy to use menus. Either login as user `root` or use the `su` command. Run `sysinstall` and enter the `Configure` menu. Within the `FreeBSD Configuration Menu`, scroll down and select the `Fdisk` option.

2. **fdisk** Partition Editor

Once inside **fdisk**, typing **a** will use the entire disk for FreeBSD. When asked if you want to “remain cooperative with any future possible operating systems”, answer **YES**. Write the changes to the disk using **w**. Now exit the FDISK editor by typing **q**. Next you will be asked about the “Master Boot Record”. Since you are adding a disk to an already running system, choose **None**.

3. Disk Label Editor

Next, you need to exit **sysinstall** and start it again. Follow the directions above, although this time choose the **Label** option. This will enter the **Disk Label Editor**. This is where you will create the traditional BSD partitions. A disk can have up to eight partitions, labeled **a-h**. A few of the partition labels have special uses. The **a** partition is used for the root partition (**/**). Thus only your system disk (e.g, the disk you boot from) should have an **a** partition. The **b** partition is used for swap partitions, and you may have many disks with swap partitions. The **c** partition addresses the entire disk in dedicated mode, or the entire FreeBSD slice in slice mode. The other partitions are for general use.

sysinstall's Label editor favors the **e** partition for non-root, non-swap partitions. Within the Label editor, create a single file system by typing **c**. When prompted if this will be a FS (file system) or swap, choose **FS** and type in a mount point (e.g, **/mnt**). When adding a disk in post-install mode, **sysinstall** will not create entries in **/etc/fstab** for you, so the mount point you specify is not important.

You are now ready to write the new label to the disk and create a file system on it. Do this by typing **w**. Ignore any errors from **sysinstall** that it could not mount the new partition. Exit the Label Editor and **sysinstall** completely.

4. Finish

The last step is to edit **/etc/fstab** to add an entry for your new disk.

19.3.2 Using Command Line Utilities

19.3.2.1 Using Slices

This setup will allow your disk to work correctly with other operating systems that might be installed on your computer and will not confuse other operating systems' **fdisk** utilities. It is recommended to use this method for new disk installs. Only use **dedicated** mode if you have a good reason to do so!

```
# dd if=/dev/zero of=/dev/da1 bs=1k count=1
# fdisk -BI da1 #Initialize your new disk
# bsdlablel -B -w -r da1s1 auto #Label it.
# bsdlablel -e da1s1 # Edit the bsdlablel just created and add any partitions.
# mkdir -p /1
# newfs /dev/dals1e # Repeat this for every partition you created.
# mount /dev/dals1e /1 # Mount the partition(s)
# vi /etc/fstab # Add the appropriate entry/entries to your /etc/fstab.
```

If you have an IDE disk, substitute **ad** for **da**.

19.3.2.2 Dedicated

If you will not be sharing the new drive with another operating system, you may use the `dedicated` mode. Remember this mode can confuse Microsoft operating systems; however, no damage will be done by them. IBM's OS/2 however, will "appropriate" any partition it finds which it does not understand.

```
# dd if=/dev/zero of=/dev/da1 bs=1k count=1
# bsdlable -Brw da1 auto
# bsdlable -e da1 # create the 'e' partition
# newfs -d0 /dev/da1
# mkdir -p /1
# vi /etc/fstab # add an entry for /dev/da1
# mount /1
```

An alternate method is:

```
# dd if=/dev/zero of=/dev/da1 count=2
# bsdlable /dev/da1 | bsdlable -BrR da1 /dev/stdin
# newfs /dev/da1
# mkdir -p /1
# vi /etc/fstab # add an entry for /dev/da1
# mount /1
```

19.4 RAID

19.4.1 Software RAID

19.4.1.1 Concatenated Disk Driver (CCD) Configuration

When choosing a mass storage solution the most important factors to consider are speed, reliability, and cost. It is rare to have all three in balance; normally a fast, reliable mass storage device is expensive, and to cut back on cost either speed or reliability must be sacrificed.

In designing the system described below, cost was chosen as the most important factor, followed by speed, then reliability. Data transfer speed for this system is ultimately constrained by the network. And while reliability is very important, the CCD drive described below serves online data that is already fully backed up on CD-R's and can easily be replaced.

Defining your own requirements is the first step in choosing a mass storage solution. If your requirements prefer speed or reliability over cost, your solution will differ from the system described in this section.

19.4.1.1.1 Installing the Hardware

In addition to the IDE system disk, three Western Digital 30GB, 5400 RPM IDE disks form the core of the CCD disk described below providing approximately 90GB of online storage. Ideally, each IDE disk would have its own IDE controller and cable, but to minimize cost, additional IDE controllers were not used. Instead the disks were configured with jumpers so that each IDE controller has one master, and one slave.

Upon reboot, the system BIOS was configured to automatically detect the disks attached. More importantly, FreeBSD detected them on reboot:

```
ad0: 19574MB <WDC WD205BA> [39770/16/63] at ata0-master UDMA33
ad1: 29333MB <WDC WD307AA> [59598/16/63] at ata0-slave UDMA33
ad2: 29333MB <WDC WD307AA> [59598/16/63] at ata1-master UDMA33
ad3: 29333MB <WDC WD307AA> [59598/16/63] at ata1-slave UDMA33
```

Όχι! Βύος: If FreeBSD does not detect all the disks, ensure that you have jumpered them correctly. Most IDE drives also have a “Cable Select” jumper. This is *not* the jumper for the master/slave relationship. Consult the drive documentation for help in identifying the correct jumper.

Next, consider how to attach them as part of the file system. You should research both vinum(8) (Εἰσαγωγή 22) and ccd(4). In this particular configuration, ccd(4) was chosen.

19.4.1.1.2 Setting Up the CCD

The ccd(4) driver allows you to take several identical disks and concatenate them into one logical file system. In order to use ccd(4), you need a kernel with ccd(4) support built in. Add this line to your kernel configuration file, rebuild, and reinstall the kernel:

```
device    ccd
```

The ccd(4) support can also be loaded as a kernel loadable module.

To set up ccd(4), you must first use bsdlable(8) to label the disks:

```
bsdlable -r -w ad1 auto
bsdlable -r -w ad2 auto
bsdlable -r -w ad3 auto
```

This creates a bsdlable for ad1c, ad2c and ad3c that spans the entire disk.

The next step is to change the disk label type. You can use bsdlable(8) to edit the disks:

```
bsdlable -e ad1
bsdlable -e ad2
bsdlable -e ad3
```

This opens up the current disk label on each disk with the editor specified by the EDITOR environment variable, typically vi(1).

An unmodified disk label will look something like this:

```
8 partitions:
#      size  offset  fstype  [fsize bsize bps/cpg]
  c: 60074784      0  unused      0      0      0  # (Cyl.  0 - 59597)
```

Add a new e partition for ccd(4) to use. This can usually be copied from the c partition, but the fstype *must* be **4.2BSD**. The disk label should now look something like this:

```
8 partitions:
```

```
#          size  offset  fstype  [fsize bsize bps/cpg]
c: 60074784    0    unused    0    0    0    # (Cyl.  0 - 59597)
e: 60074784    0    4.2BSD    0    0    0    # (Cyl.  0 - 59597)
```

19.4.1.1.3 Building the File System

Now that you have all the disks labeled, you must build the ccd(4). To do that, use ccdconfig(8), with options similar to the following:

```
ccdconfig ccd0 1 32 0 3 /dev/ad1e 4 /dev/ad2e /dev/ad3e
```

The use and meaning of each option is shown below:

- ❶ The first argument is the device to configure, in this case, /dev/ccd0c. The /dev/ portion is optional.
- ❷ The interleave for the file system. The interleave defines the size of a stripe in disk blocks, each normally 512 bytes. So, an interleave of 32 would be 16,384 bytes.
- ❸ Flags for ccdconfig(8). If you want to enable drive mirroring, you can specify a flag here. This configuration does not provide mirroring for ccd(4), so it is set at 0 (zero).
- ❹ The final arguments to ccdconfig(8) are the devices to place into the array. Use the complete pathname for each device.

After running ccdconfig(8) the ccd(4) is configured. A file system can be installed. Refer to newfs(8) for options, or simply run:

```
newfs /dev/ccd0c
```

19.4.1.1.4 Making it All Automatic

Generally, you will want to mount the ccd(4) upon each reboot. To do this, you must configure it first. Write out your current configuration to /etc/ccd.conf using the following command:

```
ccdconfig -g > /etc/ccd.conf
```

During reboot, the script /etc/rc runs ccdconfig -C if /etc/ccd.conf exists. This automatically configures the ccd(4) so it can be mounted.

Όχι! Βύθος: If you are booting into single user mode, before you can mount(8) the ccd(4), you need to issue the following command to configure the array:

```
ccdconfig -C
```

To automatically mount the ccd(4), place an entry for the ccd(4) in /etc/fstab so it will be mounted at boot time:

```
/dev/ccd0c          /media          ufs      rw      2      2
```

19.4.1.2 The Vinum Volume Manager

The Vinum Volume Manager is a block device driver which implements virtual disk drives. It isolates disk hardware from the block device interface and maps data in ways which result in an increase in flexibility, performance and reliability compared to the traditional slice view of disk storage. vinum(8) implements the RAID-0, RAID-1 and RAID-5 models, both individually and in combination.

See Εάν έχετε 22 for more information about vinum(8).

19.4.2 Hardware RAID

FreeBSD also supports a variety of hardware RAID controllers. These devices control a RAID subsystem without the need for FreeBSD specific software to manage the array.

Using an on-card BIOS, the card controls most of the disk operations itself. The following is a brief setup description using a Promise IDE RAID controller. When this card is installed and the system is started up, it displays a prompt requesting information. Follow the instructions to enter the card's setup screen. From here, you have the ability to combine all the attached drives. After doing so, the disk(s) will look like a single drive to FreeBSD. Other RAID levels can be set up accordingly.

19.4.3 Rebuilding ATA RAID1 Arrays

FreeBSD allows you to hot-replace a failed disk in an array. This requires that you catch it before you reboot.

You will probably see something like the following in /var/log/messages or in the dmesg(8) output:

```
ad6 on monster1 suffered a hard error.
ad6: READ command timeout tag=0 serv=0 - resetting
ad6: trying fallback to PIO mode
ata3: resetting devices .. done
ad6: hard error reading fsbn 1116119 of 0-7 (ad6 bn 1116119; cn 1107 tn 4 sn 11)\
status=59 error=40
ar0: WARNING - mirror lost
```

Using atacontrol(8), check for further information:

```
# atacontrol list
ATA channel 0:
  Master:      no device present
  Slave:      acd0 <HL-DT-ST CD-ROM GCR-8520B/1.00> ATA/ATAPI rev 0

ATA channel 1:
  Master:      no device present
  Slave:      no device present

ATA channel 2:
  Master:      ad4 <MAXTOR 6L080J4/A93.0500> ATA/ATAPI rev 5
  Slave:      no device present

ATA channel 3:
  Master:      ad6 <MAXTOR 6L080J4/A93.0500> ATA/ATAPI rev 5
```

```
Slave:          no device present
```

```
# atacontrol status ar0
ar0: ATA RAID1 subdisks: ad4 ad6 status: DEGRADED
```

1. You will first need to detach the ata channel with the failed disk so you can safely remove it:

```
# atacontrol detach ata3
```

2. Replace the disk.

3. Reattach the ata channel:

```
# atacontrol attach ata3
Master:  ad6 <MAXTOR 6L080J4/A93.0500> ATA/ATAPI rev 5
Slave:   no device present
```

4. Add the new disk to the array as a spare:

```
# atacontrol addspare ar0 ad6
```

5. Rebuild the array:

```
# atacontrol rebuild ar0
```

6. It is possible to check on the progress by issuing the following command:

```
# dmesg | tail -10
[output removed]
ad6: removed from configuration
ad6: deleted from ar0 disk1
ad6: inserted into ar0 disk1 as spare

# atacontrol status ar0
ar0: ATA RAID1 subdisks: ad4 ad6 status: REBUILDING 0% completed
```

7. Wait until this operation completes.

19.5 USB Storage Devices

A lot of external storage solutions, nowadays, use the Universal Serial Bus (USB): hard drives, USB thumbdrives, CD-R burners, etc. FreeBSD provides support for these devices.

19.5.1 Configuration

The USB mass storage devices driver, `umass(4)`, provides the support for USB storage devices. If you use the `GENERIC` kernel, you do not have to change anything in your configuration. If you use a custom kernel, be sure that the following lines are present in your kernel configuration file:

```
device scbus
device da
device pass
device uhci
device ohci
```

```
device usb
device umass
```

The umass(4) driver uses the SCSI subsystem to access to the USB storage devices, your USB device will be seen as a SCSI device by the system. Depending on the USB chipset on your motherboard, you only need either `device uhci` or `device ohci`, however having both in the kernel configuration file is harmless. Do not forget to compile and install the new kernel if you added any lines.

Όχι: If your USB device is a CD-R or DVD burner, the SCSI CD-ROM driver, `cd(4)`, must be added to the kernel via the line:

```
device cd
```

Since the burner is seen as a SCSI drive, the driver `atapicam(4)` should not be used in the kernel configuration.

Support for USB 2.0 controllers is provided on FreeBSD; however, you must add:

```
device ehci
```

to your configuration file for USB 2.0 support. Note `uhci(4)` and `ohci(4)` drivers are still needed if you want USB 1.X support.

19.5.2 Testing the Configuration

The configuration is ready to be tested: plug in your USB device, and in the system message buffer (`dmesg(8)`), the drive should appear as something like:

```
umass0: USB Solid state disk, rev 1.10/1.00, addr 2
GEOM: create disk da0 dp=0xc2d74850
da0 at umass-sim0 bus 0 target 0 lun 0
da0: <Generic Traveling Disk 1.11> Removable Direct Access SCSI-2 device
da0: 1.000MB/s transfers
da0: 126MB (258048 512 byte sectors: 64H 32S/T 126C)
```

Of course, the brand, the device node (`da0`) and other details can differ according to your configuration.

Since the USB device is seen as a SCSI one, the `camcontrol` command can be used to list the USB storage devices attached to the system:

```
# camcontrol devlist
<Generic Traveling Disk 1.11>          at scbus0 target 0 lun 0 (da0,pass0)
```

If the drive comes with a file system, you should be able to mount it. The [19.3](#) will help you to format and create partitions on the USB drive if needed.

To make this device mountable as a normal user, certain steps have to be taken. First, the devices that are created when a USB storage device is connected need to be accessible by the user. A solution is to make all users of these devices a member of the `operator` group. This is done with `pw(8)`. Second, when the devices are created, the `operator` group should be able to read and write them. This is accomplished by adding these lines to `/etc/devfs.rules`:

```
[localrules=1]
add path 'da*' mode 0660 group operator
```

Όχιἄβύο: If there already are SCSI disks in the system, it must be done a bit different. E.g., if the system already contains disks `da0` through `da2` attached to the system, change the second line as follows:

```
add path 'da[3-9]*' mode 0660 group operator
```

This will exclude the already existing disks from belonging to the `operator` group.

You also have to enable your `devfs.rules(5)` ruleset in your `/etc/rc.conf` file:

```
devfs_system_ruleset="localrules"
```

Next, the kernel has to be configured to allow regular users to mount file systems. The easiest way is to add the following line to `/etc/sysctl.conf`:

```
vfs.usermount=1
```

Note that this only takes effect after the next reboot. Alternatively, one can also use `sysctl(8)` to set this variable.

The final step is to create a directory where the file system is to be mounted. This directory needs to be owned by the user that is to mount the file system. One way to do that is for `root` to create a subdirectory owned by that user as `/mnt/$USER` (replace `$USER` by the login name of the actual user):

```
# mkdir /mnt/$USER
# chown $USER:$USER /mnt/$USER
```

Suppose a USB thumbdrive is plugged in, and a device `/dev/da0s1` appears. Since these devices usually come preformatted with a FAT file system, one can mount them like this:

```
% mount_msdosfs -m 644 -M 755 /dev/da0s1 /mnt/$USER
```

If you unplug the device (the disk must be unmounted before), you should see, in the system message buffer, something like the following:

```
umass0: at uhub0 port 1 (addr 2) disconnected
(da0:umass-sim0:0:0:0): lost device
(da0:umass-sim0:0:0:0): removing device entry
GEOM: destroy disk da0 dp=0xc2d74850
umass0: detached
```

19.5.3 Further Reading

Beside the [Adding Disks and Mounting and Unmounting File Systems](#) sections, reading various manual pages may be also useful: `umass(4)`, `camcontrol(8)`, and `usbdevs(8)`.

19.6 Creating and Using Optical Media (CDs)

19.6.1 Introduction

CDs have a number of features that differentiate them from conventional disks. Initially, they were not writable by the user. They are designed so that they can be read continuously without delays to move the head between tracks. They are also much easier to transport between systems than similarly sized media were at the time.

CDs do have tracks, but this refers to a section of data to be read continuously and not a physical property of the disk. To produce a CD on FreeBSD, you prepare the data files that are going to make up the tracks on the CD, then write the tracks to the CD.

The ISO 9660 file system was designed to deal with these differences. It unfortunately codifies file system limits that were common then. Fortunately, it provides an extension mechanism that allows properly written CDs to exceed those limits while still working with systems that do not support those extensions.

The `sysutils/cdrtools` port includes `mkisofs(8)`, a program that you can use to produce a data file containing an ISO 9660 file system. It has options that support various extensions, and is described below.

Which tool to use to burn the CD depends on whether your CD burner is ATAPI or something else. ATAPI CD burners use the `burncd` program that is part of the base system. SCSI and USB CD burners should use `cdrecord` from the `sysutils/cdrtools` port. It is also possible to use `cdrecord` and other tools for SCSI drives on ATAPI hardware with the ATAPI/CAM module.

If you want CD burning software with a graphical user interface, you may wish to take a look at either **X-CD-Roast** or **K3b**. These tools are available as packages or from the `sysutils/xcdroast` and `sysutils/k3b` ports. **X-CD-Roast** and **K3b** require the ATAPI/CAM module with ATAPI hardware.

19.6.2 mkisofs

The `mkisofs(8)` program, which is part of the `sysutils/cdrtools` port, produces an ISO 9660 file system that is an image of a directory tree in the UNIX file system name space. The simplest usage is:

```
# mkisofs -o imagefile.iso /path/to/tree
```

This command will create an `imagefile.iso` containing an ISO 9660 file system that is a copy of the tree at `/path/to/tree`. In the process, it will map the file names to names that fit the limitations of the standard ISO 9660 file system, and will exclude files that have names uncharacteristic of ISO file systems.

A number of options are available to overcome those restrictions. In particular, `-R` enables the Rock Ridge extensions common to UNIX systems, `-J` enables Joliet extensions used by Microsoft systems, and `-hfs` can be used to create HFS file systems used by Mac OS.

For CDs that are going to be used only on FreeBSD systems, `-U` can be used to disable all filename restrictions. When used with `-R`, it produces a file system image that is identical to the FreeBSD tree you started from, though it may violate the ISO 9660 standard in a number of ways.

The last option of general use is `-b`. This is used to specify the location of the boot image for use in producing an “El Torito” bootable CD. This option takes an argument which is the path to a boot image from the top of the tree being written to the CD. By default, `mkisofs(8)` creates an ISO image in the so-called “floppy disk emulation” mode, and thus expects the boot image to be exactly 1200, 1440 or 2880 KB in size. Some boot loaders, like the one used by the FreeBSD distribution disks, do not use emulation mode; in this case, the `-no-emul-boot` option should be used. So,

if `/tmp/myboot` holds a bootable FreeBSD system with the boot image in `/tmp/myboot/boot/cdboot`, you could produce the image of an ISO 9660 file system in `/tmp/bootable.iso` like so:

```
# mkisofs -R -no-emul-boot -b boot/cdboot -o /tmp/bootable.iso /tmp/myboot
```

Having done that, if you have `md` configured in your kernel, you can mount the file system with:

```
# mdconfig -a -t vnode -f /tmp/bootable.iso -u 0
# mount -t cd9660 /dev/md0 /mnt
```

At which point you can verify that `/mnt` and `/tmp/myboot` are identical.

There are many other options you can use with `mkisofs(8)` to fine-tune its behavior. In particular: modifications to an ISO 9660 layout and the creation of Joliet and HFS discs. See the `mkisofs(8)` manual page for details.

19.6.3 burncd

If you have an ATAPI CD burner, you can use the `burncd` command to burn an ISO image onto a CD. `burncd` is part of the base system, installed as `/usr/sbin/burncd`. Usage is very simple, as it has few options:

```
# burncd -f cddevice data imagefile.iso fixate
```

Will burn a copy of `imagefile.iso` on `cddevice`. The default device is `/dev/acd0`. See `burncd(8)` for options to set the write speed, eject the CD after burning, and write audio data.

19.6.4 cdrecord

If you do not have an ATAPI CD burner, you will have to use `cdrecord` to burn your CDs. `cdrecord` is not part of the base system; you must install it from either the port at `sysutils/cdrtools` or the appropriate package. Changes to the base system can cause binary versions of this program to fail, possibly resulting in a “coaster”. You should therefore either upgrade the port when you upgrade your system, or if you are tracking `-STABLE`, upgrade the port when a new version becomes available.

While `cdrecord` has many options, basic usage is even simpler than `burncd`. Burning an ISO 9660 image is done with:

```
# cdrecord dev=device imagefile.iso
```

The tricky part of using `cdrecord` is finding the `dev` to use. To find the proper setting, use the `-scanbus` flag of `cdrecord`, which might produce results like this:

```
# cdrecord -scanbus
Cdrecord-Clone 2.01 (i386-unknown-freebsd7.0) Copyright (C) 1995-2004 Jörg Schilling
Using libscg version 'schily-0.1'
scsibus0:
    0,0,0    0) 'SEAGATE ' 'ST39236LW      ' '0004' Disk
    0,1,0    1) 'SEAGATE ' 'ST39173W      ' '5958' Disk
    0,2,0    2) *
    0,3,0    3) 'iomega ' 'jaz 1GB       ' 'J.86' Removable Disk
    0,4,0    4) 'NEC      ' 'CD-ROM DRIVE:466' '1.26' Removable CD-ROM
    0,5,0    5) *
```

```

0,6,0    6) *
0,7,0    7) *
scsibus1:
1,0,0    100) *
1,1,0    101) *
1,2,0    102) *
1,3,0    103) *
1,4,0    104) *
1,5,0    105) 'YAMAHA  ' 'CRW4260      ' '1.0q' Removable CD-ROM
1,6,0    106) 'ARTEC   ' 'AM12S      ' '1.06' Scanner
1,7,0    107) *

```

This lists the appropriate `dev` value for the devices on the list. Locate your CD burner, and use the three numbers separated by commas as the value for `dev`. In this case, the CRW device is 1,5,0, so the appropriate input would be `dev=1,5,0`. There are easier ways to specify this value; see `cdrecord(1)` for details. That is also the place to look for information on writing audio tracks, controlling the speed, and other things.

19.6.5 Duplicating Audio CDs

You can duplicate an audio CD by extracting the audio data from the CD to a series of files, and then writing these files to a blank CD. The process is slightly different for ATAPI and SCSI drives.

SCSI Drives

1. Use `cdda2wav` to extract the audio.

```
% cdda2wav -v255 -D2,0 -B -Owav
```

2. Use `cdrecord` to write the `.wav` files.

```
% cdrecord -v dev=2,0 -dao -useinfo *.wav
```

Make sure that `2,0` is set appropriately, as described in [Ότιπιά 19.6.4](#).

ATAPI Drives

1. The ATAPI CD driver makes each track available as `/dev/acd0t nn` , where d is the drive number, and nn is the track number written with two decimal digits, prefixed with zero as needed. So the first track on the first disk is `/dev/acd0t01`, the second is `/dev/acd0t02`, the third is `/dev/acd0t03`, and so on.

Make sure the appropriate files exist in `/dev`. If the entries are missing, force the system to retaste the media:

```
# dd if=/dev/acd0 of=/dev/null count=1
```

2. Extract each track using `dd(1)`. You must also use a specific block size when extracting the files.

```
# dd if=/dev/acd0t01 of=track1.cdr bs=2352
```

```
# dd if=/dev/acd0t02 of=track2.cdr bs=2352
```

```
...
```

3. Burn the extracted files to disk using `burncd`. You must specify that these are audio files, and that `burncd` should fixate the disk when finished.

```
# burncd -f /dev/acd0 audio track1.cdr track2.cdr ... fixate
```

19.6.6 Duplicating Data CDs

You can copy a data CD to a image file that is functionally equivalent to the image file created with `mkisofs(8)`, and you can use it to duplicate any data CD. The example given here assumes that your CDROM device is `acd0`. Substitute your correct CDROM device.

```
# dd if=/dev/acd0 of=file.iso bs=2048
```

Now that you have an image, you can burn it to CD as described above.

19.6.7 Using Data CDs

Now that you have created a standard data CDROM, you probably want to mount it and read the data on it. By default, `mount(8)` assumes that a file system is of type `ufs`. If you try something like:

```
# mount /dev/cd0 /mnt
```

you will get a complaint about `Incorrect super block`, and no mount. The CDROM is not a `UFS` file system, so attempts to mount it as such will fail. You just need to tell `mount(8)` that the file system is of type `ISO9660`, and everything will work. You do this by specifying the `-t cd9660` option `mount(8)`. For example, if you want to mount the CDROM device, `/dev/cd0`, under `/mnt`, you would execute:

```
# mount -t cd9660 /dev/cd0 /mnt
```

Note that your device name (`/dev/cd0` in this example) could be different, depending on the interface your CDROM uses. Also, the `-t cd9660` option just executes `mount_cd9660(8)`. The above example could be shortened to:

```
# mount_cd9660 /dev/cd0 /mnt
```

You can generally use data CDROMs from any vendor in this way. Disks with certain ISO 9660 extensions might behave oddly, however. For example, Joliet disks store all filenames in two-byte Unicode characters. The FreeBSD kernel does not speak Unicode, but the FreeBSD CD9660 driver is able to convert Unicode characters on the fly. If some non-English characters show up as question marks you will need to specify the local charset you use with the `-C` option. For more information, consult the `mount_cd9660(8)` manual page.

Όχι! Βούζ: To be able to do this character conversion with the help of the `-C` option, the kernel will require the `cd9660_iconv.ko` module to be loaded. This can be done either by adding this line to `loader.conf`:

```
cd9660_iconv_load="YES"
```

and then rebooting the machine, or by directly loading the module with `kldload(8)`.

Occasionally, you might get `Device not configured` when trying to mount a CDROM. This usually means that the CDROM drive thinks that there is no disk in the tray, or that the drive is not visible on the bus. It can take a couple of seconds for a CDROM drive to realize that it has been fed, so be patient.

Sometimes, a SCSI CDROM may be missed because it did not have enough time to answer the bus reset. If you have a SCSI CDROM please add the following option to your kernel configuration and rebuild your kernel.

```
options SCSI_DELAY=15000
```

This tells your SCSI bus to pause 15 seconds during boot, to give your CDROM drive every possible chance to answer the bus reset.

19.6.8 Burning Raw Data CDs

You can choose to burn a file directly to CD, without creating an ISO 9660 file system. Some people do this for backup purposes. This runs more quickly than burning a standard CD:

```
# burncd -f /dev/acd1 -s 12 data archive.tar.gz fixate
```

In order to retrieve the data burned to such a CD, you must read data from the raw device node:

```
# tar xzvf /dev/acd1
```

You cannot mount this disk as you would a normal CDROM. Such a CDROM cannot be read under any operating system except FreeBSD. If you want to be able to mount the CD, or share data with another operating system, you must use mkisofs(8) as described above.

19.6.9 Using the ATAPI/CAM Driver

This driver allows ATAPI devices (CD-ROM, CD-RW, DVD drives etc...) to be accessed through the SCSI subsystem, and so allows the use of applications like sysutils/cdrdao or cdrecord(1).

To use this driver, you will need to add the following line to the /boot/loader.conf file:

```
atapicam_load="YES"
```

then, reboot your machine.

Όχι! Βùοç: If you prefer to statically compile the atapicam(4) support in your kernel, you will have to add this line to your kernel configuration file:

```
device atapicam
```

You also need the following lines in your kernel configuration file:

```
device ata
device scbus
device cd
device pass
```

which should already be present. Then rebuild, install your new kernel, and reboot your machine.

During the boot process, your burner should show up, like so:

```
acd0: CD-RW <MATSHITA CD-RW/DVD-ROM UJDA740> at ata1-master PIO4
cd0 at ata1 bus 0 target 0 lun 0
cd0: <MATSHITA CDRW/DVD UJDA740 1.00> Removable CD-ROM SCSI-0 device
cd0: 16.000MB/s transfers
cd0: Attempt to query device size failed: NOT READY, Medium not present - tray closed
```

The drive could now be accessed via the `/dev/cd0` device name, for example to mount a CD-ROM on `/mnt`, just type the following:

```
# mount -t cd9660 /dev/cd0 /mnt
```

As `root`, you can run the following command to get the SCSI address of the burner:

```
# camcontrol devlist
<MATSHITA CDRW/DVD UJDA740 1.00> at scbus1 target 0 lun 0 (pass0,cd0)
```

So `1,0,0` will be the SCSI address to use with `cdrecord(1)` and other SCSI application.

For more information about ATAPI/CAM and SCSI system, refer to the `atapicam(4)` and `cam(4)` manual pages.

19.7 Creating and Using Optical Media (DVDs)

19.7.1 Introduction

Compared to the CD, the DVD is the next generation of optical media storage technology. The DVD can hold more data than any CD and is nowadays the standard for video publishing.

Five physical recordable formats can be defined for what we will call a recordable DVD:

- **DVD-R:** This was the first DVD recordable format available. The DVD-R standard is defined by the DVD Forum (<http://www.dvdforum.com/forum.shtml>). This format is write once.
- **DVD-RW:** This is the rewritable version of the DVD-R standard. A DVD-RW can be rewritten about 1000 times.
- **DVD-RAM:** This is also a rewritable format supported by the DVD Forum. A DVD-RAM can be seen as a removable hard drive. However, this media is not compatible with most DVD-ROM drives and DVD-Video players; only a few DVD writers support the DVD-RAM format. Read the [ὉἰἸία 19.7.9](#) for more information on DVD-RAM use.
- **DVD+RW:** This is a rewritable format defined by the DVD+RW Alliance (<http://www.dvdrw.com/>). A DVD+RW can be rewritten about 1000 times.
- **DVD+R:** This format is the write once variation of the DVD+RW format.

A single layer recordable DVD can hold up to 4,700,000,000 bytes which is actually 4.38 GB or 4485 MB (1 kilobyte is 1024 bytes).

ὉἰἸίαβύοἴ: A distinction must be made between the physical media and the application. For example, a DVD-Video is a specific file layout that can be written on any recordable DVD physical media: DVD-R, DVD+R, DVD-RW etc. Before choosing the type of media, you must be sure that both the burner and the DVD-Video player (a standalone player or a DVD-ROM drive on a computer) are compatible with the media under consideration.

19.7.2 Configuration

The program `growisofs(1)` will be used to perform DVD recording. This command is part of the **dvd+rw-tools** utilities (`sysutils/dvd+rw-tools`). The **dvd+rw-tools** support all DVD media types.

These tools use the SCSI subsystem to access to the devices, therefore the ATAPI/CAM support must be added to your kernel. If your burner uses the USB interface this addition is useless, and you should read the Ὁδηγία 19.5 for more details on USB devices configuration.

You also have to enable DMA access for ATAPI devices, this can be done in adding the following line to the `/boot/loader.conf` file:

```
hw.ata.atapi_dma="1"
```

Before attempting to use the **dvd+rw-tools** you should consult the dvd+rw-tools' hardware compatibility notes (<http://fy.chalmers.se/~appro/linux/DVD+RW/hcn.html>) for any information related to your DVD burner.

Ὁδηγία: If you want a graphical user interface, you should have a look to **K3b** (`sysutils/k3b`) which provides a user friendly interface to `growisofs(1)` and many other burning tools.

19.7.3 Burning Data DVDs

The `growisofs(1)` command is a frontend to `mkisofs(8)`, it will invoke `mkisofs(8)` to create the file system layout and will perform the write on the DVD. This means you do not need to create an image of the data before the burning process.

To burn onto a DVD+R or a DVD-R the data from the `/path/to/data` directory, use the following command:

```
# growisofs -dvd-compat -Z /dev/cd0 -J -R /path/to/data
```

The options `-J -R` are passed to `mkisofs(8)` for the file system creation (in this case: an ISO 9660 file system with Joliet and Rock Ridge extensions), consult the `mkisofs(8)` manual page for more details.

The option `-Z` is used for the initial session recording in any case: multiple sessions or not. The DVD device, `/dev/cd0`, must be changed according to your configuration. The `-dvd-compat` parameter will close the disk, the recording will be unappendable. In return this should provide better media compatibility with DVD-ROM drives.

It is also possible to burn a pre-mastered image, for example to burn the image `imagefile.iso`, we will run:

```
# growisofs -dvd-compat -Z /dev/cd0=imagefile.iso
```

The write speed should be detected and automatically set according to the media and the drive being used. If you want to force the write speed, use the `-speed=` parameter. For more information, read the `growisofs(1)` manual page.

19.7.4 Burning a DVD-Video

A DVD-Video is a specific file layout based on ISO 9660 and the micro-UDF (M-UDF) specifications. The DVD-Video also presents a specific data structure hierarchy, it is the reason why you need a particular program such as `multimedia/dvdauthor` to author the DVD.

If you already have an image of the DVD-Video file system, just burn it in the same way as for any image, see the previous section for an example. If you have made the DVD authoring and the result is in, for example, the directory `/path/to/video`, the following command should be used to burn the DVD-Video:

```
# growisofs -Z /dev/cd0 -dvd-video /path/to/video
```

The `-dvd-video` option will be passed down to `mkisofs(8)` and will instruct it to create a DVD-Video file system layout. Beside this, the `-dvd-video` option implies `-dvd-compatible growisofs(1)` option.

19.7.5 Using a DVD+RW

Unlike CD-RW, a virgin DVD+RW needs to be formatted before first use. The `growisofs(1)` program will take care of it automatically whenever appropriate, which is the *recommended* way. However you can use the `dvd+rw-format` command to format the DVD+RW:

```
# dvd+rw-format /dev/cd0
```

You need to perform this operation just once, keep in mind that only virgin DVD+RW medias need to be formatted. Then you can burn the DVD+RW in the way seen in previous sections.

If you want to burn new data (burn a totally new file system not append some data) onto a DVD+RW, you do not need to blank it, you just have to write over the previous recording (in performing a new initial session), like this:

```
# growisofs -Z /dev/cd0 -J -R /path/to/newdata
```

DVD+RW format offers the possibility to easily append data to a previous recording. The operation consists in merging a new session to the existing one, it is not multisession writing, `growisofs(1)` will *grow* the ISO 9660 file system present on the media.

For example, if we want to append data to our previous DVD+RW, we have to use the following:

```
# growisofs -M /dev/cd0 -J -R /path/to/nextdata
```

The same `mkisofs(8)` options we used to burn the initial session should be used during next writes.

Σημείωση: You may want to use the `-dvd-compatible` option if you want better media compatibility with DVD-ROM drives. In the DVD+RW case, this will not prevent you from adding data.

If for any reason you really want to blank the media, do the following:

```
# growisofs -Z /dev/cd0=/dev/zero
```

19.7.6 Using a DVD-RW

A DVD-RW accepts two disc formats: the incremental sequential one and the restricted overwrite. By default DVD-RW discs are in sequential format.

A virgin DVD-RW can be directly written without the need of a formatting operation, however a non-virgin DVD-RW in sequential format needs to be blanked before to be able to write a new initial session.

To blank a DVD-RW in sequential mode, run:

```
# dvd+rw-format -blank=full /dev/cd0
```

Όχι! Βύθος: A full blanking (`-blank=full`) will take about one hour on a 1x media. A fast blanking can be performed using the `-blank` option if the DVD-RW will be recorded in Disk-At-Once (DAO) mode. To burn the DVD-RW in DAO mode, use the command:

```
# growisofs -use-the-force-luke=dao -Z /dev/cd0=imagefile.iso
```

The `-use-the-force-luke=dao` option should not be required since `growisofs(1)` attempts to detect minimally (fast blanked) media and engage DAO write.

In fact one should use restricted overwrite mode with any DVD-RW, this format is more flexible than the default incremental sequential one.

To write data on a sequential DVD-RW, use the same instructions as for the other DVD formats:

```
# growisofs -Z /dev/cd0 -J -R /path/to/data
```

If you want to append some data to your previous recording, you will have to use the `growisofs(1)` `-M` option. However, if you perform data addition on a DVD-RW in incremental sequential mode, a new session will be created on the disc and the result will be a multi-session disc.

A DVD-RW in restricted overwrite format does not need to be blanked before a new initial session, you just have to overwrite the disc with the `-z` option, this is similar to the DVD+RW case. It is also possible to grow an existing ISO 9660 file system written on the disc in a same way as for a DVD+RW with the `-M` option. The result will be a one-session DVD.

To put a DVD-RW in the restricted overwrite format, the following command must be used:

```
# dvd+rw-format /dev/cd0
```

To change back to the sequential format use:

```
# dvd+rw-format -blank=full /dev/cd0
```

19.7.7 Multisession

Very few DVD-ROM drives support multisession DVDs, they will most of time, hopefully, only read the first session. DVD+R, DVD-R and DVD-RW in sequential format can accept multiple sessions, the notion of multiple sessions does not exist for the DVD+RW and the DVD-RW restricted overwrite formats.

Using the following command after an initial (non-closed) session on a DVD+R, DVD-R, or DVD-RW in sequential format, will add a new session to the disc:

```
# growisofs -M /dev/cd0 -J -R /path/to/nextdata
```

Using this command line with a DVD+RW or a DVD-RW in restricted overwrite mode, will append data in merging the new session to the existing one. The result will be a single-session disc. This is the way used to add data after an initial write on these medias.

Όχι: Some space on the media is used between each session for end and start of sessions. Therefore, one should add sessions with large amount of data to optimize media space. The number of sessions is limited to 154 for a DVD+R, about 2000 for a DVD-R, and 127 for a DVD+R Double Layer.

19.7.8 For More Information

To obtain more information about a DVD, the `dvd+rw-mediainfo /dev/cd0` command can be ran with the disc in the drive.

More information about the **dvd+rw-tools** can be found in the `growisofs(1)` manual page, on the `dvd+rw-tools` web site (<http://fy.chalmers.se/~appro/linux/DVD+RW/>) and in the `cdwrite` mailing list (<http://lists.debian.org/cdwrite/>) archives.

Όχι: The `dvd+rw-mediainfo` output of the resulting recording or the media with issues is mandatory for any problem report. Without this output, it will be quite impossible to help you.

19.7.9 Using a DVD-RAM

19.7.9.1 Configuration

DVD-RAM writers come with either SCSI or ATAPI interface. DMA access for ATAPI devices has to be enabled, this can be done by adding the following line to the `/boot/loader.conf` file:

```
hw.ata.atapi_dma="1"
```

19.7.9.2 Preparing the Medium

As previously mentioned in the chapter introduction, a DVD-RAM can be seen as a removable hard drive. As any other hard drive the DVD-RAM must be “prepared” before the first use. In the example, the whole disk space will be used with a standard UFS2 file system:

```
# dd if=/dev/zero of=/dev/acd0 count=2
# bsdlabel -Bw acd0
# newfs /dev/acd0
```

The DVD device, `acd0`, must be changed according to the configuration.

19.7.9.3 Using the Medium

Once the previous operations have been performed on the DVD-RAM, it can be mounted as a normal hard drive:

```
# mount /dev/acd0 /mnt
```

After this the DVD-RAM will be both readable and writeable.

19.8 Creating and Using Floppy Disks

Storing data on floppy disks is sometimes useful, for example when one does not have any other removable storage media or when one needs to transfer small amounts of data to another computer.

This section will explain how to use floppy disks in FreeBSD. It will primarily cover formatting and usage of 3.5inch DOS floppies, but the concepts are similar for other floppy disk formats.

19.8.1 Formatting Floppies

19.8.1.1 The Device

Floppy disks are accessed through entries in `/dev`, just like other devices. To access the raw floppy disk, simply use `/dev/fdN`.

19.8.1.2 Formatting

A floppy disk needs to be low-level formatted before it can be used. This is usually done by the vendor, but formatting is a good way to check media integrity. Although it is possible to force larger (or smaller) disk sizes, 1440kB is what most floppy disks are designed for.

To low-level format the floppy disk you need to use `fdformat(1)`. This utility expects the device name as an argument. Make note of any error messages, as these can help determine if the disk is good or bad.

19.8.1.2.1 Formatting Floppy Disks

Use the `/dev/fdN` devices to format the floppy. Insert a new 3.5inch floppy disk in your drive and issue:

```
# /usr/sbin/fdformat -f 1440 /dev/fd0
```

19.8.2 The Disk Label

After low-level formatting the disk, you will need to place a disk label on it. This disk label will be destroyed later, but it is needed by the system to determine the size of the disk and its geometry later.

The new disk label will take over the whole disk, and will contain all the proper information about the geometry of the floppy. The geometry values for the disk label are listed in `/etc/disktab`.

You can run now `bsdlabel(8)` like so:

```
# /sbin/bsdlabel -B -r -w /dev/fd0 fd1440
```

19.8.3 The File System

Now the floppy is ready to be high-level formatted. This will place a new file system on it, which will let FreeBSD read and write to the disk. After creating the new file system, the disk label is destroyed, so if you want to reformat the disk, you will have to recreate the disk label.

The floppy's file system can be either UFS or FAT. FAT is generally a better choice for floppies.

To put a new file system on the floppy, issue:

```
# /sbin/newfs_msdos /dev/fd0
```

The disk is now ready for use.

19.8.4 Using the Floppy

To use the floppy, mount it with `mount_msdosfs(8)`. One can also use `emulators/mttools` from the ports collection.

19.9 Creating and Using Data Tapes

The major tape media are the 4mm, 8mm, QIC, mini-cartridge and DLT.

19.9.1 4mm (DDS: Digital Data Storage)

4mm tapes are replacing QIC as the workstation backup media of choice. This trend accelerated greatly when Conner purchased Archive, a leading manufacturer of QIC drives, and then stopped production of QIC drives. 4mm drives are small and quiet but do not have the reputation for reliability that is enjoyed by 8mm drives. The cartridges are less expensive and smaller (3 x 2 x 0.5 inches, 76 x 51 x 12 mm) than 8mm cartridges. 4mm, like 8mm, has comparatively short head life for the same reason, both use helical scan.

Data throughput on these drives starts ~150 kB/s, peaking at ~500 kB/s. Data capacity starts at 1.3 GB and ends at 2.0 GB. Hardware compression, available with most of these drives, approximately doubles the capacity. Multi-drive tape library units can have 6 drives in a single cabinet with automatic tape changing. Library capacities reach 240 GB.

The DDS-3 standard now supports tape capacities up to 12 GB (or 24 GB compressed).

4mm drives, like 8mm drives, use helical-scan. All the benefits and drawbacks of helical-scan apply to both 4mm and 8mm drives.

Tapes should be retired from use after 2,000 passes or 100 full backups.

19.9.2 8mm (Exabyte)

8mm tapes are the most common SCSI tape drives; they are the best choice of exchanging tapes. Nearly every site has an Exabyte 2 GB 8mm tape drive. 8mm drives are reliable, convenient and quiet. Cartridges are inexpensive and small (4.8 x 3.3 x 0.6 inches; 122 x 84 x 15 mm). One downside of 8mm tape is relatively short head and tape life due to the high rate of relative motion of the tape across the heads.

Data throughput ranges from ~250 kB/s to ~500 kB/s. Data sizes start at 300 MB and go up to 7 GB. Hardware compression, available with most of these drives, approximately doubles the capacity. These drives are available as single units or multi-drive tape libraries with 6 drives and 120 tapes in a single cabinet. Tapes are changed automatically by the unit. Library capacities reach 840+ GB.

The Exabyte "Mammoth" model supports 12 GB on one tape (24 GB with compression) and costs approximately twice as much as conventional tape drives.

Data is recorded onto the tape using helical-scan, the heads are positioned at an angle to the media (approximately 6 degrees). The tape wraps around 270 degrees of the spool that holds the heads. The spool spins while the tape slides over the spool. The result is a high density of data and closely packed tracks that angle across the tape from one edge to the other.

19.9.3 QIC

QIC-150 tapes and drives are, perhaps, the most common tape drive and media around. QIC tape drives are the least expensive “serious” backup drives. The downside is the cost of media. QIC tapes are expensive compared to 8mm or 4mm tapes, up to 5 times the price per GB data storage. But, if your needs can be satisfied with a half-dozen tapes, QIC may be the correct choice. QIC is the *most* common tape drive. Every site has a QIC drive of some density or another. Therein lies the rub, QIC has a large number of densities on physically similar (sometimes identical) tapes. QIC drives are not quiet. These drives audibly seek before they begin to record data and are clearly audible whenever reading, writing or seeking. QIC tapes measure 6 x 4 x 0.7 inches (152 x 102 x 17 mm).

Data throughput ranges from ~150 kB/s to ~500 kB/s. Data capacity ranges from 40 MB to 15 GB. Hardware compression is available on many of the newer QIC drives. QIC drives are less frequently installed; they are being supplanted by DAT drives.

Data is recorded onto the tape in tracks. The tracks run along the long axis of the tape media from one end to the other. The number of tracks, and therefore the width of a track, varies with the tape’s capacity. Most if not all newer drives provide backward-compatibility at least for reading (but often also for writing). QIC has a good reputation regarding the safety of the data (the mechanics are simpler and more robust than for helical scan drives).

Tapes should be retired from use after 5,000 backups.

19.9.4 DLT

DLT has the fastest data transfer rate of all the drive types listed here. The 1/2" (12.5mm) tape is contained in a single spool cartridge (4 x 4 x 1 inches; 100 x 100 x 25 mm). The cartridge has a swinging gate along one entire side of the cartridge. The drive mechanism opens this gate to extract the tape leader. The tape leader has an oval hole in it which the drive uses to “hook” the tape. The take-up spool is located inside the tape drive. All the other tape cartridges listed here (9 track tapes are the only exception) have both the supply and take-up spools located inside the tape cartridge itself.

Data throughput is approximately 1.5 MB/s, three times the throughput of 4mm, 8mm, or QIC tape drives. Data capacities range from 10 GB to 20 GB for a single drive. Drives are available in both multi-tape changers and multi-tape, multi-drive tape libraries containing from 5 to 900 tapes over 1 to 20 drives, providing from 50 GB to 9 TB of storage.

With compression, DLT Type IV format supports up to 70 GB capacity.

Data is recorded onto the tape in tracks parallel to the direction of travel (just like QIC tapes). Two tracks are written at once. Read/write head lifetimes are relatively long; once the tape stops moving, there is no relative motion between the heads and the tape.

19.9.5 AIT

AIT is a new format from Sony, and can hold up to 50 GB (with compression) per tape. The tapes contain memory chips which retain an index of the tape’s contents. This index can be rapidly read by the tape drive to determine the

position of files on the tape, instead of the several minutes that would be required for other tapes. Software such as **SAMS:Alexandria** can operate forty or more AIT tape libraries, communicating directly with the tape's memory chip to display the contents on screen, determine what files were backed up to which tape, locate the correct tape, load it, and restore the data from the tape.

Libraries like this cost in the region of \$20,000, pricing them a little out of the hobbyist market.

19.9.6 Using a New Tape for the First Time

The first time that you try to read or write a new, completely blank tape, the operation will fail. The console messages should be similar to:

```
sa0(ncr1:4:0): NOT READY asc:4,1
sa0(ncr1:4:0): Logical unit is in process of becoming ready
```

The tape does not contain an Identifier Block (block number 0). All QIC tape drives since the adoption of QIC-525 standard write an Identifier Block to the tape. There are two solutions:

- `mt fsf 1` causes the tape drive to write an Identifier Block to the tape.
- Use the front panel button to eject the tape.

Re-insert the tape and `dump` data to the tape.

`dump` will report `DUMP: End of tape detected` and the console will show: `HARDWARE FAILURE info:280 asc:80,96`.

rewind the tape using: `mt rewind`.

Subsequent tape operations are successful.

19.10 Backups to Floppies

19.10.1 Can I Use Floppies for Backing Up My Data?

Floppy disks are not really a suitable media for making backups as:

- The media is unreliable, especially over long periods of time.
- Backing up and restoring is very slow.
- They have a very limited capacity (the days of backing up an entire hard disk onto a dozen or so floppies has long since passed).

However, if you have no other method of backing up your data then floppy disks are better than no backup at all.

If you do have to use floppy disks then ensure that you use good quality ones. Floppies that have been lying around the office for a couple of years are a bad choice. Ideally use new ones from a reputable manufacturer.

19.10.2 So How Do I Backup My Data to Floppies?

The best way to backup to floppy disk is to use tar(1) with the -M (multi volume) option, which allows backups to span multiple floppies.

To backup all the files in the current directory and sub-directory use this (as root):

```
# tar Mcvf /dev/fd0 *
```

When the first floppy is full tar(1) will prompt you to insert the next volume (because tar(1) is media independent it refers to volumes; in this context it means floppy disk).

Prepare volume #2 for /dev/fd0 and hit return:

This is repeated (with the volume number incrementing) until all the specified files have been archived.

19.10.3 Can I Compress My Backups?

Unfortunately, tar(1) will not allow the -z option to be used for multi-volume archives. You could, of course, gzip(1) all the files, tar(1) them to the floppies, then gunzip(1) the files again!

19.10.4 How Do I Restore My Backups?

To restore the entire archive use:

```
# tar Mxvf /dev/fd0
```

There are two ways that you can use to restore only specific files. First, you can start with the first floppy and use:

```
# tar Mxvf /dev/fd0 filename
```

The utility tar(1) will prompt you to insert subsequent floppies until it finds the required file.

Alternatively, if you know which floppy the file is on then you can simply insert that floppy and use the same command as above. Note that if the first file on the floppy is a continuation from the previous one then tar(1) will warn you that it cannot restore it, even if you have not asked it to!

19.11 Backup Strategies

The first requirement in devising a backup plan is to make sure that all of the following problems are covered:

- Disk failure
- Accidental file deletion
- Random file corruption
- Complete machine destruction (e.g. fire), including destruction of any on-site backups.

It is perfectly possible that some systems will be best served by having each of these problems covered by a completely different technique. Except for strictly personal systems with very low-value data, it is unlikely that one technique would cover all of them.

Some of the techniques in the toolbox are:

- Archives of the whole system, backed up onto permanent media offsite. This actually provides protection against all of the possible problems listed above, but is slow and inconvenient to restore from. You can keep copies of the backups onsite and/or online, but there will still be inconveniences in restoring files, especially for non-privileged users.
- Filesystem snapshots. This is really only helpful in the accidental file deletion scenario, but it can be *very* helpful in that case, and is quick and easy to deal with.
- Copies of whole filesystems and/or disks (e.g. periodic `rsync(1)` of the whole machine). This is generally most useful in networks with unique requirements. For general protection against disk failure, it is usually inferior to RAID. For restoring accidentally deleted files, it can be comparable to UFS snapshots, but that depends on your preferences.
- RAID. Minimizes or avoids downtime when a disk fails. At the expense of having to deal with disk failures more often (because you have more disks), albeit at a much lower urgency.
- Checking fingerprints of files. The `mtree(8)` utility is very useful for this. Although it is not a backup technique, it helps guarantee that you will notice when you need to resort to your backups. This is particularly important for offline backups, and should be checked periodically.

It is quite easy to come up with even more techniques, many of them variations on the ones listed above. Specialized requirements will usually lead to specialized techniques (for example, backing up a live database usually requires a method particular to the database software as an intermediate step). The important thing is to know what dangers you want to protect against, and how you will handle each.

19.12 Backup Basics

The three major backup programs are `dump(8)`, `tar(1)`, and `cpio(1)`.

19.12.1 Dump and Restore

The traditional UNIX backup programs are `dump` and `restore`. They operate on the drive as a collection of disk blocks, below the abstractions of files, links and directories that are created by the file systems. `dump` backs up an entire file system on a device. It is unable to backup only part of a file system or a directory tree that spans more than one file system. `dump` does not write files and directories to tape, but rather writes the raw data blocks that comprise files and directories.

Όχι ἀβῶος: If you use `dump` on your root directory, you would not back up `/home`, `/usr` or many other directories since these are typically mount points for other file systems or symbolic links into those file systems.

`dump` has quirks that remain from its early days in Version 6 of AT&T UNIX (circa 1975). The default parameters are suitable for 9-track tapes (6250 bpi), not the high-density media available today (up to 62,182 ftpi). These defaults must be overridden on the command line to utilize the capacity of current tape drives.

It is also possible to backup data across the network to a tape drive attached to another computer with `rdump` and `rrestore`. Both programs rely upon `rcmd(3)` and `ruserok(3)` to access the remote tape drive. Therefore, the user performing the backup must be listed in the `.rhosts` file on the remote computer. The arguments to `rdump` and `rrestore` must be suitable to use on the remote computer. When `rdumping` from a FreeBSD computer to an Exabyte tape drive connected to a Sun called `komodo`, use:

```
# /sbin/rdump 0dsbfu 54000 13000 126 komodo:/dev/nsa8 /dev/da0a 2>&1
```

Beware: there are security implications to allowing `.rhosts` authentication. Evaluate your situation carefully.

It is also possible to use `dump` and `restore` in a more secure fashion over `ssh`.

Διάγραμμα 19-1. Using `dump` over `ssh`

```
# /sbin/dump -0uan -f - /usr | gzip -2 | ssh -c blowfish \
    targetuser@targetmachine.example.com dd of=/mybigfiles/dump-usr-10.gz
```

Or using `dump`'s built-in method, setting the environment variable `RSH`:

Διάγραμμα 19-2. Using `dump` over `ssh` with `RSH` set

```
# RSH=/usr/bin/ssh /sbin/dump -0uan -f targetuser@targetmachine.example.com:/dev/sa0 /usr
```

19.12.2 tar

`tar(1)` also dates back to Version 6 of AT&T UNIX (circa 1975). `tar` operates in cooperation with the file system; it writes files and directories to tape. `tar` does not support the full range of options that are available from `cpio(1)`, but it does not require the unusual command pipeline that `cpio` uses.

On FreeBSD 5.3 and later, both GNU `tar` and the default `bsdtar` are available. The GNU version can be invoked with `gtar`. It supports remote devices using the same syntax as `rdump`. To `tar` to an Exabyte tape drive connected to a Sun called `komodo`, use:

```
# /usr/bin/gtar cf komodo:/dev/nsa8 . 2>&1
```

The same could be accomplished with `bsdtar` by using a pipeline and `rsh` to send the data to a remote tape drive.

```
# tar cf - . | rsh hostname dd of=tape-device obs=20b
```

If you are worried about the security of backing up over a network you should use the `ssh` command instead of `rsh`.

19.12.3 cpio

`cpio(1)` is the original UNIX file interchange tape program for magnetic media. `cpio` has options (among many others) to perform byte-swapping, write a number of different archive formats, and pipe the data to other programs. This last feature makes `cpio` an excellent choice for installation media. `cpio` does not know how to walk the directory tree and a list of files must be provided through `stdin`.

`cpio` does not support backups across the network. You can use a pipeline and `rsh` to send the data to a remote tape drive.

```
# for f in directory_list; do
find $f >> backup.list
done
# cpio -v -o --format=newc < backup.list | ssh user@host "cat > backup_device"
```

Where *directory_list* is the list of directories you want to back up, *user@host* is the user/hostname combination that will be performing the backups, and *backup_device* is where the backups should be written to (e.g., */dev/nsa0*).

19.12.4 pax

pax(1) is IEEE/POSIX's answer to *tar* and *cpio*. Over the years the various versions of *tar* and *cpio* have gotten slightly incompatible. So rather than fight it out to fully standardize them, POSIX created a new archive utility. *pax* attempts to read and write many of the various *cpio* and *tar* formats, plus new formats of its own. Its command set more resembles *cpio* than *tar*.

19.12.5 Amanda

Amanda (Advanced Maryland Network Disk Archiver) is a client/server backup system, rather than a single program. An **Amanda** server will backup to a single tape drive any number of computers that have **Amanda** clients and a network connection to the **Amanda** server. A common problem at sites with a number of large disks is that the length of time required to backup to data directly to tape exceeds the amount of time available for the task. **Amanda** solves this problem. **Amanda** can use a "holding disk" to backup several file systems at the same time. **Amanda** creates "archive sets": a group of tapes used over a period of time to create full backups of all the file systems listed in **Amanda**'s configuration file. The "archive set" also contains nightly incremental (or differential) backups of all the file systems. Restoring a damaged file system requires the most recent full backup and the incremental backups.

The configuration file provides fine control of backups and the network traffic that **Amanda** generates. **Amanda** will use any of the above backup programs to write the data to tape. **Amanda** is available as either a port or a package, it is not installed by default.

19.12.6 Do Nothing

"Do nothing" is not a computer program, but it is the most widely used backup strategy. There are no initial costs. There is no backup schedule to follow. Just say no. If something happens to your data, grin and bear it!

If your time and your data is worth little to nothing, then "Do nothing" is the most suitable backup program for your computer. But beware, UNIX is a useful tool, you may find that within six months you have a collection of files that are valuable to you.

"Do nothing" is the correct backup method for */usr/obj* and other directory trees that can be exactly recreated by your computer. An example is the files that comprise the HTML or PostScript version of this Handbook. These document formats have been created from SGML input files. Creating backups of the HTML or PostScript files is not necessary. The SGML files are backed up regularly.

19.12.7 Which Backup Program Is Best?

dump(8) Period. Elizabeth D. Zwicky torture tested all the backup programs discussed here. The clear choice for preserving all your data and all the peculiarities of UNIX file systems is `dump`. Elizabeth created file systems containing a large variety of unusual conditions (and some not so unusual ones) and tested each program by doing a backup and restore of those file systems. The peculiarities included: files with holes, files with holes and a block of nulls, files with funny characters in their names, unreadable and unwritable files, devices, files that change size during the backup, files that are created/deleted during the backup and more. She presented the results at LISA V in Oct. 1991. See torture-testing Backup and Archive Programs (<http://berdmann.dyndns.org/zwicky/testdump.doc.html>).

19.12.8 Emergency Restore Procedure

19.12.8.1 Before the Disaster

There are only four steps that you need to perform in preparation for any disaster that may occur.

First, print the `bsdlabeled` from each of your disks (e.g. `bsdlabeled da0 | lpr`), your file system table (`/etc/fstab`) and all boot messages, two copies of each.

Second, determine that the boot and fix-it floppies (`boot.flp` and `fixit.flp`) have all your devices. The easiest way to check is to reboot your machine with the boot floppy in the floppy drive and check the boot messages. If all your devices are listed and functional, skip on to step three.

Otherwise, you have to create two custom bootable floppies which have a kernel that can mount all of your disks and access your tape drive. These floppies must contain: `fdisk`, `bsdlabeled`, `newfs`, `mount`, and whichever backup program you use. These programs must be statically linked. If you use `dump`, the floppy must contain `restore`.

Third, create backup tapes regularly. Any changes that you make after your last backup may be irretrievably lost. Write-protect the backup tapes.

Fourth, test the floppies (either `boot.flp` and `fixit.flp` or the two custom bootable floppies you made in step two.) and backup tapes. Make notes of the procedure. Store these notes with the bootable floppy, the printouts and the backup tapes. You will be so distraught when restoring that the notes may prevent you from destroying your backup tapes (How? In place of `tar xvf /dev/sa0`, you might accidentally type `tar cvf /dev/sa0` and over-write your backup tape).

For an added measure of security, make bootable floppies and two backup tapes each time. Store one of each at a remote location. A remote location is NOT the basement of the same office building. A number of firms in the World Trade Center learned this lesson the hard way. A remote location should be physically separated from your computers and disk drives by a significant distance.

Διάγραμμα 19-3. A Script for Creating a Bootable Floppy

```
#!/bin/sh
#
# create a restore floppy
#
# format the floppy
#
PATH=/bin:/sbin:/usr/sbin:/usr/bin

fdformat -q fd0
```

```

if [ $? -ne 0 ]
then
    echo "Bad floppy, please use a new one"
    exit 1
fi

# place boot blocks on the floppy
#
bsdlabel -w -B /dev/fd0c fd1440

#
# newfs the one and only partition
#
newfs -t 2 -u 18 -l 1 -c 40 -i 5120 -m 5 -o space /dev/fd0a

#
# mount the new floppy
#
mount /dev/fd0a /mnt

#
# create required directories
#
mkdir /mnt/dev
mkdir /mnt/bin
mkdir /mnt/sbin
mkdir /mnt/etc
mkdir /mnt/root
mkdir /mnt/mnt    # for the root partition
mkdir /mnt/tmp
mkdir /mnt/var

#
# populate the directories
#
if [ ! -x /sys/compile/MINI/kernel ]
then
    cat << EOM
The MINI kernel does not exist, please create one.
Here is an example config file:
#
# MINI -- A kernel to get FreeBSD onto a disk.
#
machine            "i386"
cpu                "I486_CPU"
ident              MINI
maxusers           5

options            INET                    # needed for _tcp _icmpstat _ipstat
#                _udpstat _tcpstat _udb
options            FFS                    #Berkeley Fast File System
options            FAT_CURSOR              #block cursor in syscons or pccons
options            SCSI_DELAY=15          #Be pessimistic about Joe SCSI device

```

```

options      NCONS=2                #1 virtual consoles
options      USERCONFIG          #Allow user configuration with -c XXX

config       kernel root on da0 swap on da0 and da1 dumps on da0

device       isa0
device       pci0

device       fdc0 at isa? port "IO_FD1" bio irq 6 drq 2 vector fdintr
device       fd0 at fdc0 drive 0

device       ncr0

device       scbus0

device       sc0 at isa? port "IO_KBD" tty irq 1 vector scintr
device       npx0 at isa? port "IO_NPX" irq 13 vector npxintr

device       da0
device       da1
device       da2

device       sa0

pseudo-device loop                # required by INET
pseudo-device gzip                # Exec gzipped a.out's
EOM
  exit 1
fi

cp -f /sys/compile/MINI/kernel /mnt

gzip -c -best /sbin/init > /mnt/sbin/init
gzip -c -best /sbin/fsck > /mnt/sbin/fsck
gzip -c -best /sbin/mount > /mnt/sbin/mount
gzip -c -best /sbin/halt > /mnt/sbin/halt
gzip -c -best /sbin/restore > /mnt/sbin/restore

gzip -c -best /bin/sh > /mnt/bin/sh
gzip -c -best /bin/sync > /mnt/bin/sync

cp /root/.profile /mnt/root

cp -f /dev/MAKEDEV /mnt/dev
chmod 755 /mnt/dev/MAKEDEV

chmod 500 /mnt/sbin/init
chmod 555 /mnt/sbin/fsck /mnt/sbin/mount /mnt/sbin/halt
chmod 555 /mnt/bin/sh /mnt/bin/sync
chmod 6555 /mnt/sbin/restore

#
# create the devices nodes

```

```
#
cd /mnt/dev
./MAKEDEV std
./MAKEDEV da0
./MAKEDEV da1
./MAKEDEV da2
./MAKEDEV sa0
./MAKEDEV pty0
cd /

#
# create minimum file system table
#
cat > /mnt/etc/fstab <<EOM
/dev/fd0a    /      ufs    rw  1  1
EOM

#
# create minimum passwd file
#
cat > /mnt/etc/passwd <<EOM
root:*:0:0:Charlie &:/root:/bin/sh
EOM

cat > /mnt/etc/master.passwd <<EOM
root::0:0::0:0:Charlie &:/root:/bin/sh
EOM

chmod 600 /mnt/etc/master.passwd
chmod 644 /mnt/etc/passwd
/usr/sbin/pwd_mkdb -d/mnt/etc /mnt/etc/master.passwd

#
# umount the floppy and inform the user
#
/sbin/umount /mnt
echo "The floppy has been unmounted and is now ready."
```

19.12.8.2 After the Disaster

The key question is: did your hardware survive? You have been doing regular backups so there is no need to worry about the software.

If the hardware has been damaged, the parts should be replaced before attempting to use the computer.

If your hardware is okay, check your floppies. If you are using a custom boot floppy, boot single-user (type `-s` at the `boot:` prompt). Skip the following paragraph.

If you are using the `boot.flp` and `fixit.flp` floppies, keep reading. Insert the `boot.flp` floppy in the first floppy drive and boot the computer. The original install menu will be displayed on the screen. Select the `Fixit--Repair` mode with `CDROM` or `floppy.` option. Insert the `fixit.flp` when prompted. `restore` and the other programs that you need are located in `/mnt2/rescue` (`/mnt2/stand` for FreeBSD versions older than 5.2).

Recover each file system separately.

Try to mount (e.g. `mount /dev/da0a /mnt`) the root partition of your first disk. If the `bsdlabel` was damaged, use `bsdlabel` to re-partition and label the disk to match the label that you printed and saved. Use `newfs` to re-create the file systems. Re-mount the root partition of the floppy read-write (`mount -u -o rw /mnt`). Use your backup program and backup tapes to recover the data for this file system (e.g. `restore vrf /dev/sa0`). Unmount the file system (e.g. `umount /mnt`). Repeat for each file system that was damaged.

Once your system is running, backup your data onto new tapes. Whatever caused the crash or data loss may strike again. Another hour spent now may save you from further distress later.

19.13 Network, Memory, and File-Backed File Systems

Aside from the disks you physically insert into your computer: floppies, CDs, hard drives, and so forth; other forms of disks are understood by FreeBSD - the *virtual disks*.

These include network file systems such as the Network File System and Coda, memory-based file systems and file-backed file systems.

According to the FreeBSD version you run, you will have to use different tools for creation and use of file-backed and memory-based file systems.

Όχι! Βούρα: Use `devfs(5)` to allocate device nodes transparently for the user.

19.13.1 File-Backed File System

The utility `mdconfig(8)` is used to configure and enable memory disks, `md(4)`, under FreeBSD. To use `mdconfig(8)`, you have to load `md(4)` module or to add the support in your kernel configuration file:

```
device md
```

The `mdconfig(8)` command supports three kinds of memory backed virtual disks: memory disks allocated with `malloc(9)`, memory disks using a file or swap space as backing. One possible use is the mounting of floppy or CD images kept in files.

To mount an existing file system image:

Διάγραμμα 19-4. Using `mdconfig` to Mount an Existing File System Image

```
# mdconfig -a -t vnode -f diskimage -u 0
# mount /dev/md0 /mnt
```

To create a new file system image with `mdconfig(8)`:

Διάγραμμα 19-5. Creating a New File-Backed Disk with `mdconfig`

```
# dd if=/dev/zero of=newimage bs=1k count=5k
5120+0 records in
```

```
5120+0 records out
# mdconfig -a -t vnode -f newimage -u 0
# bsdlabel -w md0 auto
# newfs md0a
/dev/md0a: 5.0MB (10224 sectors) block size 16384, fragment size 2048
    using 4 cylinder groups of 1.25MB, 80 blks, 192 inodes.
super-block backups (for fsck -b #) at:
    160, 2720, 5280, 7840
# mount /dev/md0a /mnt
# df /mnt
Filesystem 1K-blocks Used Avail Capacity Mounted on
/dev/md0a      4710    4 4330    0%    /mnt
```

If you do not specify the unit number with the `-u` option, `mdconfig(8)` will use the `md(4)` automatic allocation to select an unused device. The name of the allocated unit will be output on stdout like `md4`. For more details about `mdconfig(8)`, please refer to the manual page.

The utility `mdconfig(8)` is very useful, however it asks many command lines to create a file-backed file system. FreeBSD also comes with a tool called `mdmfs(8)`, this program configures a `md(4)` disk using `mdconfig(8)`, puts a UFS file system on it using `newfs(8)`, and mounts it using `mount(8)`. For example, if you want to create and mount the same file system image as above, simply type the following:

Διάγραμμα 19-6. Configure and Mount a File-Backed Disk with `mdmfs`

```
# dd if=/dev/zero of=newimage bs=1k count=5k
5120+0 records in
5120+0 records out
# mdmfs -F newimage -s 5m md0 /mnt
# df /mnt
Filesystem 1K-blocks Used Avail Capacity Mounted on
/dev/md0      4718    4 4338    0%    /mnt
```

If you use the option `md` without unit number, `mdmfs(8)` will use `md(4)` auto-unit feature to automatically select an unused device. For more details about `mdmfs(8)`, please refer to the manual page.

19.13.2 Memory-Based File System

For a memory-based file system the “swap backing” should normally be used. Using swap backing does not mean that the memory disk will be swapped out to disk by default, but merely that the memory disk will be allocated from a memory pool which can be swapped out to disk if needed. It is also possible to create memory-based disk which are `malloc(9)` backed, but using `malloc` backed memory disks, especially large ones, can result in a system panic if the kernel runs out of memory.

Διάγραμμα 19-7. Creating a New Memory-Based Disk with `mdconfig`

```
# mdconfig -a -t swap -s 5m -u 1
# newfs -U md1
/dev/md1: 5.0MB (10240 sectors) block size 16384, fragment size 2048
    using 4 cylinder groups of 1.27MB, 81 blks, 192 inodes.
    with soft updates
super-block backups (for fsck -b #) at:
```

```
160, 2752, 5344, 7936
# mount /dev/md1 /mnt
# df /mnt
Filesystem 1K-blocks Used Avail Capacity Mounted on
/dev/md1    4718      4 4338      0%    /mnt
```

Διάγραμμα 19-8. Creating a New Memory-Based Disk with `mdmfs`

```
# mdmfs -s 5m md2 /mnt
# df /mnt
Filesystem 1K-blocks Used Avail Capacity Mounted on
/dev/md2    4846      2 4458      0%    /mnt
```

19.13.3 Detaching a Memory Disk from the System

When a memory-based or file-based file system is not used, you should release all resources to the system. The first thing to do is to unmount the file system, then use `mdconfig(8)` to detach the disk from the system and release the resources.

For example to detach and free all resources used by `/dev/md4`:

```
# mdconfig -d -u 4
```

It is possible to list information about configured `md(4)` devices in using the command `mdconfig -l`.

19.14 File System Snapshots

FreeBSD offers a feature in conjunction with Soft Updates: File system snapshots.

Snapshots allow a user to create images of specified file systems, and treat them as a file. Snapshot files must be created in the file system that the action is performed on, and a user may create no more than 20 snapshots per file system. Active snapshots are recorded in the superblock so they are persistent across unmount and remount operations along with system reboots. When a snapshot is no longer required, it can be removed with the standard `rm(1)` command. Snapshots may be removed in any order, however all the used space may not be acquired because another snapshot will possibly claim some of the released blocks.

The un-alterable `snapshot` file flag is set by `mksnap_ffs(8)` after initial creation of a snapshot file. The `unlink(1)` command makes an exception for snapshot files since it allows them to be removed.

Snapshots are created with the `mount(8)` command. To place a snapshot of `/var` in the file `/var/snapshot/snap` use the following command:

```
# mount -u -o snapshot /var/snapshot/snap /var
```

Alternatively, you can use `mksnap_ffs(8)` to create a snapshot:

```
# mksnap_ffs /var /var/snapshot/snap
```

One can find snapshot files on a file system (e.g. `/var`) by using the `find(1)` command:

```
# find /var -flags snapshot
```

Once a snapshot has been created, it has several uses:

- Some administrators will use a snapshot file for backup purposes, because the snapshot can be transferred to CDs or tape.
- The file system integrity checker, `fsck(8)`, may be run on the snapshot. Assuming that the file system was clean when it was mounted, you should always get a clean (and unchanging) result. This is essentially what the background `fsck(8)` process does.
- Run the `dump(8)` utility on the snapshot. A dump will be returned that is consistent with the file system and the timestamp of the snapshot. `dump(8)` can also take a snapshot, create a dump image and then remove the snapshot in one command using the `-L` flag.
- `mount(8)` the snapshot as a frozen image of the file system. To `mount(8)` the snapshot `/var/snapshot/snap` run:

```
# mdconfig -a -t vnode -f /var/snapshot/snap -u 4
# mount -r /dev/md4 /mnt
```

You can now walk the hierarchy of your frozen `/var` file system mounted at `/mnt`. Everything will initially be in the same state it was during the snapshot creation time. The only exception is that any earlier snapshots will appear as zero length files. When the use of a snapshot has delimited, it can be unmounted with:

```
# umount /mnt
# mdconfig -d -u 4
```

For more information about `softupdates` and file system snapshots, including technical papers, you can visit Marshall Kirk McKusick's website at <http://www.mckusick.com/>.

19.15 File System Quotas

Quotas are an optional feature of the operating system that allow you to limit the amount of disk space and/or the number of files a user or members of a group may allocate on a per-file system basis. This is used most often on timesharing systems where it is desirable to limit the amount of resources any one user or group of users may allocate. This will prevent one user or group of users from consuming all of the available disk space.

19.15.1 Configuring Your System to Enable Disk Quotas

Before attempting to use disk quotas, it is necessary to make sure that quotas are configured in your kernel. This is done by adding the following line to your kernel configuration file:

```
options QUOTA
```

The stock `GENERIC` kernel does not have this enabled by default, so you will have to configure, build and install a custom kernel in order to use disk quotas. Please refer to Εἰσαγωγή 9 for more information on kernel configuration.

Next you will need to enable disk quotas in `/etc/rc.conf`. This is done by adding the line:

```
enable_quotas="YES"
```

For finer control over your quota startup, there is an additional configuration variable available. Normally on bootup, the quota integrity of each file system is checked by the `quotacheck(8)` program. The `quotacheck(8)` facility insures that the data in the quota database properly reflects the data on the file system. This is a very time consuming process that will significantly affect the time your system takes to boot. If you would like to skip this step, a variable in `/etc/rc.conf` is made available for the purpose:

```
check_quotas="NO"
```

Finally you will need to edit `/etc/fstab` to enable disk quotas on a per-file system basis. This is where you can either enable user or group quotas or both for all of your file systems.

To enable per-user quotas on a file system, add the `userquota` option to the options field in the `/etc/fstab` entry for the file system you want to enable quotas on. For example:

```
/dev/dals2g /home ufs rw,userquota 1 2
```

Similarly, to enable group quotas, use the `groupquota` option instead of `userquota`. To enable both user and group quotas, change the entry as follows:

```
/dev/dals2g /home ufs rw,userquota,groupquota 1 2
```

By default, the quota files are stored in the root directory of the file system with the names `quota.user` and `quota.group` for user and group quotas respectively. See `fstab(5)` for more information. Even though the `fstab(5)` manual page says that you can specify an alternate location for the quota files, this is not recommended because the various quota utilities do not seem to handle this properly.

At this point you should reboot your system with your new kernel. `/etc/rc` will automatically run the appropriate commands to create the initial quota files for all of the quotas you enabled in `/etc/fstab`, so there is no need to manually create any zero length quota files.

In the normal course of operations you should not be required to run the `quotacheck(8)`, `quotaon(8)`, or `quotaoff(8)` commands manually. However, you may want to read their manual pages just to be familiar with their operation.

19.15.2 Setting Quota Limits

Once you have configured your system to enable quotas, verify that they really are enabled. An easy way to do this is to run:

```
# quota -v
```

You should see a one line summary of disk usage and current quota limits for each file system that quotas are enabled on.

You are now ready to start assigning quota limits with the `edquota(8)` command.

You have several options on how to enforce limits on the amount of disk space a user or group may allocate, and how many files they may create. You may limit allocations based on disk space (block quotas) or number of files (inode quotas) or a combination of both. Each of these limits are further broken down into two categories: hard and soft limits.

A hard limit may not be exceeded. Once a user reaches his hard limit he may not make any further allocations on the file system in question. For example, if the user has a hard limit of 500 kbytes on a file system and is currently using

490 kbytes, the user can only allocate an additional 10 kbytes. Attempting to allocate an additional 11 kbytes will fail.

Soft limits, on the other hand, can be exceeded for a limited amount of time. This period of time is known as the grace period, which is one week by default. If a user stays over his or her soft limit longer than the grace period, the soft limit will turn into a hard limit and no further allocations will be allowed. When the user drops back below the soft limit, the grace period will be reset.

The following is an example of what you might see when you run the `edquota(8)` command. When the `edquota(8)` command is invoked, you are placed into the editor specified by the `EDITOR` environment variable, or in the `vi` editor if the `EDITOR` variable is not set, to allow you to edit the quota limits.

```
# edquota -u test

Quotas for user test:
/usr: kbytes in use: 65, limits (soft = 50, hard = 75)
      inodes in use: 7, limits (soft = 50, hard = 60)
/usr/var: kbytes in use: 0, limits (soft = 50, hard = 75)
          inodes in use: 0, limits (soft = 50, hard = 60)
```

You will normally see two lines for each file system that has quotas enabled. One line for the block limits, and one line for inode limits. Simply change the value you want updated to modify the quota limit. For example, to raise this user's block limit from a soft limit of 50 and a hard limit of 75 to a soft limit of 500 and a hard limit of 600, change:

```
/usr: kbytes in use: 65, limits (soft = 50, hard = 75)

to:

/usr: kbytes in use: 65, limits (soft = 500, hard = 600)
```

The new quota limits will be in place when you exit the editor.

Sometimes it is desirable to set quota limits on a range of UIDs. This can be done by use of the `-p` option on the `edquota(8)` command. First, assign the desired quota limit to a user, and then run `edquota -p protouser startuid-enduid`. For example, if user `test` has the desired quota limits, the following command can be used to duplicate those quota limits for UIDs 10,000 through 19,999:

```
# edquota -p test 10000-19999
```

For more information see `edquota(8)` manual page.

19.15.3 Checking Quota Limits and Disk Usage

You can use either the `quota(1)` or the `repquota(8)` commands to check quota limits and disk usage. The `quota(1)` command can be used to check individual user or group quotas and disk usage. A user may only examine his own quota, and the quota of a group he is a member of. Only the super-user may view all user and group quotas. The `repquota(8)` command can be used to get a summary of all quotas and disk usage for file systems with quotas enabled.

The following is some sample output from the `quota -v` command for a user that has quota limits on two file systems.

```
Disk quotas for user test (uid 1002):
  Filesystem  usage  quota  limit  grace  files  quota  limit  grace
```

/usr	65*	50	75	5days	7	50	60
/usr/var	0	50	75		0	50	60

On the /usr file system in the above example, this user is currently 15 kbytes over the soft limit of 50 kbytes and has 5 days of the grace period left. Note the asterisk * which indicates that the user is currently over his quota limit.

Normally file systems that the user is not using any disk space on will not show up in the output from the quota(1) command, even if he has a quota limit assigned for that file system. The -v option will display those file systems, such as the /usr/var file system in the above example.

19.15.4 Quotas over NFS

Quotas are enforced by the quota subsystem on the NFS server. The rpc.rquotad(8) daemon makes quota information available to the quota(1) command on NFS clients, allowing users on those machines to see their quota statistics.

Enable rpc.rquotad in /etc/inetd.conf like so:

```

rquotad/1      dgram rpc/udp wait root /usr/libexec/rpc.rquotad rpc.rquotad
    
```

Now restart inetd:

```

# kill -HUP `cat /var/run/inetd.pid`
    
```

19.16 Encrypting Disk Partitions

FreeBSD offers excellent online protections against unauthorized data access. File permissions and Mandatory Access Control (MAC) (see Αρχιτεκτονική 17) help prevent unauthorized third-parties from accessing data while the operating system is active and the computer is powered up. However, the permissions enforced by the operating system are irrelevant if an attacker has physical access to a computer and can simply move the computer's hard drive to another system to copy and analyze the sensitive data.

Regardless of how an attacker may have come into possession of a hard drive or powered-down computer, both **GEOM Based Disk Encryption (gbde)** and geli cryptographic subsystems in FreeBSD are able to protect the data on the computer's file systems against even highly-motivated attackers with significant resources. Unlike cumbersome encryption methods that encrypt only individual files, gbde and geli transparently encrypt entire file systems. No cleartext ever touches the hard drive's platter.

19.16.1 Disk Encryption with gbde

1. Become root

Configuring gbde requires super-user privileges.

```

% su -
Password:
    
```

2. Add gbde(4) Support to the Kernel Configuration File

Add the following line to the kernel configuration file:

```
options GEOM_BDE
```

Rebuild the kernel as described in Εἰσαγωγή 9.

Reboot into the new kernel.

3. An alternative to recompiling the kernel is to use `kldload` to load `gbde(4)`:

```
# kldload geom_bde
```

19.16.1.1 Preparing the Encrypted Hard Drive

The following example assumes that you are adding a new hard drive to your system that will hold a single encrypted partition. This partition will be mounted as `/private`. **gbde** can also be used to encrypt `/home` and `/var/mail`, but this requires more complex instructions which exceed the scope of this introduction.

1. Add the New Hard Drive

Install the new drive to the system as explained in Οἰκία 19.3. For the purposes of this example, a new hard drive partition has been added as `/dev/ad4s1c`. The `/dev/ad0s1*` devices represent existing standard FreeBSD partitions on the example system.

```
# ls /dev/ad*
/dev/ad0          /dev/ad0s1b      /dev/ad0s1e      /dev/ad4s1
/dev/ad0s1        /dev/ad0s1c      /dev/ad0s1f      /dev/ad4s1c
/dev/ad0s1a       /dev/ad0s1d      /dev/ad4
```

2. Create a Directory to Hold `gbde` Lock Files

```
# mkdir /etc/gbde
```

The **gbde** lock file contains information that **gbde** requires to access encrypted partitions. Without access to the lock file, **gbde** will not be able to decrypt the data contained in the encrypted partition without significant manual intervention which is not supported by the software. Each encrypted partition uses a separate lock file.

3. Initialize the `gbde` Partition

A **gbde** partition must be initialized before it can be used. This initialization needs to be performed only once:

```
# gbde init /dev/ad4s1c -i -L /etc/gbde/ad4s1c
```

`gbde(8)` will open your editor, permitting you to set various configuration options in a template. For use with UFS1 or UFS2, set the `sector_size` to 2048:

```
$FreeBSD: src/sbin/gbde/template.txt,v 1.1 2002/10/20 11:16:13 phk Exp $
#
# Sector size is the smallest unit of data which can be read or written.
# Making it too small decreases performance and decreases available space.
# Making it too large may prevent filesystems from working. 512 is the
# minimum and always safe. For UFS, use the fragment size
#
sector_size      =          2048
[...]
```

`gbde(8)` will ask you twice to type the passphrase that should be used to secure the data. The passphrase must be the same both times. **gbde**'s ability to protect your data depends entirely on the quality of the passphrase that you choose.¹

The `gbde init` command creates a lock file for your **gbde** partition that in this example is stored as `/etc/gbde/ad4s1c`.

Προσοχή: **gbde** lock files *must* be backed up together with the contents of any encrypted partitions. While deleting a lock file alone cannot prevent a determined attacker from decrypting a **gbde** partition, without the lock file, the legitimate owner will be unable to access the data on the encrypted partition without a significant amount of work that is totally unsupported by `gbde(8)` and its designer.

4. Attach the Encrypted Partition to the Kernel

```
# gbde attach /dev/ad4s1c -l /etc/gbde/ad4s1c
```

You will be asked to provide the passphrase that you selected during the initialization of the encrypted partition. The new encrypted device will show up in `/dev` as `/dev/device_name.bde`:

```
# ls /dev/ad*
/dev/ad0          /dev/ad0s1b      /dev/ad0s1e      /dev/ad4s1
/dev/ad0s1        /dev/ad0s1c      /dev/ad0s1f      /dev/ad4s1c
/dev/ad0s1a       /dev/ad0s1d      /dev/ad4          /dev/ad4s1c.bde
```

5. Create a File System on the Encrypted Device

Once the encrypted device has been attached to the kernel, you can create a file system on the device. To create a file system on the encrypted device, use `newfs(8)`. Since it is much faster to initialize a new UFS2 file system than it is to initialize the old UFS1 file system, using `newfs(8)` with the `-O2` option is recommended.

```
# newfs -U -O2 /dev/ad4s1c.bde
```

Προσοχή: The `newfs(8)` command must be performed on an attached **gbde** partition which is identified by a `*.bde` extension to the device name.

6. Mount the Encrypted Partition

Create a mount point for the encrypted file system.

```
# mkdir /private
```

Mount the encrypted file system.

```
# mount /dev/ad4s1c.bde /private
```

7. Verify That the Encrypted File System is Available

The encrypted file system should now be visible to `df(1)` and be available for use.

```
% df -H
Filesystem      Size  Used Avail Capacity  Mounted on
/dev/ad0s1a     1037M   72M   883M     8%    /
/devfs           1.0K   1.0K    0B   100%  /dev
/dev/ad0s1f     8.1G   55K   7.5G     0%   /home
/dev/ad0s1e     1037M  1.1M   953M     0%   /tmp
/dev/ad0s1d     6.1G  1.9G   3.7G    35%   /usr
/dev/ad4s1c.bde 150G   4.1K  138G     0%   /private
```

19.16.1.2 Mounting Existing Encrypted File Systems

After each boot, any encrypted file systems must be re-attached to the kernel, checked for errors, and mounted, before the file systems can be used. The required commands must be executed as user `root`.

1. Attach the `gbde` Partition to the Kernel

```
# gbde attach /dev/ad4s1c -l /etc/gbde/ad4s1c
```

You will be asked to provide the passphrase that you selected during initialization of the encrypted `gbde` partition.

2. Check the File System for Errors

Since encrypted file systems cannot yet be listed in `/etc/fstab` for automatic mounting, the file systems must be checked for errors by running `fsck(8)` manually before mounting.

```
# fsck -p -t ffs /dev/ad4s1c.bde
```

3. Mount the Encrypted File System

```
# mount /dev/ad4s1c.bde /private
```

The encrypted file system is now available for use.

19.16.1.2.1 Automatically Mounting Encrypted Partitions

It is possible to create a script to automatically attach, check, and mount an encrypted partition, but for security reasons the script should not contain the `gbde(8)` password. Instead, it is recommended that such scripts be run manually while providing the password via the console or `ssh(1)`.

As an alternative, an `rc.d` script is provided. Arguments for this script can be passed via `rc.conf(5)`, for example:

```
gbde_autoattach_all="YES"
gbde_devices="ad4s1c"
```

This will require that the `gbde` passphrase be entered at boot time. After typing the correct passphrase, the `gbde` encrypted partition will be mounted automatically. This can be very useful when using `gbde` on notebooks.

19.16.1.3 Cryptographic Protections Employed by `gbde`

`gbde(8)` encrypts the sector payload using 128-bit AES in CBC mode. Each sector on the disk is encrypted with a different AES key. For more information on `gbde`'s cryptographic design, including how the sector keys are derived from the user-supplied passphrase, see `gbde(4)`.

19.16.1.4 Compatibility Issues

`sysinstall(8)` is incompatible with `gbde`-encrypted devices. All `*.bde` devices must be detached from the kernel before starting `sysinstall(8)` or it will crash during its initial probing for devices. To detach the encrypted device used in our example, use the following command:

```
# gbde detach /dev/ad4s1c
```

Also note that, as `vinum(4)` does not use the `geom(4)` subsystem, you cannot use `gbde` with `vinum` volumes.

19.16.2 Disk Encryption with `geli`

A new cryptographic GEOM class is available as of FreeBSD 6.0 - `geli`. It is currently being developed by Pawel Jakub Dawidek <pj@d@FreeBSD.org>. `Geli` is different to `gbde`; it offers different features and uses a different scheme for doing cryptographic work.

The most important features of `geli(8)` are:

- Utilizes the `crypto(9)` framework — when cryptographic hardware is available, `geli` will use it automatically.
- Supports multiple cryptographic algorithms (currently AES, Blowfish, and 3DES).
- Allows the root partition to be encrypted. The passphrase used to access the encrypted root partition will be requested during the system boot.
- Allows the use of two independent keys (e.g. a “key” and a “company key”).
- `geli` is fast - performs simple sector-to-sector encryption.
- Allows backup and restore of Master Keys. When a user has to destroy his keys, it will be possible to get access to the data again by restoring keys from the backup.
- Allows to attach a disk with a random, one-time key — useful for swap partitions and temporary file systems.

More `geli` features can be found in the `geli(8)` manual page.

The next steps will describe how to enable support for `geli` in the FreeBSD kernel and will explain how to create a new `geli` encryption provider. At the end it will be demonstrated how to create an encrypted swap partition using features provided by `geli`.

In order to use `geli`, you must be running FreeBSD 6.0-RELEASE or later. Super-user privileges will be required since modifications to the kernel are necessary.

1. Adding `geli` Support to the Kernel Configuration File

Add the following lines to the kernel configuration file:

```
options GEOM_ELI
device crypto
```

Rebuild the kernel as described in Εἰσαγωγή 9.

Alternatively, the `geli` module can be loaded at boot time. Add the following line to the `/boot/loader.conf`:

```
geom_eli_load="YES"
```

`geli(8)` should now be supported by the kernel.

2. Generating the Master Key

The following example will describe how to generate a key file, which will be used as part of the Master Key for the encrypted provider mounted under `/private`. The key file will provide some random data used to encrypt the Master Key. The Master Key will be protected by a passphrase as well. Provider’s sector size will be 4kB big. Furthermore, the discussion will describe how to attach the `geli` provider, create a file system on it, how to mount it, how to work with it, and finally how to detach it.

It is recommended to use a bigger sector size (like 4kB) for better performance.

The Master Key will be protected with a passphrase and the data source for key file will be `/dev/random`. The sector size of `/dev/da2.eli`, which we call provider, will be 4kB.

```
# dd if=/dev/random of=/root/da2.key bs=64 count=1
# geli init -s 4096 -K /root/da2.key /dev/da2
Enter new passphrase:
Reenter new passphrase:
```

It is not mandatory that both a passphrase and a key file are used; either method of securing the Master Key can be used in isolation.

If key file is given as “-”, standard input will be used. This example shows how more than one key file can be used.

```
# cat keyfile1 keyfile2 keyfile3 | geli init -K - /dev/da2
```

3. Attaching the Provider with the generated Key

```
# geli attach -k /root/da2.key /dev/da2
Enter passphrase:
```

The new plaintext device will be named `/dev/da2.eli`.

```
# ls /dev/da2*
/dev/da2 /dev/da2.eli
```

4. Creating the new File System

```
# dd if=/dev/random of=/dev/da2.eli bs=1m
# newfs /dev/da2.eli
# mount /dev/da2.eli /private
```

The encrypted file system should be visible to `df(1)` and be available for use now.

```
# df -H
Filesystem      Size    Used Avail Capacity  Mounted on
/dev/ad0s1a     248M    89M   139M    38%    /
/devfs           1.0K    1.0K    0B   100%    /dev
/dev/ad0s1f     7.7G    2.3G    4.9G    32%    /usr
/dev/ad0s1d     989M    1.5M    909M     0%    /tmp
/dev/ad0s1e     3.9G    1.3G    2.3G    35%    /var
/dev/da2.eli    150G    4.1K   138G     0%    /private
```

5. Unmounting and Detaching the Provider

Once the work on the encrypted partition is done, and the `/private` partition is no longer needed, it is prudent to consider unmounting and detaching the `geli` encrypted partition from the kernel.

```
# umount /private
# geli detach da2.eli
```

More information about the use of `geli(8)` can be found in the manual page.

19.16.2.1 Using the `geli rc.d` Script

`geli` comes with a `rc.d` script which can be used to simplify the usage of `geli`. An example of configuring `geli` through `rc.conf(5)` follows:

```
geli_devices="da2"
geli_da2_flags="-p -k /root/da2.key"
```

This will configure `/dev/da2` as a `geli` provider of which the Master Key file is located in `/root/da2.key`, and `geli` will not use a passphrase when attaching the provider (note that this can only be used if `-P` was given during the `geli` init phase). The system will detach the `geli` provider from the kernel before the system shuts down.

More information about configuring `rc.d` is provided in the `rc.d` section of the Handbook.

19.17 Encrypting Swap Space

Swap encryption in FreeBSD is easy to configure and has been available since FreeBSD 5.3-RELEASE. Depending on which version of FreeBSD is being used, different options are available and configuration can vary slightly. From FreeBSD 6.0-RELEASE onwards, the `gbde(8)` or `geli(8)` encryption systems can be used for swap encryption. With earlier versions, only `gbde(8)` is available. Both systems use the `encswap rc.d` script.

The previous section, *Encrypting Disk Partitions*, includes a short discussion on the different encryption systems.

19.17.1 Why should Swap be Encrypted?

Like the encryption of disk partitions, encryption of swap space is done to protect sensitive information. Imagine an application that e.g. deals with passwords. As long as these passwords stay in physical memory, all is well. However, if the operating system starts swapping out memory pages to free space for other applications, the passwords may be written to the disk platters unencrypted and easy to retrieve for an adversary. Encrypting swap space can be a solution for this scenario.

19.17.2 Preparation

Όχιἀβῦός: For the remainder of this section, `ad0s1b` will be the swap partition.

Up to this point the swap has been unencrypted. It is possible that there are already passwords or other sensitive data on the disk platters in cleartext. To rectify this, the data on the swap partition should be overwritten with random garbage:

```
# dd if=/dev/random of=/dev/ad0s1b bs=1m
```

19.17.3 Swap Encryption with `gbde(8)`

If FreeBSD 6.0-RELEASE or newer is being used, the `.bde` suffix should be added to the device in the respective `/etc/fstab` swap line:

# Device	Mountpoint	FStype	Options	Dump	Pass#
<code>/dev/ad0s1b.bde</code>	<code>none</code>	<code>swap</code>	<code>sw</code>	<code>0</code>	<code>0</code>

For systems prior to FreeBSD 6.0-RELEASE, the following line in `/etc/rc.conf` is also needed:

```
gbde_swap_enable="YES"
```

19.17.4 Swap Encryption with geli(8)

Alternatively, the procedure for using geli(8) for swap encryption is similar to that of using gbde(8). The .eli suffix should be added to the device in the respective /etc/fstab swap line:

```
# Device          Mountpoint      FStype  Options      Dump    Pass#
/dev/ad0s1b.eli   none            swap    sw           0       0
```

geli(8) uses the AES algorithm with a key length of 256 bit by default.

Optionally, these defaults can be altered using the geli_swap_flags option in /etc/rc.conf. The following line tells the encswap rc.d script to create geli(8) swap partitions using the Blowfish algorithm with a key length of 128 bit, a sectorsize of 4 kilobytes and the “detach on last close” option set:

```
geli_swap_flags="-a blowfish -l 128 -s 4096 -d"
```

Please refer to the description of the onetime command in the geli(8) manual page for a list of possible options.

19.17.5 Verifying that it Works

Once the system has been rebooted, proper operation of the encrypted swap can be verified using the swapinfo command.

If gbde(8) is being used:

```
% swapinfo
Device          1K-blocks    Used    Avail Capacity
/dev/ad0s1b.bde  542720      0      542720    0%
```

If geli(8) is being used:

```
% swapinfo
Device          1K-blocks    Used    Avail Capacity
/dev/ad0s1b.eli  542720      0      542720    0%
```

Ὁδηγία

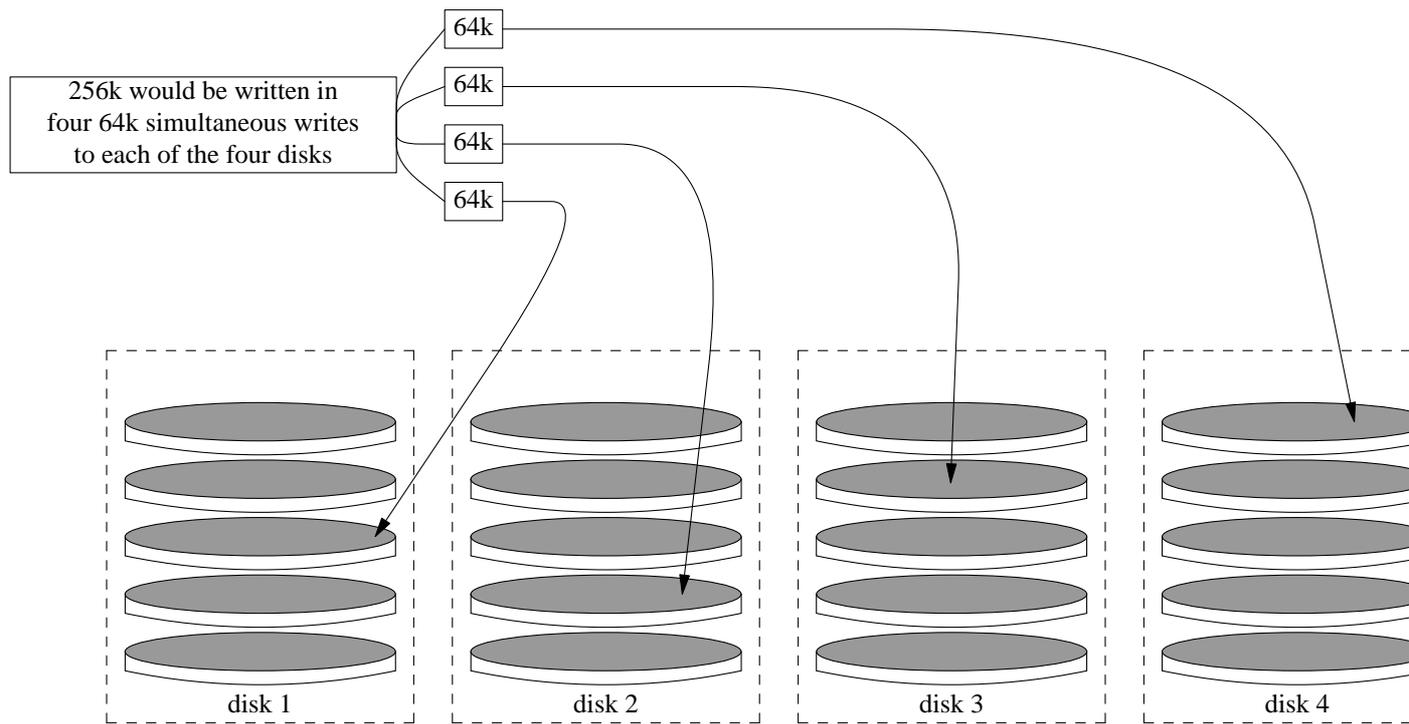
1. For tips on how to select a secure passphrase that is easy to remember, see the Diceware Passphrase (<http://world.std.com/~reinhold/diceware.html>) website.

20.3 RAID0 - Striping

Ὁ ὄστροπ ζαίει ἰά ἰγῆαιδ θῖσ ὄσῖαδ Ὑαε ἁεσῖιῖαδὲεῖγδ ὄσὲεῖγδ ἄβὲῖτδ ὄ ἰά ἰῖῖῖῖῖ ἕῖῖῖ ὄῖῖ. Ὁ ἄῖῖῖῖ ἄῖῖῖῖῖῖῖῖ, ἄδὸ ἄῖῖῖῖ ἰ ὄῖ ἄῖῖῖῖ ἄῖῖῖῖῖῖῖῖῖ ὄῖῖῖ (ἁεῖῖῖῖ). Ὁ ὄῖῖῖῖῖῖ ἄβὲῖῖ GEOM ἄῖῖῖ - ἁε ὄῖῖῖῖῖῖῖ ἰ γὸ ἕῖῖῖῖῖῖ ἁεῖ ὄ ἁεῖῖῖῖῖ RAID0, ῖ ἰῖῖῖ ἄῖῖῖ ἄῖῖῖῖ ἁε ὄ ὄῖῖῖῖῖ.

Ὁ ἰά ὄῖῖῖῖ RAID0, ὄ ἄῖῖῖ ἰ ἁῖῖῖῖῖῖ ὄ ἁῖῖῖ ὄ ἰῖῖῖ ἁῖῖῖῖῖῖ ὄῖῖῖῖῖ ὄ ἁῖῖῖ ὄῖῖῖ ἄβὲῖῖ ὄῖῖ ἄῖῖῖῖῖῖ ὄ ὄῖῖῖῖῖῖ. Ἀῖῖῖ ἰ ἁῖῖῖῖῖῖ ἰ ἄῖῖῖῖῖῖ ὄ ὄῖῖῖῖῖ ἰ ἁῖῖῖῖῖῖ 256k ἄῖῖῖῖῖῖ ὄ ἰ ἁῖῖῖῖῖῖ, ἰ ὄῖῖῖῖῖῖ RAID0 ἰῖῖῖῖ ἰ ἁῖῖῖῖῖ ὄῖῖῖ ἰ ἁῖῖῖ 64k ὄ ἁε ἰ ἁῖῖ ἄῖῖ ὄῖῖ ὄ ἰῖῖῖῖῖ ἄβὲῖῖῖῖ ἰ ὄῖῖ ὄῖῖῖῖῖῖῖῖ, ὄ ῖῖῖῖῖῖ ἰῖῖῖῖῖ ἰῖῖῖ ἁῖῖῖῖῖῖῖ ἄῖῖῖῖῖῖ/ἁῖῖῖῖῖῖ (I/O). ῖ ἄῖῖῖῖῖῖ ἄῖῖῖ ἰῖῖῖῖῖ ἰ ἄῖῖῖῖῖῖ ἄῖῖῖῖῖῖῖῖ, ἰ ὄ ἁῖῖῖῖ ὄῖῖῖῖῖῖῖ ἁεῖῖῖῖῖ ἄβὲῖῖ.

Ἐῖῖῖ ἄβὲῖῖ ὄ ἰ ἰ ἁῖῖῖ stripe RAID0 ἄῖῖῖῖῖ ἰ ἁῖῖῖ ὄῖῖ ἁεῖῖῖ ἰ ἁῖῖῖῖῖ, ἁεῖῖ ἰ ἁεῖῖῖῖῖ I/O ἰῖῖῖῖῖῖ ἁῖῖῖῖῖῖ ἁῖῖῖ ὄῖ ἁῖῖῖῖ ὄῖ ἁῖῖῖῖῖῖ, ὄ ὄῖῖῖῖῖ ἄῖῖῖῖῖῖῖ ἄβὲῖῖῖῖῖ.



Ἀῖῖῖῖῖῖῖ Stripe ἄῖῖ ἰ ἁεῖῖῖῖῖῖῖῖῖ ἰῖῖῖῖῖῖ Ἀῖῖῖῖῖῖῖῖῖ

1. Ὁῖῖῖῖῖ ὄῖ Ὑῖῖῖῖῖῖ ἁεῖῖῖῖῖ geom_stripe.ko:


```
# kldload geom_stripe
```
2. Ἀῖῖῖῖῖῖῖῖ ἁῖῖ ὄῖῖῖῖ - ἁε ἁεῖῖῖῖῖ ὄῖῖῖῖ ὄῖῖῖῖῖῖῖ. Ἀῖ ἰ ὄῖῖῖ ὄῖῖῖῖῖῖ ἰ ἁῖῖῖ ἁεῖῖῖῖῖῖῖῖ root, ὄῖῖῖῖῖῖῖῖ ὄῖ ὄῖῖῖῖῖῖῖ ὄ ἁῖῖῖῖῖῖ ὄῖ ἁῖῖῖῖῖῖῖ ὄῖῖῖῖῖῖῖῖ, ἁῖῖῖ ὄῖ /mnt:


```
# mkdir /mnt
```
3. Ἐῖῖῖῖῖῖ ὄ ἰῖῖῖῖ ὄῖ ὄῖῖῖῖῖῖ ἁεῖ ὄῖῖ ἄβὲῖῖῖῖ ὄῖῖ ὄῖῖῖῖῖῖῖ ἰ ἁῖῖῖῖ stripe, ἁεῖ ἁῖῖῖῖῖῖῖῖ ὄ ἰ ὄῖῖῖῖ stripe. Ἀεῖ ἄῖῖῖῖῖῖῖῖ, ἁεῖ ἰ ἁῖῖῖῖῖῖῖῖ ἰῖῖῖ stripe ἁῖῖ ἁῖῖ ἁῖῖ ἁῖῖῖῖῖῖῖῖῖ ἁεῖ ἁῖῖῖῖ ἁεῖῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖῖ ATA, ἁῖῖῖ ὄ. ὄῖῖῖ /dev/ad2 ἁεῖ /dev/ad3:


```
# gstripe label -v st0 /dev/ad2 /dev/ad3
```

Metadata value stored on /dev/ad2.

Metadata value stored on /dev/ad3.
Done.

- 4. ΆñŪðå Ýία óððιέçιÝñ label (ðβίαέα έάóάòìΠóåñì) óðι íÝì òììì, έάέ ååέάóάóðΠóå òìì ðñìάðέέåñìÝñ έβåέå åέέβίçóçð (bootstrap):

```
# bsdlabel -wB /dev/strip/st0
```

- 5. Ç åέååέέάóβå áððΠ έå ççιέιòñåΠóåέ óç óðóέåðΠ st0, έåέðð έάέ åýì åέùìå óðóέåðÝð óðìì έάóŪέιñì /dev/strip. Ìέ óðóέåðÝð áððÝð έå ììŪæìíðåέ st0a έάέ st0c. Óðì óçìåβì áððù, ìðñìåðåð ðέÝñì íå ççιέιòñåΠóåå óýóóçìå åñ÷åβùì óðç óðóέåðΠ st0a ÷ñçóέììðιέβìóåð òì åñççóέέέ ðñìåñåñìåå newfs:

```
# newfs -U /dev/strip/st0a
```

Έå ååβðå ìέå ìåŪέç óåñŪ åñέèìβì íå ðåñìŪ åñΠåìñå áðù óçì ìέùìç óåð, έάέ ìåðŪ áðù έβåå ååððåñìùέåððå ç åέååέέάóβå έå Ý÷åέ ìέèέçñùέåβ. Ì òìììð έå Ý÷åέ ççιέιòñåçέåβ έάέ έå åβìåέ Ýðιέììð åέå ðñìŪŪñðçóç.

Άέå íå ðñìŪåñðΠóåðå ÷åέñìέβίçóå òì stripe ðìð ççιέιòñåΠóåðå:

```
# mount /dev/strip/st0a /mnt
```

Άέå íå åβìåðåέ áððùìåðå ç ðñìŪŪñðçóç áððìý òìð óðóðΠìåðìð åñ÷åβùì έάóŪ óçì åέååέέάóβå åέέβίçóçð, òìðìέåðΠóåð óέð ðέçñìŪñåð ðìð òìììð óðì åñ÷åβì /etc/fstab. Άέå òì óέìðù áððù, ççιέιòñåñìåå Ýία ìùέέì óçìåβì ðñìŪŪñðçóçð, òì stripe:

```
# mkdir /stripe
# echo "/dev/strip/st0a /stripe ufs rw 2 2" \
  >> /etc/fstab
```

Óì Ūñèñùìå geom_stripe.ko έå ðñÝðåέ íå òìðβìåðåέ áððùìåðå έáóŪ óçì åέέβίçóç ðìð óðóðΠìåðìð. ΆέðåέÝððå óçì ðåñåέŪðù åìðìέΠ, åέå íå ðñìŪέÝóåðå óçì έáóŪέέççç ñýèìέçç óðì /boot/loader.conf:

```
# echo 'geom_stripe_load="YES"' >> /boot/loader.conf
```

20.4 RAID1 - Mirroring

Óì mirroring (έåέñåðéóìùð) åβìåέ ìέå òå÷ñέñåβå ðìð ÷ñçóέììðιέåβðåέ áðù ðìέέÝð åðåέñåð έάέ ìέέέåέìýð ÷ñΠóðåð åέå íå áóóåέβóìòì òå åååñÝία òìðð ÷ññβð åέåέìðÝð. Óå ìέå åέŪðåìç mirror, ì åβóέìð Å åβìåέ áðέðð Ýία ðέβñåð åìðñåñåñì òìð åβóέìð Á. ¹ ìðñìåβ ìέ åβóέìέ Å+Å íå åβìåέ åìðñåñåñå òùì åβóέùì A+B. ¶ó÷åðå ìå óçì åέñέåΠ åέŪðåìç òùì åβóέùì, òì óçìåìðέέù åβìåέ ìðέ ìέ ðέçñìŪñåð åìùð åβóέìð Π ìέåð έáóŪðìççóçð åìðέåñŪñìðåέ òå Ūέέìðð. Ìέ ðέçñìŪñåð áððÝð ìðñìåβ åñåùðåñå íå áðìέåðåðåðåìýì ìå åýέìέì òñùðì, Π íå åìðέåñåñåñì ÷ññβð íå ðñìέççέåβ åέåέìðΠ óðéð ððçñìåðåð òìð ìç÷åβìðð Π óðçì ðñùóååççç òùì åååñÝñì. Ìðììýì åέùìå έάέ íå ìåðåðåñìέýì έάέ íå òðέå÷έìýì óå Ūέέì, áóóåέÝð ìÝñìð.

Άέå íå ìåέέìΠóåðåðå, ååååέùέåβðå ìðέ òì óýóóçìå óåð Ý÷åέ åýì ðέççñìýð åβóέìðð βåέìð ìåÝέìðð. Óðå ðåñåååβåìåðå ìåð ååñìñìåå ìðέ ìέ åβóέìέ åβìåέ óýðìð SCSI (åðåðέåβåð ðñùóååçççð, da(4)).

20.4.1 Mirroring óðìðð Ååóέέìýð Άβóέìðð

ÓðìέÝððìðåð ìðέ òì FreeBSD Ý÷åέ ååέåðåðåðåέåβ óðì ðñðòì åβóέì da0, έå ðñÝðåέ íå ñðèìβóåðå òì gmirror(8) íå áðìέççåýóåέ åέåβ òå ååóέέŪ åååñÝία òìð.


```
# Device          Mountpoint  FStype  Options  Dump  Pass#
/dev/mirror/gm0slb  none        swap    sw       0     0
/dev/mirror/gm0sla  /           ufs     rw       1     1
/dev/mirror/gm0sld  /usr        ufs     rw       0     0
/dev/mirror/gm0slf  /home       ufs     rw       2     2
#/dev/mirror/gm0s2d /store      ufs     rw       2     2
/dev/mirror/gm0sle  /var        ufs     rw       2     2
/dev/acd0           /cdrom      cd9660  ro,noauto 0     0
```

Άðáíáέέέíβóðά ðí óýóççιά:

```
# shutdown -r now
```

ΕὰòÛ ðçí άέέβίççòç ðíð ððóðβιάðíð, εά ðñÝðáέ ðεÝíí íá ÷ñçóέíðíεάβóáέ ç ððóέάðβ gm0 áíðβ áέά ðçí da0. ÌáòÛ ðí ðÝεíð ðçð άέέβίççòç, ìðñάβóá íá άεÝáíáðá ùέé ùεά εάέóíðñáíýí ðúóðÛ, áíáðÛεííóáð ðçí Ýíñáí ðçð áíðíεβð mount:

```
# mount
Filesystem      1K-blocks  Used    Avail Capacity  Mounted on
/dev/mirror/gm0sla  1012974  224604  707334    24%  /
devfs            1          1         0    100%  /dev
/dev/mirror/gm0slf 45970182  28596  42263972    0%  /home
/dev/mirror/gm0sld 6090094 1348356 4254532    24%  /usr
/dev/mirror/gm0sle 3045006 2241420 559986     80%  /var
devfs            1          1         0    100%  /var/named/dev
```

Ç Ýíñáíð ðάβíáðáέ ðúóðβ, ùððò áíáíáíúóάí. ÓáέέέÛ, áέά íá ìáέέíβóáέ í ððá÷ñíέóíùð, áέóÛááðá εάέ ðçí ððóέάðβ da1 ðóí mirror, ÷ñçóέíðíεβíóáð ðçí áέüεíðεç áíðíεβ:

```
# gmirror insert gm0 /dev/da1
```

ΕὰòÛ ðç áεÛñεάέá ðíð ððá÷ñíέóíý ðíð mirror, ìðñάβóá íá ááβóá ðçí ðññíáí ðçð áεάάέέάóβáð ìá ðçí ðáñáέÛòù áíðíεβ:

```
# gmirror status
```

ÌáòÛ ðí ðÝεíð ðçð áüñçóçð ðíð mirror, εάέ áóíý Ý ÷íðí ððá÷ñíέóáβ ùεά ðá áááñÝíá, ç Ýíñáíð ðçð ðáñáðÛíù áíðíεβð εά ìíέÛáέé ìá ðçí áέüεíðεç:

```
      Name      Status  Components
mirror/gm0  COMPLETE  da0
                                     da1
```

Άí ððÛñ÷íðí ðñíáεβιάðá, β áí ðí mirror áñβóέáðáέ áέüíá ðóç áεάάέέάóβá ððá÷ñíέóíý, ðí ðáñÛááέáíá εά ááβ÷íáέ DEGRADED áíðβ áέά COMPLETE.

20.4.2 Άíðέíáðβðέóç ðñíáέçìÛòùí

20.4.2.1 Õí óýóççιά áñíáβóáέ íá ìáέέíβóáέ

Άí ðí óýóççιά ðáð ðóáíáðÛáέ ðá ìεά ðñíðñíðβ ðíð ìíέÛáέé ìá ðçí ðáñáέÛòù:

```
ffs_mountroot: can't find rootvp
```


Άέά ίά αέαιίενὔόάά αóðP ός óóéαòP, ááááέὺéáβáά ùóé ááι άβίάé ðñíóáñόçìÝίç ός áááñÝίç óóéαìP, éáé ίáέéíPóáά όì ááβìííá áíðóçñáòçòð gated(8):

```
# gated
```

Άέά ίά ðñíóáñóPóáάά όçí óóéαòP óóì ίç-ὔίçíá ðáèὔóç, -ñçóéìðíéPóáά όéð áéùéìòéàð áíòíèÝò:

```
# ggatec create -o rw 192.168.1.1 /dev/da0s4d  
ggate0  
# mount /dev/ggate0 /mnt
```

Άðù ááþ éáé óóì áíPð, ìðìñáβάά ίά Ý ÷ ááά ðñíóáάόç óòç óóéαòP ÿÝóù όìò óçìáβìò ðñíóὔñóççòð /mnt.

Όçìáβúç: ÐñÝðáé ίά όìéόóáβ ùóé ç áéááééáóáá éá áðíóý-áé áí ç óóéαòP άβίáé όç áááñÝίç óóéαìP ðñíóáñόçìÝίç, áβáά óóìí áíðóçñáòçòð, áβáά όá ïðíéíáPðíòá ὔééì ððíéíáéóóð όóì áβéðòí.

¼óáí ááí ÷ ñáéὔæáóáά ðèÝíí όç óóéαòP, ìðìñáβάά ίά όçí áðíðñíóáñóPóáάά ïá áóóὔéáéá, ÷ ñçóéìðíéPóáάά όçí áíòíèP umount(8), ùðùð áβíáóáé éáé ïá ïðíéááPðíòá ὔéèç óóéαòP áβóèì.

20.6 ÄçìéìñāPíóáò ÁóééÝóáò (Labels) óóéò ÓóóéáòÝò Άβóéὺι

Έáóὔ όç áéὔñéáéá όçð áñ-ééìðíççòçð, óóçí áééβίççόç όìò óóóðPíáóìò, ï ðöñPíáð όìò FreeBSD éá äçìéìñāPóáé óá áðáñáβóçóá áñ-áβá áéá éὔéá óóéαòP ðìò áíé-íáýáé. ΆóðP ç ÿÝèìò áíβ-íáðóççò óóéαòþí, ìðìñáβ ίά äçìéìñāPóáé ðñíæPíáóá. Άέά ðáñὔááéáìá, óé éá áβíáé áí ðñíóéÝóíðíá Ýíá íÝì áβóèì USB; Άβίáé áñéáðὔ ðééáíü íéá óóéαòP ïíPìçð flash ίá ðὔñáé óì ùññá ðá0 éáé ç áñ-éèP ðá1 ίá ïáðáééíçèáβ όóì ðá1. Άðú éá ðñíéáéÝóáé ðñíæPíáóá όççí ðñíóὔñóççòçð ðùí óóóóçìὔóùí áñ-áβùí, áí ððὔñ-íøí íé áíðóóéé-áð éáðá-ùñβóáéð όìòð óóì /etc/fstab, éáé ìðìñáβ áéùíá éáé ίá ðáñáìðíæβóáé όçí éáñíéèP áééβίççόç όìò óóóðPíáóìò.

Íéá éýóç áβíáé ίá ñðéìβáóáά όéð óóéαòÝð SCSI ïá ðÝòíéí ðñúðí, þóðá ç áñβéìççόç óìòð ίá áβíáé óóíá-ùíáíç. þóé, éὔéá óìñὔ ðìò ðñíóéÝóáάá íéá íÝá óóéαòP óóìí áéááèðP SCSI éá áβóáά óβáñòñìò ùóé éá éὔááé áñéèìü ðìò ááí Ý-áé ÷ ñçóéìðíéçèáβ. Áéèὔ ðé áβíáóáé ïá óéð óóéαòÝð USB ðìò ìðìñáβ ίá áíóééáóáóóPóíòí óìí éýñéí SCSI áβóèì; Άóðú ìðìñáβ ðñὔáíáóé ίá óóìááβ, éáèþð íé óóéαòÝð USB áíé-íáýííóáé éáðὔ áὔóç ðñéí áðù óìí áéááèðP SCSI. Íéá éýóç áβíáé ίá áὔæáðá όéð óóéαòÝð áðóÝð ïùíí ìáðὔ όççí áééβίççόç óìò óóóðPíáóìò. Íéá ὔéèç ÿÝèìò áβíáé ίá ÷ ñçóéìðíéáβáá ïùñí íéá óóéαòP óýðìò ATA éáé ίá íçí éáðá-ùñáβáά ðìòÝ óìòð áβóèìòð SCSI óóì /etc/fstab.

Όðὔñ-áé ùóóúóí éáéýðáñç éýóç. × ñçóéìðíéPíóáð óìí áíççòçóééù ðñúáñáìá glabel, Ýíáð áéá-áéñéóóðð P ÷ ñPóççð, ìðìñáβ ίá áðíæþóáé áðééÝóáð óóéð óóéαòÝð áβóéì éáé ίá óéð ÷ ñçóéìðíéPóáé óóì /etc/fstab, áíðóβ áéá óá óóìááóéèὔ ïñúíáóá óóéαòþí. ΆðáéäP ç glabel áðíèçéáýáé όççí áðééÝóá όóìí óáéáðóáβì ðñÝá óìò éὔéá ðáñí-Ýá (óóéαòðð áβóèì), ç áðééÝóá áéáóçñáβóáé éáé ìáðὔ áðù όççí áðáíáééβίççόç óìò óóóðPíáóìò.

× ñçóéìðíéPíóáð áóðP όççí áðééÝóá ùò ùññá óóéαòPð, éá ìðìñáβáά ίá ðñíóáñóPóáάá ðὔíóá όì óýóóçíá áñ-áβùí, ὔó-ááá ïá όì ðñáñíáóééù ùññá óóéαòPð ðìò Ý-áé áðíæèáβ óóì áβóèì.

Όçìáβúç: Άáí ÷ ñáéὔæáóáé óóééèὔ ίá óìíβóíòíá ùóé áððP ç áðééÝóá éá ðñÝðáé ίá áβíáé ïùíéìç. Όì áíççòçóééù ðñúáñáìá glabel ìðìñáβ ίá äçìéìñāPóáé óúóìí ïùíéìáð óúí éáé ðñíóùñéíÝò áðééÝóáð. ïùñí íé ïùíéìáð áðééÝóáð áéáóçñíýíóáé áíÝðááð ìáðὔ áðù íéá áðáíáééβίççόç. Άáβáά όç óáèβáá manual όçð glabel(8) áéá ðáñéóóúóáñáð ðéçñíòíñβáð ó-áðééèὔ ïá óá áβäç ðùí áðééáðþí.

20.6.1 Ἄβäç Ἀóέέάòβι έάέ Ḑάνάääβäìάóá

Ὀδὺñ÷ιòι äγì óýðιέ áóέέάòβι, ç äáιέèβ ἄóέέÝóá έάέ ç ἄóέέÝóá óðóðβιáðιò äñ÷áβυì. Ἰέ ἄóέέÝóáð ìðìñáβ íá äβíáέ ðñιòυñέíÝð β ìιέíιáð. Ἰέ ìιέíιáð ἄóέέÝóáð ìðìñιýí íá äçιέíòñäçέíιýí ìá óéð áíðιέÝð tunefs(8) β newfs(8). Óðçí ðáñβðòυóç áðòβ, έá äçιέíòñäçέíιýí óá Ἰίá ððιέáðὺέíäι ðιò /dev. Ἄέá ðáñὺááέäìá, íέ ἄóέέÝóáð óðóέάòβι ìá óýóðçíá äñ÷áβυì UFS2, έá äçιέíòñäçέíιýí óòιí έáðὺέíäι /dev/ufs. Ἰιέíιáð ἄóέέÝóáð ìðìñιýí äðβóçð íá äçιέíòñäçέíιýí ìá ðñβóç óçð áíðιέèð ç label label. Ἰέ ἄóέέÝóáð áðóÝð äáí áíáñòβιíóáέ áðυ ðι óýóðçíá äñ÷áβυì, έάέ äçιέíòñäçιέííóáέ óòιí έáðὺέíäι /dev/label.

Ἰέ ἄóέέÝóáð ðñιòυñέíιý óýðιò, ð ὺñιíóáέ óá èὺέá äðáíáέέβιçóç ðιò óðóðβιáðιò. Ἰέ ἄóέέÝóáð áðóÝð äçιέíòñäçιέííóáέ óòιí έáðὺέíäι /dev/label έάέ äβíáέ óÝέáέáð áέá ðáέñáíáíóέóιíýð. Ἰðìñáβðá íá äçιέíòñäçιέííóáð ðñιòυñέíÝð ἄóέέÝóáð ìá óçí áíðιέèβ ç label create. Ἄέá ðáñέóóυðäñáð ðççñιòιñβáð, áέááὺóáð óç óáέβäá manual óçð ç label(8).

Ἄέá íá äçιέíòñäçιέííóáð íέá ìιέíιç ἄóέέÝóáð áέá Ἰίá óýóðçíá äñ÷áβυì UFS2, ð ùñβð íá έáðáóðñÝðáðá ðá äááñ Ἰίá ðιò ðáñέÝ÷áέ, ð ñçóέíιðιέèβðáð óçí áέυέíðèç áíðιέèβ:

```
# tunefs -L home /dev/da3
```

ðñιέáέìðιβçóç: Ἀí ðι óýóðçíá äñ÷áβυì äβíáέ äáìὺðι, ç ðáñáðὺì ìáíðιέèβ ìðìñáβ íá ðñιέáέÝóáέ έáðáóðñιòβ äááñÝιú. ὺðóυóι, áí ðι óýóðçíá äñ÷áβυì äβíáέ äáìὺðι, óðυ÷ιò óáð έá ðñÝðáέ íá äβíáέ íá áέááñὺðáðá ðá äñ÷áβä ðιò äáí ðñçóέíιðιέíιýíóáέ, έáέ ù÷έ íá ðñιòέÝóáðá ἄóέέÝóáð.

Ἐá ðñÝðáέ ðβñá íá ððὺñ÷áέ íέá ἄóέέÝóáð óòιí έáðὺέíäι /dev/ufs ç ìðιβá ìðìñáβ íá ðñιòóáέáβ óòι /etc/fstab:

```
/dev/ufs/home /home ufs rw 2 2
```

Óçíáβυóç: Ὀι óýóðçíá äñ÷áβυì äáí ðñÝðáέ íá äβíáέ ðñιòáñçιýíí έáέðð áέðáέáβðá óçí áíðιέèβ tunefs.

Ἰðìñáβðá ðβñá íá ðñιòáñðβóáðá ðι óýóðçíá äñ÷áβυì ìá ðι óðιèç ðñυðι:

```
# mount /home
```

Ἄðυ äáβ έáέ ðÝñá, έáέ υòι ðι ὺñέñυìá geom_label.ko ðιñðβιáðáέ óòιí ððñβíá ìÝóυ ðιò /boot/loader.conf β áóυóιí Ἰ÷áðá áὺέáέ óçí áðέέíäβ GEOM_LABEL óòιí ððñβíá óáð, áέυìá έáέ áí ðι υñíá óçð óðóέáðβð áέέὺíáέ, äáí έá Ἰ÷áέ έáíέὺ äðóíáíβ äðβáñáóç óòι óýóðçíá óáð.

Ἰðìñáβðá äðβóçð íá äçιέíòñäçιέííóáð óðóðβιáðá äñ÷áβυì ìá ðñιáðέέäáíÝιç ἄóέέÝóáð, ð ñçóέíιðιέèβíóáð óçí áðέέíäβ -L óðçí áíðιέèβ newfs. Ἄáβðá óçí óáέβäá manual ðιò newfs(8) áέá ðáñέóóυðäñáð ðççñιòιñβáð.

Ἰðìñáβðá íá ðñçóέíιðιέèβðáðá óçí ðáñáέὺðυ áíðιέèβ áέá íá έáðáóðñÝðáðá íέá ἄóέέÝóáð:

```
# glabel destroy home
```

Ὀι áðυìáí ðáñὺááέäìá äáβ÷íáέ ðυð ìðìñιýí íá äιέíιýí ἄóέέÝóáð óðéð έáðáóιβóáέð ðιò äβóέιò áέέβιçóçð.

ðáñὺááέäìá 20-1. Ἀçιέíòñäçιέííóá Ἀóέέάòβι óéðέ έáðáóιβóáέð ðιò Ἄβóέιò Ἀέέβιçóçð

Ἀçιέíòñäçιέííóáð ìιέíιáð ἄóέέÝóáð óðéð έáðáóιβóáέð ðιò äβóέιò áέέβιçóçð, ðι óýóðçíá óáð έá óíá÷βóáέ íá áέέέíáβ έáñιέέὺ áέυìá έáέ áí ìáðáóÝñáðá ðι äβóέι óá ὺέέí áέááέðβ β áέυìá έáέ óá áέáðιñáðéèυ óýóðçíá. Óòι ðáñὺááέäìá ìáð,


```
/dev/ufsuid/486b6fc38d330916 /var ufs rw 2 2
/dev/ufsuid/486b6fc16926168e /usr ufs rw 2 2
```

Ἰδιδέαβδιδόα έάδὺδιδός έάέέΎδάέ άάάάυñέóδóέέυι ufsuid ιδιδίñάβ ίά δñιδόάνδóçέάβ ίά όιδί βάέιδ όñυδιδ, ÷ ùñβδ ίά όδὺñ ÷ έέ δέΎιδ άίΎάέç ίά άçιδιδόñάçέάβ ίυιδέç άδóέέΎόά ÷ έέñιδέβιδóά. Ç δñιδόΎñδóç ίΎόυ άδóέέΎόάδ ufsuid, δάνΎ ÷ έέ όιδ δέάιδΎέδçιά όçδ άίάίάñδóçβάδ άδύ όιδ υñίά óδóέάδδδ, όιδ ιδιδίβιδ δάνΎ ÷ ιδιδί έάέ ιδέ ίυιδέίάδ άδóέέΎόάδ.

20.7 UFS Journaling ἸΎόυ GEOM

Ὀδçι Ύέαιός 7.0 όιδ FreeBSD δειδιδέαβδóά έάέ δñδóç όññὺ ç ιΎά (έάέ άδύ δειδιδό άίάίάίυάιδç) άδιδόυδóδά έάέ ÷ ñδóç çιδιδιδιδιδιδό (journal) όιδ όýóδçιά άñ ÷ άβυιδ. Ç δειδιδιδóç δάνΎ ÷ άδóάέ ιΎόυ όιδ όδιδόóδδδιδιδιδό GEOM έάέ ιδιδίñάβ ίά ñδιδέóδάβ άýέιδέα ιΎόυ όιδ άιδçέçóέέιδý δñιδάñὺιδιδιδό gjournal(8).

Ὀέ άβιδάέ όιδ journaling; Ὀιδ journaling άδιδέçέάýάέ όά Ύία άñ ÷ άβιδ έάόάάñάδδδ (log, çιδιδιδιδιδιδέ, δδ άδδδδ journal) όέδ όδιδέέάάΎδ όιδ óδóδδιδιδιδό άñ ÷ άβυιδ. δάνὺάάέάιδά όδιδέέάάδδ άβιδάέ ιδέ άέέάάΎδ όιδ άδάέόιδýίόάέ έάέ ίέα δδδδç έάέάέέάόβá άάάñάδδδ όδιδ άβóέιδ. ρóέ, όδιδ log άδιδέçέάýιδιδόάέ ιδέ άέέάάΎδ όδά ίάόά-άάάñΎία (meta-data) έάέ όδά βάέα όά άñ ÷ άβá, δñέιδ άβιδάέ ç όάέέέδ (έάñιδέέδ) άδιδδδδóç όιδόδ όδιδ άβóέιδ. Ὀιδ άñ ÷ άβιδ έάόάάñάδδδ ιδιδίñάβ άñάυόάñά ίά ίάιδá ÷ ñçóέιδιδιδέçέάβ βδóά ç όδιδέέάάδ ίά άβιδάέ άδύ όçι άñ ÷ δ, άιδάόάέβειιδόάδ ίά άδóυ όιδ όñυδιδ υδóέ όιδ όýóδçιά άñ ÷ άβυιδ έά δάνάιδάβιδάέ όά óδάέñδ έάόδὺδóάç.

δñυέάέόάέ ιδóέάόδóέέὺ έάέ ίέα άέυιδά ιΎέιδά δñιδóέάιδç άδύ άδδδδέάά άάάñΎιδυ έάέ άóιδΎδάέάδ όδιδ όýóδçιά άñ ÷ άβυιδ. Ὀά άιδβέάόç ίά όά Soft Updates όά ιδιδίβá άιδιδδβειιδόιδ έάέ όδιδ ÷ ñάβδιδόιδ όçι Ύιδόç άάάñάδδδ όυιδ ίάόά-άάάñΎιδυ, έάέ όυιδ óδιδέιδιδóδυδιδ (Snapshots) όά ιδιδίβá άβιδάέ άέέυιδάδ όιδ óδóδδιδιδιδό άñ ÷ άβυιδ όά ίέα άάάñΎιδç óδέάδδ, όιδ log άδιδέçέάýάδάέ όά ÷ ññιδόδ Ύ ÷ έέ έέ ÷ ùñçέάβ άέέέέὺ έάέ άóδύ όιδ όέιδυ, έάέ όά ίάñέέΎδ δάνέδδδρóaέδ ιδιδίñάβ ίά άδιδέçέάýάδάέ όά άιδάέδδ άέάόιδάδóέέυιδ άβóέιδ.

Ὀά άιδβέάόç ίά δειδιδιδέδδάέδ journaling όά Ύέέα óδóδδιδιδιδό άñ ÷ άβυιδ, ç ιΎέιδιδό gjournal άάóβáέόάέ όά blocks, έάέ άάιδ δειδιδιδέαβδóάέ υδó ιΎñιδ όιδ óδóδδιδιδιδό άñ ÷ άβυιδ, άέέὺ ίυιδ υδó άδΎέδóάç όιδ GEOM.

Ἄέα άίάñάιδιδιδóç όçδ όδιδιδóδδñέιδçδ gjournal, έά δñΎδάέ ίά όδὺñ ÷ έέ ç δάνάέὺδύδ άδέέιδάδ όδιδ δδñδιδά όιδ FreeBSD. Ç άδέέιδάδ άδóδδ όδὺñ ÷ έέ άδύ δñιδάδέέιδάδ όçι Ύέαιός 7.0 έάέ υέάδ όέδ ίάυδóάñάδ άέάυόάέδ όιδ FreeBSD.

```
options UFS_GJOURNAL
```

Άιδ ÷ ñάέὺάάόάέ ίά δñιδόάνδδδιδιδόάέ όυιδέέ ίά journaling έάόδὺ όçι άέέβιδóç, έά δñΎδάέ άδδóçδ ίά όιδδδδιδιδόάέ άδóυιδάόά έάέ όιδ Ύñέñυιδά δδñδιδά geom_journal.ko. Ἄέα όιδ όέιδυ άóδύ, δñιδóέΎόά όçι δάνάέὺδύδ άñάιδδ όδιδ άñ ÷ άβιδ /boot/loader.conf:

```
geom_journal_load="YES"
```

Άιδέέάέόέέέὺ, ç έάέόιδόñάβá άδóδδ ιδιδίñάβ ίά άιδóυιδάóυέάβ όά Ύία δñιδόάνιδιδόΎιδυ δδñδιδά, ίά όçι δñιδóέδδç όçδ δάνάέὺδύδ άñάιδδδ όδιδ άιδóβóδιδέ÷ιδ άñ ÷ άβιδ ñδιδέβóάυιδ:

```
options GEOM_JOURNAL
```

Ç άçιδιδιδόñάβá journal όά Ύία έέάýέάñιδ όýóδçιά άñ ÷ άβυιδ, ιδιδίñάβ όδñά ίά άβιδάέ ίά όά άέυειδóέα άδιδάόά, έάññδιδόάδ υδóέ ç óδóέάδδδ da4 άβιδάέ Ύιδάδ ιΎιδ άβóέιδδ SCSI:

```
# gjournal load
# gjournal label /dev/da4
```

Ὀδί οἰάβι ἀδου ἐά ὀδῦν-ἄε ἰέα ὀδοέἄδP /dev/da4 ἐάεῖ ἐάε ἰέα ὀδοέἄδP /dev/da4. journal. Ὀδς ὀδοέἄδP ἀδδP ἰδῖνἄβδἄ ὀῖνἄ ἰά ἀϰιέῖῶἡἄPῶἄδἄ ὀγῶδϰἰἄ ἄἡ-ἄβῦἰ:

```
# news -O 2 -J /dev/da4. journal
```

ϰ δἄνἄδῦἰ ἀίῶῖεP ἐά ἀϰιέῖῶἡἄPῶἄε Ἰἰἄ ὀγῶδϰἰἄ ἄἡ-ἄβῦἰ UFS2 ὀδς ὀδοέἄδP /dev/da4. journal, ϰ ἰδῖβἄ Ἰ-ἄε Pἄϰ ὀδῖῶδPἡέϰ ἄεἄ journaling.

Ἰδῖνἄβδἄ ἰἄ -ἡϰῶῖἡἰδῖεPῶἄδἄ ὀϰἰ ἀίῶῖεP mount ἄεἄ ἰἄ δῖνῖῶἡἰδῖεPῶἄδἄ ὀϰἰ ὀδοέἄδP ὀδἰ ἀδῆῶδῖϰῶἰ ὀϰἰἄβἰ δῖνῖῶἡἰδῖεPῶἄδῶ, ὑδῶδ ὀἄβἰἄῶἄε δἄἡἄῆῦῶδ:

```
# mount /dev/da4. journal /mnt
```

Ὀϰἰἄβῦῶϰ: Ὀδϰἰ δἄἡβδδῶδῶϰ ἄἡῆἄδῖῖ slice, ἐά ἀϰιέῖῶἡἄϰῆἄβ Ἰἰἄ journal ἄεἄ ἔῦῆἄ ἀδῆἰἡἡῖῶδ slice. Ἀέἄ δἄἡῦἄἄἄἄἄἄἄ, ἄἰ ὀδῦἡ-ἰῶἰ ὀἄ slices ad4s1 ἔἄε ad4s2 ὀῦῶἄ ὀἰ gjournal ἐά ἀϰιέῖῶἡἄPῶἄε δῆῶ ὀδοέἄδῶδ ad4s1. journal ἔἄε ad4s2. journal.

Ἀέἄ ἐἄῆῶἄἡϰ ἀδῦἄἰῶϰ, βῶδῶ ἄβἰἄε ἀδῆῶδῖϰῶP ϰ ὀῖἡϰῶϰ ὀἰῶ journal ὀἄ ἄῆἄἡἡἄῶῆῆῶ ἄβῶῆἰ. Ἀέἄ ὀῆῶ δἄἡῆδῶῖῶἄῆῶ ἀῶδῶ, ἰ δἄἡἡ-Ἰἰἄ ῶἄἡῖῖῖῖῖῖῖ (ϰ ὀδοέἄδP ἄβῶῆῖῶ δῖῶ ἐἄ δἄἡῆἸ-ἄε ὀἰ journal) δῖἡἸἄἄ ἰἄ ἄβἰἄῶἄε ὑδ ἄἡῦἰἄῶἡῶδ ὀδϰἰ ἀίῶῖεP, ἄἰ Ἰῶδῶ ἰἄῶῦ ὀϰ ὀδοέἄδP ἄβῶῆῖῶ ὀδϰἰ ἰδῖβἄ ἐἄ ἄἰἡἡἡἡἡἡἡἡ ὀἰ journaling. Ἰδῖνἄβδἄ ἄδβῶϰῶ ἰἄ ἄἰἡἡἡἡἡἡἡἡ ὀἰ journaling ὀἄ ὀδῦἡ-ἰῶἰ ὀδοῶῖῖἰἄῶἄ ἄἡ-ἄβῦἰ -ἡϰῶῖἡἡἡἡἡἡἡἡ ὀϰἰ ἀίῶῖεP tunefs. Ὑῶδῦῶἰ, ἐἄ δῖἡἸἄἄ ἰἄ ἔἡἄῶῶἄἄ ἄἰῶῖἡἡἡἡἡἡ ἄῶῶἄῆἄβἄδ ὀῦἰ ἄἡ-ἄβῦἰ ὀἄδ, δῖἡῖ ἄδῆ-ἄῆἡῶἄἄἄ ἰἄ ἔῦἰἄῶἄ ἄῆἄἄἄἄ ὀἄ Ἰἰἄ ὀδῦἡ-ἰῖ ὀγῶδϰἰἄ ἄἡ-ἄβῦἰ. Ὀῶῆῶ δἄἡῆῶῶῶῶῶῶῶ δἄἡῆῶῶῶῶῶῶ, ϰ tunefs ἐἄ ἀδῖῶῶ-ἄε ἄἰ ἄἄἰ ἰδῖἡἸῶἄἄ ἰἄ ἀϰιέῖῶἡἡἡἡῶἄἄ ὀἰ journal, ἄῆῦ ἄδῶἰ ἄἄἰ ὀἄδ δῖἡῖῶἄῶἄῶἄῶ ἄδῦ ἄδῖῖῆἄἄἄ ἄἄἡἡἸῦἰ δῖῶ ἰδῖἡἡἡ ἰἄ δῖἡἸῶῆῆἄἄ ἄδῦ ἔἄῆP -ἡῖῶϰ ὀϰῶ tunefs.

Ἀβἰἄἄ ἄδβῶϰῶ ἄῶἰἄῶῦἰ ἰἄ -ἡϰῶῖἡἡἡἡἡἡἡἡ journaling ὀῶἡἰ ἄβῶῆἰ ἄῆῆῖῖϰῶϰῶ ἄἡῦῶ ὀδοῶῖῖἰἄῶἡῶ FreeBSD. Ἀέἄἄῦῶῶἄ ὀἰ Ὑἡἡἡἡ Ὀῆἡἡἡῖῖϰῶϰ ὀἰῶ UFS Journaling ὀἄ Ἰἰἄ Desktop Ὀδῖῖῖῖῖῖῖῖ (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/gjournal-desktop) ἄῆἄ ἔἄδῶἡἡἡἡἡἡδ ἰῶϰἄβἄῶ.


```
vfs.zfs.arc_max="40M"
vfs.zfs.vdev.cache.size="5M"
```

Άέα άίάεοδέεουάπνάνο πδείβόάέο ό÷άδέέΎ ιά όζί άάέοδόςιδιβζός όιζ ΖFS, άάβόά όι <http://wiki.freebsd.org/ZFSTuningGuide>.

21.2.2 × ηζόςείιδιέπιδάο όι ΖFS

ΌδΎπ÷άέ Ύιάο ιζ÷άίέόςιζ άέέβιζόςζό όιζ άδέονΎδάρ όόι FreeBSD ιά δνιόάνδΠράέ ΖFS pools έάόΎ όζ άέΎπνέάά όζ άέέβιζόςζό όιζ όδόςΠιδάοιζ. Άέα ιά όιζ πδείβόάά, άέδάρΎδάρ δέδ άέιιζέδ άίδιεΎδ:

```
# echo 'zfs_enable="YES"' >> /etc/rc.conf
# /etc/rc.d/zfs start
```

Όι δδυιέδί άδόςιζ όιζ έάείΎιζ όδιεΎδάρ υδέ Ύ÷άά άέάέΎέιζδ όπνέδ SCSI άβέιζδ, έάέ υδέ όά ιζιιάόά όδόςάδπ όιζ άβιάέ da0, da1 έάέ da2. ¼όςιέ άέάέΎδόςι άβέιζδ IDE έά δνΎδάρ ιά ÷ηζόςείιδιέΠόςι όδόςέδΎδ όιζ όγδίο ad άίδβ άέα δέδ άίδβόςιέ÷άδ SCSI.

21.2.2.1 Pool ιά ιά ιυίι Άβέι

Άέα όζί άζιέιζδπνάβ άίυδ ΖFS pool ιά Ύιά ιυίι άβέι (÷ύπνδ άδίαδύδόςά άί÷Πδ όόάείΎδουί), ÷ηζόςείιδιέΠράά όζί άίδιεΠ zpool:

```
# zpool create example /dev/da0
```

Άέα ιά άάβόά όι ιΎι pool, άίάδΎδάρ όζί Ύιζ όζ άίδιεΠδ df:

```
# df
Filesystem      1K-blocks      Used      Avail Capacity  Mounted on
/dev/ad0s1a     2026030    235230    1628718    13%      /
devfs            1            1            0    100%     /dev
/dev/ad0s1d     54098308   1032846   48737598     2%      /usr
example         17547136      0    17547136     0%      /example
```

Ζ Ύιζιζδ άδδΠ άάβ÷ίάέ έάέάνΎ υδέ όι example pool υ÷έ ιυίι Ύ÷άέ άζιέιζδπνέάβ, άέέΎ Ύ÷άέ άδβόςζδ δνιόάνδόςέβ έέυέάδ. Άβιάέ άδβόςζδ άέάέΎέιζ υδ έάνιέέυ όγόςόςι άπ÷άβυί, ιδιπνάβόά ιά άζιέιζδπνάβόά άπ÷άβά όά άδδυ, έάέ Ύέιε ÷πδράδ ιδιπνιζι άδβόςζδ ιά όι άιζ, υδδδ όάβιάδάρ όδός δάνάέΎδδ δάνΎάέάι:

```
# cd /example
# ls
# touch testfile
# ls -al
total 4
drwxr-xr-x  2 root  wheel    3 Aug 29 23:15 .
drwxr-xr-x 21 root  wheel   512 Aug 29 23:12 ..
-rw-r--r--  1 root  wheel    0 Aug 29 23:15 testfile
```

Άδόςδ÷Πδ άδδυ όι pool άάι ÷ηζόςείιδιέάβ έΎδιέι άδδυ όά δέάνιέέδΠιδάό όιζ ΖFS. Άζιέιζδπνάβόά Ύιά όγόςόςι άπ÷άβυί όά άδδυ όι pool έάέ άίάνιζδιέΠράά όά άδδυ όζ όδιδβόςζδ:

```
# zfs create example/compressed
```

```
# zfs set compression=gzip example/compressed
```

Ὀì óγóçìά ἄñ÷âβὺì example/compressed ἄβίἄέ δέΥίí Ἰίἄ óδιδέἄóìΥίí ZFS óγóçìά. ἈίεειÙδὺì ἰἄ ἰίóέἄñÙδὺì ἰἄñέέÙ ἰἄἄÙέἄ ἄñ÷âβἄ ὄἄ ἰἄδὺì, ἰἄδἄδὲἄβἄδ ὄδñ ἄἄóÙειἄñ /example/compressed.

Ἰδñἄβδἄ ὅβñἄ ἰἄ ἰἄἄñἄñἄñἄñἄñἄñἄñ ὄç ὄδιδβἄóç ἄñÙδὺìἰἄδ:

```
# zfs set compression=off example/compressed
```

Ἰἄἄ ἰἄ ἰἄδιδñἄñἄñἄñἄñἄñ ὄì óγóçìά ἄñ÷âβὺì, ἄέδἄέΥἄδ ὄç ἄέυειἄδèç ἰἄἄἄἄἄ ἄἄἄ ἰἄἄἄἄἄἄἄἄ ὄì ἰἄδιδἄἄἄἄ ἰἄἄἄ ὄἄ ἄἄἄἄἄἄἄἄ ḡññἄñἄñἄñἄñἄñἄñ df:

```
# zfs umount example/compressed
# df
Filesystem 1K-blocks    Used    Avail Capacity  Mounted on
/dev/ad0s1a 2026030 235232 1628716    13%    /
devfs      1          1        0    100%    /dev
/dev/ad0s1d 54098308 1032864 48737580    2%    /usr
example    17547008      0 17547008    0%    /example
```

ḡññἄñἄñἄñἄñἄñ ἰἄἄ ὄì óγóçìά ἄñ÷âβὺì, βἄδἄ ἰἄ ἄβίἄέ ἄἄἄ ḡἄἄἄ ḡññἄñἄñἄñἄñἄñ, ἄἄἄ ἰἄἄἄἄἄἄἄἄ ὄì ÷ñçἄἄἄἄἄἄἄἄ ἄἄἄἄ ἄἄἄἄ, ὄç ἰἄἄἄἄἄ df:

```
# zfs mount example/compressed
# df
Filesystem      1K-blocks    Used    Avail Capacity  Mounted on
/dev/ad0s1a      2026030 235234 1628714    13%    /
devfs            1          1        0    100%    /dev
/dev/ad0s1d     54098308 1032864 48737580    2%    /usr
example         17547008      0 17547008    0%    /example
example/compressed 17547008      0 17547008    0%    /example/compressed
```

Ἰδñἄβδἄ ἰἄββἄ ὄì pool ἄἄἄ ὄì óγóçìά ἄñ÷âβὺì ἰἄἄἄἄἄἄ ὄç Ἰññἄ ὄç ἰἄἄἄἄἄ mount:

```
# mount
/dev/ad0s1a on / (ufs, local)
devfs on /dev (devfs, local)
/dev/ad0s1d on /usr (ufs, local, soft-updates)
example on /example (zfs, local)
example/data on /example/data (zfs, local)
example/compressed on /example/compressed (zfs, local)
```

¼δὺδ ḡἄñἄἄἄἄññἄñἄ, ὄì óγóçìά ἄñ÷âβὺì ZFS ἰδñἄβ ἰἄ ÷ñçἄἄἄἄἄἄἄ ἄἄἄ ἄἄἄἄ ὄγóçìά ἄñ÷âβὺì ἰἄδÙ ὄç ἄçἄἄἄἄἄἄ ὄἄ. Ἰἄἄἄἄ, ἄἄἄἄἄἄἄ ḡñἄἄ ἄἄἄἄ ἄἄἄἄἄἄἄἄ. Ὀἄἄ ḡἄñἄἄἄἄἄ ḡἄñἄἄἄἄἄ ἄçἄἄἄἄññἄñἄ Ἰἄἄ ἰἄἄ ὄγóçìά ἄñ÷âβὺì, ὄì data. ἄἄ ἰἄἄἄἄἄἄἄἄ ὄç ἰἄἄἄἄἄἄ ἄἄἄñἄἄ ὄἄ ἰἄδὺì, ἄἄἄ Ἰἄἄἄ ὄì ñἄἄἄἄἄἄἄἄ βἄδἄ ἰἄ ἄñἄἄἄἄἄ ἄἄἄ ἰἄἄἄἄἄἄἄ ἄἄἄñἄἄἄἄἄἄ:

```
# zfs create example/data
# zfs set copies=2 example/data
```

Ἰḡññἄñἄ ὅβñἄ ἰἄ ἄἄἄἄ ὄἄ ἄἄἄñἄἄ ἄἄἄ ὄç ἄἄἄἄἄἄἄἄ ὄç ÷βñἄ ἄβñἄἄἄἄ ἰἄἄ ὄç ἰἄἄἄἄἄ df:

```
# df
Filesystem      1K-blocks    Used    Avail Capacity  Mounted on
```

/dev/ad0s1a	2026030	235234	1628714	13%	/
devfs	1	1	0	100%	/dev
/dev/ad0s1d	54098308	1032864	48737580	2%	/usr
example	17547008	0	17547008	0%	/example
example/compressed	17547008	0	17547008	0%	/example/compressed
example/data	17547008	0	17547008	0%	/example/data

Δὰñáðçñῖῖóðà ùéè ÈÙèà óγóóçìá àñ÷âβùì óðì pool àâβ÷íáé ðì βáειì ìÝããèò èéèèÝóéìò ÷ḡñìò. Ἀðòùò àβíáé èéè ì èùìàò ðìò ÷ñçóéììðìéìÝìà ðçì áìòìèḡ ðḡ óà ùéá óà ðàñááâβàìáðá, àéá íá àâβñìòìà ùéè óà óóóðìáðá àñ÷âβùì ÷ñçóéììðìéìÝì ìùì ðì ÷ḡñì ðìò ÷ñáèÙæìíðáé èéè ùéá ììèñÙæìíðáé ðì βáειì ÷ḡñì (ðì èìéìù÷ñçóðì áðùèáìá — pool). Ὀðì óγóóçìá àñ÷âβùì ZFS Ýììéáð ùðùò ìé ðùììé (volumes) èéè ìé èáóáðìḡóáéð (partitions) àáì Ý÷ìòì ìùçìá. Ἀíòβèáðá, ðìèèÙ óóóðìáðá àñ÷âβùì ììèñÙæìíðáé ðì βáειì ÷ḡñì, ðì pool. Ìðìñâβðá íá èáóáñâḡóáðá ðì óγóóçìá àñ÷âβùì èéè èáðùðéì ðì βáειì ðì pool ùðáì àáì óà ÷ñáèÙæìóðá ðèÝì:

```
# zfs destroy example/compressed
# zfs destroy example/data
# zpool destroy example
```

Ìé ðèèçñìβ àβóéìé ìà ðì èéèñù ÷æÙíá, àβíáé áìáðùòáðèðì. Ἔðáì Ýíáð àβóéìò ÷æÙóáé, óà àáññÝíá ðìò ÷Ùñìóáé. Ìéá ìÝèìàò àéá íá áðìóγáìòìà ðçì áðḡèáéá àáññÝìùì áìáéðβáð áìùð ÷æáóìÝñò àβóéìò àβíáé íá àçìéìòñâḡóìòìà ìéá óóóðìé÷βá RAID. Ὀá pools ðìò ZFS Ý÷ìòì ó÷ àæéáðèâβ ḡóðá íá ððìóðçñβæìòì áðòù ðì ÷áñáèðçñéóðéèù. Ç èáéðìòñâβá áððḡ áìáéýáðáé óðçì áðùìáçç áìùðçðá.

21.2.2.2 ZFS RAID-Z

Ἔðùð áìáéÝñáìà ðñìçáìòìÝìùð, ç áìùðçðá áððḡ ðñìùðìèÝðáé ùéè ÷ñçóéììðìéìÝìà ðñáéð óðóèáðÝð SCSI ìà ììùìáðá óðóèáðḡì da0, da1 èéè da2. Ἀéá íá àçìéìòñâḡóìòìà Ýíá pool óγðìò RAID-Z, àèòáèìÝìà ðçì áéùèìðèç áìòìèḡ:

```
# zpool create storage raidz da0 da1 da2
```

Ὀçìáβùòç: Ç Sun óðìéóðÙ íá ÷ñçóéììðìéìÝìðáé áðù ðñáéò ùò áìéèÙ óðóèáðÝð óà óðóðìé÷βáð óγðìò RAID-Z. Ἀí ÷ñáèÙæìóðáé íá àçìéìòñâḡóáðá Ýíá pool ìà ðàñéóóùðáñìòð áðù àÝèá àβóéìòð, àβíáé ðñìðéìùðáñì íá ðì ÷ññìóáðá óà ììÙááð áðù ìéèñùðáñá RAID-Z pools. Ἀí àéáèÝðáðá ìùì äýì àβóéìòð áèèÙ ÷ñáèÙæìóðá ðçì áðìáðùðçðá áìì÷ḡð óðáèìÙðùì, βóùð àβíáé èáéýðáñì íá ÷ñçóéììðìéḡóáðá Ýíá ZFS mirror. Ἀâβðá ðç óáèìáá manual ðìò zpool(8) àéá ðàñéóóùðáñáð èáððììÝñáéáð.

Èá àçìéìòñâçèâβ ðì storage zpool. Ìðìñâβðá íá áðáèçèáýóáðá ðì áðìòÝèáóìá ÷ñçóéììðìéḡóáð, ùðùð èéè ðñìçáìòìÝìùð, ðèð áìòìèḡð mount(8) èéè df(1). Èá ìðìñìýóáìá íá ÷ñçóéììðìéḡóìòìà ðàñéóóùðáñìòð àβóéìòð, ðñìòéÝòììóáð óà ììùìáðá óðóèáðḡì ðìòð óðì ðÝèìò ðçð ðàñáðÙìù èβóðáð. Ἀçìéìòñâḡóá Ýíá ìÝì óγóóçìá àñ÷âβùì óðì pool, ðì ìðìβì èá ììñÙæìóðáé home èéè ùðìò èá áðìèçèáýìíðáé ðáèèèÙ óà àñ÷âβá ðùì ÷ñçóðḡì:

```
# zfs create storage/home
```

Ìðìñìýìà ðḡñá íá áìáñáìðìéḡóìòìà ðçì óòìðβáóç èéè íá èñáðÙìá áðèðèÝìì áìòβáñáóá ðùì èáóáèùáñì èéè ðùì àáññÝìùì ðùì ÷ñçóðḡì. Ἔðùð èéè ðñìçáìòìÝìùð, ìðìñìýìà íá ðì áðèðý÷ìòìà ÷ñçóéììðìéḡóáð ðèð ðàñáèÙðù áìòìèḡð:

```
# zfs set copies=2 storage/home
# zfs set compression=gzip storage/home
```

Ἄέα ίά ἀβίαέ ἀδδὺδ ì íŸìδ έάδὺέιτῖρδ δὺί ÷ñçóðπí, áíδέαñὺδδᾶ δᾶ ἀᾶñŸία δῖδδ δᾶ ἀδδὺί έάέ ᾶçíείδñᾶΠδδᾶ δῖδδ έάδὺέέççῖρδδ δδῖᾶῖέέῖŸδ ᾶδδῖŸδ:

```
# cp -rp /home/* /storage/home
# rm -rf /home /usr/home
# ln -s /storage/home /home
# ln -s /storage/home /usr/home
```

Ὀᾶ ἀᾶñŸία δὺί ÷ñçóðπí έᾶ ᾶδῖέçέᾶŸῖῖδᾶέ δπñᾶ δδῖ íŸì δýóðçíᾶ ᾶñ÷ᾶβὺί /storage/home. Ἄέα ίά δῖ ᾶδᾶέçέᾶŸδᾶδᾶ, ᾶçíείδñᾶΠδδᾶ Ḳία íŸì ÷ñΠδδç έᾶέ ᾶέóŸέέᾶδᾶ δδῖ δýóðçíᾶ ìᾶ δῖ íŸì έῖᾶᾶᾶέᾶδῖ.

Ἄῖέείὺδδᾶ ίᾶ ᾶçíείδñᾶΠδδᾶ Ḳία δδέᾶῖέϋδδδῖ (snapshot) δδῖ ῖδῖβῖ έᾶ ῖδῖñᾶβδᾶ ίᾶ ᾶδᾶίŸέέᾶδᾶ ᾶñᾶϋδᾶñᾶ:

```
# zfs snapshot storage/home@08-30-08
```

Ὀçῖᾶέπδδᾶ ῖδέ ç ᾶδῖέῖῖᾶΠ ᾶçíείδñᾶβᾶδ δδέᾶῖέϋδδδῖδῖ έᾶέδῖῖñᾶᾶβ ῖῖñ ῖᾶ δñᾶῖᾶδδῖέϋ δýóðçíᾶ ᾶñ÷ᾶβὺί, έᾶέ ῖ ÷έ δᾶ έὺδῖέῖ ῖᾶῖῖῖŸῖ έᾶδὺέῖῖᾶ Π ᾶñ÷ᾶβῖ. Ἰ ÷ᾶñᾶέδΠñᾶδ @ ÷ñçóέῖῖδῖέᾶβδᾶέ ῖδ έᾶᾶ ÷ῖñέóδῖέϋ ῖᾶδᾶίŸ δῖδ δδóδΠῖᾶδῖδ ᾶñ÷ᾶβὺί έᾶέ δῖδ ῖῖῖᾶδῖδ δῖῖῖδ. Ἀί έᾶδᾶóδñᾶδᾶᾶ ῖ έᾶδὺέῖῖᾶδ ᾶᾶñŸῖῖ έὺδῖέῖδ ÷ñΠδδç ᾶδῖέᾶδᾶóδΠδδᾶ δῖῖ ῖᾶ δçí ᾶíδῖέΠ:

```
# zfs rollback storage/home@08-30-08
```

Ἄέα ίᾶ ᾶᾶβδᾶ ῖέᾶ έβδδᾶ δὺί ᾶέᾶέŸóέῖῖῖ δδέᾶῖέϋδδδῖῖ, ᾶέδᾶέŸóδᾶ δçí ᾶíδῖέΠ ῖs δδῖῖ έᾶδὺέῖῖᾶ .zfs/snapshot δῖδ δδóδΠῖᾶδῖδ ᾶñ÷ᾶβὺί. Ἄέα δᾶñŸᾶέᾶῖᾶ, ᾶέα ίᾶ ᾶᾶβδᾶ δῖ δδέᾶῖέϋδδδῖδῖ δῖδ ᾶçíείδñᾶΠδδᾶῖᾶ δñῖçῖῖῖŸῖδ, ᾶέδᾶέŸóδᾶ δçí δᾶñᾶέὺδδῖ ᾶíδῖέΠ:

```
# ls /storage/home/.zfs/snapshot
```

Ἀβίαέ ᾶδῖᾶδὺί ίᾶ ᾶñŸδᾶδᾶ έὺδῖέῖ script δῖδ ίᾶ ᾶçíείδñᾶᾶβ ῖçῖέᾶβᾶ δδέᾶῖέϋδδδᾶ δὺί ᾶᾶñŸῖῖ δὺί ÷ñçóðπí. ὺδδὺδῖ, ῖᾶ δçí δŸñῖᾶῖ δῖδ ÷ññῖδ, δᾶ δδέᾶῖέϋδδδᾶ έᾶ έᾶδᾶῖᾶέπδῖδῖ ῖᾶᾶὺῖ δῖδῖδδῖ δῖδ ÷πñῖδ δδῖ ᾶβδῖ. ῖδῖñᾶβδᾶ ίᾶ ᾶέᾶñŸδᾶδᾶ δῖ δñῖçῖῖῖᾶñ δδέᾶῖέϋδδδῖ ÷ñçóέῖῖδῖέπῖδᾶδ δçí δᾶñᾶέὺδδῖ ᾶíδῖέΠ:

```
# zfs destroy storage/home@08-30-08
```

Ἄᾶῖ δδŸñ÷ᾶέ έῖᾶῖδ, ῖᾶδὺ ᾶδῖ ῖέᾶδ ᾶδδŸδ δδῖδ ᾶῖέείŸδ, ίᾶ έñᾶδΠδῖῖῖᾶ δῖ /storage/home δδçí δᾶñῖŸᾶ έᾶδὺδᾶóç δῖδ. ῖᾶδᾶδñŸδᾶ δῖ δδῖ δñᾶῖᾶδῖέϋ δýóðçíᾶ ᾶñ÷ᾶβὺί /home:

```
# zfs set mountpoint=/home storage/home
```

×ñçóέῖῖδῖέπῖδᾶδ δῖδ ᾶíδῖέŸδ df έᾶέ mount έᾶ ᾶῖŸῖᾶ ῖδῖ δῖ δýóðçíᾶ ÷ᾶέñβᾶᾶδᾶέ δῖŸῖ ᾶδδῖ δῖ δýóðçíᾶ ᾶñ÷ᾶβὺί ῖδ δῖ δñᾶῖᾶδῖέϋ /home:

```
# mount
/dev/ad0s1a on / (ufs, local)
devfs on /dev (devfs, local)
/dev/ad0s1d on /usr (ufs, local, soft-updates)
storage on /storage (zfs, local)
storage/home on /home (zfs, local)
# df
Filesystem      1K-blocks    Used    Avail Capacity  Mounted on
/dev/ad0s1a      2026030    235240  1628708    13%      /
devfs            1            1         0    100%     /dev
/dev/ad0s1d     54098308   1032826  48737618     2%      /usr
```

```
storage           26320512      0 26320512      0%   /storage
storage/home      26320512      0 26320512      0%   /home
```

Àáð ðείεεçñðíáðáε ç ñýείεóç òιò RAID-Z. Άέά ίά äÝ÷àððά áίáσινÝð εάðÛððάóçð ò÷ ðéεÛ ίά ðά òðððíáðά áñ÷àβùι εάðÛ òç ίðéðàñéíð áéðÝεάóç òιò periodic(8), àðððά òçί ðáñáéÛòùι áίðίεð:

```
# echo 'daily_status_zfs_enable="YES"' >> /etc/periodic.conf
```

21.2.2.3 ÁíÛéðçóç òιò RAID-Z

ËÛεά είεάóιεéù RAID Ý÷áé ίέα ίÝείαι áεά áðβàεάðç òçð εάðÛððάóðò òιò, εάé òι ZFS áái áðίðáεáβ áίáβñáóç. Ìðñáβðά ίά ááβðά òçί εάðÛððάóç ðùι òððéáððί òιò RAID-Z ÷ñçóéιðίεðíðáð òçί áéùείðεç áίðίεð:

```
# zpool status -x
```

Áί ùεά ðά pools áβίáé ðά ðáεð εάðÛððάóç, εά ðÛñáðά òι áéùείðéι ιðίðιά:

```
all pools are healthy
```

Áί òðÛñ÷áé éÛðίεί ðñùáεçιά, ð.÷. éÛðίεìò áβóεìò Ý÷áé áááé áéðùð εάéðίòñáβáð, εά ááβðά òçί ðáñéáñáðð òçð εάðÛððάóçð ðά Ýίá ιðίðιά ùðò òι ðáñáéÛòùι:

```
pool: storage
state: DEGRADED
status: One or more devices has been taken offline by the administrator.
Sufficient replicas exist for the pool to continue functioning in a
degraded state.
action: Online the device using 'zpool online' or replace the device with
'zpool replace'.
scrub: none requested
config:
```

NAME	STATE	READ	WRITE	CKSUM
storage	DEGRADED	0	0	0
raidz1	DEGRADED	0	0	0
da0	ONLINE	0	0	0
da1	OFFLINE	0	0	0
da2	ONLINE	0	0	0

```
errors: No known data errors
```

Ïι ðáñáðÛùù ááβ÷íáé ùéé ç òððéáððð ðÝεçεά áéðùð εάéðίòñáβáð áðù òιí áεά÷áéñéóðð. Áððù áβίáé áεðεάéá áεά òι òðáéáñéíéÝíι ðáñÛááεáιá. Άέά ίά ðáéáβ ι áβóεìò áéðùð, ÷ñçóéιðίεðεçεά ç ðáñáéÛòùι áίðίεð:

```
# zpool offline storage da1
```

Ìðñιýíá ððñά ίά áίðééáðáóðððίðιá òι áβóει da1 ίáðÛ òçί áðáíáñáðίβçóç òιò òðððíáðίð. Ìðáί òι óýóðçιά áðáíÝεéáé ðά εάéðίòñáβά, ìðñιýíá ίά ÷ñçóéιðίεððίðιá òçί áéùείðεç áίðίεð áεά ίά áίçìáñðίðιá òι óýóðçιά áεά òçί áίðééáðÛððάóç òιò áβóεìò:

```
# zpool replace storage da1
```

Ἄδὺ άάρ, ιδιñγία ίά äέΥάñοιά ίάίὺ όζί έάδὺόδάόζ, άδδρ όζ οἰñὺ ÷ññò όζί άδέείάρ -x:

```
# zpool status storage
pool: storage
state: ONLINE
scrub: resilver completed with 0 errors on Sat Aug 30 19:44:11 2008
config:
```

NAME	STATE	READ	WRITE	CKSUM
storage	ONLINE	0	0	0
raidz1	ONLINE	0	0	0
da0	ONLINE	0	0	0
da1	ONLINE	0	0	0
da2	ONLINE	0	0	0

errors: No known data errors

¼δὺδὸ όάβιάόάέ όοί δάνὺάέάιá, όά δὺίόά όάβιάόάέ ίά έάέοιññáγί όόόέιέάέὺ.

21.2.2.4 Ἀδäέρδäόζ ἌääñÝíϋί

¼δὺδὸ áíáόÝñáíá δñçáñοιÝíϋδ, οἱ ZFS ÷ñçόέñδιδέάβ checksums (áέññβοίάόά äέÝá÷ίò) äέá ίά äδäέçέáγόáέ όζί áέáñáέϋόçόá οὺί áδιδέçέáοιÝíϋί äääñÝíϋί. Ὄá áέññβοίάόά äέÝá÷ίò áñññäñδιδέγίόáέ áδδϋñáόá έáδὺ όζί áçιέιññáβá οὺί όδδὸζιὺδὸὺί áñ÷άβὺί, έáέ ιδιñγίá ίά áδáñññäñδιδέçέγίί ιÝόϋ όçδ άδϋñáίçδ άίδιδέρδ:

```
# zfs set checksum=off storage/home
```

Ἄδδϋ άár άβιάέ äáíέέὺ έάέρ έáÝá, έάέρδ όá checksums έáδäέáñáὺñοι áέὺ÷έόοι áδιδέçέáδδέέϋ ÷ññí, έáέ άβιάέ διδέγ δέι ÷ñρόέñ ίά όá Ý÷ίοíá áñññäñδιδέçιÝíá. Ἄδβόçδ äáí όάβιάόάέ ίά δññέáέγίί έὺδιδέá όçιáίόέέρ έáέδδὸδÝñçόç ϐ äδέáὺñοιόç. Ιá όá checksums áñññäñδιδέçιÝíá, ιδιñγίá ίά æçδρβοίοíá áδὺ οἱ ZFS ίά äέÝáñáέ όζί áέáñáέϋόçόá οὺί äääñÝíϋί ÷ñçόέñδιδέβίόáδ όá äέá äδäέρδäόç. Ç äέáäέέáόβá áδδρ άβιάέ áñóδρ ùδ “scrubbing.” Ἄέá ίά äέÝáñáόá όζί áέáñáέϋόçόá äääñÝíϋί διδό pool storage, ÷ñçόέñδιδέρδδá όζί δáñáέὺδὸὺ άίδιδέρδ:

```
# zpool scrub storage
```

Ç äέáäέέáόβá áδδρ ιδιññáβ ίá δὺñáέ áñέáδρ ϐñá, áíὺέιáá ίá όζί διδίϋόçόá οὺί áδιδέçέáοιÝíϋί äääñÝíϋί. Ἄδβόçδ ÷ñçόέñδιδέáβ δὺñá διδέγ οἱ äβόέι (I/O), οὺοι ϐόδá όá έὺέá äääñÝίç όδέáñρ ιδιññáβ ίá äέδäέáβδäέ ίϋñ ίέá δÝοίέá äέáäέέáόβá. Ιáδὺ όζί ιδιδέçέññόç διδό scrub, έá áíáíáñέáβ έáέ ç áíáοññὺ έáδὺόδäόçδ, όζί ιδιδέçέáβδäέ ίá äáβδä æçδρβίόáδ όζί ίá όζί δáñáέὺδὸὺ άίδιδέρδ:

```
# zpool status storage
pool: storage
state: ONLINE
scrub: scrub completed with 0 errors on Sat Aug 30 19:57:37 2008
config:
```

NAME	STATE	READ	WRITE	CKSUM
storage	ONLINE	0	0	0
raidz1	ONLINE	0	0	0
da0	ONLINE	0	0	0
da1	ONLINE	0	0	0
da2	ONLINE	0	0	0

errors: No known data errors

Óðí ðáñÛäáéáíá íáð äìòáíβæáðáé éáé ç ÷ññíéèð óðéáìð ðíð ðèíèèçñðèçéá ç áíóíèð scrub. Ç äöíáðúòçðá áððð íáð áíáóóáèβæáé áéáñáéúòçðá äääñÝíùí óá íääÛéí áÛèò ÷ññíò.

ÕðÛñ ÷íðí ðèèÝò áéùíá áðéèäÝò áéá ðí óýóóçíá áñ÷áβùí Æ. Äåβðá òéð óáèβááð manual zfs(8) éáé zpool(8).

ĖāöÜëáéī 22

Ī Āéá÷ăéñéóôĲò Ôüùí Vinum

22.1 Óýñĩç

ĪôéāĲôā āβôēĩôð éáé áī Ÿ÷ăôā, ðŪĩóā ôðŪñ÷ĩôĩ ðééáĩŪ ðñĩāēĲĩáóá:

- Īðĩāā ĩā āβĩáé ðĩēý ĩéēñĩβ.
- Īðĩāā ĩā āβĩáé ðĩēý āñāĩβ.
- Īðĩāā ĩā ĩçĩ āβĩáé āñēāðŪ áĩēúðéóóĩē.

Āéá óā ðñĩāēĲĩáóā áððŪ, Ÿ÷ĩôĩ ðñĩóáēāā éáé ôēĩðĩēçēāā āēŪōĩñāð ēýóáēð. ĩāð ôð÷ĩŪ ÷ñçōēĩðĩēĩýĩāĩñð ðñũðĩð ðñĩóóāðβāð, āβĩáé ĩā ôçĩ ÷ñĲôç ðĩēēāðēĩ éáé ĩñēóĩŸĩāð ðĩñŸð ðāñēððĩ (redundant) āβôēĩ. Āēðũð áðũ ôçĩ ððĩóðĲñēĩç ðĩð ðāñŸ÷ăóáé áéá óðóēāðŸð (ēŪñôāð éáé āēāāēðŸð) hardware RAID, ôĩ āáóéēũ óýóçĩā ôĩð FreeBSD ðāñēēāĩāŪĩáé ôĩ áéá÷ăéñéóôĲ ôüùĩ (volume manager) Vinum, Ÿĩā ðñũāñāĩā ĩāĲāçôçð óýðĩð ĩðēĩē ôĩ ĩðĩβĩ ôēĩðĩēāā āēēĩēēĩýð āβôēĩðð. Ôĩ Vinum áðĩēāēāβðáé éáé Āéá÷ăéñéóôĲò Ôüùĩ, éáé āβĩáé Ÿĩāð ĩāçāũð āēēĩēēēĩ āβôēĩ ðĩð áĩóēĩāðððβāēé óā ðāñāðŪĩũ ðñĩāēĲĩáóā. Ôĩ Vinum ðāñŸ÷ăé éáé ēáéýðāñç āðāēēĩā, áðũāĩôç éáé áĩēĩðéóðā óā ó÷Ÿôç ĩā óā ðāñāĩĩóéāēŪ óðóðĲĩáóā áðĩēðēāðôçð, éáé ôēĩðĩēāā óā ĩĩôŸēā RAID-0, RAID-1 éáé RAID-5, ôüôĩ ĩāĩĩũŸĩā, Ÿĩôĩ éáé óā óóĩāðāóĩũ ĩāðāĩý ôĩðð.

Ôĩ ēāðŪēāēĩ áððũ ðāñŸ÷ăé ĩéā áðéóēũðçôç ôũĩ ðééáĩĩ ðñĩāēçĩŪðũĩ ðũĩ ðāñāĩĩóéāēĩ óðóçĩŪðũĩ áðĩēðēāðôçð, éáé ĩéā āéóāāũāĲ óôĩ Āéá÷ăéñéóôĲ Ôüùĩ Vinum.

Ôçĩāβũòç: ĩāēēĩĩĩóáð áðũ ôĩ FreeBSD 5 éáé ĩāðŪ, ôĩ Vinum ĩāĩāñŪðôçēā Ĳóðā ĩā áĩóũĩāððēāāā óðçĩ āñ÷ēðāēðĩēēĲ GEOM (ĖāöÜëáéī 20), áéáðçñĩĩóáð Ÿóðũôĩ ðéð āñ÷ēēŸð éāŸāð, ĩñĩēĩāĩā, éáé ôç ĩĩñôĲ ðũĩ ĩāðā-āāāñŸĩũĩ (metadata) ðĩð áðĩēçēāýĩĩóáé óðĩĩ āβôēĩ. Ç ĩŸā áððĲ āēāĩ÷Ĳ ĩĩĩŪæáðáé *gvinum* (áðũ ôĩ *GEOM vinum*). Ôĩ áēũēĩôēĩ ēāβĩāĩĩ áĩāðŸñāðáé óôĩĲēũð óðĩ *Vinum* Ÿò áðçñçĩŸĩç Ÿĩĩĩéā, Ūó÷ăðā ĩā ðéð ēāððĩŸñāēāð ôçð ôēĩðĩβçôçð. ¼ēāð ĩē áĩðĩēŸð éā ðñŸðāē ôĲñā ĩā éāēĩýĩóáé ĩā ôç ÷ñĲôç ôçð *gvinum*, ôĩ Ūñēñũĩā ððñĩĩā (kernel module) Ÿ÷ăé ĩāðĩĩĩāóðāāβ óā *geom_vinum.ko* áðũ *vinum.ko*, éáé Ÿēā óā āñ÷ăāā óðóēāðĩ āñβóēĩĩóáé óðĩĩ ēāðŪēĩāĩ /dev/gvinum áĩðā āēā /dev/vinum. Āðũ ôĩ FreeBSD 6 éáé ĩāðŪ, ç ðāēēŪ ôēĩðĩβçôç ôĩð Vinum āāĩ ðāñēēāĩāŪĩáóáé ðēŸĩĩ óôĩ āáóéēũ óýóçĩā.

22.2 Īē Āβôēĩē Āβĩáé Ĳĩēý ĩéēñĩβ

Īē āβôēĩē āβĩĩóáé ĩēĩŸĩā éáé ĩāāāēýðāñĩē, āēēŪ ĩā ôũĩ βāēĩ ñðēũĩ áóĩŪĩĩóáé āðβôçð éáé ĩē áðāéðĲóáēð ĩāð óā áðĩēçēāððéēũ ÷Ĳñĩ. ĲĩēēŸð ðĩñŸð éā āñāēāβðā óā ēŸôç ĩā ÷ñāēŪæáððā Ÿĩā óýóçĩā āñ÷ăāβũĩ ĩāāāēýðāñĩ áðũ ôĩðð āβôēĩðð ðĩð Ÿ÷ăðā áéāēŸôēĩðð. Óβāĩōñā ôĩ ðñũāēçĩā áððũ āāĩ āβĩáé ôũôĩ Ÿĩôĩĩũ Ÿôĩ ðñēĩ āŸēā ÷ñũĩéā, āēēŪ āĩāēĩēĩōēāā ĩā ððŪñ÷ăē. ĩāñēēŪ óðóðĲĩáóā áðēēýĩôĩ áððũ ôĩ ðñũāēçĩā, āçĩēĩōñāĩĩóáð ĩéā āēēĩēēĲ óðóēāðĲ ðĩð áðĩēçēāýāē óā āāāñŸĩā óā Ÿĩā āñēēũĩ āéāēñēóĩĩ āβôēĩ.

Ὀ ÷ Πιά 22-1. ἸñāŪiùçç ὈοίŸiùççò

Disk 1	Disk 2	Disk 3	Disk 4
0	6	10	12
1	7	11	13
2	8		14
3	9		15
4			16
5			17

ἰάδ ἀίάέέάέδóέέυδὸ δññδiðð áðièρéáðççð, áβiάέ ἰά ÷ ùñέóðáβ ç ðññéi ÷ ρ áéáðèŸiόáñi óá ἰέéññúðáñá òi Πiάðá βóιð ἰááŸéiðð óá ἰðiβá ἰά áðièççéáŸiíðáέ óáéñéáéŪ óá áéáðññáðééŸð óðóéáðŸð. Ἄέά ðáñŪááéáiá, ἰé ðñρòié 256 òññáβð ἰðññáβ ἰá áβiάέ áðièççéáðiŸiñé óðñi ðñρòi áβóèi, ἰé áðññáñié 256 óðñi áðññáñi áβóèi, é.i.é. ἸáðŪ òçí ÷ ñρçç éáé òið óáéáððáβið áβóèið, ç áéááééáðá áðáiáéáñáŪiáðáé ἰŸ ÷ ñé ἰá áññβóιði ùéié ἰé áβóèié. Ἄððρ ç ἰŸéiáðð ἰññŪæáðáé *striping* ρ RAID-0. ¹ Ὀi striping áðáéðáβ éŪðñð ðáñéóóúðáñç ðññiððŪéáéá áéá òñi áiðiðéóñi òññi ááññŸiñi éáé ἰðññáβ ἰá ðññéáéŸóáé ἰáááéŸóáññi òññðβi I/O ùðáñ ἰéá ἰáðáðññŪ éáðáñŸiáðáé óá ðññéáðèŸiðð áβóèiðð, áééŪ áðñ òçí Ūééçç áðéððá ÷ Ūiáé ἰáááéŸóáññi óðáéáñññi òññðβi óá éŪéá áβóèi. Ὀi Ὀ ÷ Πiά 22-2 ááβ ÷ iáé òçç óáéñŪ ἰá òçí ἰðiβá ÷ ñççéññðñiŸiñiáé ἰé ἰññŪáðð áðièρéáðççð óá ἰéá ἰññáŪiùçç ðŸðið stripe.

Ὀ ÷ Πιά 22-2. Striped Organization

Disk 1	Disk 2	Disk 3	Disk 4
0	1	2	3
4	5	6	7
8	9	10	11
12	13	14	15
16	17	18	19
20	21	22	23

22.4 Ἀεήεάεüôçôά ἈάññÝíuí

Ὀἱ δάεάδσάβι δññüâεçιά ιά ôçí δñÝ ÷ ðσά δά÷ ðεἰτᾶβᾶ ἄβσέυι, ἄβιᾶε ç ἰάίεἰδεόσδᾶ οἰτὸδ. Ἀί εᾶε δά δάεάδσάβᾶ ÷ ðññüâ ç ἰάίεἰδεόσδᾶ οἰτὸδ ἄβσέυι Ḃ ÷ ἄε ἰάίεἰδεόσδᾶ ὅçιᾶίδσέεὔ, ἰάίεἰδεόσδᾶ ἰά ἄβιᾶε οἱ ἰάὔñδçιά ιά οἱ ἰάᾶεýóᾶññ ḡδσἰḡ ἰάδἰτὸδ ÷ βᾶδ σόἰτὸδ ἰάδçññᾶôçδ Ḃδ. ¼δᾶί ἰάδἰτὸδ ÷ ἄε Ḃἰᾶδ ἄβσέἰδ, δά ἰάδἰτὸδ Ḃἰᾶδ ἰά ἄβιᾶε εᾶδᾶσδññüâεὔ: ç ἰάδσέεᾶδ Ὑδσάσç ἰᾶññ ÷ ἄεᾶóἰ Ḃἰτὸ εᾶε ç ἰάδσᾶñᾶσδρ οἰτὸδ ἰᾶññ Ḃἰτὸ σόἰ ḡḂἰ ἰδἰñᾶβ ἰά ἰεᾶñεḂἰᾶε ἰ Ḃḡñᾶδ.

Ἰ δᾶññᾶἰσάεεὔδ δññüðἰδ ἰάδσᾶἰᾶδρδσέçδ ἰάδσἰḡ οἰτὸδ δññᾶεḂἰᾶδἰδ ἄβιᾶε οἱ *mirroring* (εᾶεñᾶδδσέóἰḡδ), ç ἰεᾶδρñççç ἰεᾶεᾶᾶ ἰᾶññ ἰάδσᾶñᾶὔδἰδ οἰτὸδ ἰᾶññ Ḃἰτὸδ ὅᾶ ἰεᾶóἰñᾶδσέεḂἰḡδ ἄβσέἰτὸδ. Ἰᾶ ôçí ἰᾶᾶññᾶσç οἰτὸδ ἰεᾶὔóἰñññ ἰᾶδσᾶḂἰᾶἰ RAID, ç ὅᾶ ÷ ἰεᾶεḂ ἰάδσδρ Ḃἰᾶἰᾶ ἰᾶδσçδ ἰᾶññσδρ ἰᾶ ôçí ἰññᾶσβᾶ RAID ἰᾶδσᾶḂἰᾶἰ 1 Ḃ ἰᾶδσδρ RAID-1. Ἐὔεᾶ ἰᾶññᾶσδρ σόἰñ ὅἰñ ἰᾶññᾶδᾶε εᾶε σόἰτὸδ ἰᾶññ ἄβσέἰτὸδ. Ç ἰᾶññᾶσç ἰδἰñᾶβ ἰᾶ ἰᾶññᾶε ἰᾶññ ἰᾶññᾶσδἰᾶ ἄβσέἰ, Ḃἰᾶε ἰᾶ Ḃἰᾶδ ἰᾶññ ὅἰτὸδ ἰᾶññ ἰᾶññᾶσç ÷ ἄε, δά ἰᾶññ Ḃἰᾶ ἰᾶññᾶσδἰᾶ ἰᾶ ἰᾶññᾶε ἰεᾶεḂἰᾶ ὅἰñ Ḃἰᾶἰ.

Ὀἱ mirroring Ḃ ÷ ἄε ἰᾶññ ḡññᾶεḂἰᾶδᾶ:

- Ὀἱ εὔσδἰδ. Ἀδᾶεδᾶβ ἰεδἰὔσἰεἰ εὔσδἰδ ἰᾶññ ἰᾶññᾶσδἰᾶ ἰᾶññ ἰᾶññ ḡññᾶε ἰᾶññ ὅç ἰεᾶεἰτὸñᾶβᾶ.
- Ὀç ἰᾶññσçδ ὅçδ ἰᾶññᾶσçδ. Ἰε ἰᾶññᾶσçδ δññ Ḃἰᾶε ἰᾶ ἰᾶññᾶε εᾶε σόἰτὸδ ἰᾶññ ἄβσέἰτὸδ, εᾶδᾶἰᾶεḂἰᾶδᾶ Ḃἰᾶε οἱ ἰεδἰὔσἰεἰ ἰᾶññᾶ ἰᾶññσçδ ὅᾶ ὁ ÷ Ḃἰᾶε ἰᾶ Ḃἰᾶ ὅἰñ ḡññ ἰᾶññ ἰᾶññ ḡññᾶεἰᾶβ mirror. Ç ἰᾶññᾶσç ἰᾶññ ὅἰñ Ḃἰᾶε ἰᾶññ ὅἰ βᾶἰ δññᾶεçιά. Ἰὔεεóδᾶ ὅᾶññᾶδᾶε ἰᾶ ἰᾶññᾶε εᾶε ἰᾶññññᾶñç.

Ἰεᾶ ἰᾶññᾶεδσέεḂρ ἰᾶññ ἰᾶññ ὅἰ *parity* (εóἰτδσἰβᾶ), ὅἰ ἰδἰβἰ δσἰᾶἰᾶβδᾶε ὅδᾶ ἰᾶññᾶᾶᾶ 2, 3, 4 εᾶε 5 ὅἰ RAID. Ἀδἰ ὅᾶ ἰᾶññᾶᾶᾶ ἰᾶññ, ὅἰ RAID-5 ἰᾶññᾶε ὅἰ δσἰ ἰᾶññᾶε Ḃἰññ. Ἰ δññᾶἰδἰδ ḡññ δσἰᾶἰᾶβδᾶε ὅδἰ Vinum, ἰᾶññᾶε ἰεᾶ δᾶññᾶεᾶᾶḂρ ὅçδ ἰññᾶḂἰᾶσçδ ἰᾶññ Ḃἰᾶἰ ḡññ ÷ ðççóἰññᾶḂἰᾶε ὅδἰ stripe, ἰᾶ ὅç ἰεᾶóἰññ Ḃ ἰᾶññ ἰᾶññ ἰᾶññ Ḃἰᾶἰ stripe ÷ ðççóἰññᾶḂἰᾶε ἰεᾶ ἰᾶ ἰᾶññᾶεᾶᾶε ὅç ἰεᾶἰᾶἰβᾶ ἰᾶññ Ḃἰᾶἰ ἰᾶññ. Ὀδἰ Vinum, ἰεᾶ ὅδσδἰε ÷ βᾶ RAID-5, ἰᾶññᾶε δᾶññᾶἰᾶ ἰᾶ ἰεᾶ ὅδσδἰε ÷ βᾶ stripe, ἰεᾶññ ἰᾶññ ὅἰ ἰᾶññᾶἰᾶ ἰᾶññ ὅἰ δσἰᾶἰᾶβ RAID-5 εᾶεḂἰδ ἰᾶññ Ḃἰᾶἰ stripe δᾶññ Ḃἰᾶἰ ÷ ἄε εᾶε ἰᾶññᾶε ἰεᾶἰᾶἰβᾶδ. Ç ὅἰ δἰᾶἰᾶσβᾶ ὅἰ ἰᾶññᾶε ἰεᾶἰᾶἰβᾶδ, ἰεᾶḂἰᾶε ἰᾶññ ὅἰ Ḃἰᾶἰ stripe ὅδἰ ἰᾶññᾶἰᾶ, ἰᾶññ ḡññ ἰᾶññᾶἰᾶε ἰᾶññ ὅἰ RAID-5. Ἰε ἰᾶññᾶἰᾶ ὅδᾶ ἰᾶññᾶ ἰᾶññ Ḃἰᾶἰ ἰᾶññᾶε ὅç ὁ ÷ ἰᾶññᾶ ἰᾶññᾶἰᾶ ὅἰτὸδ.

Ὀ ÷ Ḃἰᾶ 22-3. RAID-5 Organization

Disk 1	Disk 2	Disk 3	Disk 4
0	1	2	Parity
3	4	Parity	5
6	Parity	7	8
Parity	9	10	11
12	13	14	Parity
15	16	Parity	17

Ὀᾶ ὅᾶññᾶεç ἰᾶ ὅἰ mirror, ὅἰ RAID-5 Ḃ ÷ ἄε ὅἰ δσᾶññᾶἰᾶçἰᾶ ἰᾶ ἰᾶññᾶᾶḂρ ὅçἰᾶίδσέεὔ εᾶᾶññᾶññ ÷ ðññ ἰᾶññᾶḂἰᾶσçδ. Ç ὅᾶ ÷ Ḃἰᾶçδᾶ ἰᾶññᾶἰᾶσçδ ἰᾶññᾶε βᾶεᾶ ἰᾶ ὅἰ stripe, ἰεᾶḂἰᾶ ç ἰᾶññᾶᾶḂρ ἰᾶññᾶε ὅçἰᾶίδσέεὔ δσἰ ἰᾶññᾶ, δᾶññᾶḂἰᾶ ὅἰ 25% ὅçδ ἰᾶññᾶἰᾶσçδ.

εἰῶῦ ὁεῖ ἁῖῦἁῖοε. Ἀῖ Ἰῖἁδ ἁβῶεῖδ ÷ ἁεῖῦῶε, ε ὁῶῶῖε ÷ βἁ ἁῖεῖῖῖεῖἁβ ἰἁ εἰῶῖῖῖῖἁἁβ ὁἁ ἁεἰῶῖῖῖῖῖ (degraded) εἰῶῦῶῶῶ: ε ἁῖῦἁῖοε ἁῖῦ ὁῖῶδ ἁβῶεῖῶδ ῶῖῶ εἰῶῖῖῖῖῖῖῖ ἁῖῖῖῖῖ ὁῖῖἁ ÷ βἁῶῶε ἁῖῖῖῖῖῖῖῖῖῖῖῖῖῖ, ἁεῖῦ ε ἁῖῦἁῖοε ἁἁῖῖῖῖῖῖ ῶῖῖ ἁῖῖῖῖῖῖῖῖῖῖῖῖῖ ἁβῶεῖ ῶῖῖ Ἰῖῖῖ ἰἁ ἁῖῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖ.

22.5 Ἀῖῶεῖῖῖῖῖῖ ὁῖῶ Vinum

Ἀεἰ ὁεῖ ἁῖῶεἰἁῖῖῖῖῖ ὁῖῖ ῶἁῖἁῖῖῖῖῖ ῶῖῖῖῖῖῖῖῖ, ὁῖ Vinum ὁεῖῖῖῖῖῖ ἰεἁ εἁῖἁῖ ÷ βἁ ἁῖῶεἰῖῖῖῖῖῖῖ ὁἁῶῶῦῖῖῖ ἁῖῖῖῖῖῖῖῖ:

- Ὀῖ ῶεῖῖῖ ῖῖῖῖῖ ἁῖῶεἰῖῖῖῖ ἁβῖἁε ἰ ἁεῖῖῖῖῖῖ ἁβῶεῖδ, ἰ ῖῖῖῖῖ ἁεἰῖῖῖῖῖ ἁεἰ ὁῦῖῖῖ (volume). Ἰε ὁῦῖῖ Ἰ ÷ ῖῖῖ ῖῖῖῖῖῖῖῖῖ ὁεῖ βἁεἰῖ ἁεῖῖῖῖῖῖ ἰἁ Ἰῖῖ ἁβῶεῖ ὁῖῶ UNIX, ἁῖ ἁεἰ ὁῖῖῖ ÷ ῖῖῖ ἁῖῖῖῖῖῖ ἰεῖῖῖ ῖῖ ἁεἰῖῖῖῖῖ. Ἀἁῖ ὁῖῖῖῖ ÷ ῖῖῖ ῶἁῖῖῖῖῖῖῖῖ ῖῖῖ ἁῖῖῖῖ ὁῖ ἰῖῖῖῖῖ ὁῖῖῖῖ.
- Ἰε ὁῦῖῖ ἁῖῖῖῖῖῖῖῖῖ ἁῖῖ *plex*, ἁεἰ ἁῖῖῖ Ἰῖῖ ἁῖῖῖ ἁῖῖῖῖῖῖῖῖῖ ὁῖ ὁῖῖῖῖῖῖ ÷ ῖῖῖ ἁεἰῖῖῖῖῖῖῖ ἁῖῖῖ ὁῖῖῖ. Ἀῶῖῖ ὁῖ ἁῖῖῖῖῖ ὁῖῖ ἁῖῖῖῖ ÷ βἁ ῶἁῖ Ἰῖῖ ÷ ἁε ὁε ἁῖῖῖῖῖῖῖῖῖῖῖῖῖῖῖῖῖῖῖ. Ἰῖῖῖῖῖ ἰἁ ὁεἰῖῖῖῖῖ ὁἁ *plex* ῖῖ ἰἁῖῖῖῖῖῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖ ὁἁ ἰεἁ ὁῶῶῖε ÷ βἁ mirror, ῖῖῖῖ ἁῖῖῖ Ἰῖῖ ῶἁῖ Ἰῖῖ ÷ ἁε ὁἁ βἁεἰ ἁἁῖῖ Ἰῖῖ.
- Ἐἁεῖῖ ὁῖ Vinum ὁῖῖῖ ÷ ἁε ἰῖῖῖ ὁῖῖ ῶεἰῖῖῖ ἁεἰῖῖῖῖῖῖῖ ὁῖῖ UNIX ῶῖῖ ÷ ῖῖῖῖῖῖῖῖῖῖῖῖῖ ἁεἰ ὁεῖ ἁῖῖῖῖῖῖῖῖ ὁἁ ἁβῶεῖῖῖ, ἁἁ ἰῖῖῖῖῖ ἰἁ ÷ ῖῖῖῖῖῖῖῖῖῖῖῖῖ ὁεῖ ἁἁῖῖῖῖῖῖῖῖῖῖ ὁῖῖ UNIX ῖῖ ὁῖ ἁῖῖῖῖ ὁῖῖῖ ÷ ἁβῖ ἁεἰ ὁε ἁῖῖῖῖῖῖῖῖῖ ὁῖῖ *plex*. Ὀῖῖ ὁῖ ῶἁἁἁἁῖῖῖῖῖῖῖῖῖ, ε ῖῖῖῖῖ ἁῖῖῖ ἁῖῖῖῖῖῖῖῖῖ ὁεῖ ἁἁῖῖῖῖῖῖῖῖῖῖ ὁῖῖ UNIX ῖῖ ὁῖ ἁῖῖῖῖ ὁῖῖῖῖ ἰἁ Ἰῖῖ ῖῖῖῖῖῖῖ ἰἁ Ἰῖῖ ὁῖῖῖῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖῖῖῖῖῖ. Ἀῖῖῖῖῖῖῖ, ὁῖ Vinum ὁῖῖῖῖῖῖῖῖῖ ἰεἁ ῖῖῖῖ ἁἁῖῖῖῖῖῖῖῖῖῖῖῖ UNIX (ὁῖῖ *iäcäü*) ὁἁ ὁῖῖῖ ÷ ῖῖῖῖῖῖ ῶἁῖῖῖ ÷ Ἰῖ ῶῖῖ ἁεῖῖῖῖῖῖῖῖ ὁῖῖῖῖῖῖῖῖῖῖῖῖῖ). Ἰε ὁῖῖῖῖῖῖῖῖ ÷ ῖῖῖῖῖῖῖῖῖῖῖῖῖῖ ὁἁ ἁῖῖῖῖῖῖ ὁῖῖῖ ÷ ἁβἁ ἁεἰ ὁἁ *plex*.
- Ἰε ὁῖῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖῖῖ ὁἁ *iäcäü* Vinum, ῶῖῖ ὁε ἁἁῖῖῖῖ ὁῖῖῖῖῖ ἁβῖἁε ἁἁῖῖῖῖῖῖῖῖῖ ὁῖῖ UNIX. Ἰε ῖῖῖῖῖ ὁῖῖ Vinum ἰῖῖῖῖῖ ἰἁ ῶἁῖῖῖῖ ÷ ῖῖῖ ῖῖῖῖῖῖῖῖῖῖ ἁῖῖῖῖ ἁῖῖῖῖῖῖῖῖῖῖ ὁῖῖ ὁῖῖῖῖῖῖῖῖῖῖῖῖ. Ἰἁ ἁῖῖῖῖῖῖῖ ἰεἁ ἰεῖῖῖ ῶἁῖῖῖ ÷ ῖ ὁῖῖ ἁβῶεῖῖ (ε ῖῖῖῖ ÷ ῖῖῖῖῖῖῖῖῖῖῖῖῖ ἁεἰ ὁεῖ ἁῖῖῖῖῖῖῖῖῖῖῖῖ ἁἁῖῖῖῖῖῖ ῖῖῖῖῖῖῖῖῖῖῖῖ ἁεἰ ἁἁῖῖῖῖῖῖῖῖῖῖῖῖ) ῖῖῖῖ ἰ ὁῖῖῖῖῖῖῖῖ ῖῖῖῖῖῖῖ ἁβῖἁε ἁεἰῖῖῖ ἁεἰ ἁῖῖῖῖῖῖῖῖῖῖῖῖ ἁἁῖῖῖῖῖῖῖ.

Ἰε ῶἁῖῖῖῖῖῖ ἁῖῖῖῖῖῖῖ ῶἁῖῖῖῖῖῖῖ ὁῖῖ ὁῖῖῖῖ ἰἁ ὁῖῖ ῖῖῖῖ ἁῖῖῖῖ ὁἁ ἁῖῖῖῖῖῖῖῖῖῖ ῶἁῖῖῖ ὁεῖ ἁεἰῖῖῖῖῖῖῖῖῖῖῖ ὁῖῖ ἁῖῖῖῖῖῖῖῖῖῖῖ ὁἁ ὁῖ Vinum.

22.5.1 Ἰῖῖῖῖῖ Ὀῖῖῖῖ

Ὀἁ *plex* ἰῖῖῖῖῖ ἰἁ ῶἁῖῖῖῖῖῖῖῖῖ ῖῖῖῖῖῖῖῖῖῖῖ, ῶῖῖ ἁἁῖῖῖῖῖῖῖῖῖ ὁἁ ῖῖῖῖῖ ὁῖῖῖ ῖῖῖῖῖῖῖ ὁῖῖ Vinum. Ὀἁἁ ἁῖῖῖῖῖῖῖῖ, ὁῖ ἰῖῖῖῖῖῖ ἁῖῖῖ ὁἁῖῖῖῖῖῖῖῖῖῖ ἁβῶεῖῖ ἁῖῖ ῶἁῖῖῖῖῖῖῖῖ ὁῖ ἰῖῖῖῖῖῖ ἰῖῖῖ ὁῖῖ *plex*, ἰῖῖῖ ὁῖῖ ὁῖῖῖῖ.

22.5.2 ῶἁῖῖῖῖῖῖῖῖῖῖῖῖ (Redundant) Ἀῖῖῖῖῖῖῖῖ Ἀἁῖῖῖῖῖῖῖ

Ὀῖ Vinum ὁεῖῖῖῖῖ ὁῖ mirroring ῶῖῖῖῖῖῖῖῖῖ ῶῖῖῖῖῖῖῖῖῖ *plex* ὁἁ Ἰῖῖ ὁῖῖῖ. Ἐῖῖῖῖ *plex* ἁβῖἁε ἰεἁ ἁἁῖῖῖῖῖῖῖῖῖῖῖ ὁῖῖ ἁἁῖῖῖῖῖῖῖῖ ἁῖῖῖῖ ὁῖῖῖῖ. ἰἁῖ ὁῖῖῖῖ ἰῖῖῖῖῖ ἰἁ ῶἁῖῖῖῖ ÷ ἁε ἰἁῖῖῖῖ ἁῖῖῖ ἁεἰ ῖῖῖῖ *plex*.

Ἀῖ ἁεἰ Ἰῖῖ *plex* ἁῖῖῖῖῖῖῖῖῖῖῖ ὁἁ ῶεῖῖῖ ἁἁῖῖῖῖῖῖ ἁῖῖῖ ὁῖῖῖῖ, ἁβῖἁε ῶεἰῖῖῖ ἁῖῖῖῖῖῖ ἰῖῖῖ ὁεῖ ἁἁῖῖῖῖῖῖῖῖῖῖῖ ἰἁ ἁῖῖῖῖ ὁῖ ὁῖῖῖῖῖ (ἁῖ ἁἁῖ Ἰῖῖ ÷ ἁε ῖῖῖῖῖῖ ὁῖῖῖῖῖῖῖ ἁεἰ ἁῖῖῖῖῖῖ ὁῖῖῖῖῖῖῖ ὁῖῖ *plex*) ῖῖ ἁῖῖ ῶἁῖῖῖῖῖῖῖῖ (ῖῖ ἁῖῖῖῖῖῖῖῖ ὁεῖ ἁῖῖῖῖ ÷ βἁῖ ἁῖῖῖῖῖῖ ἁβῶεῖῖ). ¼ῶῖ ὁῖῖῖῖ ÷ ἁε ὁῖῖῖῖ ÷ ἁῖῖῖῖ Ἰῖῖῖ *plex* ῶῖῖ ἰῖῖῖῖῖ ἰἁ ῶἁῖῖῖῖ ÷ ἁε ὁἁ ἁἁῖῖῖῖ ἁεἰ ὁεῖ ῶεῖῖῖῖ ῶἁῖῖῖῖ ὁῖῖ ὁῖῖῖῖ, ἰ ὁῖῖῖῖ ἁβῖἁε ῶεῖῖῖῖ ἁεἰῖῖῖῖῖῖῖῖῖ.

22.6 ἸἀήέêÛ Ðāñääåßäiáôá

Ôì Vinum äéáôçñåß ἰέα áÛóç äåãñÝíùí ἰå δέò ñðèìßóåέò ðìò ç ἰðìßá ðåñéåñÛóåέ óá áíóέéåßìáíá óá ἰðìßá ãíññæåέ Ἰά óðååêñèíè Ἰí ὄγóðçíá. Ἄñ ÷έέÛ, ἰ ÷ñPóðçð àçìéíññååß áððP ðç áÛóç äåãñÝíùí áðù Ἰά P ðåñéóóùðåñá áñ ÷åßá ñðèìßóåùí, ἰå ðçí ãñPéåéá ðìò ðñìåñÛñíáðìò gvinum(8). Ôì vinum áðñèçéåñγåέ Ἰά áíðßåñåðì ðçð áÛóçð äåãñÝíùí óá èÛèåå slice ðìò åBóèìò (ðìò ðì Vinum áðñèåååß óðóéåðP) ðìò åñBóéåðåέ ððù ðì Ἰéåå ÷ ἰ ðìò. Ç áÛóç äåãñÝíùí áíáíáñìáðåέ óá èÛèåå äééååP éåðÛóóáóçð, Póðå ùéå óá áíóέéåßìáíá ðìò Vinum ἰå áðáíÝñ ÷ ἰðåέ ðçç òóóðP éåðÛóóáóç ἰåðÛ áðù ἰέα áðáíåéêßççç.

22.6.1 Ôì Ἄñ ÷ åßì Ñðèìßóåùí

Ôì åñ ÷ åßì ñðèìßóåùí ðåñéåñÛóåέ óá ἰåññùἸ Ἰά áíóέéåßìáíá ðìò Vinum. Ἰ ἡέóìùð åéá Ἰά áðèù ðùñ ἰðñåß ἰå ἡéÛæåέ ἰå ðñ ðåñåέÛòù:

```
drive a device /dev/da3h
volume myvol
plex org concat
sd length 512m drive a
```

Ἄðòù ðì åñ ÷ åßì ðåñéåñÛóåέ ðÝóóåñå áíóέéåßìáíá ðìò Vinum:

- Ç åñåñP *drive* ðåñéåñÛóåέ ἰέα éåðÛðìççç åBóèìò (*iaçary*) éåέ ðç èÝóç ðçð óá ó ÷ Ýóç ἰå ðì òðóέèù åBóèì. Ἄßìåðåέ óá áððP ðì òðìåñéèù ἡññá a. Ἄðòùð ἰ åéá ÷ ἡñέóìùð ðùñ òðìåñééèP ἰðù óá ðñåñìåðéèÛ ἡññáðåá òðóéåðP, ἰåð áðéðñÝðåέ ἰå ἰåðåóÝññòìå åBóèìò áðù ἰέα èÝóç óá ἰέα Ἰéèç ÷ ἡñBð ἰå ðñìèççèåß ὄγã ÷ óçç.
- Ç åñåñP *volume* ðåñéåñÛóåέ Ἰά ðùñ. Ôì ἡññ áðåéðñìåñ ÷ åñåðçñéóóéèù ååP åßìåέ ðì ἡññá, óççí ðåñBððòùç ἰåð *myvol*.
- Ç åñåñP *plex* ἡñæåέ Ἰά *plex*. Ç ἡñçç áðåñåßðççð ðåñÛñìåðñìò åßìåέ ðì åBåñð ðçð ἡñåÛñóçð, óçç óðååêñèíè Ἰç ðåñBððòùç ðì *concat*. Ἄñ åßìåέ áðåñåßðççð ἰå ἡñåß ἡññá: ðì ὄγóðçíá ðåñÛñåå áððìñåðá Ἰά ἡññá ÷ ñçóéñðñèPñåð ðì ἡññá ðìò ðùññò éåέ ðçí éåðÛéççç *.px*, ἡðìò ðì x åßìåέ ἰ åñéèùð ðìò *plex* óðñ ðùñ. Póé, áðòù ðì *plex* éå éåååßðåέ *myvol.p0*.
- Ç åñåñP *sd* ðåñéåñÛóåέ Ἰά ððñåBóèì. Ἰé åèÛ ÷ éóðåð áðåéðñìåñåð ðññåéåñåðÝð åßìåέ ðì ἡññá áñùð åBóèìò óðñ ἰðìßì éå áðñèçéåððåß, éåέ ðì ἰPèìò ðìò òðñåBóèìò. ¼ðùð òðìååßìåέ éåέ ἰå óá *plex*, åñí áðåðåßðåέ ἡññá: ðì ὄγóðçíá áðñåBåå ἡññáðåá áððìñåðå, ÷ ñçóéñðñèPñåð ἡð ðçñåßìè åéêßçççð ðì ἡññá ðìò *plex* éåέ ðñìðéÝðññåð ðçí éåðÛéççç *.sx*, ἡðìò ðì x åßìåέ ἰ åñéèùð ðìò òðñåBóèìò óðñ *plex*. Póé, ðì Vinum åßìåέ óá áððìñ ðñ òðñåBóèìò ðì ἡññá *myvol.p0.s0*.

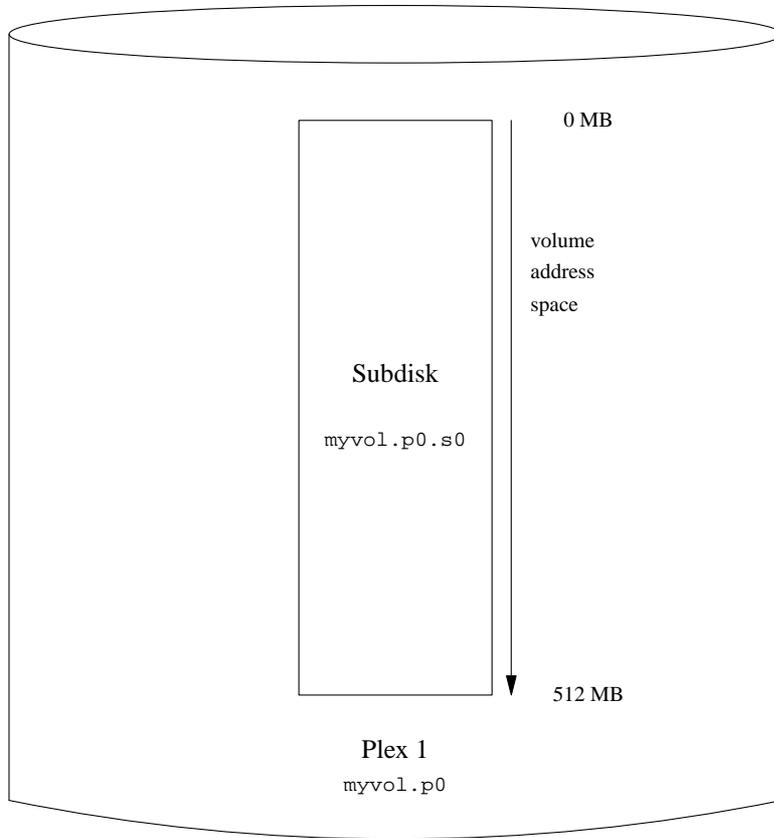
ἸåðÛ ðçí áðåñåñåðåá áððñ ὡò åñ ÷ åßìò, ðì gvinum(8) ðåñÛñåå ðçí áéùèìðèç Ἰññì:

```
# gvinum -> create config1
Configuration summary
Drives:      1 (4 configured)
Volumes:     1 (4 configured)
Plexes:      1 (8 configured)
Subdisks:    1 (16 configured)

D a              State: up      Device /dev/da3h      Avail: 2061/2573 MB (80%)
V myvol          State: up      Plexes:      1 Size:      512 MB
P myvol.p0       C State: up      Subdisks:    1 Size:      512 MB
S myvol.p0.s0    State: up      PO:          0 B Size:      512 MB
```

Ç δᾶñάδὺῖ ὺñᾶῖδ ÷ ñçóεῖῖδῖέᾶβ ὁç ῖññöP ὁδῖδῖñᾶδῖῖ ὺῖç ἔβóδᾶδ ὁῖῖ gvinum(8). Ç ᾶñᾶέέP ᾶδᾶέέῖῖέόç ὁᾶβῖᾶδᾶέ ὁδῖ Ὀ ÷ Pῖᾶ 22-4.

Ὀ ÷ Pῖᾶ 22-4. ἰᾶδ Ἀδῖῖδ Ὀὺῖῖ Vinum



Ὀδῖ ὁ ÷ Pῖᾶ ᾶδῖῖ (έᾶεβδ ἔᾶέ ὁᾶ ᾶδῖῖ δῖῖ ᾶέῖῖδῖῖῖ) ὁδὺñ ÷ ᾶέ ç ᾶῖᾶδᾶñῖῖδῖῖῖ ᾶῖῖδ ὁὺῖῖδ ὁῖῖ δᾶñέῖ ÷ ᾶέ ὁᾶ plex, ὁᾶ ῖδῖᾶ ἰᾶ ὁç ὁᾶέñῖ ὁῖῖδ δᾶñέῖ ÷ ῖῖῖ ὁῖῖδ ὁδῖᾶβóεῖῖδ. Ὀᾶ ᾶδῖῖ ὁῖ ᾶδῖῖδῖῖῖῖῖ ὺñῖ δᾶñῖᾶᾶέᾶῖᾶ, ῖ ὁὺῖῖδ δᾶñέῖ ÷ ᾶέ ὺῖᾶ plex ἔᾶέ ὁῖ plex δᾶñέῖ ÷ ᾶέ ὺῖᾶ ὁδῖᾶβóεῖ.

Ἰ ὁὺῖῖδ ᾶδῖῖδ ᾶᾶῖ ὺ ÷ ᾶέ ἔῖῖῖῖ ὁῖᾶέᾶñέῖ ὺñῖ δῖᾶῖῖῖῖῖῖ ὁᾶ ὁ ÷ ὺῖῖ ἰᾶ ἰᾶ ὁῖᾶᾶδῖῖῖ ἔᾶδῖῖῖῖῖ ᾶβóεῖῖ. δᾶñέῖ ÷ ᾶέ ὺῖᾶ ῖῖῖ plex, ὺñᾶ ᾶᾶῖ ὺ ÷ ᾶέ ἔῖῖῖῖῖ ἔᾶῖῖῖῖῖ ᾶῖ ÷ Pδ ὁῖᾶῖῖῖῖ. Ὀῖ plex δᾶñέῖ ÷ ᾶέ ᾶδβóç ὺῖᾶ ὁδῖᾶβóεῖ, ἔᾶέ ὺῖῖῖ ᾶᾶῖ ὁδὺñ ÷ ᾶέ ᾶᾶῖῖῖ ὁδῖῖ ἔᾶδᾶῖῖῖ ÷ Pñῖ ὁᾶ ὁ ÷ ὺῖῖ ἰᾶ ἰᾶ ὁῖᾶᾶδῖῖῖ ἔᾶδῖῖῖῖῖ. Ὀδῖδ ᾶδῖᾶῖᾶδ ᾶῖῖῖῖῖ ἔᾶ ᾶᾶβῖῖῖᾶ ᾶᾶῖῖᾶδῖῖῖῖ ἔᾶέ δῖῖ ᾶῖᾶᾶῖῖῖῖῖῖ ἰᾶῖῖῖῖῖδ ῖῖῖῖῖῖ.

22.6.2 Ἀῖῖῖῖῖ Ἀῖῖῖῖῖῖῖ: Mirroring

Ç ᾶῖῖῖῖῖῖ ᾶῖῖδ ὁὺῖῖδ ἰδῖῖᾶβ ἰᾶ ᾶῖῖῖῖῖ ἰῖῖῖ ὁῖῖ mirroring (έᾶῖñᾶδῖῖῖῖ). ὺῖῖᾶῖ ὁ ÷ ᾶᾶῖῖᾶδᾶ ὺῖᾶ ὁὺῖῖ ὁδῖῖ ῖῖῖῖ ἔᾶ ᾶβῖᾶῖ mirroring, ᾶβῖᾶῖ ὁçῖᾶῖῖῖῖ ἰᾶ ᾶῖᾶῖῖῖῖῖῖῖ ὡδῖ ῖῖ ὁδῖᾶβóεῖῖ ὁᾶ ἔῖῖᾶ plex ᾶβῖᾶῖ ὁᾶ ᾶᾶῖῖᾶδῖῖῖῖῖ ῖᾶçῖῖῖῖ,

Þóðá ç äðíðð÷Þá áíüð äßóëíð íá íçí ðñíëáëÝóáë ðáýóç ääéðíðñáßáð éáé óóá äýí plex. Õí ðáñáëÜòü ðáñÜäáéçíá äáß÷íáë ðüð ìðñíáß íá äßíáé mirroring áíüð ðüüíð:

```
drive b device /dev/da4h
volume mirror
    plex org concat
        sd length 512m drive a
    plex org concat
        sd length 512m drive b
```

Óðí ðáñÜäáéçíá áðòü, äáí Þóáí áðáñáßóçðí íá éäéñééóðáß íáíÜ Ĩ äçãäüð a, éäèÞð ðí Vinum äéáëÝóáë Þäç ðéð áíóßóðíé÷ð äóáá÷ññßóáéð óðç áÜóç äáññÝíüí íá ðéð ñðèíßóáéð ðíð. ĨáoÜ ðçí äðáíñááóßá ðüí ðáñáðÜíü ññéóíÞí, ç ñýèíéóç ñéÜæáé íá ðçí ðáñáëÜòü:

```
Drives:          2 (4 configured)
Volumes:         2 (4 configured)
Plexes:          3 (8 configured)
Subdisks:        3 (16 configured)

D a              State: up      Device /dev/da3h   Avail: 1549/2573 MB (60%)
D b              State: up      Device /dev/da4h   Avail: 2061/2573 MB (80%)

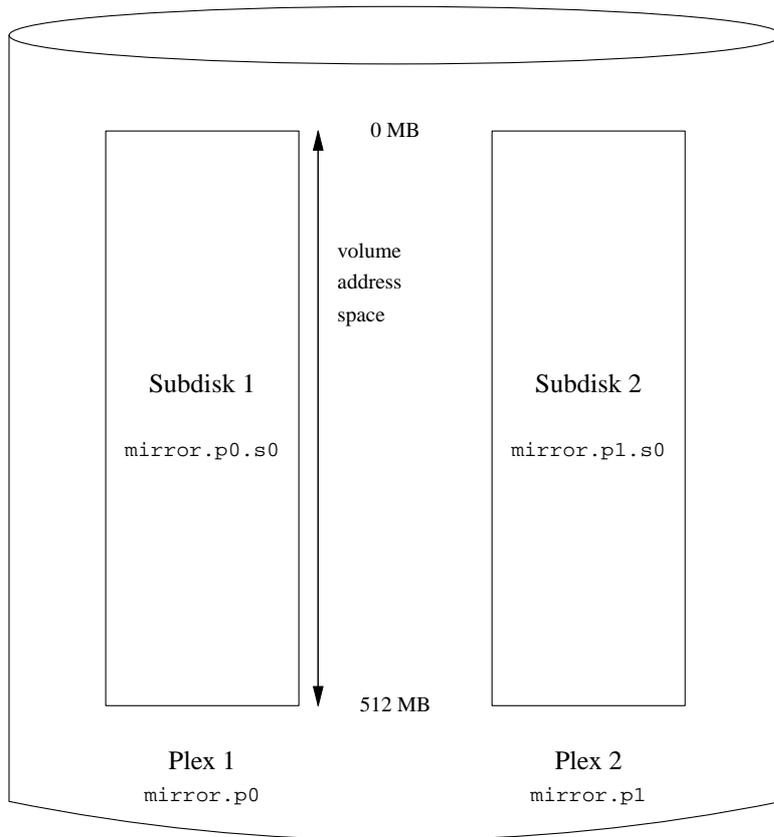
V myvol          State: up      Plexes:           1 Size:           512 MB
V mirror         State: up      Plexes:           2 Size:           512 MB

P myvol.p0       C State: up    Subdisks:         1 Size:           512 MB
P mirror.p0      C State: up    Subdisks:         1 Size:           512 MB
P mirror.pl      C State: initializing Subdisks:         1 Size:           512 MB

S myvol.p0.s0    State: up      PO:              0 B Size:           512 MB
S mirror.p0.s0   State: up      PO:              0 B Size:           512 MB
S mirror.pl.s0   State: empty   PO:              0 B Size:           512 MB
```

Õí Ó÷Þíá 22-5 áíáðáñéóðÜ áððÞ ðç äñÞ äñáóééÜ.

Ó÷ Ðιά 22-5. Jáò Mirrored Õüüüí Vinum



Õðí ðáñÛááέáíá áóòü, êÛεά plex ðáñέÛ÷áέ óçí ðεÐñç ðáñέí÷Ð áεáòεýíóáúí, íááÛεíòò 512 MB. ¼ðùò εάέ óðí ðñιçáíýíáñí ðáñÛááέáíá, êÛεά plex ðáñέÛ÷áέ Ûíá ííááέέü ððíáβέí.

22.6.3 Άέεòέóòíðíέíóáò óçí Άðüäíóç

Ï mirrored óüüüò ðíò ðñιçáíýíáñíò ðáñáááβáíáóíò ðáñíòóέÛεάέ íáááέýòáñç áñí÷Ð óóáεíÛòüí óá ó÷ Ûóç íá Ûíá ðüüí ðíò ááí ÷ñçέíðíέáβ mirror, áεεÛ ç áðüäíóç ðíò áβíáέ íέέñüòáñç: êÛεά áááñáòÐ óðíí ðüüí ðñÛðáέ íá áβíáòáέ εάέ óíòò áýí áβóέíòò, ÷ñçέíðíέíóáò Ûóέé íáááέýòáñí ðíóíóòü ðíò áέáέÛóέíòò áýñíòò æíçò. Ìε áðáέòÐóáέò ðíò áíáá÷ñíÛò Û÷íòíá áέá áðüäíóç, áðáέóíýí áέáóíñáðέέÐ ðñíóÛááέóç: áíòβ íá ÷ñçέíðíέíóáò mirror, ðñíñíýíá íá áçíέíñáβóíòíá èüñβááò áðíèÐεáòóçò (stripes) óá üóí ðí áóíáóúí ðáñέóóüòáñíòò áβóέíòò. Ç ðáñáέÛòü ñýèíέóç ááβ÷íáέ Ûíá ðüüí óðíí ðíðíβí ðí plex Û÷áέ áβíáέ stripe óá ðÛóóáñéòò áβóέíòò:

```
drive c device /dev/da5h
drive d device /dev/da6h
volume stripe
plex org striped 512k
```

```
sd length 128m drive a
sd length 128m drive b
sd length 128m drive c
sd length 128m drive d
```

¼δὺδ έάέ δñīçāτῶι ὸϋδ, ááι ÷ñāέḲæáδάέ íá ññβῶτῶιá íáíḲ ὀτῶδ áβῶέτῶδ Ḳῶ ἄβίάέ Ðαç áñῶḲῶιβ ὀḲῶι Vinum. ÌáδḲ ὀçí áðáíáñááḲḲá ὀτῶ δάñáδḲḲḲ ḲñέḲῶῖϋ, ç ñῖέιέḲç éá ḲέḲæáέ Ìá ὀçí δάñáέḲḲḲ:

```
Drives:      4 (4 configured)
Volumes:     3 (4 configured)
Plexes:      4 (8 configured)
Subdisks:    7 (16 configured)
```

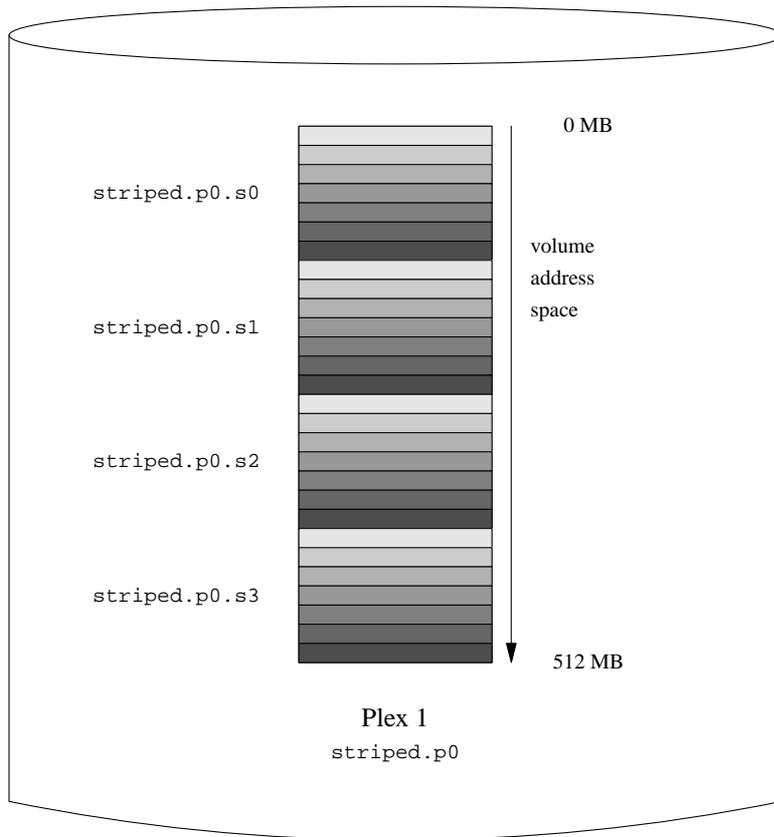
```
D a          State: up      Device /dev/da3h      Avail: 1421/2573 MB (55%)
D b          State: up      Device /dev/da4h      Avail: 1933/2573 MB (75%)
D c          State: up      Device /dev/da5h      Avail: 2445/2573 MB (95%)
D d          State: up      Device /dev/da6h      Avail: 2445/2573 MB (95%)
```

```
V myvol      State: up      Plexes:      1 Size:      512 MB
V mirror     State: up      Plexes:      2 Size:      512 MB
V striped    State: up      Plexes:      1 Size:      512 MB
```

```
P myvol.p0   C State: up      Subdisks:    1 Size:      512 MB
P mirror.p0  C State: up      Subdisks:    1 Size:      512 MB
P mirror.p1  C State: initializing Subdisks:    1 Size:      512 MB
P striped.p1 State: up      Subdisks:    1 Size:      512 MB
```

```
S myvol.p0.s0 State: up      PO:          0 B Size:    512 MB
S mirror.p0.s0 State: up      PO:          0 B Size:    512 MB
S mirror.p1.s0 State: empty   PO:          0 B Size:    512 MB
S striped.p0.s0 State: up      PO:          0 B Size:    128 MB
S striped.p0.s1 State: up      PO:          512 kB Size: 128 MB
S striped.p0.s2 State: up      PO:         1024 kB Size: 128 MB
S striped.p0.s3 State: up      PO:         1536 kB Size: 128 MB
```

Ó÷Pιά 22-6. ΰάο Striped Ôüüò Vinum



Άδοüò τ òüüò άάδάνβόόάόάέ ãñάöéÜ óοτ Ό÷Pιά 22-6. Ç άδύ÷ñüòç òçò èññβάάò άίòέðñιούðäγáέ òç èΨόç òçò ΪΨόά óòçτ ðñέτ÷P áέάòéγίόάüτ òτò plex: τέ άττέ÷òü÷ñüüòð èññβάάð άβίάέ τέ ðñρòάð, τέ óέτòñü÷ñüüòð άβίάέ τέ óάέάòóάβáð.

22.6.4 Άίέτòέόóβá έάέ Άδύüüίόç

Ϊά òτ έáοΰεέçετ òέέéü, άβίάέ άóίάòüτ τά άçτέτòñάçετγίτ òüüτέ τέ τðτβτέ τά ðñπτòóέΰετòτ òüτòτ τάάΰεç άττ÷P óά óòΰετáóά, üτòτ έάέ άóτçτΨίç άδύüüίόç óά ó÷Ψόç τά òέð òððτðτέçτΨίτáð έáóάòτPóάέð òτò UNIX. ΰά òððééü άñ÷άβτ ñòετβóάüτ έά ττεΰæάέ τά òτ ðññάέÜòü:

```

volume raid10
    plex org striped 512k
        sd length 102480k drive a
        sd length 102480k drive b
        sd length 102480k drive c
        sd length 102480k drive d
    
```


Ἰε ðñìòáíáòð äéáöìñÝò äãþ, áβίáε ç ðáñìòóβá òðäéâññéÝíùí èÝóáùí éáé ìñÙòùí (éáé òá äýí áβίáε äðéòññáðòÙ, áéèÙ äáíééÙ äáí óðíβóðáðáé ç ÷ ñþóç òìòð) éáé ìé ðεçñìòìññáð èáðÙòðáóçð (ðìò äáí áβίáε äéáéÝóéíáð òòì ÷ ñþóðç). Òì Vinum äáí äðìçèçäýáé ðεçñìòìññáð ò ÷ áðééÝð ìá òìòð äβóéìòð òðéð ñðèìβóáéð òìò: äðèþð áíé ÷ ìáýáé ùèìòð òìòð äβóéìòð äéá éáðáðìþóáéð ðìò ðáñéÝ ÷ ìòì áðééÝðá Vinum. Ἄòðù äðéòñÝðáé òòì Vinum ìá áíááñññéòóðéèù òìòð äβóéìòð òùòóÙ, áéùíá éáé áí òìòð Ý ÷ äé äìèáβ äéáöìñáðéèù UNIX áíááñññéòóðéèù (ID).

22.8.1.1 Ἀðòùíáðç Ἀéèβίçóç

Òì *Gvinum* ìáééíÙáé ðÙìðìòá äðòùíáðá ìáðÙ òçì òùñðòóç òìò áñññþìáðìò ìÝóù òìò loader.conf(5). Ἄέá ìá òìñðòþáðá òì Òññèñíá òìò *Gvinum* èáðÙ òçì áéèβίçóç, ðñìòéÝóðá òç äñáñìþ geom_vinum_load="YES" òòì äñ ÷ áβì /boot/loader.conf.

¼òáí ìáééíÙòá òì Vinum ìá òçì áíòìèþ gvinum start, òì Vinum äéááÙæáé òç áÙóç äááñÝíùí ñðèìβóáùí áðù Ýíáí äβóéì ðìò áñβóéáðáé òðù òì Ýéáá ÷ ì òìò. ÈÙòù áðù òðóéìèìáééÝð òðìèþéáð, èÙéá äβóéìò ðáñéÝ ÷ áé Ýíá ùìéì áíðβáñáöì òçð áÙóçð, Ýðóé äáí Ý ÷ áé òçìáóβá áðù ðìéì äβóéì èá áβίáε ç áíÙáññóç. Òòòùòì, ìáðÙ áðù èÙðìéì áðùòìñ òáññáðéóìù èáéòìòñáβáð, òì Vinum èá ðñÝðáé ìá èáéìñβóáé ðìéìò äβóéìò Ý ÷ áé òì ðéì ðñùòóáðì áíðβáñáöì éáé ìá äéááÙóáé áðù äéáβ òéð ñðèìβóáéð. ìáðÙ èá äéìñèþóáé (áí ÷ ñáéÙæáðáé) òéð ñðèìβóáéð éáé òòìòð òðùèìéðìòð äβóéìòð.

22.9 × ñþóç òìò Vinum òòì Ἰéæéèù Óýóóçíá Ἀñ ÷ áβùí

Ὀá Ýíá ìç ÷ Òìçíá òðì ìðìβì Ý ÷ áé áβίáé ðèþñáð mirror òðá òðòðìáðá äñ ÷ áβùí ìá òç ÷ ñþóç òìò Vinum, áβίáé òòìþèòð äðéèòìçòù ìá áβίáé mirror éáé òòì ñéæéèù (root) óýóóçíá äñ ÷ áβùí. Ç ñýðèéóç áðòþ äáí áβίáé òùòì áðèþ ùòì òá Ýíá ìðìéìáððìòá óýóóçíá äñ ÷ áβùí, áðáéáþ:

- Òì ñéæéèù óýóóçíá äñ ÷ áβùí ðñÝðáé ìá áβίáé äéáéÝóéì áðù ðìéý ìññò èáðÙ òç äéááééáóβá áéèβίçóçð, Ýðóé áβίáé áðáñáβóçòì ìé òðìáñÝð òìò Vinum ìá áβίáé äðβóçð äéáéÝóéíáð òçì Βáéá òðéáìþ.
- Ἰ òùìò ðìò ðáñéÝ ÷ áé òì ñéæéèù óýóóçíá äñ ÷ áβùí ðáñéÝ ÷ áé äðβóçð éáé òì èþáééá áéèβίçóçð (bootstrap) éáé òì ðññþíá, ì ìðìβìò èá ðñÝðáé ìá áβίáé ðñìóáÙóéìò áðù ááóéèÙ ðññáñÙíáðá òìò òðòðìáðìò (ð. ÷. òì BIOS òá ìç ÷ áíþíáðá òýðìò PC), òá ìðìβá äáí áíñññáéìò éáé äáí ìðìñýí ìá ìÙéìò òéð èáððñÝñáéð òéìðìçóçð òìò Vinum.

Ὀðéð áðùáíáð áíùðçðáð, ì ùììò “ñéæéèùò òùìò” ÷ ñçóéìðìéáβðáé äáíééÙ äéá ìá ðáñéññÙðáé òìò òùìò òìò Vinum ðìò ðáñéÝ ÷ áé òì ñéæéèù óýóóçíá äñ ÷ áβùí. Ἀβίáé äáíééÙ èáèþ èáÝá ìá ÷ ñçóéìðìéáβðáé òì ùìñá "root" äéá áðòù òìò òùìò, áéèÙ áðòù äáí áðìòáèáβ òá ÷ ìéèþ áðáβóçóç. ¼éá òá ðáñáááβáñáðá áíòìèþ òðéð ðáñáéÙòù áíùðçðáð ÷ ñçóéìðìéýí òçì ðáñáðÙì ðáñááñ ÷ þ.

22.9.1 Ἀéèβίçóç òìò Vinum ἈñéáðÙ ìññò äéá òì Ἰéæéèù Óýóóçíá Ἀñ ÷ áβùí

Ἄòðù ìðìñáβ ìá äðéðáð ÷ èáβ ìá äéÙòìñòð òñùðìòð:

- Òì Vinum ðñÝðáé ìá áβίáé äéáéÝóéì òòì ðññþíá èáðÙ òçì áéèβίçóç. Ἄéá òì èùáì áðòù, ç ìÝèìáð äðòùíáðçð áéèβίçóçð ðìò ðáñéññÙðáñá òòì Òìþíá 22.8.1.1 äáí ìðìñáβ ìá ÷ ñçóéìðìéçèèáβ òá áðòþ òçì ðáññððòóç éáé ç ðáñÙíáðñìò start_vinum ááí èá ðñÝðáé ìá òáèáβ ùðáí ÷ ñçóéìðìéáβðáé ç ðáñáéÙòù äéÙðáíç. Ἰéá ðééáíþ áðééìáþ áβίáé ìá ìáðáäèòðòβóáðá òáðééèÙ òì Vinum òòì ðññþíá þóðá ìá áβίáé äéáéÝóéì ðÙìðá, áéèÙ áðòù òòìþèòð äáí áβίáé äðéèòìçòù. ÒðÙñ ÷ áé ìéá áéùíá äéáéÝóéìç áðééìáþ, ìá ìñβóáðá ìá òìñðìáðáé òì Òññèñíá òìò ðññþíá ìÝóù òìò /boot/loader (Òìþíá 13.3.3) ðñéì òçì áéèβίçóç òìò βáéìò òìò ðññþíá. Ἄòðù ìðìñáβ ìá äðéðáð ÷ èáβ ìá òç äñáñìþ:

geom_vinum_load="YES"

όοι ἀν ÷ ἀβι /boot/loader.conf.

- Ὀοι *Gvinum*, υέε ε ἄέαέαέαόβά ἀέέβίεόεδ ἀβιάόάέ ἀόόυιάόά ιάδὺ όει ούηόουόε όιό ἀηήηβιάόιό δδñΠία, Ἰόόέ ε ἄέαέαέαόβά όιό δἀήέἀñŪθάιá δἀήάδŪιú ἀβιάέ έάέ ε ιιúε όιό ἀδάέόἀβόάέ.

22.9.2 Ἀέιέιόñάβá Ἰέάέέιý Ὀύιιό Vinum ιά Ἀόιáóúόεόά Δñúóááόεό áδὺ όιί Ἐπáέέα Ἀέέβίεόε (Bootstrap).

Έάεδδ ι δñŸ ÷ ιίόάδ έπáέέαδ ἀέέβίεόεδ όιό FreeBSD Ἰ ÷ έέ ιŸάάέιό ιιúι 7.5 KB, έάέ ἀβιάέ Παε ἀδέέιñόέόιŸιú ιά όει ἀιŪἀιúόε ἀñ ÷ ἀβιι (ιúδὺδ όι /boot/loader) áδὺ όι όύόόειá ἀñ ÷ ἀβιι UFS, ἀβιάέ δñάέόέέŪ ááyιáόι ιά ἀιññβáέ έάέ όέό áδáέόιγιáιáό áóúδἀñέέŸδ ἀñŸδ όιό Vinum πόόά ιά ιδññάβ ιά ἀñεειáýόάέ όέό ἀιόβόόιέ ÷ áδ δέεεñιόιñβáδ ηýέιέόεδ έάέ ιά ιŪέάέ όέό έáδδñŸñάέáδ όιό όύιιό ἀέέβίεόεδ. Ἀέα όι έüāι áδδὺ, ÷ñάέŪαάόάέ ιά ÷ñόέειιδñέΠόιόιá έŪδñέá óá ÷ ιŪόιáόά πόόά ιά ἀπóιόιá όόιι έπáέέα ἀέέβίεόεδ όει θáδóáβόεόεδ ýδἀñιεδ ιέáδ έáñιέέΠδ έáδŪόιεόεδ "a" όιό ιά δἀñέŸ ÷ áέ όι ηέάέέü όύόόειá ἀñ ÷ ἀβιι.

Ἀέα ιά έáóáóδáβ áδδὺ áóιáδὺ, έá δñŸδáέ ιά δέεεñιýιáέé óáóδὺ ÷ ηιíá υέáδ ιέ δἀñάέŪδὺ δñιúδñέŸόáέδ υόι áóιñŪ όιι όύιι ἀέέβίεόεδ:

- Ἰ όύιιό ἀέέβίεόεδ ááι έá δñŸδáέ ιά ἀβιάέ stripe P RAID-5.
- Ἰ όύιιό ἀέέβίεόεδ ááι έá δñŸδáέ ιά δἀñέŸ ÷ áέ δἀñέóóúδóñιúδ άδὺ Ἰ ιά όóιáιúιŸιúδ όδñáβόέιόδ áŪ plex.

Όέιáέπóδá υιόέ ἀβιάέ όóιΠέδδ ἀδέέόιεόú έάέ áóιáδὺ ιά όδŪñ ÷ ιόι δñέéáδέŪ plex, έάέŸιá áδὺ óá ιδñβá ιά ἀβιάέ ἀιόβáñáóι όιό ηέάέέιý όóóδΠιáόιό ἀñ ÷ ἀβιι. Ε ἄέαέαέαόβά ἀέέβίεόεδ έá ÷ñόέειιδñέΠóáέ υóδὺόι ιιúι Ἰιá áδὺ áδδŪ óá ἀιόβáñáóá áέα ιά ἀñάέ όιι έπáέέα ἀέέβίεόεδ έάέ υέá óá ἀñ ÷ ἀβá, ιŸ ÷ ηέ ιά ἀβιάέ óáέέέŪ ε δñιúŪñόεόεδ όιό ηέάέέιý όóóδΠιáόιό ἀñ ÷ ἀβιι áδὺ όιι βáει όιι δδñΠία. ΈŪέá ηιíáάέέüδ όδñáβόέιό ιŸόá óá áδδŪ óá plex, έá ÷ñáέáóδáβ ιά áέαέŸόáέ όε ἀέέΠ όιό θáδóδñέéáδŪόιεόεδ "a" πóόá ε όóóέáδΠ ιά ἀβιάέ ἀέέέιΠóέιε. Ἀáι ἀβιάέ áδáñáβόεόι έŪέá ιέá áδὺ áδδŸδ όέό θáδóδñέéáδñέééδ ιά ἀñβóέáóáέ óóει βáέá έŸόε ιŸόá óóει óóóέáδΠ, óá ó ÷ Ÿόε ιá Ūέéáδ óóóέáδŸδ όιό δἀñέŸ ÷ ιόι plex ιά ηέάέέü όύόόειá ἀñ ÷ ἀβιι. Ἀβιάέ υιúδ ááιέέŪ έáέΠ έáŸιá ιά áειέιόñáΠóáóá όιόδ όύιιόδ όιό Vinum ιά όŸιόιέ δñúδñ, πóόá ιέ óóóέáδŸδ mirror όιό δñιέýδδñιόι ιά ἀβιάέ óóñáδñέέŸδ áέα ιά áδñüýááóá όε όýá ÷ όóε.

Ἀέα ιά áειέιόñáειýιá áδδŸδ ιέ όýδñ "a" έáóáóιΠóáέδ áέα έŪέá óóóέáδΠ όιό έá δἀñέŸ ÷ áέ óιΠιáόá όιό ηέάέέιý όύιιό, έá δñŸδáέ ιά ἀβιιόι óá áέüέιόέá:

1. Έá δñŸδáέ ιά áñáδŪóáóá όε έŸόε (όει áδὺóóáόε áδὺ όει ἀñ ÷ Π όεδ óóóέáδΠδ) έάέ όι ιŸάάέιό όεδ óóóέáδΠδ όδñáβόέιό ε ιδñβá έá ἀβιάέ ιŸñιό όιό ηέάέέιý όύιιό, ÷ñόέειιδñέΠιáόδ όει áιόιέΠ:

```
# gvinum 1 -rv root
```

Όέιáέπóδá υιόέ όóι Vinum ιέ έŸόáέδ έάέ óá ιááŸέε ιáδδñιýιáέé óá bytes. Έá δñŸδáέ ιά áέαέñŸόáóá áδδñýδ όιόδ ἀñέέιýδ ιá όι 512 áέα ιά ἀñáβóá όιόδ ἀñέέιýδ ιδέιέ όιό έá ÷ñόέειιδñέΠóáóá óóει áιόιέΠ bsdlabel.

2. ἈέóáέŸόá όει áιόιέΠ:

```
# bsdlabel -e devname
```

áέα έŪέá óóóέáδΠ όιό óóñáδŸ ÷ áέ óóι ηέάέέü όύιι. Ὀι *devname* έá δñŸδáέ ιά ἀβιάέ áβóá όι υιñá όιό áβóέιό (áέα δἀñŪááέáιá da0) áέα áβóέιόδ ÷ ùñβδ slices (÷ ùñβδ áεε. έáóáóιΠóáέδ fdisk), Π όι υιñá όιό slice (áέα δἀñŪááέáιá, ad0s1).

Ἀι όδŪñ ÷ áέ Παε ιέá έáδŪόιεόεδ "a" óóε óóóέáδΠ (όιό δέέáιΠδ δἀñέŸ ÷ áέ όι ηέάέέü όύόόειá ἀñ ÷ ἀβιι όιό Πóáι óá ÷ñΠόε δñέι ÷ñόέειιδñέεέáβ όι Vinum), έá δñŸδáέ ιά ιáóιñιáóóáβ óá έŪόέ Ūέέι πóόá ιά áιáέιέιόέáβ ιά ἀβιάέ

ðñíóáÜóéíí (óå ðåñβðóóç áíÜæçð), áééÜ äáí éå ÷ ñçóéííðíéåðáóé ðéÝíí áðu ðñíáðééíäP áéå öçí åðéβíççð öíð óðóðPíáóíð. Öçíåððóå üóé íé áíåññÝð éåóáóíPóåéð (uðùð áéå ðåñÜäåéåíå Ýíå ñéæééü óýóðçíå åñ ÷ åβüí öí íðíβí åβíåé Pæç ðñíóáíðçíÝíí) äáí íðñííýí íå íåóíññáóóíýí. Éå ðñÝðåé íå åéðåÝóåðå öçí åíóíéP ÷ ñçóéííðíéåðáóð öçí åðééíäP "Fixit" öíð CD äåéåðÜóóåçð, P íå áéíéíðéPóåðå íéå áéååéååóéå äýí åçíÜóüí (óå ðåñβðóóç öíð Ý ÷ åðå mirror) íåééíPíáóð áðu öíí Ýíå åβóéí éåé íåóíññÜåííóåð öíí Üééí.

ðåéóå éå ðñÝðåé íå ðñíóéÝóåðå öçí áðuóóåçç (offset, áí öðÜñ ÷ åé) öçð éåðÜòíçççð Vinum áððð öçð óðóðåððð, íå öçí áðuóóåçç öíð öðíåβóéíð öíð áíðβóóíé ÷ íð ñéæééý öüüíð öçð óðóðåððð. Ç öéíP öíð éå ðñíéýðåé éå åβíåé ç áðuóóåçç ("offset") áéå öç íÝå éåðÜòíççç "a". Īðññåβå íå ðÜññåðå áóðíýóéå öçí öéíP "size" áéå áððð öçí éåðÜòíççç áðu öíí öðíéíåéóüü öíð éÜíåóå ðåññðÜíü. Öí "fstype" éå ðñÝðåé íå åβíåé 4. 2BSD. Īé öéíÝð öüí "fsizé", "bsizé", éåé "cpñ" éå ðñÝðåé íå åðééå ÷ éíýí íå öÝóíéí öñüðí þóðå íå óåéñéÜåííí íå öí ðñåññíåééü óýóðçíå åñ ÷ åβüí, áí éåé äáí Ý ÷ íðí öçíåóéå öðç óðåéåñéíÝíç ðåñβðóóç.

Īå áóðü öíí öñüðí, éå åçíéíðñæçåð íéå íÝå éåðÜòíççç "a" ç íðíβå åðééåýððåé öçí éåðÜòíççç öíð Vinum óå áððð öç óðóðåðð. Öçíåððóå üóé ç åíóíéP bsdlåbel éå åðéðñÝðåé áððð öçí åðééÜéððç üüíí áí ç éåðÜòíççç öíð Vinum Ý ÷ åé åðéóçíåíéåð éåðÜéççå íå fstype "vinum".

- 3. Áóðü åβíåé üéí! ÖðÜñ ÷ åé ðéÝíí íéå þåððí-éåðÜòíççç "a" óå éÜèå óðóðåðð ç íðíβå Ý ÷ åé áíðβåñåðí öíð ñéæééý öüüíð. Öðíβóóåéé íå åðåççéåýóåðå íáíÜ öí åðíðÝéåóíå, ÷ ñçóéííðíéåðáóð íéå åíóíéP uðùð öçí ðåñåéÜòù:

```
# fsck -n /dev/devnamea
```

Éå ðñÝðåé íå öéíÜóðå üóé íé éÝóåéð öüí åñ ÷ åβüí öíð ðåñéÝ ÷ íðí ðéçñíóíñβåð åéÝå ÷ íð ðñÝðåé íå åβíåé ö ÷ åðééÝð üð ðñíð öí ñéæééü óýóðçíå åñ ÷ åβüí öíð åñβóéåðåé óóí öüüí öíð Vinum, éåé í íðíβíð (éåðÜ öçí åçíéíðñåðå éåéíýñéíð ñéæééý öüüíð Vinum) íðññåð íå íçí óåéñéÜæéé íå öí ñéæééü óýóðçíå åñ ÷ åβüí öíð åβíåé áíåññü öç ååññÝíç óóéåíP. Éå ðñÝðåé éåéåðåðåñå íå öñíñðβóåðå óå åñ ÷ åβå /etc/fstab éåé /boot/loader.conf.

Ööçí åðüñåíç åðåíåééβíççç, í éþåééåð åééβíçççð éå ðñÝðåé íå åíóíðβóåé öéð éåðÜéçççåð ðéçñíóíñβåð åéÝå ÷ íð áðu öí íÝí (Vinum) ñéæééü óýóðçíå åñ ÷ åβüí éåé íå åñÜóåé éåðÜéççå. Ööí öÝéíð öçð äéååéååóéåð åñ ÷ ééíðíβçççð öíð ððñþíå, éåé íåðÜ öçí áíåååééåð üéüí öüí óðóðåððþí, öí íþíóíå öí íðíβí ååð ÷ íåé öçí åðéðð ÷ þ éåéóíðññåð öíð åå ÷ åéñðíåóíð íéÜæéé íå öí ðåñåéÜòù:

```
Mounting root from ufs:/dev/gvinum/root
```

22.9.3 ÐåñÜäåéåíå Ñýéíéóçð Ñéæééý Öüüíð íå Vinum

ĪåðÜ öçí ñýéíéóç öíð ñéæééý öüüíð íå öí Vinum, ç Ýíñåð öçð åíóíéPð gvinum 1 -rv root éå íéÜæéé íå öçí ðåñåéÜòù:

```
...
Subdisk root.p0.s0:
  Size:      125829120 bytes (120 MB)
  State: up
  Plex root.p0 at offset 0 (0 B)
  Drive disk0 (/dev/da0h) at offset 135680 (132 kB)

Subdisk root.p1.s0:
  Size:      125829120 bytes (120 MB)
  State: up
  Plex root.p1 at offset 0 (0 B)
  Drive disk1 (/dev/dalh) at offset 135680 (132 kB)
```


ðññóÛñòçç ìüñí ðñò áñüò ðìPñáðñò ðçð òòóέάòPò. Áí ðññέάέóάέ íá ðñññóáñòPóáðá áðòP ðç òòóέάòP áññüòáñá ìá áðñáòñòçç ðá ááññáòPò-áíÛáñóçð, áβñάέ áðñáβòçðñ ñá áóáέñÝóáðá ðá ððñέñέðá plex ðñò ñέάέέñÝ ðùìñò ðñò Vinum, έάεPò áðòÛ έá ðáñέÝ ÷ ññ ðáññÝñá ðñò ááñ áβñάέ ðá òðá ÷ ññέóññ ìá ðçñ έáðÛòñçç ðñò Ý ÷ áðá Páç ðñññóáñòPóáέ.

22.9.4.2 ÒññòPñáέ ìüñí ñ Ááoέέüò ÈPáέέáð Áέέβñççð

Áí ç òññòñòç ðñò /boot/loader ááñ áβñάέ áðέðð÷Pò, áεÛÛ ñ ááoέέüò èPáέέáð áέέβñççð (primary bootstrap) òññòPñáðáέ (èÛòέ ðñò ìðññáβðá ñá áέáðέòòPóáðá áεÝá ÷ ññóáð áñ áñòáñβáðáέ ñέá ðáýέá òççñ ðÛñü áñέóðáñP áññá ðçð ñέññçð έáðÛ ðñ áñ÷έέü òóÛáέñ áέέβñçççð), ìðññáβðá ñá ðññòðáέPóáðá ñá áέáέñPóáðá ðç ááoέéP áέέβñççç ðá áðòñ ðñ òçñáβñ ÷ ñççóέññòññPñáð ðñ ðεPðòññ **space**. ìá áðòñ ðññ ðññüðñ, ç áέέβñççç έá òðáñáðPóáέ òññ òóÛáέñ áýñ (ááβðá ðñ ÒñPñá 13.3.2). ìðññáβðá ááP ñá ðñññðáέPóáðá ñá áέέέñPóáðá áðñ ñέá áñáέéáέðέéP έáðÛòñçç, ð.÷. ðçñ έáðÛòñçç ðñò ðáñέáβ ÷ á ðñ ñέάέέü òýòðçñá áñ ÷ áβññ ðñò ñáðáέέñPóáðá áðñ ðñ "a" üðáñ ñáέέñPóáðá ñá ÷ ñççóέññòññáβðá ðñ Vinum.

22.9.4.3 Ááñ Áβñáðáέ ÈáñéÛ Áέέβñççç, ñ ÈPáέέáð Áέέβñçççð ðñññέáéáβ Panic

Áðòñ ìðññáβ ñá òññááβ áñ ñ èPáέέáð áέέβñçççð έáðáóðñáðáβ áðñ ðçñ ááέáðÛòðáóç ðñò Vinum. Áðòðð÷Pò, ðñ Vinum ðçñ ðñÝ ÷ ññóá òðέáñP áðPñáέ ìüñí 4 KB áέáýέáñá òççñ áñ ÷ P ðçð έáðÛòñççð ðñò ðñέñ áñ ÷ βóáέ ñá áñÛóáέ ðέð ðεçñññòññáð ðçð áðέέáðáέβááð ðñò. Ûòòññòñ ðá òóÛáέá Ýñá έáέ áýñ έáεPò έáέ ðñ bsdlable ðñò áññññáðPñáðáέ áñÛñáðá ðñòð, ÷ ñáέÛáέññáέ 8 KB. Póέ, áñ ñέá έáðÛòñççç Vinum ñáέβñááá òççñ èÝòç 0 ñÝóá ðá Ýñá slice P áβóέñ ðñò ðññññβáέññáí áέá áέέβñççç, ç ááέáðÛòðáóç ðñò Vinum έá έáðÝòðñáðá ðññ èPáέέá áέέβñçççð.

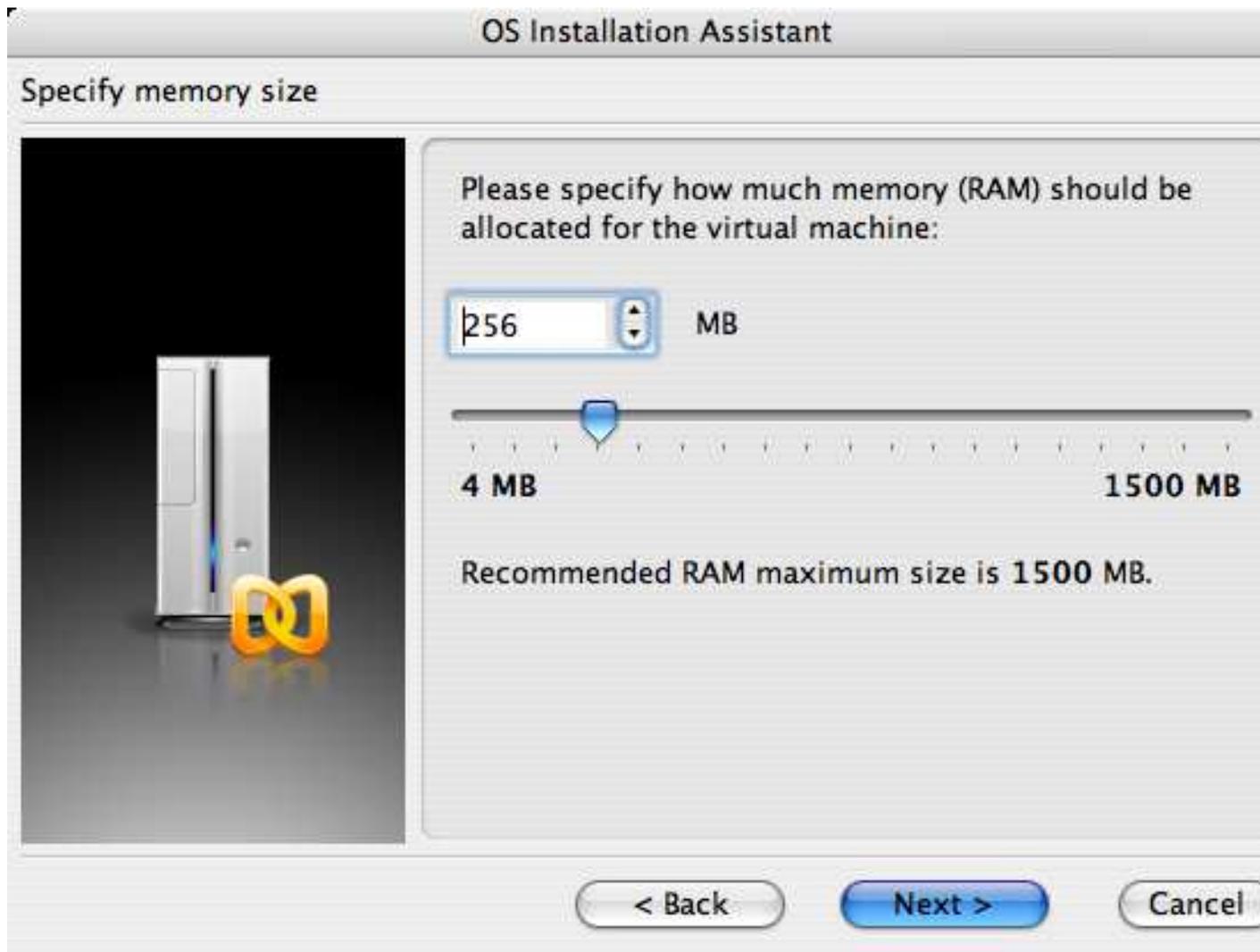
ìá ðññ βáέñ ðññüðñ, áñ ç ðáñáðÛñü έáðÛòðáóç áðέáέññέñέáβ áέá ðáñÛááέáñá ñáέέñPñáðá áðñ Ýñá CD “Fixit” έáέ áðáñááέáέéòðñPñáð ðññ èPáέέá áέέβñçççð ñá ðç áñPéáέá ðçð áñññéPð bsdlable -B (üðñð ðáñέáñÛòðáðáέ òññ ðññá 13.3.2), ñ èPáέέáð áέέβñçççð έá έáðáóðñÝPáέ ðçñ áðέέáðáέβáá ðñò Vinum, ðñ ñðñññ ááñ έá ìðññáβ ðεÝññ ñá áññññβóáέ ðñòð áβóέñð ðñò. Áñ έáέ ðñ ðáñáðÛñü ááñ έáðáóðñÝPáέ ðá ááññÝñá ñòέñβóáññ P ðá ðñáññáðééÛ ááññÝñá ðñò ððÛñ ÷ ññ òññòð ðñññòð (έáέ ç áñÛέðççç ðñòð áβñάέ áññáðP áñ áPóáðá ñáñÛ áέñέáPð ðέð βáέáð ñòέñβóáέð òññ Vinum ñá ðέð áñ ÷ έέÝð òáð), ç έáðÛòðáóç áέññèPñáðáέ áñέáðÛ áýóέñέá. Èá ðñÝðáέ ñá ñáðáέέñPóáðá ñέñέεçñç ðçñ έáðÛòñççç ðñò Vinum ðñòèÛ ÷ έóðññ έáðÛ 4 KB Póðá ñá ñçñ ððÛñ ÷ áέ òýáέñññòç ñáðáýñ ðçð áðέέáðáέβááð ðñò Vinum έáέ ðñò èPáέέá áέέβñçççð.

ÒçñáέPóáέò

1. Òñ RAID òçñáβñáέ *Redundant Array of Inexpensive Disks* έáέ ðáñÝ ÷ áέ áέÛòññáð ñññòÝð áññ ÷ Pò ðá òòÛέñáðá, áñ έáέ òççñ ðáñáðÛñü ÷ ñPóç ñ ñññò áβñάέ èÛðñð ðáñáðέáñçðέéüð: ðñ RAID-0 ááñ ðáñÝ ÷ áέ έáñéÛ òÝðñέá ðñññðáóáβá ááññÝññ.

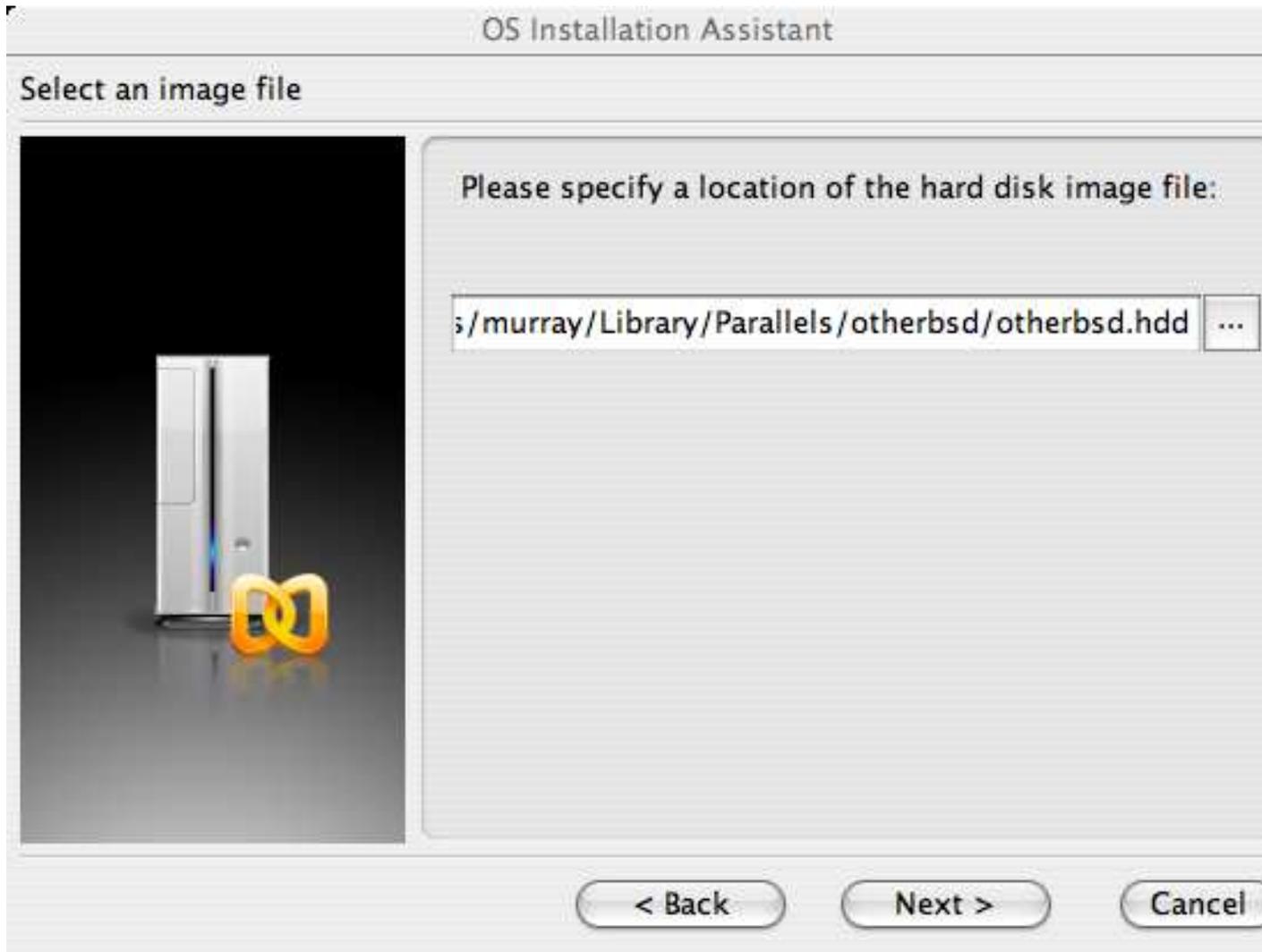


Η βόα Υία εραέετι ιΥααετò αβόετò εάε ιΠιçò ðτò ία αίòαδτèñβτáòάε óòá ó÷Υαέα ðτò Υ÷αòá αέα ðçί áεετíεεττδτβçòç ðτò FreeBSD. 4GB αβόετò εάε 512MB ιΠιçò αττòεάγττí ίέα ÷-άνŪ αέα ðτòð ðáñέóóττòáñττòð ÷-ñβóòáð ðτò FreeBSDιΥόά áδττ ðτ **Parallels**:

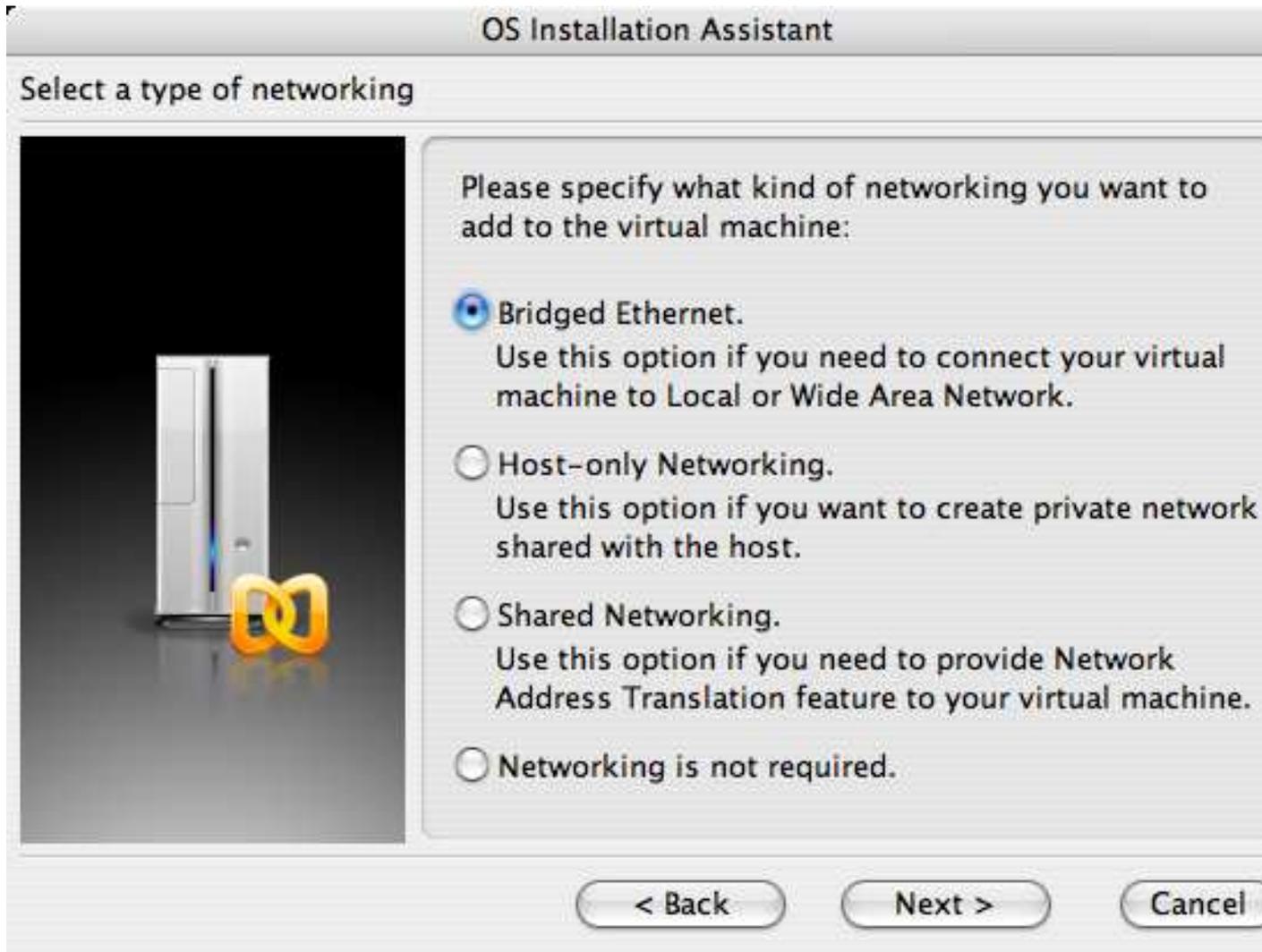


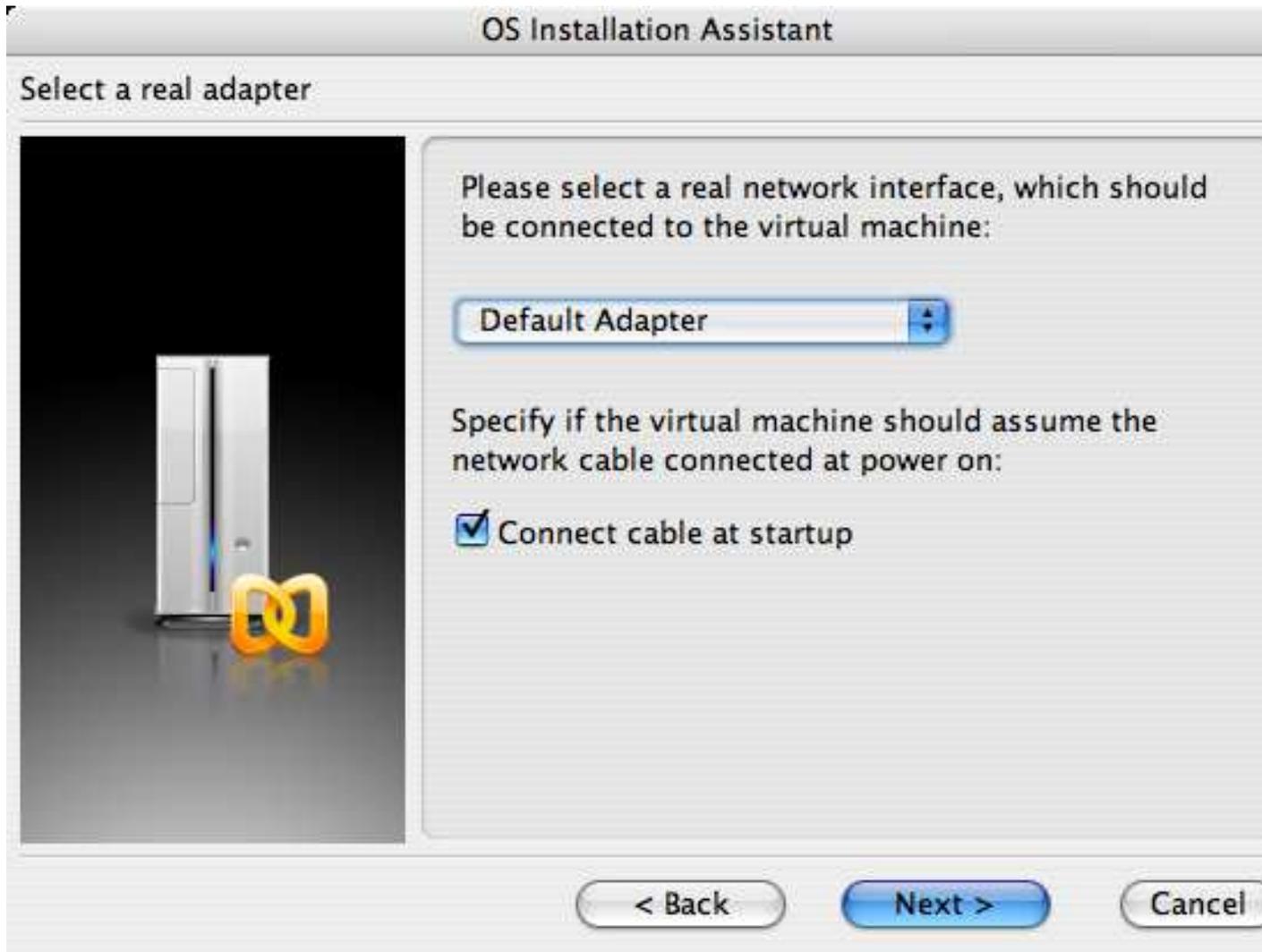






Αδειάζει ορί ούδι αέεόυόσο εάε οίί οηιόάνηα Υά αέεόγιό:



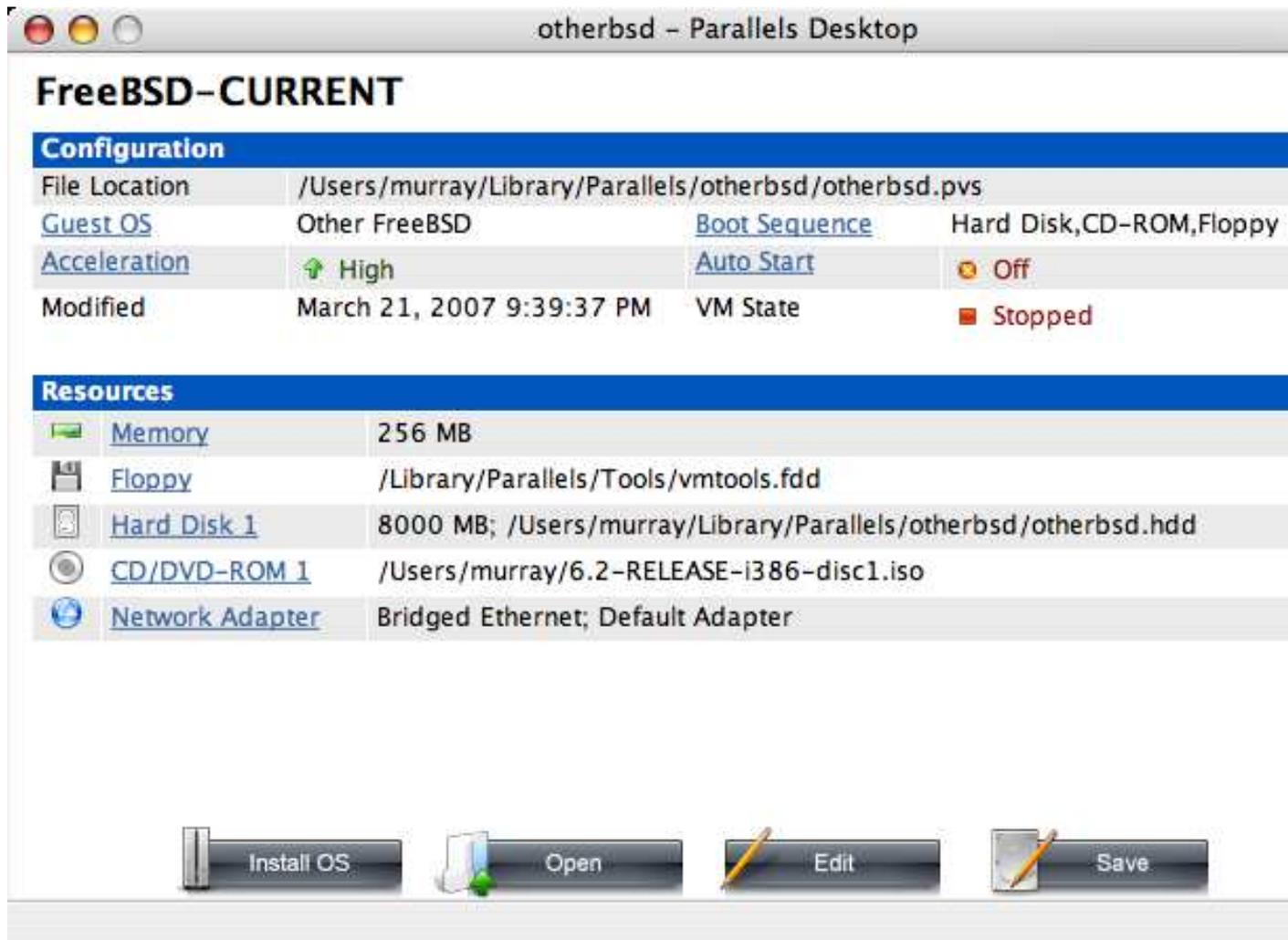


Άδιδεάσός έάέ οΎεο ούι ηδιδάαί:

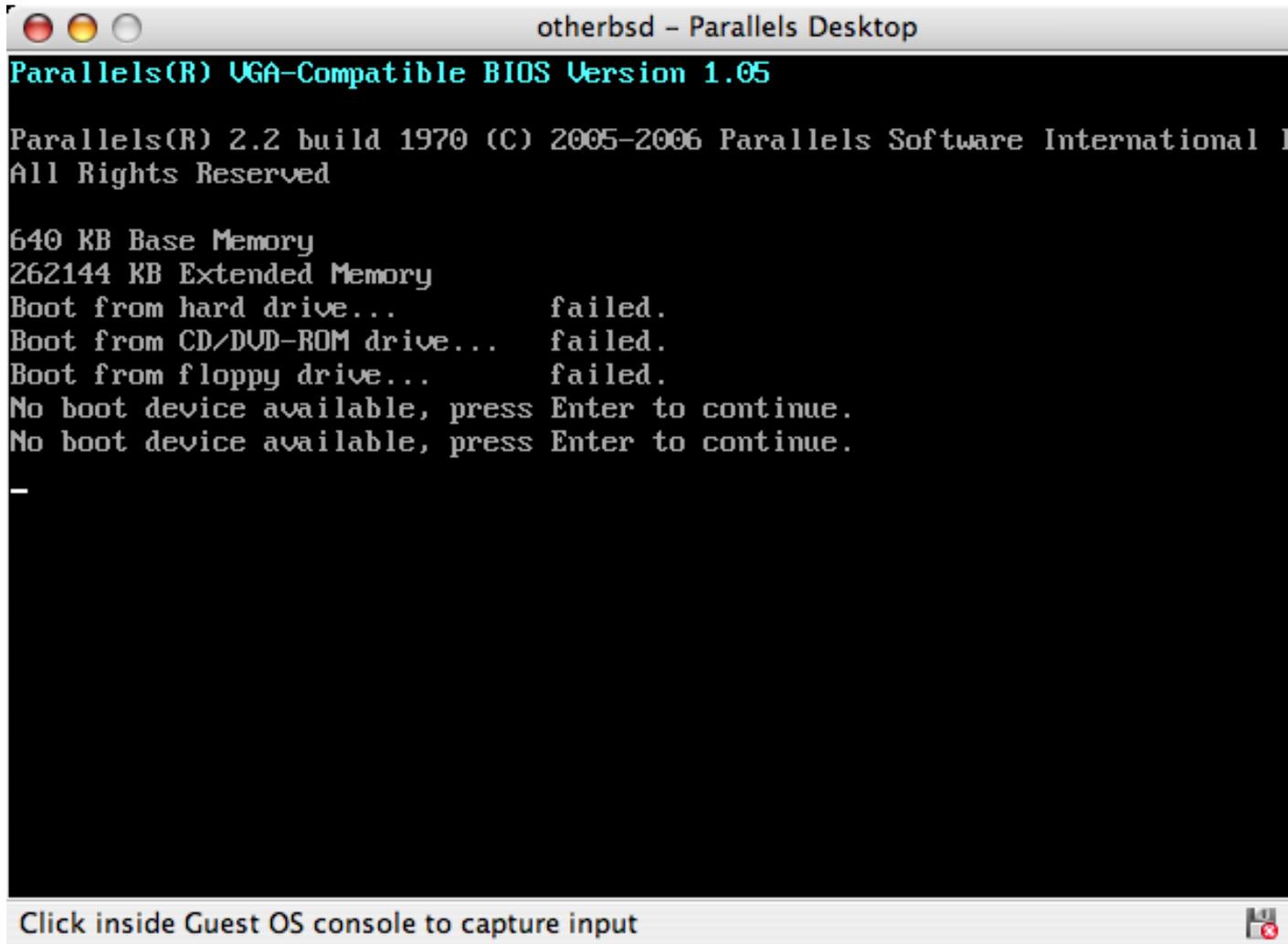




Η εικόνα δείχνει το βοηθό εγκατάστασης του FreeBSD. Ο βοηθός είναι έτοιμος να ξεκινήσει την εγκατάσταση του FreeBSD. Μπορεί να είναι απαραίτητο να εισαχθεί ο δίσκος CD/DVD-ROM του FreeBSD. Εισαγάγετε τον δίσκο CD/DVD-ROM εάν απαιτείται και κάντε κλικ στο «Finish» για να προχωρήσετε. Αποεπιλέξτε την επιλογή «Ξεκινήστε την εγκατάσταση του πελάτη OS» εάν δεν θέλετε να εγκαταστήσετε το πελάτη OS. Η επιλογή «Ξεκινήστε την εγκατάσταση του πελάτη OS» είναι επιλεγμένη. Διαβάστε τον Οδηγό Έκτακτης Ανάγκης για περισσότερες πληροφορίες σχετικά με τη διαμόρφωση του εικονικού μηχανήματος και την εγκατάσταση του πελάτη OS. Κάντε κλικ στο «Άνοιγμα Οδηγου Έκτακτης Ανάγκης».



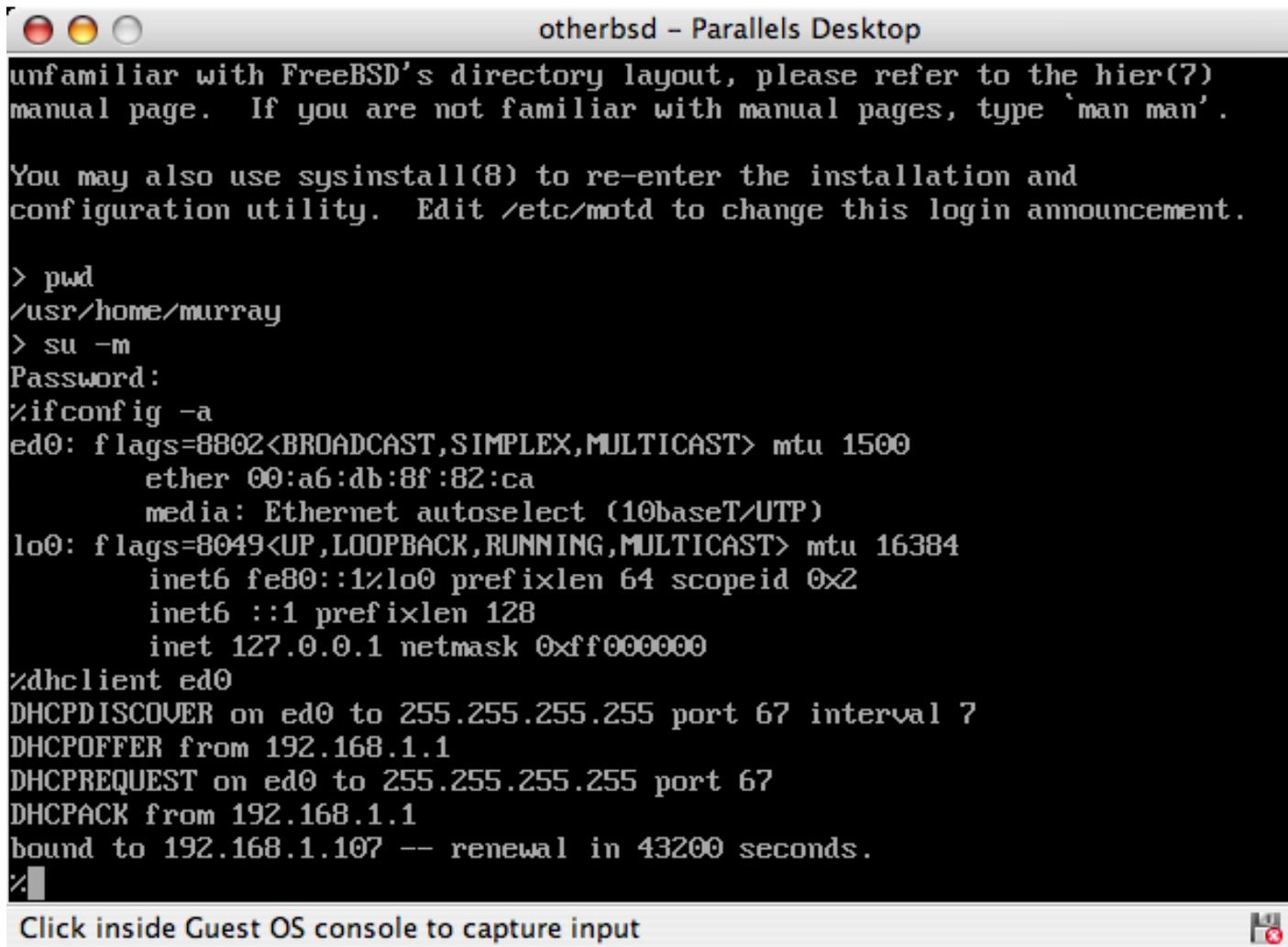
¼οάι Ý ÷ àðà áíðéοóðιé ÷ Þοάé οç ðçãÞ àãéáðÛοόάοçð, àðάíáéééιÞοόά οι áééιíééι οýοόçíá ðáðÞíοάð áðéÛ οι éιòιðß οçð àðάíáéééβίççð (reboot) οίò **Parallels**. Οί **Parallels** éá íáééιÞοάé íá Ýíá áéáééι BIOS οί ιðιβι ðñÞοά áéÝã ÷ áé áÛί ððÛñ ÷ áé áéáéÝóéη éÛðιéι CD-ROM, ùðòð éÛíáé éáé Ýíá οðóéιéíáééι BIOS.



Óå áððð ðç ðåñβððùός εά åñåέ ðί ιΎόί ååέάóÛόάόçð ðιò FreeBSD έάέ εά ίåέείβόάέ ðί **sysinstall** ùðùò ðåñέåñÛόåόάέ óðί ÊäöÛεάεί 2. Ìðñåβðå ίά ååέάόάóðβόåðå ðί X11, åέεÛ ιç åñέείÛόåðå ίά ñòèιβóåðå áððð ðç óóέåìð.



40áí ðáèáεπόάðá íá ðçí ááèáðÜóóáóç, εÜíðá íéá áðáíáèèβζçç óðí ðñÝóèí áéèíéèü FreeBSD.



23.2.1.2 ἸὰὸάέçðÝð ðιὸ boot loader

Ἀόρυ Ἰ ÷ áέ ἀάέάόάόάέαβ ἀδέð ÷ ð ðι FreeBSD ð ðι Mac OS X ἰὰ ðι **Parallels**, ððŪñ ÷ ἰðί ἰάñέέŪ ἀΠιάόά áέτιç ðιὸ ἰðιñί ἰά óáð ἀἰçèΠóιðί ἰά ñðèἰβóáð ðι ἰάέἰἰέέü óáð óýóçἰά.

1. ἸὰὸάέçðÝð ðιὸ boot loader

Ὀἰ ðιέἰ óçἰάἰóέέü ἀΠιά ἀβἰάέ ἰά ἰάεΠóáð ðι ἰÝάáèð ðιὸ kern.hz ðñἰéáçἰÝñἰ ἰά ἰάἰἰἰéΠóáð ðç CPU ἰÝόά áðü ðι **Parallels**. Ἀóðü ἰðιñáβ ἰά ἰάβἰάέ ἰά ðι ἰά ðñἰóéÝóáð ðçἰ áέüἰἰðèç ἰñἰἰΠ ð ðι /boot/loader.conf:

```
kern.hz=100
```

× ùñβð áðð ðç ñýèἰéóç, Ἰά ἰñἰἰἰÝð FreeBSD ð ðι **Parallels** éá éáðáἰáεΠἰάέ ðι 15% ðçð CPU áñüð ἰñἰðýñçñἰ ðι Mac®. ἸὰðŪ áðü ðçἰ ἰééááΠ, ç éáðáἰŪἰéóç éá ðÝóáé éἰðŪ ð ðι 5%.

2. Ἀçἰἰἰñáβá ἰÝἰ ðñ ÷ ἰβἰð ñðèἰβóáùἰ ðιὸ ððñΠἰά

Ἰðñἰñáβá ἰά ἰóáéñÝóáðá ἰéáð ðιὸð ἰäçἰἰýð ἰéá SCSI, FireWire, éáé USB óóóéáðÝð. Ὀἰ **Parallels** ðáñÝ ÷ áé Ἰά ἰáέἰἰéü ðñἰóáñἰἰἰἰ ἰá ἰáέóýἰð ἰ ἰðἰβἰð ÷ ñçóéἰἰðἰéáβðáé áðü ðι ἰäçἰü ed(4), ἰðüðá ἰἰἰé ἰé ἰäçἰἰβ ἰéá ἰáέððáéÝð óóóéáðÝð ἰáéüð ðüἰ ed(4) éáé miibus(4) ἰðἰñἰἰἰ ἰά ἰóáéñἰἰἰἰ ἰáðü ðι ððñΠἰά.

3. Ñýεíεçç äééçýíç

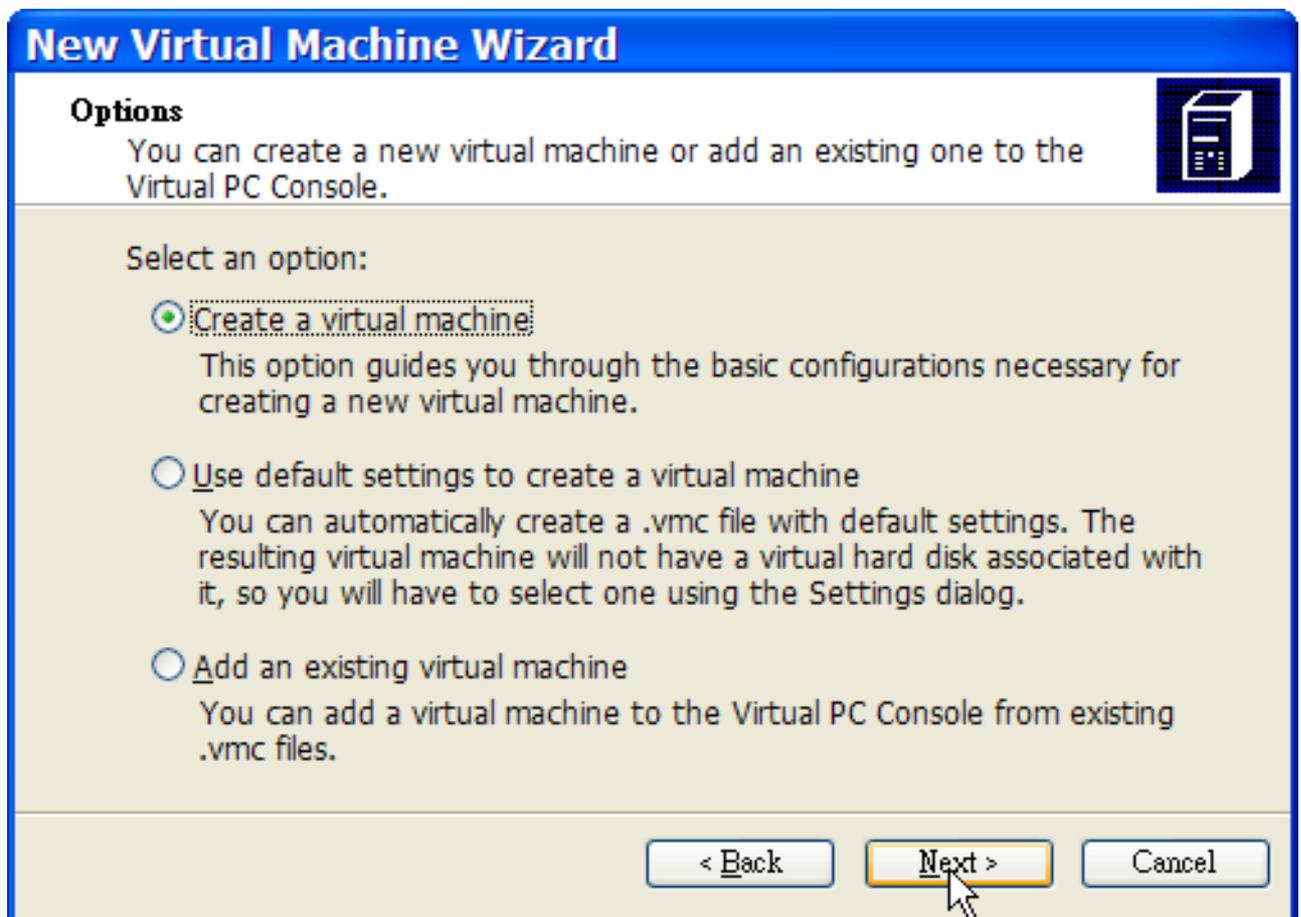
Ç ðéí áðεP ñýεíεçç äééçýíç εÙíáé ÷ñPçç çíç DHCP áéá íá ççíááεáβ çí äééííééú çáç çýçççíá ççí βáéí çíðééú äβéççí íá çíí Mac. Áççú íðíñáβ áýêíεá íá äβíáé íá çí íá ðñíçèÝççáçç çç ãñáíñP ifconfig_ed0="DHCP" ççí /etc/rc.conf. Ðíεçðéíεúççáñáç ñçèíβççéç äééçýíç ðãñεãñÙçííççé ççí εãçÙεáéí ΕãçÙεáéí 32.

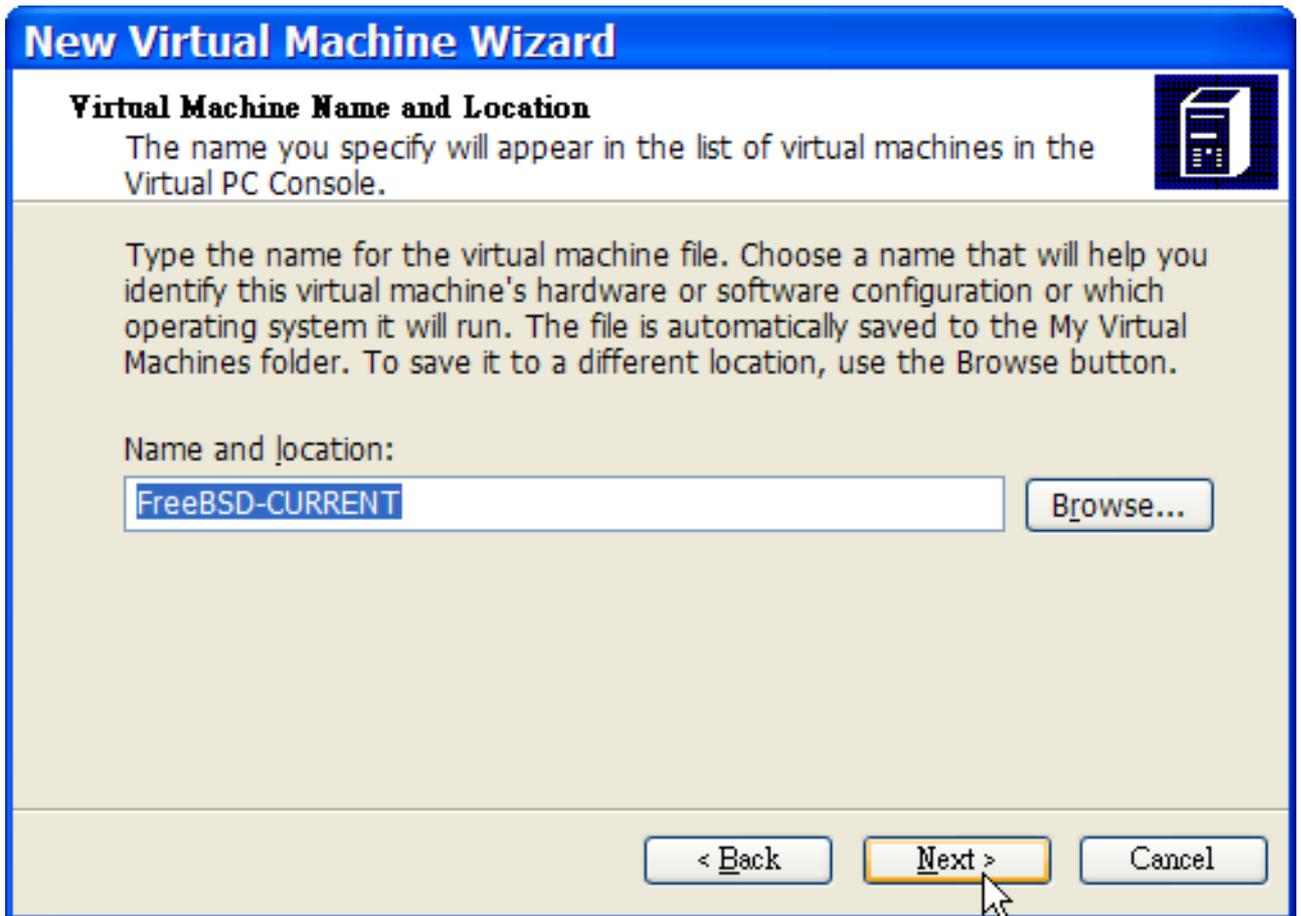
23.2.2 Çí Virtual PC ççá Windows

Çí **Virtual PC** áéá Windows äβíáé Ýíá ðñíúíí ççç Microsoft çíç äéáçðβεáççé áéá àññáÙí εáçÝááçíá. Ááβçá çéç áðáéçðPççéç ççççðPíáççíç (http://www.microsoft.com/windows/downloads/virtualpc/sysreq.mspx). ÌáçÙ ççí äáéáçççççççç ççç **Virtual PC** ççá Microsoft Windows, ï ÷ñPçççç ðñÝðáé íá ñçèíβççé Ýíá äééííééú íç÷Ùíçíá éáé íá äáéáçççççççç çí çééíñáíýíáñí εáéçíçñáééú çíç áðééçíáβ.

23.2.2.1 Áäéáçççççççç ççç FreeBSD ççí Virtual PC/Microsoft® Windows

Çí ðñPççí áPíá çççí äáéáçççççççç ççç FreeBSD ççá Microsoft Windows íá ÷ñPççç ççç **Virtual PC**, äβíáé ç çççéíçñáβá áñúç íÝíç äééííééú íç÷áíPíáççíç áéá ççí äáéáçççççççç ççç. ÁðééÝíçá Create a virtual machine úçáí áñúççéáβçá:





Όχι άποός Operating System άέέΥιά Other:

New Virtual Machine Wizard

Operating System

Select the operating system you plan to install on this virtual machine.

Selecting an operating system here allows the wizard to recommend appropriate settings for this virtual machine. If the desired guest operating system is not listed, select an operating system that requires an equivalent amount of memory or select Other.

Operating system:

Default hardware selection:

Memory: 128 MB
 Virtual disk: 16,384 MB
 Sound: Sound Blaster 16 compatible



< Back
Next >
Cancel

Από την επιλογή του λειτουργικού συστήματος, η διαδικασία θα προτείνει τις κατάλληλες ρυθμίσεις για την κεντρική μνήμη RAM, τον δίσκο, τον ήχο και άλλες ρυθμίσεις. Εάν το επιθυμητό λειτουργικό σύστημα δεν βρίσκεται στον κατάλογο, επιλέξτε το λειτουργικό σύστημα που απαιτεί την ίδια ποσότητα μνήμης ή επιλέξτε Άλλο. Απαιτήσεις μνήμης: 4GB για το FreeBSD και 512MB για το Virtual PC.

New Virtual Machine Wizard

Memory 

You can configure the RAM on this virtual machine.

To improve the performance of this virtual machine and run more applications on its operating system, increase the amount of RAM allocated to it. To leave more RAM for other virtual machines on your system, use the recommended RAM allocation.

Recommended RAM: [128 MB]

Allocate RAM for this virtual machine by:

Using the recommended RAM

Adjusting the RAM

Set the RAM for this virtual machine:

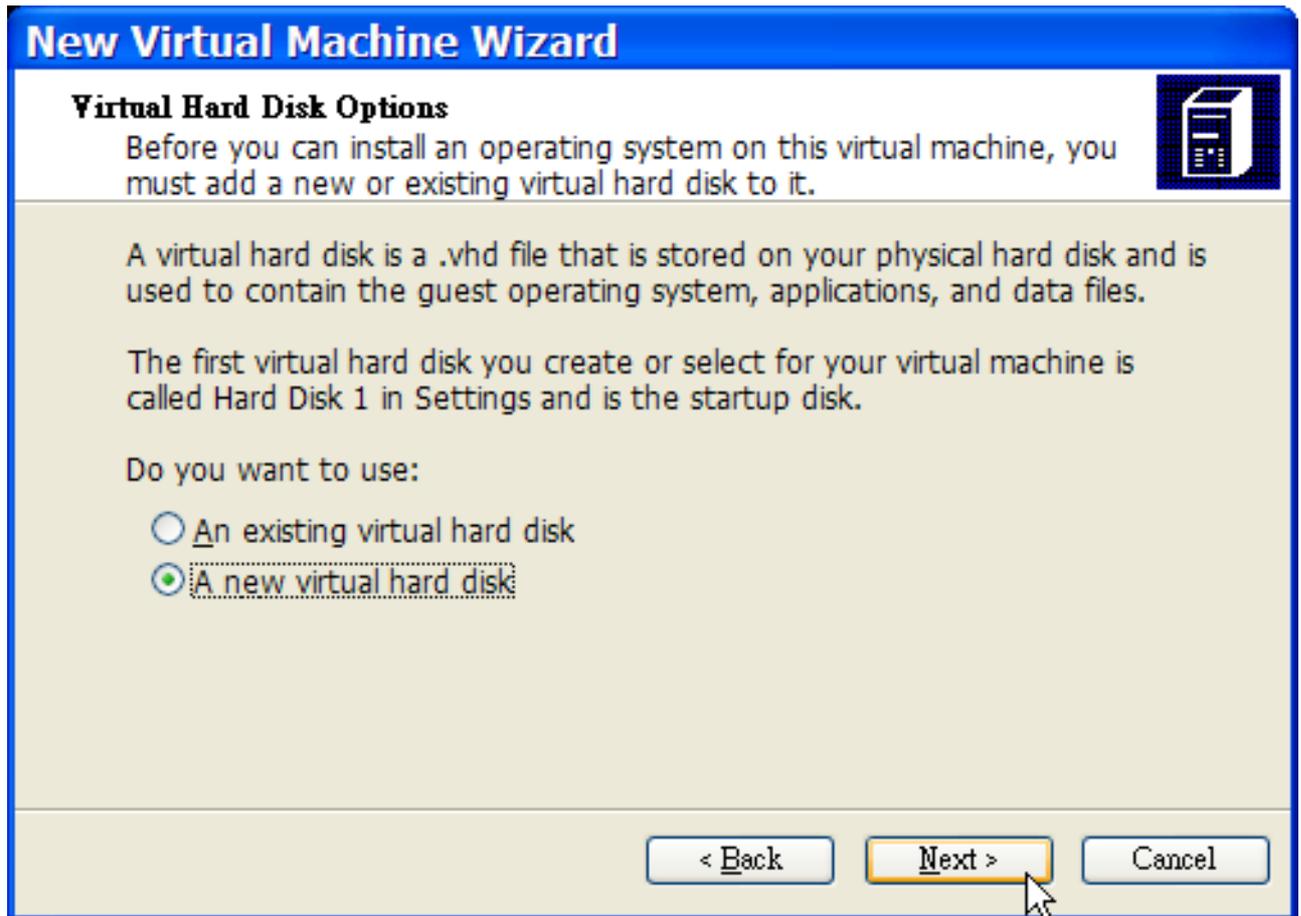
4 MB

1079 MB

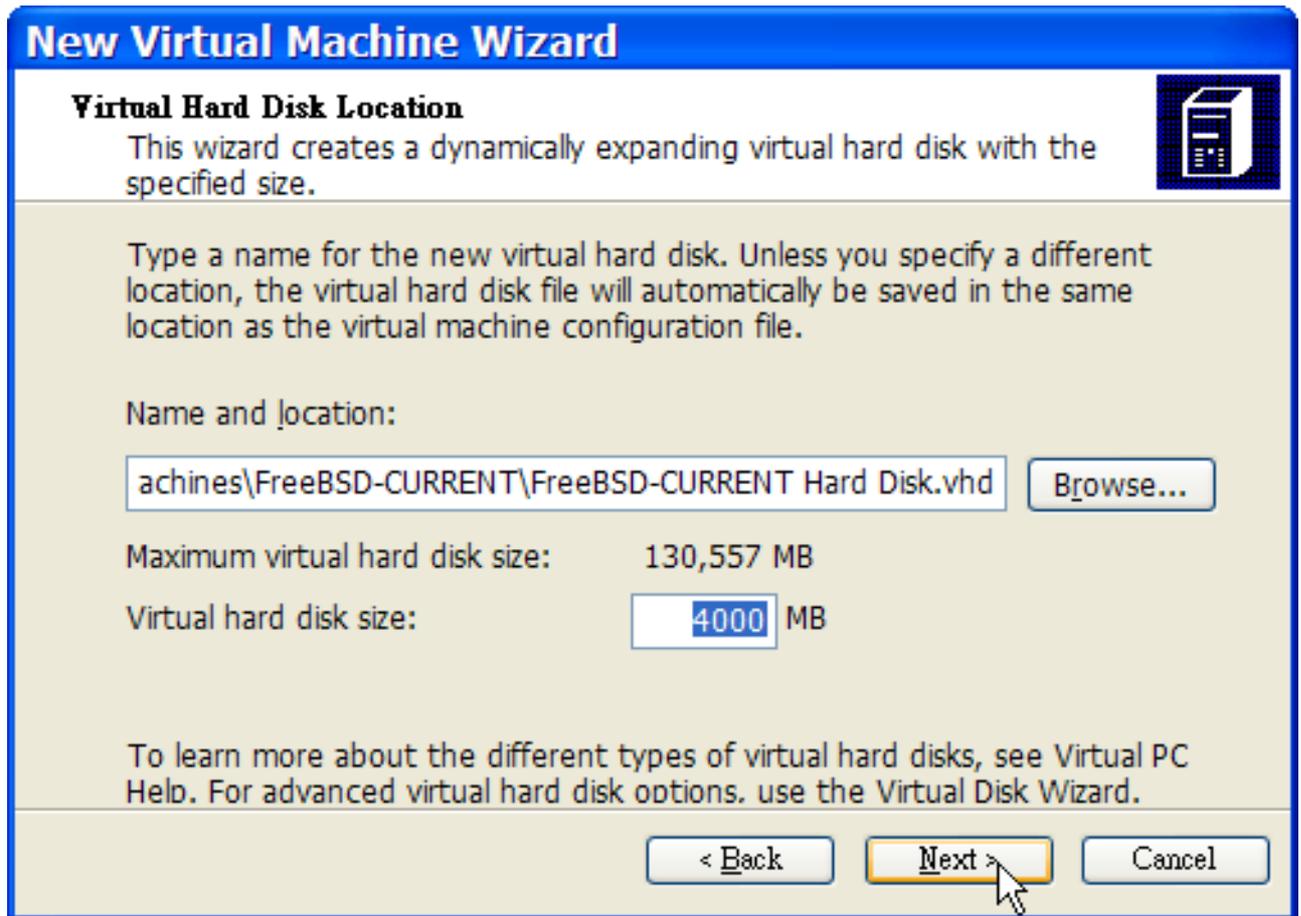


512 MB

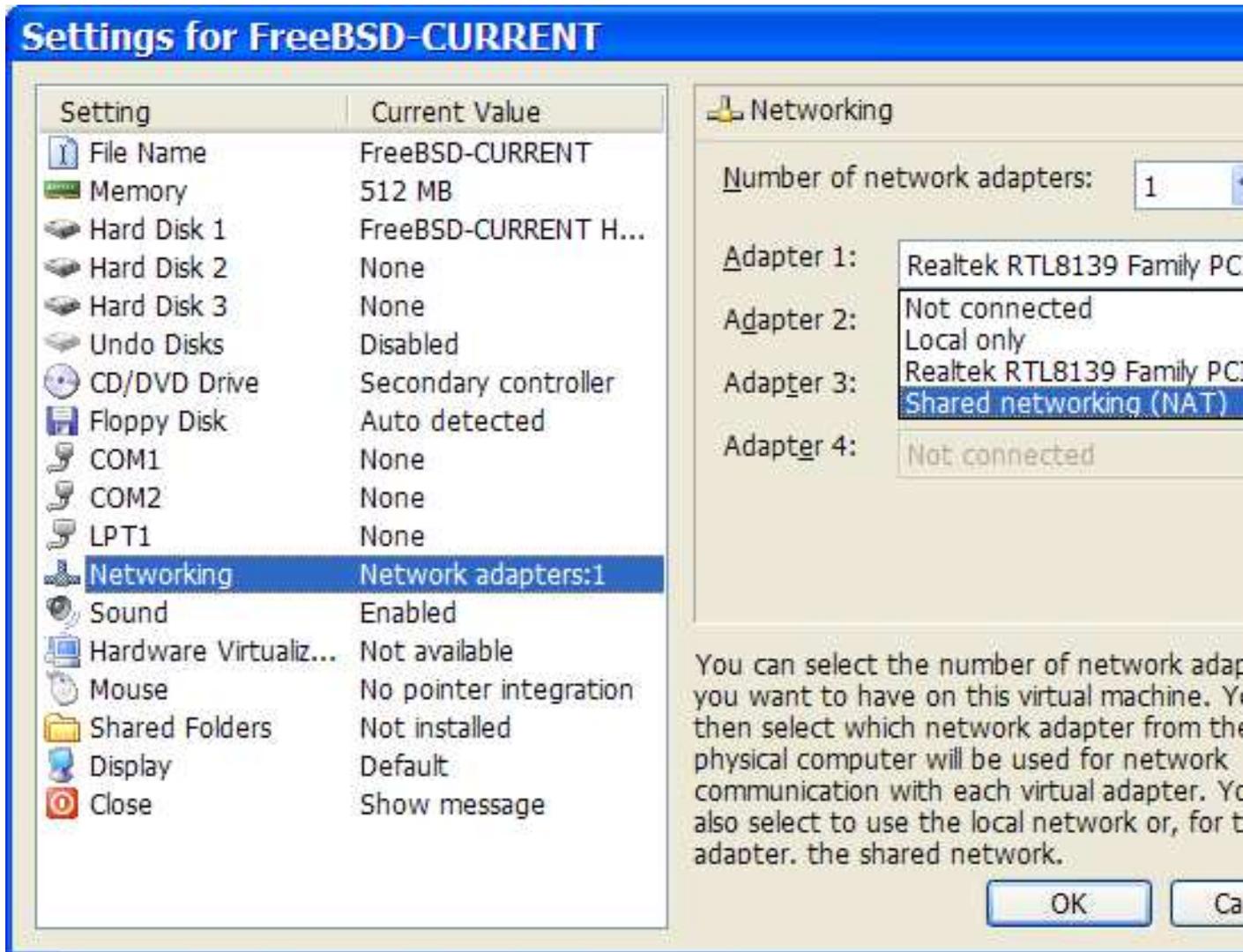
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Ίερέεηπόά άδρεέάγίρόάδ όέδ ηόειβόάέδ:

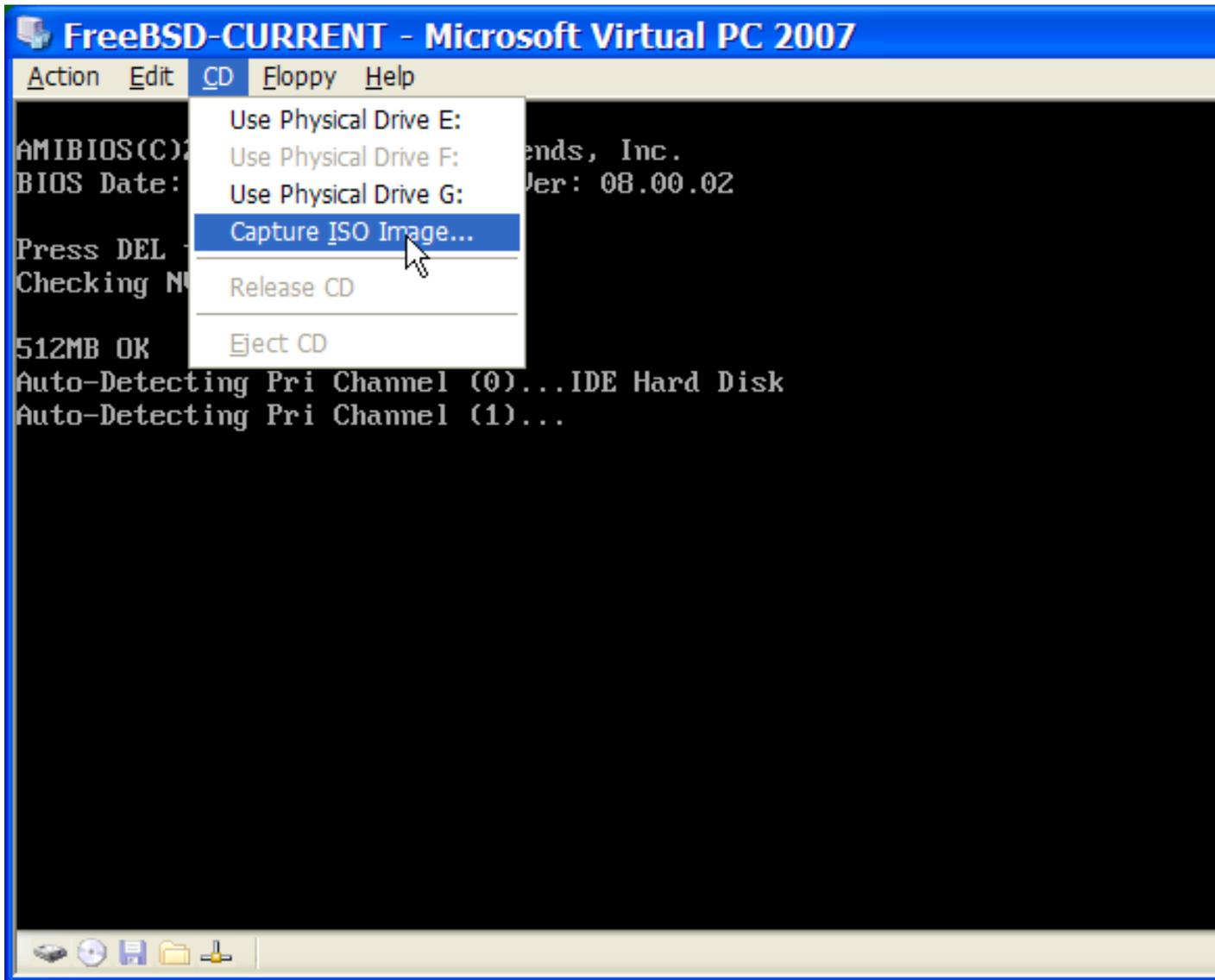




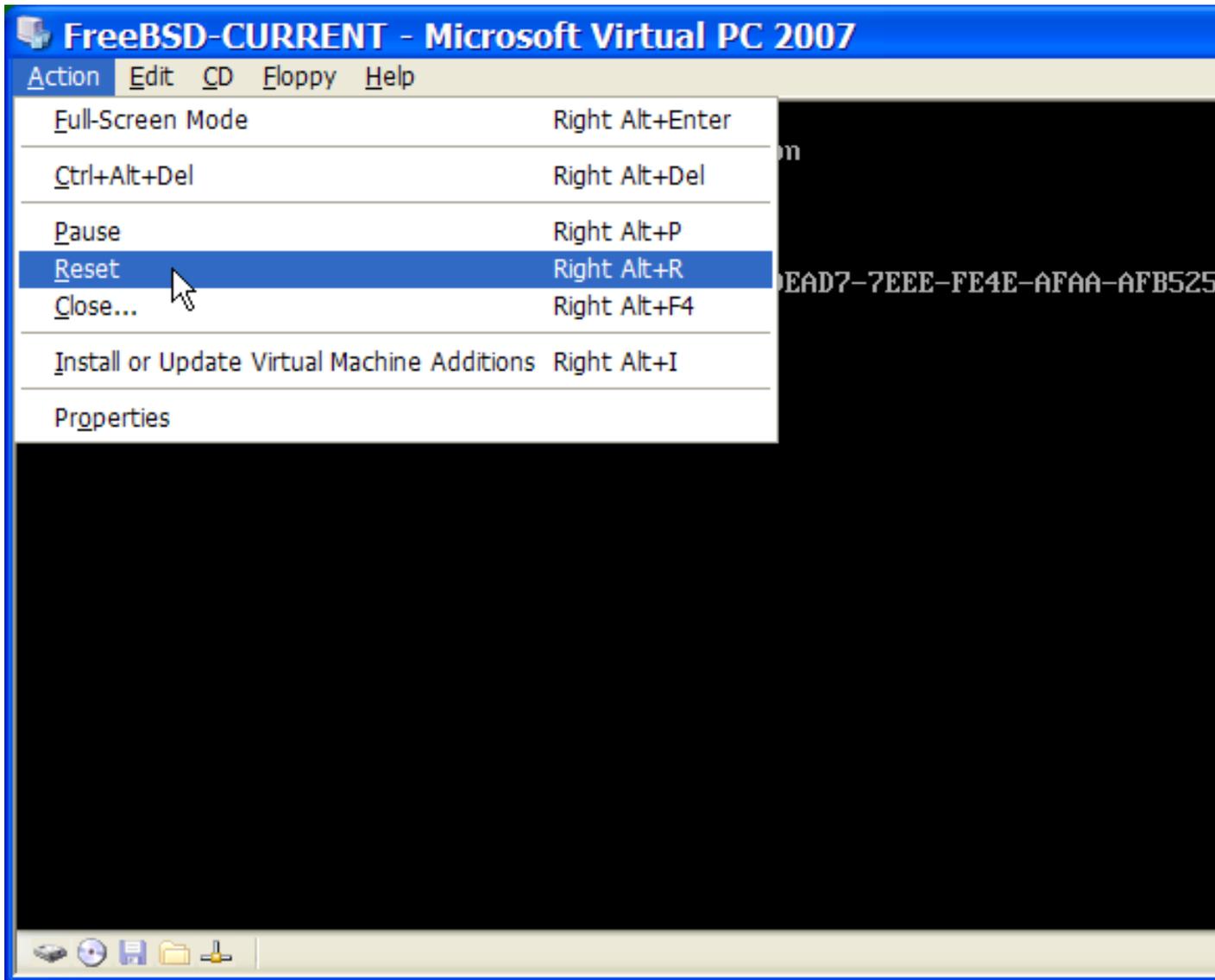


Άοίγυ άçίέιòñáΠóáòá ðçί άέέιέέèΠ ιç÷άíΠ óáð áέá ðí FreeBSD, έá ðñÝðáέ ίá ááέáóáóðΠóáòá ðí έáέóιòñáέέü óá áóðΠí. Í έáέýðáñìð ðñüðìð áβίáέ ίá ÷ñçóέιíðíéΠóáòá Ýίá áðü óá áðβóçιά CDROM ðìò FreeBSD Π ίá έáóááÙóáòá έÙðíéí áñ÷áβì ISO áðü ðçί áðβóçιç ðìðíéáóβá FTP, ÷ííóáð ðí έáðÙέέçéí áñ÷áβì ISO óðí ðìðéü óáð óýóóçιά áñ÷áβìí ðùí Windows (Π ðí áíðβóðíé÷í CDROM óðíí íäçäü), έÙίðá áέðéü έέέé óðí άέέιíβáéí ðçð άέέιέέèΠ ð÷÷άíΠð FreeBSD áέá ίá ðçί áέέéíΠóáòá. ðáέóá έÙίðá έέέé óðí CD έáé áðééÝíðá Capture ISO Image... óðí ðáñÙέðñí ðìò **Virtual PC**. Έá áìóáíéóóáβ Ýίá ðáñÙέðñí ðìò έá óáð áðéðñÝðáέ ίá óóó÷áðβóáòá ðíí άέέιέέéü íäçäü CDROM íá Ýίá áñ÷áβì ISO Π έáé íá ðíí ðñááíáíóééü óáð íäçäü.

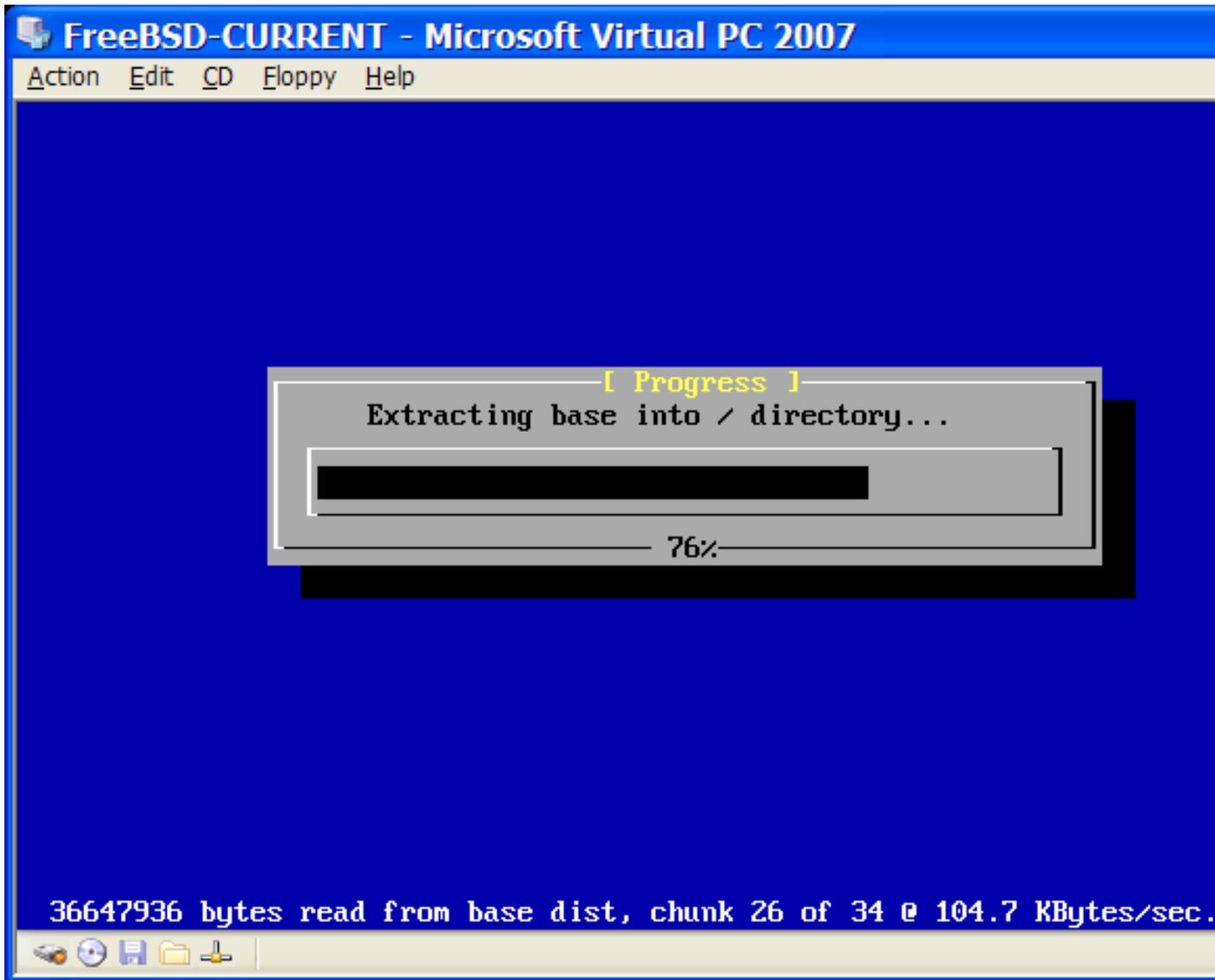




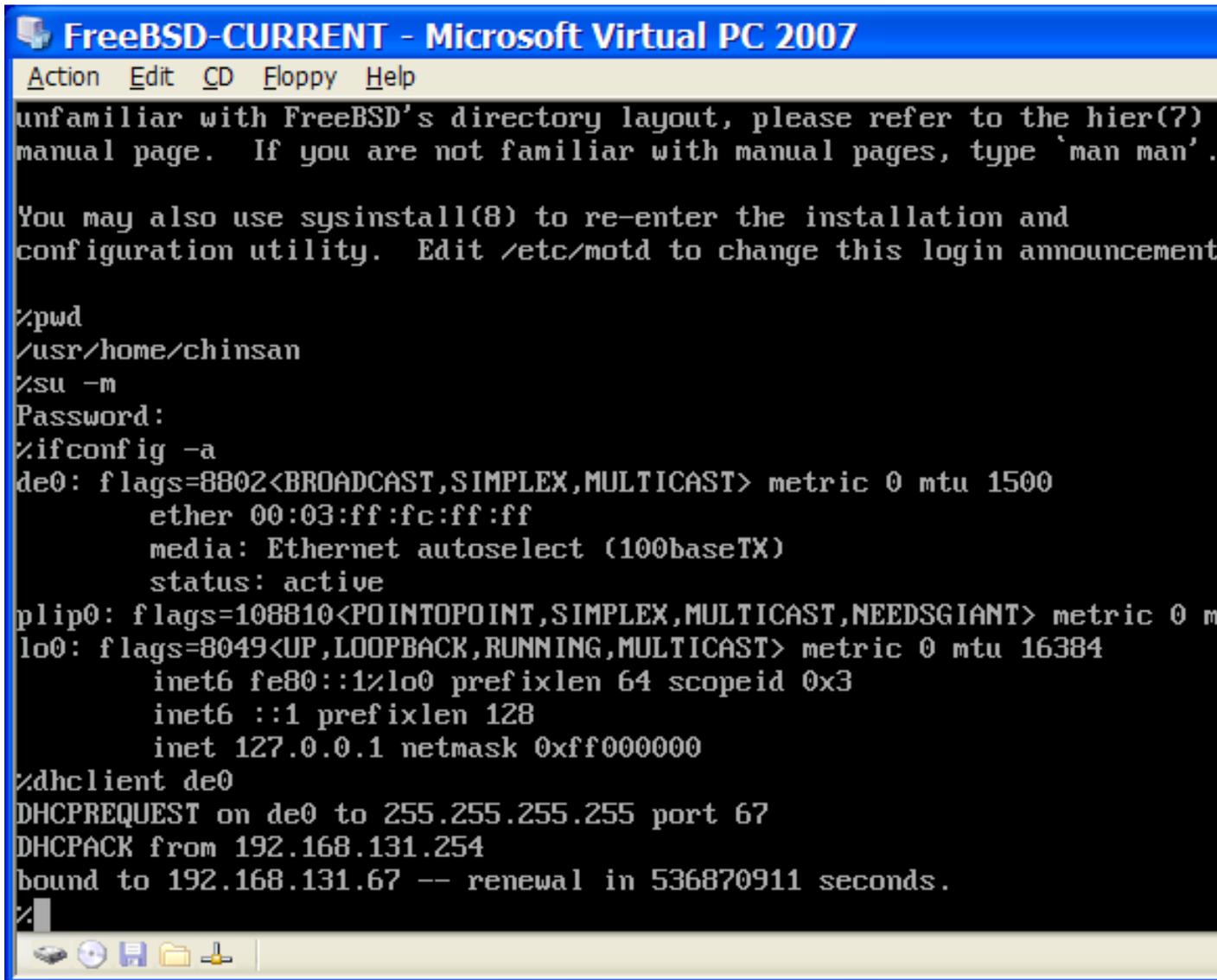
Το εικονίδιο CD-ROM στο κάτω μέρος της οθόνης του Virtual PC, αγγίζοντας το με το ποντίκι, ανοίγει το μενού CD-ROM. Στο μενού αυτό, επιλέγοντας "Capture ISO Image...", δημιουργείται ένα αρχείο ISO που περιέχει την εικόνα του CD-ROM. Το αρχείο αυτό μπορεί να χρησιμοποιηθεί για να εγκαταστήσει το FreeBSD στο εικονικό PC. Το εικονίδιο CD-ROM στο κάτω μέρος της οθόνης του Virtual PC, αγγίζοντας το με το ποντίκι, ανοίγει το μενού CD-ROM. Στο μενού αυτό, επιλέγοντας "Capture ISO Image...", δημιουργείται ένα αρχείο ISO που περιέχει την εικόνα του CD-ROM. Το αρχείο αυτό μπορεί να χρησιμοποιηθεί για να εγκαταστήσει το FreeBSD στο εικονικό PC.



Óος áεéΠ ιάδ θάνβδδουός, εά áίε :- íáyóáé õι ιΎóι ááέáoÛóóáoçð õιõ FreeBSD éáé εά íáέéíΠóáé ç óðίçèéóιΎίç áéááéεáoβά ááέáoÛóóáoçð ιΎóου õιõ **sysinstall**, ùðòð ðánεάνÛóáoáé óοι ÊäöÛεάέι 2. Ìðíáβóá íá ðñι :- ùñΠóáðá íá ðçί ááέáoÛóóáoç, áεéÛ ιç ðñιόðáεΠóáðá íá ððεìβóáðá õι áñáóέéù óýóóçíá X11 ðç áááñΎίç óóέáìΠ.



¼óáí ðáéáéþóáðá ðçí ááéáóÛóóáóç, íç íá÷Ûóáðá íá ááÛéáðá ðí CDROM áðü ðíí íäçäü (P íá éáðáñáþóáðá ðçí áíðáóðíé÷ç óðó÷Ýóéóç íá ðí áñ÷áβí ISO). Ìðíñáβóá Ýðáéðá íá áðáíáéééíþóáðá óçç íÝá óáð ááéáóÛóóáóç ðíð FreeBSD.



23.2.2.2 Νύειέόç ðĩ FreeBSD óĩ Virtual PC óå Microsoft Windows

Ἰὰ ðĩ ðçĩ ἄðéð ÷ ð ἄἄἄðÛóóáç ðĩ FreeBSD óóå Microsoft Windows ἰÝóù ðĩ **Virtual PC**, ἑά ðñÝðἄἑ ἰά ἄἑðἄἑÝóáðἄ ἰἑά óἄñÛ ἄðũ ñðἑἰβóἄἑð ἄἑά ἰά ἄἄἑðἑóóĩðĩἑἑðἄðἄ ðçĩ ἑἄἑðĩðñἄἑ ᰄĩó óóóðḂἰἄðĩò óἄ ðἄñἑἄÛἑἑĩ ἄἑἑĩἑἑḂ ð ìç ÷ ἄἑḂð.

1. ἘÝóἄ ᰄἑĩÝð óóἑð ἰἄðἄἄἑçóÝð ðĩó ðĩñðũðḂ ἄἑἑḂḂḂçóçð

Ç ðἑĩ óçĩἄἰðἑἑḂ ñýἑἑóç ἄḂἰἄἑ ἰἄ ἰἄἑḂóἄðἄ ðçĩ ðἑἑḂ ðçð ἰἄðἄἄἑçóḂð kern.hz ἄἑἑ ἰἄ ἰἄἑḂóἄðἄ ðç ÷ ñḂóç ðçð CPU óĩ FreeBSD ùðἄἰ ðĩ ÷ ñçóἑἑἑðἑἄḂðἄ óóĩ ἄἑἑἑἑἑũ ðἄñἑἄÛἑἑĩ ðĩó **Virtual PC**. Ἄððũ ἰðĩñἄḂ ἰἄ ἄðἑóἄð ÷ ἑἄḂ ðñĩóἑÝóĩóἄð ðçĩ ðἄñἄἑÛðũ ññἄἑḂ ðἑἑ ἄñ ÷ ἄḂἑ /boot/loader.conf:

```
kern.hz=100
```

× ùñβò áððß ðç ñýèιέόç, ιέα áέέίίέέß ιç÷άίß FreeBSD óðι **Virtual PC**, ùóáf áέòáέάβòάέ ÷ ùñβò öññòβι, έά ÷ ñçóέιθιέάβ ðáñβðιθ ðι 40% ðιò áðáíáñάάóðß óá Ýίá ιç÷Ûίçιά ιά ιβά CPU. ÌáðÛ áðu ðçí áέέάáß áððß, ç ÷ ñßóç έά áβίάέ έιíðÛ óðι 3%.

2. Άçιέιθñáßòá Ýίá ιÝι áñ÷άβι ñòèιβóáιí ðòñßιά

Ìðìñáβòá ιά áóáέñÝóáðá ùέά óá ðñιáñÛιáðá ιáßáçóçð ãέά óðóέáðÛð SCSI, Firewire έάέ USB. Õι **Virtual PC** ðáñÝ÷άέ ιέα áέέίίέέß έÛñðá áέέóγιò ç ιθιβά ððιόðçñβæáðáέ áðu ðι ðñúáñáιá ιáßáçóçð de(4), Ûñά ìðìñáβòá ιά áóáέñÝóáðá ùέáð ðέð Ûέéáð έÛñðáð áέέóγιò áðu ðιí ðòñßιά, áέðιð áðu ðι de(4) έάέ ðι miibus(4).

3. Ñýèιέόç áέέóγιò

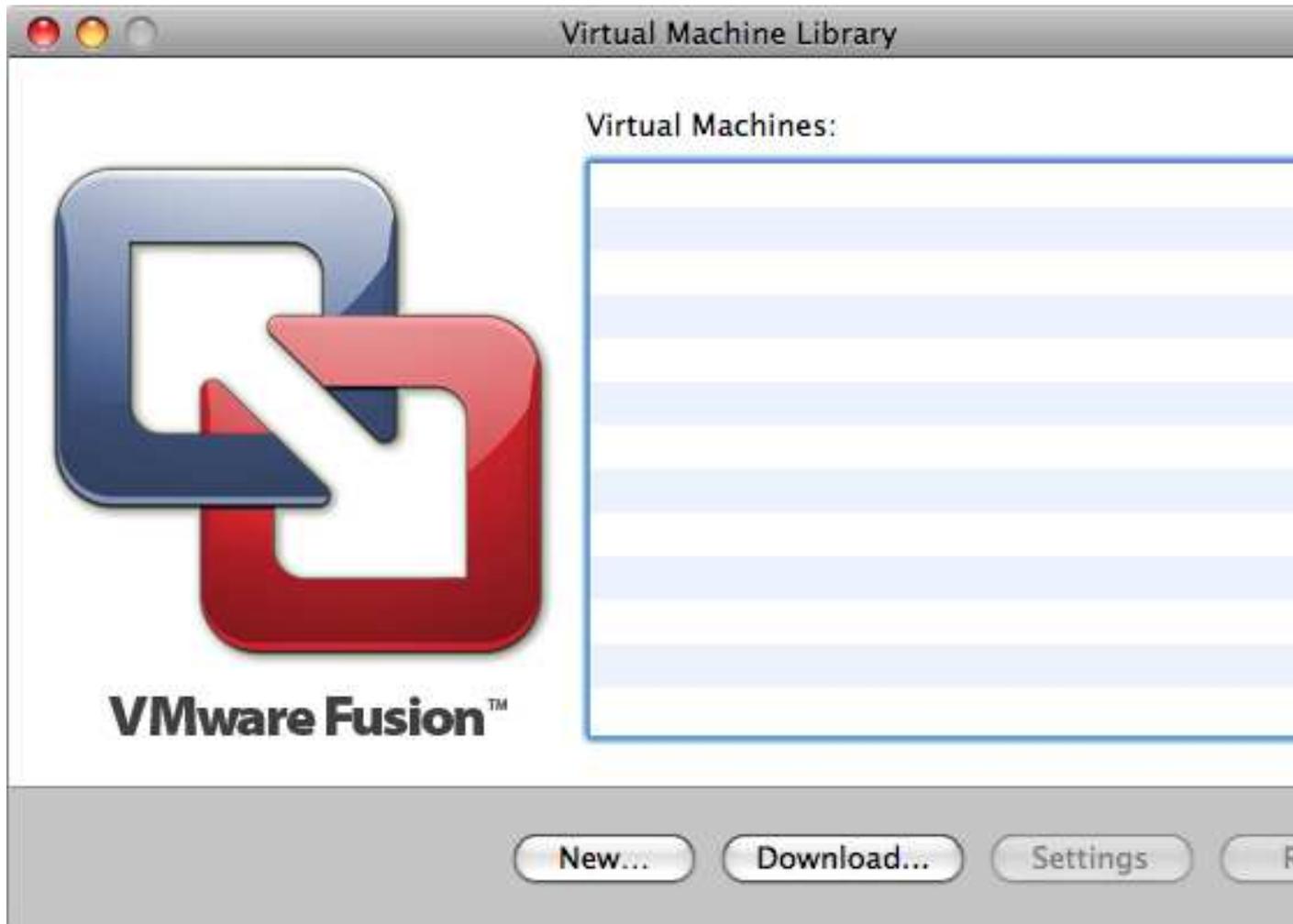
Ç ðεί áðßß ñýèιέόç áέέóγιò ðáñέέáíáÛιáέ ðç ÷ ñßóç ðιò ðñùðιέúέέιò DHCP áέά ιά óðιáÝóáðá ðι áέέίίέέú ιç÷Ûίçιά óáð óðι βáέι ðιðέέú áβέððι ιά ðι ιç÷Ûίçιά ιáίέóðß. Áððι áðέóðá÷Ûιáðáέ ðñιòέÝðιιðáð ðç áñáιñ ifconfig_de0="DHCP" óðι /etc/rc.conf. Ìðìñáβòá ιά áñáβòá ðεί ðñι÷ ùñçιÝίáð ñòèιβóáέð áέέóγιò óðι ÊäöÛεάεί 32.

23.2.3 Õι VMware óá MacOS

Õι **VMware Fusion** áέά Mac áβίάέ Ýίá áιðιñέέú ðñúáñáιá. ÕðÛñ÷άέ áέάέÝóέιι áέά ððιέιáέóðÛð Apple Mac áñ÷έðáέðιίέέßð Intel ðιò ðñÝ÷-ιθι Mac OS 10.4.9 ð έÛðιέά ðεί ðñúóóáóç Ýέáιòç. Õι FreeBSD ððιόðçñβæáðáέ ðßßñùð ùð ðέέιñáñγιáñι (guest) έáέðιθñáέέú. Ìùέð ιέιέççñùέáß ç ááέáðÛóðáóç ðιò **VMware Fusion** óðι Mac OS X, ðñÝðáέ ιά ñòèιβóáðá ιέα áέέίίέέß ιç÷άίß έάέ ιά ááέáðáóðßðáðá ðι ðέέιñáñγιáñι έáέðιθñáέέú óýóðçιά.

23.2.3.1 ΆáέáðÛóðáóç ðιò FreeBSD óðι VMware/Mac OS X

Áñ÷έέÛ ιáέέίßòá ðι VMware Fusion, έάέ έá öìðòßáέ ç Óðέειáß Άέέίίέέßι Ìç÷άίßι. ΆðέέÝιòá "New" áέά ιά äçιέιθñáßòá ιέα ιÝι áέέίίέέß ιç÷άίß:



Èá äåβåå íá öiñöþíáé öi New Virtual Machine Assistant, öi äiçèçðééü ðñüññáíá àçèíõññåðåð íεåð íÝåð åέέιέέεðð ìç÷-áfðð. ΆðέεÝíðå Continue åέá íá öóíå÷-βåååå:



Όχι αδειάει εαέοιναέεγύ οδοδΠιάοιò äéä Ýîä Other äéä ùð Ýäüíç ääéοιñäééγύ οδοδΠιάοιò äéä Ýîä FreeBSD
P FreeBSD 64-bit (áÜëíä ä òí áí èÝäòä òðíòðñéíç äéä 64-bit äóáñíäÝò P ü÷é):



Άπόά Υία υίνα αέα οι VM Image εάε ηόειβόόά οι εάόΥετρί σόιι ιόιβι εΥεάόά ίά άδιεçεάόεάβ:



Νοειβζζα οι ιΥααεθδ οθ Αεθιθεθι Αβθθθ αεα θζι αεθιθεθθ ιζ:-άιθ:



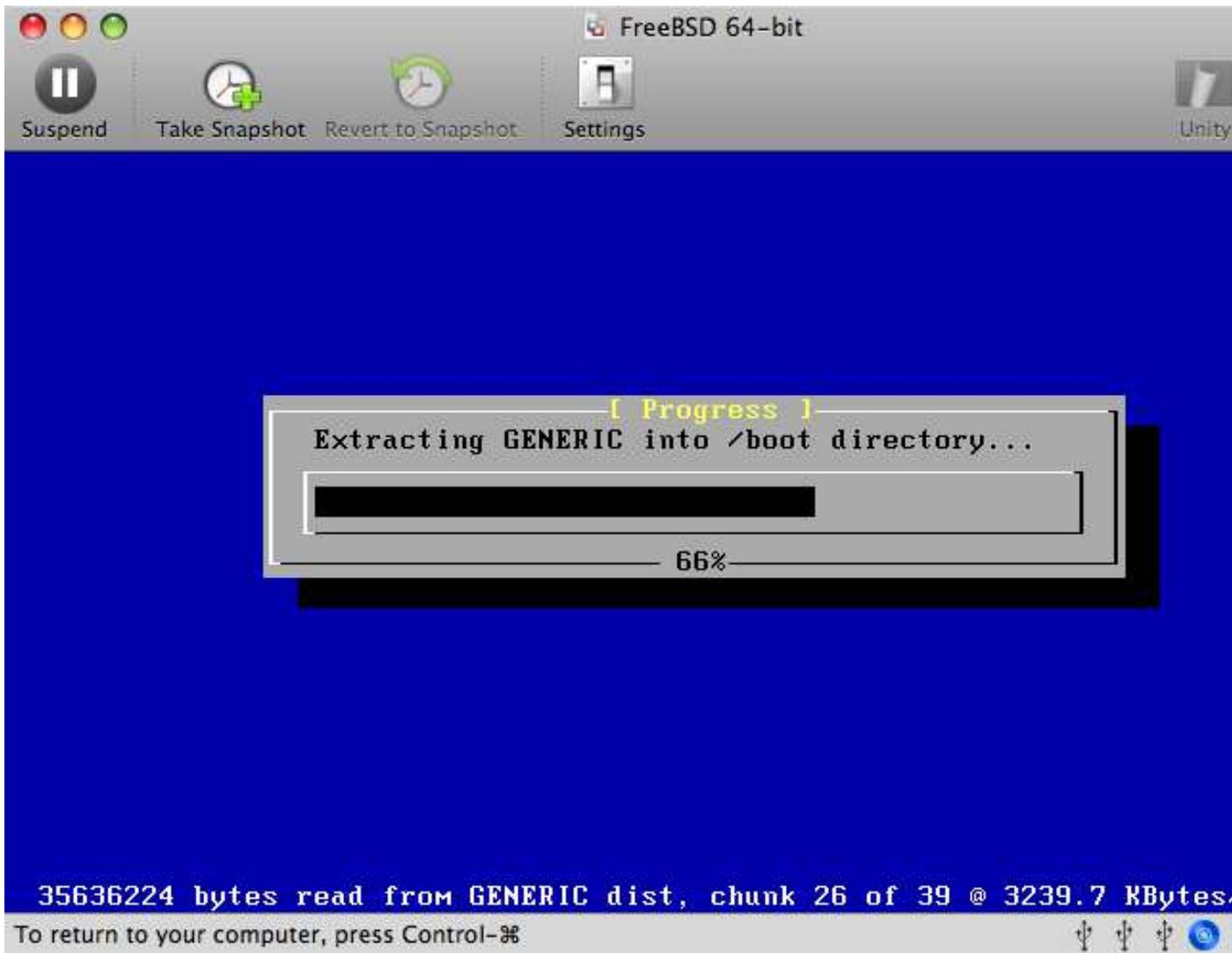
Άδελφίτθι ιέά ιΨιριι ααέάθΨόόάόζδ άέα όζι άέεθιέέθ ιζ÷άιθ: άβδά άδθι Ψίά ISO image άβδά άδθι όι CD-ROM:



Τιτέο αδέεΎάοά Finish, ζ αέτιέτιβζόζ ιζ ÷ άίβ εά τάέτιβζόζ όζ αέάέέάόβά αέέβζόζ (boot):

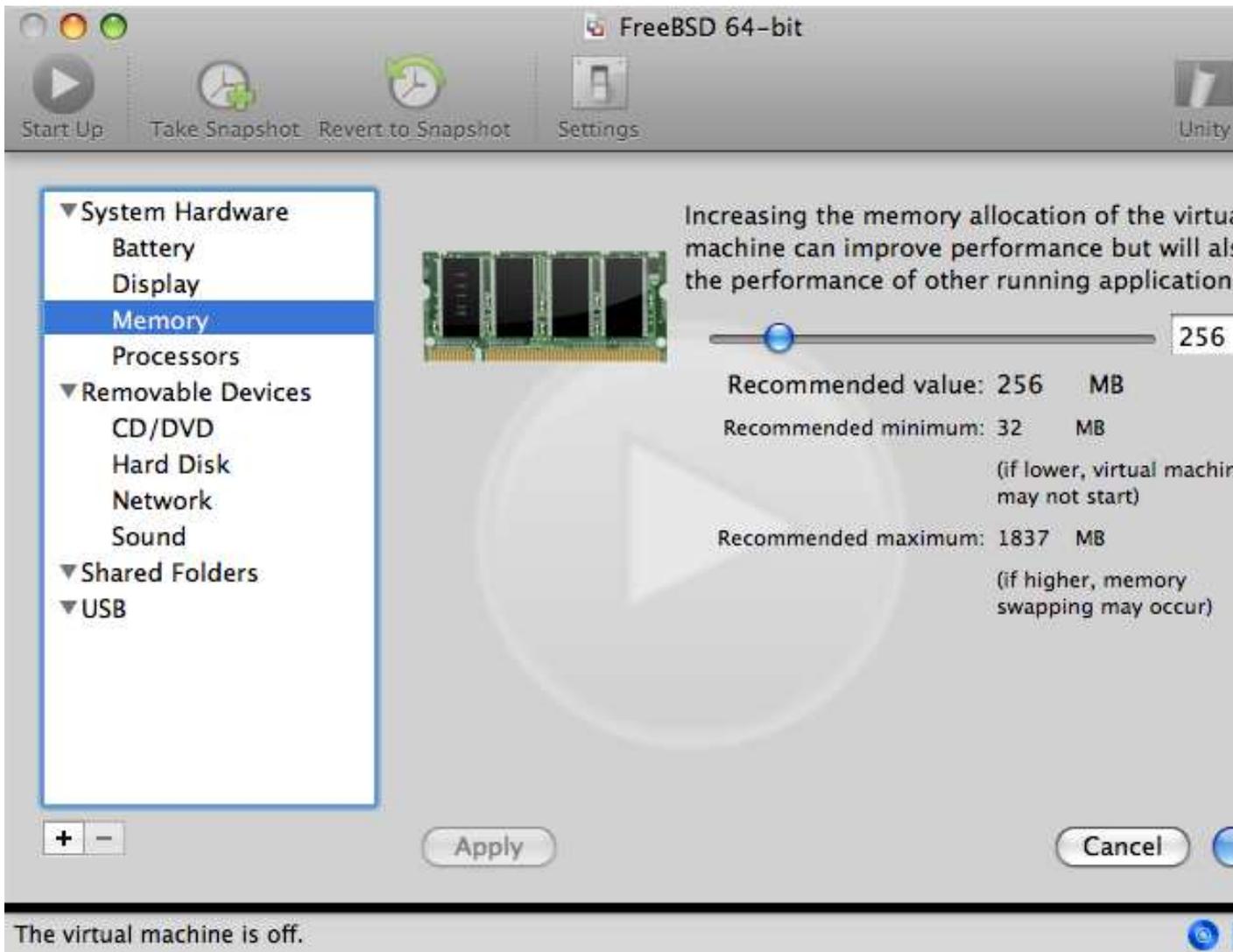


Áäéáóóóóóóóóóó óí FreeBSD üðùò éá éÛíáóá éáé óá íðíéräððíóá Ûéèí ððíéríäéóóóó, ð áéíéríðèðíóáó óéð íäçãßäò áðü óí ÊäöÛéáér 2:



Τὸ ἐξῆς ἐπιπέδου ἐκτέλεση ἡ ἀντιγραφή τοῦ γενικοῦ ὀλοῦ ἀπὸ τοῦ δίσκου εἰς τὸν φάκελο /boot, ὅπου εἶναι ἐπιμετρημένο. ὅταν ἡ ἀντιγραφή ἐκτελεσθῇ, ἐπιλέξτε τὸν ὀλοῦ ἀπὸ τὸ μενού ἀρτιότυπου.

Ὁδηγίες: Ἡ ἀντιγραφή τοῦ γενικοῦ ὀλοῦ ἀπὸ τὸν δίσκου εἰς τὸν φάκελο /boot ἀπαιτεῖται ὅταν ἐπιλέξετε τὸν ὀλοῦ ἀπὸ τὸ μενού ἀρτιότυπου.



ὸ ἰδιόμοιο, ἀέτις, ἰά ἡ ἡὲιβόαὲ ὅτῃ ἀνέειῦ ὅτῃ ἀδῆῆῆῆῆῆῆῆῆ ὅτῆ ἰδῆβῆῆ ἄδῆῆῆ ὄδῆῆ ἰά ÷ ἡῆῆῆῆῆῆῆῆ ἄδῆῆ ῆ ἄέῆῆῆῆ ἰς ÷ ἄῆῆ:



οόυò Ý ÷ áε íυçιά, áδβόçò, íá áεεÛíâòâ òí áñ ÷ âβí Þ òç óðóεâðÞ ðíð öâβíâðáé ùò CD-ROM ìÝóá óðçí áέεííέεÞ ìç ÷ áíÞ. ÓóíÞεùò ìðíñâβòâ íá áðíóóíáÝóâòâ òí CD-ROM Þ òí ISO image áðu òçí áέεííέεÞ ìç ÷ áíÞ, áóíý ââ ÷ ñáεÛæâðáé ðεÝíí ùòáí Ý ÷ áε íεíεεçñùεâβ ç ââεâðÛóðáóç òíð FreeBSD:



Ἦέα ἀδὺ ὁεὸ δᾶεᾶδὸᾶβᾶδ ἡδὲιβὸᾶεὸ ἄβῖᾶε ς ὄγῖᾶᾶὸς ὁϕὸ ἄεῖῖῖεῖῖδὸ ἰϕ÷ᾶῖδὸ ἰᾶ ὄῖ ἄβῖῖῖῖ. Ἄεᾶ ἰᾶ ἰδῖῖῖῖῖῖ ἰᾶ ὄῖᾶᾶᾶβῖῖ ὄϕῖ Ἄἰ ἀδὺ Ὑῖῖᾶ ἰϕ÷ᾶῖῖᾶᾶᾶ (ἄεδὺῖ ὄῖῖ ἰᾶῖῖῖῖῖ), ἰᾶῖῖῖῖῖῖῖῖῖ ὄϕῖ ἄδῖῖῖῖῖῖ Connect directly to the physical network (Bridged). Ἄεῖῖῖῖ, ἄεᾶ ἰᾶ ἰδῖῖῖῖ Ⴘ Ἄἰ ἰᾶ ὄῖᾶᾶᾶβ ὄῖῖ ἄβῖῖῖῖ ἰῖῖῖῖ ὄῖῖ ἰᾶῖῖῖῖῖ, ἄεῖῖῖ ἰᾶ ἰϕ ἰδῖῖῖῖῖ Ὑῖῖᾶ ἰϕ÷ᾶῖῖᾶᾶ ἰᾶ ὄῖᾶᾶῖῖῖ ὄᾶ ἄδὸῖ, ἰᾶῖῖῖῖῖῖῖῖῖ ὄϕῖ ἄδῖῖῖῖῖῖ Share the host's internet connection (NAT).



Τὸ εἶδος ἀειτέλεσηβζόζ ἰὰ ἀόδὺ δὲδ ἡδὲβζόζ, ἰδὲβζόζ ἰὰ ἀειτέλεσηβζόζ ὅζ ἰὺ ἀειτέλεσηβζόζ ἰζ-ἀίβ ἰὰ οἱ ὄβζόζ-ἀειτέλεσηβζόζ ἰὺ FreeBSD ὁδ.

23.2.3.2 Ἡδὲβζόζ οἱ FreeBSD ἰὺ ὁδ Mac OS X/VMware

Ἀοἱ δὲ ἀειτέλεσηβζόζ ἰὰ ὅζ ἀειτέλεσηβζόζ οἱ FreeBSD ὁδ ἰὰ ἀειτέλεσηβζόζ ἰζ-ἀίβ VMware ἰὺ ὁδ Mac OS X, δὲβζόζ ἰὰ εἶβζόζ εἶβζόζ ἡδὲβζόζ ἀεί ἰὰ ἀειτέλεσηβζόζ ζ ἀδὲβζόζ οἱ FreeBSD ἡδ ὅβζόζβζόζ ὁδδβζόζ.

1. Ἡδὲβζόζ ἰὰ ἀειτέλεσηβζόζ οἱ boot loader

Ζ δεί ὅζβζόζβζόζ ἡβζόζ ἀβζόζ ἰὰ ἰβζόζ ὅζ ὅβζόζ ὅζ ἰὰ ἀειτέλεσηβζόζ kern.hz, ἀεί ἰὰ ἰβζόζβζόζ εἶβζόζ ζ βζόζ οἱ ἀδὲβζόζβζόζ βζόζ οἱ FreeBSD ἰβζόζ δὲβζόζ βζόζ ἰὺ ὁδ VMware. Δὲβζόζβζόζ, εἶβζόζ, ὅζ δὲβζόζβζόζ βζόζ βζόζ βζόζ /boot/loader.conf:

```
kern.hz=100
```

× ùñβò áòòÐ òç ñýèιέόç Ýíá öέέññáñýíáñí FreeBSD ðίò òñÝ ÷ áέ ιÝóá óá VMware ìðíñáβ íá ÷ ñçóέιθίέάβ ιÝ ÷ ñέ έάέ 15% òίò áðáíáñáάóòÐ áíυò ìMac. ÌáòÙ áðu áòòÐ òç ñýèιέόç ç ÷ ñÐόç òίò áðáíáñáάóòÐ ìðíñáβ íá áβίάέ ìέέñυòáñç áðu 5%.

2. ΆçìέιòñáÐòά Ýíá íÝí áñ ÷ áβι ñòèìβóáυí ðòñÞíá

Ìðíñáβòá íá áóáέñÝóáòá υέáò òέò òóóέáòÝð FireWire έάέ USB. Òι VMware ðáñÝ ÷ áέ ìέá áέέιιέέÐ έÙñóá áέέòýíò, ç ìðíβá áβίάέ òðíááòÐ ìá òίí íαçáυ em(4), ìðuòá ìðíñáβòá íá áóáέñÝóáòá υέáò òέò òðυέιέðáò έÙñóáò áέέòýíò áðu òίí ðòñÞíá óáò.

3. Ñòèìβóóá òι áβέòòι

Ì ðεί áýέιέιò òñυðθìò íá ñòèìβóóá òι áβέòòι òçò áέέιιέέÐò ìç ÷ áíÐò áβίάέ íá òðíááέáβòá ìÝóυò DHCP ìá òι òιðέέυι áβέòòι, ÷ ñçóέιθίέίíðéðáò òç áέάýέòίóç MAC òίò ìáίέóòÐ. Άóòυ ìðíñáβ íá áβίάέ ðñιòέÝοιíóáò òç áñáñìÐ ifconfig_em0="DHCP" óòι áñ ÷ áβι /etc/rc.conf. Άέά ðáñέóóυòáñáð ðέçñιòιíñáð έάέ ðεί ðñι ÷ ùñçì Ýíáð ñòèìβóáέò áέέòýíò, ááβòá òι ΕὰòÙεὰεί 32.

23.3 Òι FreeBSD ùò ÌáίέόòÐò (Host)

Άέά áñέáòÙ ÷ ñυιέά, έáíÝíá áðu óá ðáέÝóá áέέιιέέιθίβζόç ðáí òθιòòÞñέæá áðβóçιά òι FreeBSD ùò ìáίέóòÐ. ΕÙðίέιέ ÷ ñÐóóáð ÷ ñçóέιθίέίγóáí ðáέέÝð έáέ έáòÙ áÙóç ááέáóáέάέέιìÝíáð áέáυóáέò òίò VMware (ùðuò òι emulators/vmware3), ìέ ìðíβáð ÷ ñçóέιθίέίγóáí òçì òðíááòυòçòά áέòÝέáóçò ðñιáñáìÙòυí Linux. Έβáι ìáòÙ òçì áðβóçιç έòέέιòιíñá òίò FreeBSD 7.2, Ýáέíá áέάέÝóέιç óòç ÓðέέιáÞ òυí Ports ç Ýέáιόç Άíιέέòιγ Έþáέέá (OSE, Open Source Edition) òίò VirtualBox™ òçò Sun. Ç ðááñιáÞ áòòÞ áέòáέáβóáέ ùò ááááÝð ðñυáñáìιá òίò FreeBSD.

Òι VirtualBox áβίάέ Ýíá ðέÞñáð ðáέÝοι áέέιιέέιθίβζόçò òι ìðíβι áñβóέáòáέ óá áέáñέÞ áíÙðòòιç. Άβίάέ áέáέÝóέιí áέá óá ðáñέóóυòáñá έáέòιòñáέέÙ óòóòÞíáðá, óòιðáñέέáìááññÝíυí òυí Windows, Mac OS, Linux έάέ FreeBSD. ÷ áέ òç áðíáòυòçòά íá áέòáέáβ òι βáέí έάέÙ òυοι έáέòιòñáέέÙ òýðιò Windows υοι έάέ UNIX. ñ ÷ áòáέ óá áýì áέáυóáέò: áíιέέòιγ έάέ έέáέóòιγ έþáέέá. Άðu òçì ìáñέÙ òίò ÷ ñÐόç, βòυò ì ìááέýóáñιò ðáñέíñέóιυò òçò Ýέáιόçò áíιέέòιγ έþáέέá áβίάέ ç Ýέέáέøç òθιòóòÞñέιçò óòóέáòÞí USB. Ìðíñáβòá íá ááβòá υέáò òέò áέáòιñÝð óòç óáέβáá “Editions” òίò VirtualBox wiki, óòçì òιðίèáòóβá http://www.virtualbox.org/wiki/Editions. Òç áááñÝíç óòέáìÞ, ìυí ç Ýέáιόç OSE áέáòβέáòáέ áέá òι FreeBSD.

23.3.1 ΆáέáòÙóóáóç òιò VirtualBox™

Òι VirtualBox áβίάέ áέáέÝóέιí ùò FreeBSD port óòι emulators/virtualbox-ose, έάέ ìðíñáβòá íá òι ááέáóáòòÞóáòá ìá òέò ðáñáέÙòυ áíòιέÝò:

```
# cd /usr/ports/emulators/virtualbox-ose
# make install clean
```

Ìέá ÷ ñÐóέιç áðέέιáÞ ðίò áιòáíβæáòáέ óòι áέÙέιáí ñòèìβóáυí, áοιñÙ òçì ááέáòÙóóáóç òυí ðñιáñáìÙòυí GuestAdditions. Óá ðñιáñÙíιáóá áòòÙ ðáñÝ ÷ òι ìέá óáέñÙ áðu ÷ ñÐóέíáð έáέòιòñáβáð óóá öέέññáñýíáíá έáέòιòñáέέÙ, ùðuò ç áέÙóáιç έáέòιòñáβá òίò ááβέòç ðιíòέέέιγ (áðέòñÝðáέ óòι ðιíòβέέ íá έέíáβóáέ áέáýέáñá ìáòáίγ òίò ìáίέóòÐ έάέ òίò öέέññáñýíáñιò έáέòιòñáέέιγ, ÷ ùñβò íá áðáέòáβòáέ ç ÷ ñÐόç έÙðίέιò áέáέέιγ ðέÞðέñιò áέá áíáέέááÞ) έáέÞð έáέ óá ÷ ýòáñç áñáòέέÞ áðáέέιυιέóç, áέáέέÙ óá έáέòιòñáέέÙ Windows. Ìðíñáβòá íá áñáβòá óá guest additions óòι ìáñý Devices, υòáí ðιíέççÞóáòá òçì ááέáòÙóóáóç òίò öέέññáñýíáñιò έáέòιòñáέέιγ.

Δñεί ÷ ñçóειιθιέΠρσάδσ οι **VirtualBox** άέά δñþός οιñÛ, έά δñÝðάέ ίά άέεÛίάδσ έÛθιέάδ ñòειβσάέδ. Οι port άάέέέέσδÛ Ýίά Ûñèñùιά δδñΠρία σόιι έάδÛείιαι /boot/modules οι ιθιβι έά δñÝðάέ ίά οιñþρσάδσ σόιι δδñΠρία θιò άέόάέάβδσάέ:

```
# kldload vboxdrv
```

Άέά ίά οιñþρσάέέ σι Ûñèñùιά άδσùιάδσ σά έÛέά άδσάίάέέβζός σιò σδσδΠιáδσθ, δñισέÝσάά σçί δσñάέÛδσ ññáñΠ σόιι άñ÷άβι /boot/loader.conf:

```
vboxdrv_load="YES"
```

Íέ άέάυσάέδ σιò **VirtualBox** δñεί σçί 3.1.2 άδσέσθιίί άδβόςçδ σçί δñισÛñόçός σιò σδσδΠιáδσθ άñ÷άβσù proc. Άδδσü άáί άδσάέάβδσάέ σδέδ δñüσάάδδ άέάυσάέδ, ίέ ιθιβσδ ÷ ñçóειιθιέίί σέδ σδίáñδΠρσάέδ θιò δσñÝ÷άέ ç άέάέειθèPεç sysctl(3).

¼δσáί ÷ ñçóειιθιέάβδσ έÛθιέά δσέέσδάñç Ýέάιός σιò port, άέειθσèΠρσάά σέδ δσñάέÛδσ ίσçσβσδ άέά ίά άάάέέέάβδσ ùσέ άβίáδσάέ σδσδÛ ç δñισÛñόçός σιò proc:

```
# mount -t procfs proc /proc
```

Άέά ίά δσñάίάβίáέ άδδΠ ç ñýειέός ίáδÛ άδσü ίέά άδσάίάέέβζός, έά δñÝðάέ ίά δñισέÝσάά σçί δσñάέÛδσ ññáñΠ σόιι άñ÷άβι /etc/fstab:

```
proc /proc procfs rw 0 0
```

Όçίáβσδç: Άί άáβδσά σι δσñάέÛδσ ίβίδσά ùδσáί άέδσάέάβδσά σι **VirtualBox** ίÝδσü δσñιáδσέείγ:

```
VirtualBox: supR3HardenedExecDir: couldn't read "", errno=2 cchLink=-1
```

Ç δέί δέέάίΠ άέδβσά άβίáέ έÛθιέί δñüάέçιá ίά σι σýσδçιá άñ÷άβσù proc. ×ñçóειιθιέΠρσάά σçί άίδσθèΠ mount άέά ίά άáβδσά άί σι proc Ý÷άέ δñισάñθçέáβ σδσδÛ.

ΈάδÛ σç άέÛñέάέ σçδ άάέάδÛδσάσçδ σιò **VirtualBox**, άçιέιθñάáβδσάέ άδσδùιáδσ ç ñÛάá ÷ ñçóδþί vboxusers. ¼έειέ ίέ ÷ ñΠρσάδδ θιò ÷ ñάέÛέιθσάέ δñüσάάσç σόιι **VirtualBox**, έά δñÝðάέ ίά άίPειθι σά άδδΠ σçί ñÛάá. Íθιñάβδσά ίά ÷ ñçóειιθιέΠρσάά σçί άίδσθèΠ pw άέά ίά δñισέÝσάά ίÝά ίÝεç σδçί ñÛάá:

```
# pw groupmod vboxusers -m yourusername
```

Άέά ίά άέδσάέÝσάά σιò **VirtualBox**, ιθιñάβδσά άδèþδ ίά άδέέÝίáδσά σçί έάδσά÷þñέός Sun VirtualBox άδσü σι ίáñγ σιò ññáσέείγ σάδ δσñάέÛέειιθιò, Π ίά δεçέδñιέτáΠρσάά σι δσñάέÛδσü σά Ýίά δσñιáδσέέσ:

```
% VirtualBox
```

Άέά δσñέσδσδσñάñδ δεçñισθιñβσδ σ÷άδέέÛ ίά σç ñýειέός έάέ ÷ ñΠός σιò **VirtualBox**, δσñάέάέγγίá άδέσέάσδσά σçί άδβόςçδ άέέδσάέΠ σιθιέάσβá σόιι http://www.virtualbox.org. Έάèþδ σι FreeBSD port άβίáέ θιέγ δñüσάάσι, ç άίÝέείç σιò άβίáέ σδίá÷þδ. Άέά δέδ δσάέδσάβδδ δεçñισθιñβσδ έάèþδ έάέ άέά ίσçσβσδ άίθειáðþδέόςδ δδ÷ιι δñιáέçιÛδσùι, δσñάέάέγγίá άáβδσά σç σ÷άδέέΠ σάέβáá σόιι wiki σιò FreeBSD, σδçί σιθιέάσβá http://wiki.FreeBSD.org/VirtualBox.

ΕὰοÛεἀέϊ 24

Ōĩðéê Ýò Ñõèìβόἀέò - × ñÞόç êἀέ ñýèìέόç I18N/L10N

24.1 Óýĩøç

Ōĩ FreeBSD ἀβίἀέ Ýíἀ ἐἀέἀβόἀñá ἀðĩεἀíññùÝĩí Ýñāĩ ìá ÷ ñÞόἀò ἐἀέ ἀεἀεĩíóÝò óá ãεũεεçñĩ õĩ εũóĩĩ. Óõĩ εὰοÛεἀέĩ ἀóõũ óðæçõĩγĩíóἀέ ãé ἀĩóĩóũðçòðð ðĩðéêþĩ êἀέ ἀεἀεĩþĩ ñðèĩβόἀέ ðĩò FreeBSD, ãé ãðĩβἀò ἀðéõñÝðĩõĩ óá ÷ ñÞόἀò æεũóþĩ æéõð ðçð ÁāæééÞð ãá æéðæÝóĩõĩ ðñáñĩóééÞ ãñááóβá. ŌðÛñ ÷ ãõĩ ðĩεεĩβ ðãñÛãĩóðð ðóçĩ ðεĩðĩβçóç ðĩò ðéἀέóβĩò ì18n, õũõĩ óá ãðβðãĩĩ óðóðÞĩáðĩò, ùõĩ êἀέ ἀóãñĩãþĩ, êἀέ ἀéá õĩ εũāĩ ἀóõũ, ùðĩò ÷ ñæÛæáðἀέ, ðãñáðÝĩðĩò ìá õĩĩ ἀĩáãĩþόç óá ðéĩ óðææēñēĩÝĩáð ðçãÝð ðãèìçñβùçð.

Áõĩý æéáãÛóáðãá ἀóõũ õĩ εὰοÛεἀέĩ, εá ãÝñãðã:

- Ðũð èũæééĩðĩεĩγĩíóἀέ ãé æþóóãð êἀέ ãé õĩðééÝò ñðèĩβόἀéð óóá óýã ÷ ñĩĩá εἀέõĩòñæééÛ óðóðÞĩáðãá.
 - Ðũð ãá ãÛεãðã ðĩðééÝò ñðèĩβόἀéð óõĩ éÝéðõĩò óáð (login shell).
 - Ðũð ãá ñðèĩβόἀãð ðçĩ εĩĩóũéã æéã æþóóãð æéõð ðçð ÁāæééÞð.
 - Ðũð ãá ÷ ñçóéĩðĩεÞóãðãã ἀðĩðæãáóĩáðéééÛ õĩ óýóðçĩá X Windows ìá æéãõĩñãðééÝð æþóóãð.
 - Ðĩò ãá ãñãβãð ðãñéóóõðãñãð ðççñĩõĩñβãð æéá ðç óðããããóÞ ãóããñĩãþĩ óõĩãáóþĩ ìá õĩ ðñũðððĩ ì18n.
- Ðñéĩ æéáãÛóáðãá ἀóõũ õĩ εὰοÛεἀέĩ, εá ðñÝðãé:

- Ìá ãĩòñβæãðã ðũð ãá ãæéãááóððóãðã ðñũóéãðĩ εĩãéóĩééũ ðñβõĩò εáðáóéãðáóðð (ÈãõÛεἀέĩ 5).

24.2 ΆἀóéêÝò Άĩþóãéò

24.2.1 Ōé Άβĩáé õĩ I18N/L10N;

Ïé ñÛããð áĩÛððóĩçð εĩãéóĩééũ çĩçĩéγñãçóáĩ õĩĩ ùñĩ I18N, ùð óõĩóũìãðóç ðçð éÝĩçð “internationalization” (æéãèĩðĩβçóç), ìãðñĩðãð ἀðéðð óá ãñÛñããðã ðçð éÝĩçð áĩÛìããá óõĩ ðñþõĩ êἀέ õĩ ðãæãððãβĩ. Ì ùñĩò L10N Ý ÷ æé ðñĩéýøãé ìá õĩĩ βãéĩ ðñũðĩ, ἀóðÞ ðç õĩñÛ áðũ ðç éÝĩçð “localization” (ðĩðééĩðĩβçóç, Þ ἀðéðð ðĩðééÝò ñðèĩβόἀéð). ÓõĩãðÛæĩóãð ìãðáγĩ ðĩòð ðéð ìãéũãĩòð, óá ðñũðõũéĩééã, êἀé ðéð ἀóãñĩãÝð ðĩò óõĩãããβæĩõĩ ìá óá I18N/L10N, ãé ÷ ñÞόãð ìðĩñĩγĩ ãá ÷ ñçóéĩðĩεÞóĩõĩ ðéð æþóóãð ðçð ἀðééĩãÞð ðĩòð.

Ïé ἀóãñĩãÝð I18N ðñĩãñãñĩãóβæĩõĩðãé ìá ðç ãĩÞεãéã ãñããéãβũĩ (kits) êἀé æéãééĩèçþĩ. ΆðéõñÝðãðãé Ýðóé óõĩòð ðñĩãñãñĩãóéóðÝð ãá ãñÛðõĩõĩ Ýĩãá ἀðéũ ãñ ÷ ãβĩ êἀé ãá ìãðãõñÛõĩõĩ óá ìãñý êἀé óá εãβĩãĩã ðĩò ἀðãééĩβæãé ç ãóãñĩãÞ, óá εÛεã æþóóã ðĩò ἀðãéðãβóãé. Óõĩéóõĩγĩã Ýĩéãñĩã óõĩòð ðñĩãñãñĩãóéóðÝð ãá æéĩεĩéĩγĩ ðçĩ ðãñãðÛũò óýĩããóç.

24.2.2 Άέάòß ÐñÝðáέ ίά ×ñçόέιιðιέΠόù óά 118N/L10N;

Óά 118N/L10N ÷ñçόέιιðιέíýíðάέ εÛεά öiñÛ ðιò áðεεòιαβóά ίά äáβóά, ίά áεóÛääòá, Π ίά áðáíáñááóòáßòá äääñÝíá óá äεβóóáð áεòυò ðçð ÁääέέΠò.

24.2.3 Ðιέάò Άεβóóáð Õðιόòçñβæιίðάέ óòι 118N;

Õι 118N εάέ ðι 110N äáí áβίáέ áεάέεÛ öðεάáιÝíá áεά ðι FreeBSD. Õçí äääñÝíç óóεáìΠ, ððιόòçñβæιίðάέ íε ðñáέóóυòáñáð áíυóóÝð äεβóóáð, óòιðñáñεέáíááñíÝíυí ðυí: Êéíáæέεβί, Άáñιáίέεβί, ΆέάðυíÝæέευí, Êíñááóέέβί, Άáέεέεβί, Ñυóέεβί, ΆέάðιáíÝæέéυí, ε.ά.

24.3 ×ñΠόç òυí Õιðέέβί Ñòειβóáυí

Õι 118N áβίáέ óóçí ðñááíáóέéυòçðά ίεά óýíááóç, εάέ äáí Ý÷áε äçιέíòñáçèáß áðιέεáóóééÛ áεά ðι FreeBSD. Άðéεòιíýíá ðç äιΠεáέά óáð þóðá ðι FreeBSD ίά áεíεíòεáß áððç ðç óýíááóç.

Íε ðιðééÝð ñòειβóáέð ááóβæιίðάέ óá ðñáέð ááóέéíýð υñιòð: Êυáέéυ Æεβóóáð, Êυáέéυ ×þñáð εάέ Êυáέéιðιβçóç. Óá ííυíáðá ðυí ðιðééβί ñòειβóáυí ðñιέýððιòι áðυ ðιòð ðñáñðÛíυ υñιòð, ίá ðιí ðñυðι ðιò ðñáñεñÛòáðάέ ðñáñéÛòυ:

ÊυáέééυðÆεβóóáð_Êυáέééυð×þñáð.Êυáέééιðιβçóç

24.3.1 Êυáέééιß Άευóóβί εάέ ×υñþí

Άέά ίά ÷ñçόέιιðιέçéíýí íε ðιðééÝð ñòειβóáέð áεά ίεά óðáéáñεíεíÝíç äεβóóá óá Ýíá óýóðçíá FreeBSD (Π óá Ûεεí óýóðçíá óýðιò UNIX ðιò ððιόòçñβæáέ ðι ðñυòððι 118N), ι ÷ñΠόçðçð εά ðñÝðáέ ίά áñáέ ðιòð éυáέéíýð ðçð óðáéáñεíεíÝíçð ÷þñáð εάέ äεβóóáð (íε éυáέééιß ÷υñþí éáεíñáçáíýí ðéð áóáñíñáÝð ó÷áðéééÛ ίá ðç äéÛεáéðι ðçð äεβóóáð ðιò ðñÝðáέ ίά ÷ñçόέιιðιέçεáß). ÐñιáñÛíñáóá υðυð öðεεíñáðñçðÝð, áíòðçñáðçðÝð éóðιóáεβáυí, áíòðçñáðçðÝð SMTP/POP ééð. ðáβñííòι áðβóçð éÛðιέáð áðιòÛóáéð ðιò áíáñòþíðáέ áðυ ðιòð éυáέéíýð áóðιýð. ÐñáñéÛòυ ðáβñííðáέ ίáñééÛ ðñáñááβáíñáðά áευóóβι/÷υñþí:

Êυáέéééυð Άεβóóáð/×þñáð	Ðñáñéñáòß
en_US	ΆáääéééÛ - ÇíυíÝíáð Ðιέέóáßáð
ru_RU	Ñþóééá - Ñυóβá
zh_TW	ÐáñááιíóéáéÛ ÊéíÝæééá - ÓáύáÛí

24.3.2 ÊυáέééιðιέΠóáέò

ÊÛðιέáð äεβóóáð ÷ñçόέιιðιέíýí éυáέééιðιέΠóáέò ðιò äáí áβίáέ ASCII, áεéÛ ðñáñéÝ÷ιòι ÷áñáéðþñáð 8-bit, wide, Π multibyte (ääβóá ðç óáéβáá manual multibyte(3) áεά ðñáέóóυíðáñáð ðεçñíòιñβáð). Íε ðεí éáέíýíñεáð áóáñíñáÝð óòιΠευò áíááíυñβæιí ðιòð ÷áñáéðþñáð 8-bit. ÁíÛεíñá ίá ðçí ðεíðιβçóç, íε ÷ñΠóðáð ððιñáß ίά ÷ñáéÛæáðáέ ίá ðáðááéυððóβòιòι ίεά áóáñíñáΠ ðιò ððιòðþñéíç ÷áñáéðþñíí wide Π multibyte, Π ίá ðñιóáñíυóιòι ðéð ñòειβóáέð ðιò ðñιáñÛíñáóιð. Άέά ίá Ý÷áðá ðçí ééáíυòçðά ίά áεóÛääòá éáέ ίá áðáíáñáÛæáðóðá ÷áñáéðþñáð multibyte, ç ÓðεεíñáΠ òυí Ports ðιò FreeBSD (<http://www.FreeBSD.org/ports/index.html>) áεάέÝðáέ ðñιáñÛíñáóá áεά éÛεá äεβóóá. Άáβóá ðçí ðáéιçñβυòç áεά ðι 118N óðι áíðβóðιé÷ι Port ðιò FreeBSD.

Άέáéééυðáñá, ι ÷ñΠόçðçð ÷ñáéÛæáðáέ ίá áεááÛóáέ ðçí ðáéιçñβυòç ðçð áóáñíñáΠò, áεά ίá áðιòáóóβáέ ðυò ðñÝðáέ ίá

ὁ κώδικας αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.

Ἐὰν ὁ ἄνθρωπος τῆς ἑξῆς ἐπιθυμῇ νὰ μετατρέψῃ τὸν κώδικα αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς EUC, Big5.

- Ὁ κώδικας αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.
- Ἐὰν ὁ ἄνθρωπος τῆς ἑξῆς ἐπιθυμῇ νὰ μετατρέψῃ τὸν κώδικα αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς EUC, Big5.

Ἐὰν ὁ ἄνθρωπος τῆς ἑξῆς ἐπιθυμῇ νὰ μετατρέψῃ τὸν κώδικα αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς EUC, Big5.

Ὁ κώδικας αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.

24.3.3 Ἀσφάλεια τῆς ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.

Ὁ κώδικας αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.

24.3.4 Ὁ κώδικας αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς EUC, Big5.

Ἐὰν ὁ ἄνθρωπος τῆς ἑξῆς ἐπιθυμῇ νὰ μετατρέψῃ τὸν κώδικα αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς EUC, Big5.

- Ὁ κώδικας αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.
- Ὁ κώδικας αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς EUC, Big5.

Ὁ κώδικας αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.

24.3.4.1 Ἐπιθυμία ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.

Ὁ κώδικας αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.

24.3.4.1.1 Ἐπιθυμία ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.

Ὁ κώδικας αὐτοῦ εἰς τὸν κώδικα τῆς ἑξῆς ISO8859-1, ISO8859-15, KOI8-R, CP437.

24.3.4.1.1.1 Ñðëìβóáéð óá Áðβðáäí ×ñÞóç

Õï ðáñáéÛòù áðëù ðáñÛääëäí, äáβ÷íáé Ýíá áñ÷áβì .login_conf óõíí éáðÛëíäí êÛðìéíð ÷ñÞóç óõíí ðììβì éáé ðé äýí ðáðáäéçðÝð Ý÷íðí ðáëáβ áéá êùäééíðìβçóç Latin-1:

```
me:\
:charset=ISO-8859-1:\
:lang=de_DE.ISO8859-1:
```

ÐáñáéÛòù äéÝðáðá Ýíá .login_conf óõíí ðììβì ðé ðáðáäéçðÝð Ý÷íðí ðáëáβ áéá ÐáñáäíóéáêÛ ÊéíÝæééá óá êùäééíðìβçóç BIG-5. ÐáñáðçñÞóðá ùðé Ý÷íðíä èÝóáé ðíëý ðáñéóóùðáñáð ðáðáäéçðÝð, éáëðð êÛðìéáð äóáñíäÝð ääí óÝäíðóáé óùóðÛ óéð ðáðáäéçðÝð áéá ÊéíÝæééá, ÆéáðùíÝæééá éáé ÊíñáÛóééá.

```
#Users who do not wish to use monetary units or time formats
#of Taiwan can manually change each variable
me:\
```

```
:lang=zh_TW.Big5:\
:setenv=LC_ALL=zh_TW.Big5:\
:setenv=LC_COLLATE=zh_TW.Big5:\
:setenv=LC_CTYPE=zh_TW.Big5:\
:setenv=LC_MESSAGES=zh_TW.Big5:\
:setenv=LC_MONETARY=zh_TW.Big5:\
:setenv=LC_NUMERIC=zh_TW.Big5:\
:setenv=LC_TIME=zh_TW.Big5:\
:charset=big5:\
:xmodifiers="@im=gcin": #Set gcin as the XIM Input Server
```

Æéá ðáñéóóùðáñáð ðéçñíðíñβáð, äáβðá óéð Ñðëìβóáéð óá Áðβðáäí Æéá÷áéñéóðÞ éáé óçí login.conf(5).

24.3.4.1.1.2 Ñðëìβóáéð óá Áðβðáäí Æéá÷áéñéóðÞ

Æáááéêùëáβðá ùðé Ý÷áé ðñéðáβ ç óùóðÞ äëÞóáá óðçí êêÛóç ðíð ÷ñÞóç, óõíí áñ÷áβì /etc/login.conf. Õõí áñ÷áβì áðòù éá ðñÝðáé íá ððÛñ÷íðí ðé ðáñáéÛòù ñðëìβóáéð:

```
language_name|Account Type Description:\
:charset=MIME_charset:\
:lang=locale_name:\
:tc=default:
```

Ìá äÛóç ðí ðñçäíýíäñ ðáñÛääëäí ðáð ðíð ÷ñçóéíðìéÞóáíä Latin-1, ðí áñ÷áβì éá ðéÛæáé ðá ðí ðáñáéÛòù:

```
german|German Users Accounts:\
:charset=ISO-8859-1:\
:lang=de_DE.ISO8859-1:\
:tc=default:
```

Ðñéí êÛíáðá äéëááÝð óðéð ÊëÛóáéð Áéóüäíð (Login Classes) ðùí ÷ñçóðÞí, äéðáéÝóðá óçí ðáñáéÛòù áíóíëÞ:

```
# cap_mkdb /etc/login.conf
```

Þóðá íá áíáñäíðìéçéìýí óõíí óýóðçíá ðé äéëááÝð ðíð êÛíáðá óõíí /etc/login.conf.

ÁέéáãÞ ÊëÛóáùí Áέóüäíð ìÝóù óçð vipw(8)

×ñçόéíðíéÞóáð óçí vipw áéá íá ðñíóéÝóáðá íÝíðð ÷ñÞóðáð, éáé êÛíóá óçí éáóá÷Þñέόç íá ñíéÛæáé ìá óçí ðáñáéÛòù:

```
user:password:1111:11:language:0:0:User Name:/home/user:/bin/sh
```

ÁέéáãÞ ÊëÛóáùí Áέóüäíð ìÝóù óçð adduser(8)

×ñçόéíðíéÞóáð óçí adduser áéá íá ðñíóéÝóáðá íÝíðð ÷ñÞóðáð, éáé Ýðáέóá áéíéíðéÞóáð óέð ðáñáéÛòù ìäçáβáð:

- ÈÝóóá òí defaultclass = language óòí /etc/adduser.conf. Íá Ý÷áðá ððüøç óáð ùéé óá áððÞ óçí ðáñβðòùóç, éá ðñÝðáé íá ññβóáðá ìéá êëÛόç default áéá ùéíðð òíðð ÷ñÞóðáð Ûééùí äéùóðí.

- Ìéá áíáééáéðéêÞ éýόç, áβíáé íá áðáíðÛðá êÛèá òíñÛ óόçí áñÞóçόç

```
Enter login class: default []:
```

```
ðíð ììóáíβæáðáé áðü óçí adduser(8).
```

- Áέüíá ìéá áíáééáéðéêÞ éýόç, áβíáé íá ÷ñçόéíðíéÞóáðá òí ðáñáéÛòù óá êÛèá ÷ñÞóç ðíð èÝéáðá íá ðñíóéÝóáðá éáé ì ìðíβíð ÷ñçόéíðíéáβ äéáòíñáðéêÞ äéÞóóá:

```
# adduser -class language
```

ÁέéáãÞ ÊëÛóáùí Áέóüäíð ìÝóù óçð pw(8)

Áí ÷ñçόéíðíéáβóáð óçí pw(8) áéá íá ðñíóéÝóáðá íÝíðð ÷ñÞóðáð, éáéÝóóá óçí ìá òíí ðáñáéÛòù òñüðí:

```
# pw useradd user_name -L language
```

24.3.4.1.2 ÌÝèíäíð Áñ÷áβúí Áέέβίççòð Èáéýóíðð

Óçíáβùóç: Ç ìÝèíäíð áððÞ äáí óðíβóðáóáé, éáεÞð áðáέðáβ äéáòíñáðééÝð ñðèìβóáéð áéá êÛèá äéáòíñáðééù ðñüñáíá ìá èáéýóíðð ðíð ÷ñçόéíðíéáβóáé. ðñíóéìÞóóá éáéýóáñá óçí ìÝèíäíð òùí ÊëÛóáùí Áέóüäíð.

Áéá íá ðñíóéÝóáðá óέð òíðééÝð ñðèìβóáéð éáé òí óáð ÷áñáéðÞñùí MIME, ñðèìβóáð áðεÞð óέð äýí ìáðááεçðÝð ðáñéáÛééíðòð ðíð óáβííóáé ðáñáéÛòù óòí áñ÷áβí /etc/profile Þ/éáé óòí /etc/csh.login. Èá ÷ñçόéíðíéÞóíð òá ÁáñíáíééÛ ùð äéÞóóá áéá òí ðáñáéÛòù ðáñÛááéäíá:

```
Óòí /etc/profile:
```

```
LANG=de_DE.ISO8859-1; export LANG
MM_CHARSET=ISO-8859-1; export MM_CHARSET
```

```
1 óòí /etc/csh.login:
```

```
setenv LANG de_DE.ISO8859-1
setenv MM_CHARSET ISO-8859-1
```

ÁíáééáéðééÛ, ìðíñáβóá íá ðñíóéÝóáðá óέð ðáñáðÛíù ìäçáβáð óòí /usr/share/skel/dot.profile (áíóβóðíé÷á ìá óέð ìäçáβáð áéá òí /etc/profile ðíð áβááíá ðáñáðÛíù), Þ óòí /usr/share/skel/dot.login (áíóβóðíé÷á ìá óέð ìäçáβáð áéá òí /etc/csh.login ðíð áβááíá áðβόçð ðáñáðÛíù).

Ãéá ôí X11:

Óôí \$HOME/.xinitrc:

```
LANG=de_DE.ISO8859-1; export LANG
```

1.

```
setenv LANG de_DE.ISO8859-1
```

ÃíÛëíáá íá ôí êÝéðòíð ðíð ÷ñçóéíðíéáβðá (ääβðá ðáñáðÛíù).

24.3.5 Ñðèíβóáéð áéá ôçí Êííóüéá

Ãéá üéá óá single C óáð ÷áñáéðΠñùí, ìðñáβðá íá èÝóáðá ðéð ãñáíáíóíóáéñÝð ôçð êííóüéáð óðí /etc/rc.conf áéá ôçí áðéèðíçðP äëβóóá, ãñÛíííóáð:

```
font8x16=font_name  
font8x14=font_name  
font8x8=font_name
```

Ôí font_name äâð ðñíéýððáé áðü ôí áíðβóðíé÷í ãñ ÷áβí ðíð éáðáéüüáíð /usr/share/syscons/fonts, áóáéñþíóáð ôçí éáðÛëçíç .fnt.

Ãí ÷ñáéÛëáðáé, ÷ñçóéíðíéáβðá ôçí éáðÛëçéçç áíðéóðíβ÷çóç ðççèðñíéíáβíð (keymap) éáé ðéííçð áéá ôí óáð ÷áñáéðΠñùí single C ðíð ÷ñçóéíðíéáβðá, ìÝóó ðíð sysinstall. Ìüéèð áéðáéÝóáðá ôí **sysinstall**, áðééÝíðá ôí **Configure**, éáé Ýðáéóá ôí **Console**. ÁíáééáéðééÛ, ìðñáβðá íá ðñíóéÝóáðá ôí ðáñáéÛòù óðí /etc/rc.conf:

```
scrnmap=screenmap_name  
keymap=keymap_name  
keychange="fkey_number sequence"
```

Óðçí ðáñβððòùóç áððP, ôí screenmap_name ðñíÝñ÷áðáé áðü Ýíá ãñ ÷áβí ðíð éáðáéüüáíð /usr/share/syscons/scrnmaps, ÷ññβð ôçí éáðÛëçíç .scm. Ç áíðéóðíβ÷çóç ðéííçð ìáæβ ìá ôçí áíðβóðíé÷ç ãñáíáíóíóáéñÛ, ÷ñçóéíðíéáβðáé óðíPèùð áéá ôçí áðÝéðáóç ðíð 8íð bit óðí 90, áéá êÛñðáð VGA ðíð ÷ñçóéíðíéýí ìPðñá ÷áñáéðΠñùí ìá 8 óðPéàð.

Ãí Ý÷áðá áíáñáíðíéçíÝí ðíí äáβííá **moused** óðí ãñ ÷áβí /etc/rc.conf:

```
moused_enable="YES"
```

éáéü éá áβíáé íá áíáðÛóáðá ðéð ðççñíðññβáð ó÷áðééÛ ìá ôíí ãññÝá ðíð ðííðéééý ðíð ãíðáíβæííðáé óðçí ðáñáéÛòù ðáñÛáñáóí.

Ï ðñíáðééáíÝíð ãññÝáð ðíð ðííðéééý ðíð ÷ñçóéíðíéáβðáé áðü ôí ðñüãñáííá ðáPáçóçð syscons(4), éáðáéáíáÛíáé ðéð èÝóáðéð 0xd0-0xd3 ðíð óðíüéíð ÷áñáéðΠñùí. Ãí áððP ç ðáñéí÷P ÷áñáéðΠñùí äáí áβíáé äéáéÝóéíç óðç äëβóóá ðíð ÷ñçóéíðíéáβðá, éá ðñÝðáé íá ìáðáééíPóáðá ôçí ðáñéí÷P ðíð ãññÝá Ýíù áðü áððPí. Áéá íá áβíáé áðòù óðí FreeBSD, ðñíóéÝóáðá ôçí áéüéíðéç ãñáííP óðí /etc/rc.conf:

```
mousechar_start=3
```

Ὁ `keymap_name` ὁρίζεται ἀπὸ τὴν ἰσοβαρῆ `/usr/share/syscons/keymaps`, ἢ ἄλλο ἕνα ἰσοβαρῆ `.kbd`. Ἄν ἂν ἰσοβαρῆ ὁρίζεται ἀπὸ τὴν ἰσοβαρῆ `kbdmap(1)` ἢ ἀπὸ τὴν ἰσοβαρῆ `keymap(1)` ἢ ἀπὸ τὴν ἰσοβαρῆ `keymap(1)`.

Ἡ `keychange` ἰσοβαρῆ ὁρίζεται ἀπὸ τὴν ἰσοβαρῆ `keychange` (function keys), ἢ ἀπὸ τὴν ἰσοβαρῆ `keychange` (function keys), ἢ ἀπὸ τὴν ἰσοβαρῆ `keychange` (function keys).

Ἡ `ttys` ἰσοβαρῆ ὁρίζεται ἀπὸ τὴν ἰσοβαρῆ `ttys` ἢ ἀπὸ τὴν ἰσοβαρῆ `ttys`.

Ὄνομα × ἰσοβαρῆ	Ὄνομα ἰσοβαρῆ
ISO8859-1 ἢ ISO8859-15	cons2511
ISO8859-2	cons2512
ISO8859-7	cons2517
KOI8-R	cons25r
KOI8-U	cons25u
CP437 (ὁρίζεται ἀπὸ τὴν ἰσοβαρῆ VGA)	cons25
US-ASCII	cons25w

Ἡ `wide P multibyte` ἰσοβαρῆ ὁρίζεται ἀπὸ τὴν ἰσοβαρῆ `wide P multibyte` ἢ ἀπὸ τὴν ἰσοβαρῆ `wide P multibyte`.

ἰσοβαρῆ	Ὄνομα ἰσοβαρῆ
Ἑλληνική (BIG-5)	chinese/big5con
ἰσοβαρῆ	japanese/kon2-16dot ἢ japanese/mule-freewnn
ἰσοβαρῆ	korean/han

24.3.6 ἰσοβαρῆ X11

Ἡ `X11` ἰσοβαρῆ ὁρίζεται ἀπὸ τὴν ἰσοβαρῆ `X11` ἢ ἀπὸ τὴν ἰσοβαρῆ `X11`.

Ὁ `~/.Xresources`, ἢ ἄλλο ἕνα ἰσοβαρῆ `~/.Xresources` ἢ ἀπὸ τὴν ἰσοβαρῆ `~/.Xresources`.

24.3.6.1 ἰσοβαρῆ ἰσοβαρῆ

Ἡ `Xorg` ἰσοβαρῆ ὁρίζεται ἀπὸ τὴν ἰσοβαρῆ `Xorg` ἢ ἀπὸ τὴν ἰσοβαρῆ `Xorg`.

24.3.6.2 ÁέόάαùāÞ ìç-Áãëëéëþí ×āñáéðÞñùí

Ç ìÿëïäò áέóúäò X11 (XIM, X11 Input Method), áßíáé Ýíá íÿí ðñüòðòí áέá üëòð òíòð ðáéÛðáð X11. ¼éáð íé áòāññãÿð òíò X11 éá ðñÝðáé íá āñÛòííóáé ùð ðáéÛðáð òíò XIM, éáé íá éāñáÛíòí áßòíäí áðu āíòðçñāðçðÿð áέóúäò XIM. ÕðÛñ ÷íòí áέáéÿóëíé áéÛòíñíé āíòðçñāðçðÿð XIM, áéá áéáóíñāðééÿð äëþóáð.

24.3.7 Ñýèìéóç ÁéòððùòÞ

ËÛðíéá óáð ÷āñáéðÞñùí single C áßíáé óòíÞèùð āíóúìáòùíÿíá óòí Þáéí òí ðéééü òùí áéòððùòÞí. Óá óáð ÷āñáéðÞñùí óýðíò wide Þ multibyte áðáέóíÿí áéáééÿð ññèìßóáéð, éáé óòíéóóíÿíá íá ÷ñçóëíðíéÞóáðá òí **apsfilter**. Ìðñāßðá áðßòçð íá ìáðáðñÿðáðá òí ÿāñāñòí óáð óá PostScript Þ PDF, ÷ñçóëíðíéÞíðáð āñāáéāßá áéáééÛ òðéáāíÿíá áéá òç óðāéāññéíÿíç äëþóá.

24.3.8 ÐññÞíáð éáé ÓðóòÞíáðá Áñ÷āßùí

Ïí óýóðçíá āñ÷āßùí FFS (fast filesystem) òíò FreeBSD ìðññāß íá áéá÷āñéóðáß ííúìáðá āñ÷āßùí ðíò áíÞëíòí óá óáð single C (áßíáé 8-bit clean, āāßðá éáé òí multibyte(3)), áééÛ āāí áðíèçéāÿáé òí óáð ÷āñáéðÞñùí ðíò ÷ñçóëíðíéáßðáé. Ìā Ûééá éüāéá, áßíáé 8-bit áééÛ āāí āíññßáéé ðßðíðá áéá òçí éùāééíðíßçóç òùí ÷āñáéðÞñùí. Áðßòçíá, òí FFS āāí òðíðçññßáéé áéüíá óáð ÷āñáéðÞñùí wide Þ multibyte. ÕðÛñ ÷íòí ùóòùóí éÛðíéá áíáíÛñçðá patches áéá òí FFS ðíò òðíðçññßáéíòí áððÿð ðéð āíóíáòùòçðáð. Ðññéáéóáé ìññí áéá ðñíóùñéíÿð éáé ìç ìáðáðÿñóéíáð éÿóáéð Þ hacks, éáé ÿ÷íòìá áðíðóáßóáé íá ìçí óá ðāñééÛāíòíá óòí éāíðñééü āÿíðñí ðçāāßíò éþáééá. Áāßðá ðéð éóòíóáéßāáð òùí áíóßòíé÷÷íí ãéùóòÞí áéá ðāñéóóúðāñāð ðççñíòññßāð éáé áéá íá áíáéðÞóáðá óá áðāñāßòçðá āñ÷āßá.

Ïí óýóðçíá āñ÷āßùí MS-DOS óòí FreeBSD ÿ÷āé òçí āíóíáòùòçðá íá ññèìéóðáß þóðá íá ìáðáðñÿðáé ìáðáÿÿ òùí óáð ÷āñáéðÞñùí Unicode, òíò MS-DOS, éáé òíò óáð ÷āñáéðÞñùí ðíò ÿ÷āé āðééāāāß áéá òí óýóðçíá āñ÷āßùí òíò FreeBSD. Áéá ðāñéóóúðāñāð éāððñÿñāéáð, āāßðá òç óáéßāá manual mount_msdosfs(8).

24.4 Ìáðáāëþðéóç ÐññāñāíìÛòùí I18N

ÐíééÛ ports òíò FreeBSD áéáéÿòíòí òðíðçðññéíç I18N. Óā ìāñééÛ áðu áððÛ, òí -I18N áßíáé ìÿñíò òíò ííúìáòíò òíòð. Óá ðññāñÛííáðá áððÛ, éáé ðíééÛ ðāñéóóúðāñā, ÿ÷íòí áíóúìáòùíÿíç òðíðçðññéíç áéá I18N éáé āāí ÷ñáéÛæíðáé Ûééāð áéáééÿð ññèìßóáéð.

Ûóòùóí, óá éÛðíéáð áòāññãÿð üððò ç **MySQL**, éá ðñÝðáé íá ññèìéóðáß òí `makefile` ìā òí āðéèðìçðù óáð ÷āñáéðÞñùí. Áððù óòíÞèùð āßíáðáé ðāñíÞíðáð ìéá ðéíÞ óòí **configure** óòíð ðçāāßíò éþáééá, Þ áééÛæíðáð òí Þáéí òí `Makefile`.

24.5 Õïðééÿð Ññèìßóáéð āéá Óðāéāññéíÿíáð ãëþóáð

24.5.1 Ñþóééç ãëþóóá (Ëùāéééíðíßçóç KOI8-R)

Áéá ðāñéóóúðāñāð ðççñíòññßāð ó÷āðééÛ ìā òçí éùāééíðíßçóç KOI8-R, āāßðá ðéð Áíáòñÿð Ó÷āðééÛ ìā òí Óáð ×āñáéðÞñùí KOI8-R (Ññóééü Óýññéí ×āñáéðÞñùí) (<http://koi8.pp.ru/>).

24.5.1.1 ÕιδέεÛδ Ñδειβόάέδ

ÕιδεάδΠόά όέδ áéüëïðèç ãñáñÛδ όóì áñ÷áβì óád ~/.login_conf:

```
me:My Account:\
:charset=KOI8-R:\
:lang=ru_RU.KOI8-R:
```

Άέά δάñάάβáñáδά δñö ó÷áðβæííóáέ íá όέδ ÕιδέεÛδ Ñδειβόάέδ, ááβðá δññçäÿíáíáð áíúôçðáð óá áððü ðì έáöÛεάει.

24.5.1.2 Ñýèìέόç Êñíóüέáð

- ΔññíóèÛðá όçí áéüëïðèç ãñáñÛδ όóì áñ÷áβì /etc/rc.conf:


```
mousechar_start=3
```
- ×ñçóéññðñέΠόά áðβóçð όέδ δάñáέÛðü ñδειβόάέδ όóì /etc/rc.conf:


```
keymap="ru.koi8-r"
scrnmap="koi8-r2cp866"
font8x16="cp866b-8x16"
font8x14="cp866-8x14"
font8x8="cp866-8x8"
```

- Άέά έÛèá έáδά÷ðñέόç ttyv* όóì áñ÷áβì /etc/ttys, ÷ñçóéññðñέΠόά ðì cons25r ùð όýðñ ðáññáðééñý.

Άέά δάñάάβáñáδά δñö ó÷áðβæííóáέ íá όçí ñýèìέόç όçð έññóüέáð, ááβðá δññçäÿíáíáð áíúôçðáð áððñý ðñö έáðáέáβñö.

24.5.1.3 Ñýèìέόç Άέðððüð

Έáèð ðé δáñέóóüðáññé áέðððüðÛδ ðñö áέάέÛðñí Ññóέéñýð ÷áñáέððñáð Û÷÷ññ áíóññáðññÛç όçí έüáέéñóáέβáá CP866, έá ÷ñáέáóðáβðá áέáέέü öβέðññ áñüäñö áέá íá íáðáðñÛðáð áðñ ðì KOI8-R όóì CP866. Õñ öβέðññ áððñ ááέáέβóðáðάέ áðñ ðññáðééññΠ όóì /usr/libexec/lpr/ru/koi2alt. Ç έáδά÷ðñέόç áέá Ûñá Ñðóέéñ áέðððüðΠ όóì /etc/printcap έá ññέÛæáέ íá όçí δάñáέÛðü:

```
lp|Russian local line printer:\
:sh:of=/usr/libexec/lpr/ru/koi2alt:\
:lp=/dev/lpt0:sd=/var/spool/output/lpd:lf=/var/log/lpd-errs:
```

Άáβðá ðñ printcap(5) áέá ðéñ έáððññáñΠ δάñéáñáðΠ.

24.5.1.4 Óýóðçíá Áñ÷áβñí MS-DOS έάέ Ñðóέéá ññññáðá Áñ÷áβñí

Õñ δάñáέÛðü ððñááέáñá έáδά÷ðñέόç όóì fstab(5) áññáññðñέáβ όçí ððñóððñéñç áέá Ñðóέéá ññññáðá áñ÷áβñí óá ðñññáññóçñÛñ óðóððñáðá áñ÷áβñí όýðñö MS-DOS:

```
/dev/ad0s2 /dos/c msdos rw,-Wkoi2dos,-Lru_RU.KOI8-R 0 0
```

Ç áðééññΠ -L áðééÛááέ όέδ ðñðééÛδ ñδειβόάέδ ðñö έá ÷ñçóéññðñέçéñññ, έάέ ç -w ññβæáέ ðññ ðβñáέá íáðáðñññðð ÷áñáέððñññ. Άέá íá ÷ñçóéññðñέΠόáðá όçí áðééññΠ -w ááááέéüέáβðá ùέé Û÷÷áð ðñññáññóðáέ όçí έáðÛðñçóç /usr ðñéñ όçí έáðÛðñçóç MS-DOS, έáèð ðé ðβñáέáð íáðáðñññðð áñβóέññóáέ όóì /usr/libdata/msdosfs. Άέá δάñέóóüðáññáð ðéçññññññáð, ááβðá ðç óáέβáá manual ðñö mount_msdosfs(8).

24.5.1.5 Νýèìέόç X11

1. ΆέοάεΎοά δñΠόά όέο ááíéέΎο οἰδέέΎο ñδειβόάéο δἰο Ύ÷ἰοἰά Παç δññéñÛοάé.

2. Αἰ ÷ñçοέἰἰἰεάβδὰ οἰἰ áἰοδçñάοçòΠ **Xorg**, ááéάόάοòΠóόά οἰ δάέΎοἰ x11-fonts/xorg-fonts-cyrillic.

ΆέΎαἰόά όçἰ áἰἰόçόά "Files" όοἰ áñ÷άβἰ /etc/X11/xorg.conf. Έά δñΎδáé íá δñἰέέΎοάά όçἰ δññáéÛοἰ áññἰΠ δñéἰ áδἰ ἰδἰéάáΠδἰόά Ûéç éάόά÷ññέόç FontPath:

```
FontPath "/usr/local/lib/X11/fonts/cyrillic"
```

Όçἰάβυόç: Άάβδὰ όόçἰ ÓδεéἰāΠ οἰ Ports áéá δññέόόóδññò èðñéééέΎο áññἰáδἰόάéñΎο.

3. Άέά όçἰ áἰññἰἰἰβçόç δἰο ΝἰοέéἰΎ δέçéðñἰéἰāβἰο, δñἰέέΎοάά όέο δññáéÛοἰ áññἰΎο όόçἰ áἰἰόçόά "Keyboard" οἰο áñ÷άβἰο xorg.conf:

```
Option "XkbLayout" "us,ru"
Option "XkbOptions" "grp:toggle"
```

Άάάάéúèáβδὰ áδβçò ἰδé ç áññἰΠ XkbDisable áβἰάé áἰññἰñΠ (íññéáñéοἰΎἰç ἰò ó÷ἰééἰ).

Αἰ ÷ñçοέἰἰἰεβδὰά οἰ grp:toggle ç áἰáééáΠ RUS/LAT éá áβἰáόáé íá οἰ **Άἰéú Alt**, áἰΠ áἰ èΎοάόά grp:ctrl_shift_toggle, ç áἰáééáΠ éá áβἰáόáé íá οἰ **Ctrl+Shift**. Άέά grp:caps_toggle, ç áἰáééáΠ RUS/LAT éá áβἰáόáé íá οἰ **CapsLock**. Ç éáññéèΠ éáéδἰòññáβά οἰο **CapsLock** áἰáéἰἰóèáβ íá áβἰάé áéáèΎοéἰç ἰΎóἰ οἰο όδἰáόάοἰΎἰ δèΠèðñἰΎ **Shift+CapsLock** (ἰἰñ óá éáòÛόόáόç LAT). Οἰ grp:caps_toggle áéá èÛδἰéἰ Ûáἰἰόοἰ èúāἰ, ááἰ éáéδἰòññáβ óοἰ **Xorg**.

Αἰ οἰ δέçéðñἰéἰúáéἰ óάó áéáèΎοáé δèΠèðñá "Windows", éáé Ύ÷áόά δññáόçñΠóáé ἰδé èÛδἰéá áδἰ óá ἰç-άéöáñééἰçóééÛ δèΠèðñá Ύ÷ἰοἰ èÛèἰò áἰóéóοἰβ÷çόç ἰδáἰ áβδóá óá éáòÛόόáόç RUS, δñἰέέΎοάά όçἰ δññáéÛοἰ áññἰΠ όοἰ áñ÷άβἰο xorg.conf:

```
Option "XkbVariant" ",winkeys"
```

Όçἰάβυόç: Οἰ Νπρόέἰ ΧΚΒ δέçéðñἰéἰúáéἰ βóοδ ááἰ éáéóἰòññáβ íá áóáñἰἰΎο δἰο ááἰ Ύ÷ἰοἰ óδéá÷δáβ áéá όέο áἰόβóδἰé÷áò οἰδέέΎο ñδειβόάéο.

Όçἰάβυόç: ἰé áóáñἰἰΎο δἰο όçñἰΎἰ όéο áèÛ÷éόόáò δññáéáñáóΎο οἰδέéἰἰ ñδειβόáúἰ, éá δñΎδáé íá éáéἰΎἰ áδἰ ἰññβò όç όδἰÛñδçόç XtSetLanguageProc (NULL, NULL, NULL); ἰΎóá όοἰἰ èΠáééá οἰοδ.

Άάβδὰ οἰ KOI8-R áéá οἰ óýóόçἰá X Window (<http://koi8.pp.ru/xwin.html>) áéá δññέόόóδññò ἰäçāβáò ó÷áδééÛ ἰá όçἰ äçἰéἰòññáβά áóáñἰἰáἰἰ X11 δἰο ἰá ÷ñçοέἰἰἰἰéἰΎο οἰδέéΎο ñδειβόάéο.

24.5.2 Ôïðééÿð Ñöèìßóáéð áéá ÐáñáäïóéáéÛ Êéíÿæééá ÔáúáÛí

Ôï FreeBSD-Taiwan Project Ý÷áé äçíéíõñãÞóáé Ýíá HOWTO áéá óá Êéíÿæééá óóï FreeBSD, òï ïðíßì ìðñãßðá íá ãñãßðá óóç áéáýèðíóç <http://netlab.cse.yzu.edu.tw/~statue/freebsd/zh-tut/>, ÷ñçóéíðèéðíóáð ðèéÛ Êéíÿæééá ports. Ì òñÿ÷úí óóíðÛêðçð òíð Êéíÿæééíð FreeBSD Howto áßíáé í Shen Chuan-Hsing <statue@freebsd.sinica.edu.tw>.

Ì Chuan-Hsing Shen <statue@freebsd.sinica.edu.tw> Ý÷áé äçíéíõñãÞóáé óçí Êéíÿæééç Óðéëíã FreeBSD (CFC) (<http://netlab.cse.yzu.edu.tw/~statue/cfc/>) ÷ñçóéíðèéðíóáð óçí èùáééíðèíßçóç zh-L10N-tut òíð FreeBSD-ÔáÁáÛí. Óá ðáéÿðá éáé óá scripts áéáðßéáíóáé óóç áéáýèðíóç <ftp://freebsd.csie.nctu.edu.tw/pub/taiwan/CFC/>.

24.5.3 Ôïðééÿð Ñöèìßóáéð áéá óçí ÆãñíáíééÞ Æëðóóá (áéá ¼éáð óéð Æëðóóáð ðíð Æáóßæííðáé óóï ISO 8859-1)

Ì Slaven Rezac <eserte@cs.tu-berlin.de> Ý÷áé ãñÛðáé Ýíá ãçãüí áéá óçí ÷ñÞóç ðúí umlauts óá Ýíá ìç÷Ûíçíá FreeBSD. Ì ãçãüí áßíáé ãñáíÿñð óóá ÆãñíáíééÛ éáé áéáðßéáðáé óóçí òíðèáóßá <http://user.cs.tu-berlin.de/~eserte/FreeBSD/doc/umlaute/umlaute.html>.

24.5.4 Ôïðééÿð Ñöèìßóáéð áéá óçí ÆëçíééÞ Æëðóóá

Ì Nikos Kokkalis <nickkokkalis@gmail.com> Ý÷áé ãñÛðáé Ýíá ðèÞñáð Ûñèñí áéá óçí ððíóðÞñéíç ðçð ÆëçíééÞð ãëðóóáð óóï FreeBSD. Ôï Ûñèñí áððü áéáðßéáðáé ùð ìÿñð ðçð áðßóçìçð ÆëçíééÞð òáéìçñßùóçð òíð FreeBSD, óóçí òíðèáóßá http://www.freebsd.org/doc/el_GR.ISO8859-7/articles/greek-language-support/index.html (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/greek-language-support/index.html).

24.5.5 Ôïðééÿð Ñöèìßóáéð Æéá Æéáðùíÿæééá éáé ÊíñáÛðééá

Æéá Æéáðùíÿæééá, äãßðá óóçí òíðèáóßá <http://www.jp.FreeBSD.org/>, áñ Æéá ÊíñáÛðééá, äãßðá óóçí òíðèáóßá <http://www.kr.FreeBSD.org/>.

24.5.6 Ôáéìçñßùóç òíð FreeBSD óá Æëðóóáð Æêòùð óçð ÆáãéééÞð

ÊÛðèíéé áèáéííóÿð òíð FreeBSD Ý÷íðí ìáðáóñÛóáé òíÞíáðá ðçð òáéìçñßùóçð òíð óá Ûééáð ãëðóóáð. Ìé ìáðáóñÛóáéð áððÿð áéáðßéáíóáé ìÿóù óðíáÿóíùí óóçí éÿñéá áééððáéÞ òíðèáóßá òíð FreeBSD (<http://www.FreeBSD.org/index.html>) Þ óóíí éáðÛéíãí /usr/share/doc.

25.2 Ἀντιμετώπιση τοῦ FreeBSD

Ἡ ἀσφάλεια ἀντιμετώπισης ἀσφαλείας ἀπὸ τῆς ἑξῆς ἡμέρας εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD.

Ἄλλοι ἀπὸ τὴν ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD.

Ὁδηγίες: Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD.

Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD.

```
# gunzip -c freebsd-update-upgrade.tgz | tar xvf -
# mv freebsd-update.sh /usr/sbin/freebsd-update
# mv freebsd-update.conf /etc
```

Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD.

25.2.1 Ὁ ἄνθρωπος ἔχει ἄσφαλεία

Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD.

```
# Components of the base system which should be kept updated.
Components src world kernel
```

Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD.

Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD. Ἡ ἀσφάλεια τοῦ FreeBSD εἶναι ἡ ἀσφάλεια τοῦ FreeBSD.

```
# Paths which start with anything matching an entry in an IgnorePaths
# statement will be ignored.
IgnorePaths
```

Οι οδοί που αρχίζουν με οτιδήποτε αντιστοιχεί σε μια εγγραφή στην IgnorePaths, ο οποιοδήποτε κείμενο στον φάκελο /bin ή /sbin θα αγνοείται. Η διαδρομή /etc/passwd, /etc/shadow, /etc/crontab, /etc/fstab, /etc/timezone και /etc/hosts δεν θα αγνοούνται.

```
# Paths which start with anything matching an entry in an UpdateIfUnmodified
# statement will only be updated if the contents of the file have not been
# modified by the user (unless changes are merged; see below).
UpdateIfUnmodified /etc/ /var/ /root/ /.cshrc /.profile
```

Η διαδρομή /etc/crontab και /etc/passwd θα ενημερωθούν μόνο αν ο κεντρικός κατάλογος της ελεύθερης FreeBSD δεν έχει τροποποιηθεί, οπότε οι αρχές /etc/passwd και /etc/shadow θα ενημερωθούν επίσης. Η διαδρομή /etc/crontab, η KeepModifiedMetadata, η /etc/timezone και η /etc/hosts θα ενημερωθούν από το FreeBSD-update εάν η διαδρομή /etc/crontab δεν έχει ενημερωθεί.

```
# When upgrading to a new FreeBSD release, files which match MergeChanges
# will have any local changes merged into the version from the new release.
MergeChanges /etc/ /var/named/etc/
```

Οι αρχές /etc/crontab και /etc/passwd θα ενημερωθούν μόνο αν ο κεντρικός κατάλογος της ελεύθερης FreeBSD δεν έχει τροποποιηθεί, οπότε οι αρχές /etc/passwd και /etc/shadow θα ενημερωθούν επίσης. Η διαδρομή /etc/crontab, η KeepModifiedMetadata, η /etc/timezone και η /etc/hosts θα ενημερωθούν από το FreeBSD-update εάν η διαδρομή /etc/crontab δεν έχει ενημερωθεί.

```
# Directory in which to store downloaded updates and temporary
# files used by FreeBSD Update.
# WorkDir /var/db/freebsd-update
```

Ο ορισμός της διαδρομής /var/db/freebsd-update είναι ο κατάλογος στον οποίο θα αποθηκευτούν οι αρχές, οι οποίες θα ελεγχθούν για να βεβαιωθεί ότι είναι οι σωστές αρχές.

```
# When upgrading between releases, should the list of Components be
# read strictly (StrictComponents yes) or merely as a list of components
# which *might* be installed of which FreeBSD Update should figure out
# which actually are installed and upgrade those (StrictComponents no)?
# StrictComponents no
```

Αν η διαδρομή /var/db/freebsd-update είναι yes, οι αρχές /etc/passwd και /etc/shadow θα ελεγχθούν για να βεβαιωθεί ότι είναι οι σωστές αρχές. Η διαδρομή /var/db/freebsd-update είναι no, οι αρχές /etc/passwd και /etc/shadow δεν θα ελεγχθούν.

25.2.2 Patches Οδηγός για Αρχιγνώση

Οι αρχές του οδηγού για Αρχιγνώση, οι οποίες είναι οι αρχές /etc/passwd και /etc/shadow, θα ενημερωθούν από το FreeBSD-update εάν η διαδρομή /etc/crontab δεν έχει ενημερωθεί.

```
# frebsd-update fetch
# frebsd-update install
```

Αἱ τῶν ἀναβαθμῶν ἀφαιρέσεις ἀναβαθμῶν οὐκ ἐπιτρέπεται, ἐὰν ἡ ἀναβαθμῶν ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἄλλες ἀναβαθμῶν, οἱ ἀναβαθμῶν ἐπὶ τῶν ἀναβαθμῶν ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται.

```
@daily                                root    frebsd-update cron
```

Ἡ ἀναβαθμῶν ἀναβαθμῶν οὐκ ἐπιτρέπεται ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται.

Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται.

```
# frebsd-update rollback
```

Ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται.

Οἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται.

Ὁδηγός: Ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται.

Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται.

Ὁδηγός: Ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται ἡ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται. Αἱ ἀναβαθμῶν οὐκ ἐπιτρέπεται.

25.2.3 Άιάάέιβόάέò óά ίέñŸò έάέ ίάâŪεάò Άέüóάέò

Ç áεάέέάóβá áòòP έá áðñáεñŸίáέ óá ðáέέŪ áñ÷άβá áíóέέάέίáίέειŸ έpάέέá (object files) έάέpð έάέ óέò ðáέέŸò áέάέειéPεάò, éŪíŸíóáò óέò ðáñέóóüòáñáò áóáñŸáŸò ðñβòüŸ έáóáóέάóóópŸ íá ίç έάέóíòñáŸíŸ. Óáò óóίέóóŸŸíá áβòá íá áðñáέάóáóòPóáòá üέá óá áάέάóáóóçŸŸ íá ports έάέ íá óá áάέάóáóòPóáòá íáŸŪ, P íá óá áíáάάέιβóάέá áñáüðáñá, ÷ñçóέŸŸðíέpŸíóáð ðŸ áŸçέçóέέü ðñüáñáŸíá ports-mgmt/portupgrade. Íέ ðáñέóóüòáñŸé ÷ñPóóáð έá èŸέŸíóŸ íá éŪíŸíóŸ íέá äŸέέíáóóέéP ίáóááέpðóέóç ÷ñçóέŸŸðíέpŸíóáð óçŸ áέüέŸíòέç áíóŸéP:

```
# portupgrade -af
```

Íá áóòü ðŸŸ ðñüðŸ áíáóóáέβáóáέé üέé óá ðŪíóá έá áðáíáάέάóáóóáέŸŸŸ óüóòŪ. ÓçŸáέpóá üέé áŸ èŸóáðá óçŸ íáóáάέçòð ðáñέáŪέέŸŸíóð BATCH óóçŸ ðέŸP yes, üέáð íé ðέέáŸŸò áñùòPóáέð ðŸò έá áŸíóáίέóóŸŸŸ έáóŪ óç áέάέέέáóβá, έá áðáíóçέŸŸŸ áóòüŸíáóá íá yes. póέ ááŸ ððŪñ÷áέ ðέŸŸŸ áŸŪáέç áέá ðáñŸŸíááóç ðŸò ÷ñPóóç έáóŪ óç áέŪñέáέá óçð áέááέέáóβáð íáóáάέpðóέóçð.

Άί ÷ñçóέŸŸðíέáβóάέ ðñŸóáñŸŸíóŸŸŸ ðòñPŸíáð, ç áέάάέέáóβá áíáάŪέíέóçð áβŸíáέ áέáóñŪ ðέŸ ðŸέŸðέŸéç. Έá ÷ñáέáóáβòá ŸŸíá áíóβáñáóŸŸ ðŸò ðòñPŸíá GENERIC óóŸŸ έáóŪέŸŸŸŸ /boot/GENERIC. Άí ááŸ ððŪñ÷áέ Páç Ÿ ðòñPŸíáð GENERIC óóŸŸ óŸóóçŸíá óáð, ðŸñáβòá íá ðŸŸ áíáέòPóáòá ÷ñçóέŸŸðíέpŸíóáð íέá áðü óέò ðáñáέŪòð íáéüáŸŸòð:

- Άí Ÿ÷áðá íáóáάέüòòβóάέ ðñŸŸóáñŸŸíóŸŸŸ ðòñPŸíá ŸŸŸŸ íέá óŸñŪ, Ÿ ðòñPŸíáð óóŸŸ έáóŪέŸŸŸŸŸŸ /boot/kernel.old áβŸíáέ óóçŸ ðñááŸíáóέέüóçóá Ÿ GENERIC. Άðέpð íáóŸŸñŸŸŸóá ðŸŸ έáóŪέŸŸŸŸŸŸ óá /boot/GENERIC.
- Άí Ÿ÷áðá óòóέéP ðñüóááóç óóŸŸ ίç÷ŸŸŸŸŸ, ðŸñáβòá íá áάέáóáóòPóáòá ŸŸíá áíóβáñáóŸŸ ðŸò ðòñPŸíá GENERIC áðü ðŸ CD-ROM óçð áάέáðŪóóáóçð. ÓŸðŸέáðPóáð ðŸ CD-ROM óóŸŸŸŸŸŸ íäçäŸŸ έάέ ÷ñçóέŸŸðíέPóóáð óέò ðáñáέŪòð áŸŸŸéŸòð:

```
# mount /cdrom
# cd /cdrom/x.y-RELEASE/kernels
# ./install.sh GENERIC
```

ΆíóέέáóáóòPóáð ðŸ x.y-RELEASE íá ðŸòð ðñááŸíáóέέŸŸŸð áñέέŸŸŸð óçð ŸέáŸŸóçð ðŸò ÷ñçóέŸŸðíέáβòá. Í ðòñPŸíáð GENERIC έá áάέáóáóóáέáβ áðü ðñŸŸáðέέŸŸŸŸŸŸ óóŸŸ έáóŪέŸŸŸŸŸŸ /boot/GENERIC.

- Άí ááŸ Ÿ÷áðá éŪðŸέá áðü óέò ðáñáðŪŸŸŸŸŸ áðέέŸŸŸŸŸ, ðŸñáβòá íá íáóáάέüòòβóáòá έάέ íá áάέáóáóòPóáòá ðŸŸ ðòñPŸíáð GENERIC íŸóü ðŸò ðçááβŸŸ έpáέέá:

```
# cd /usr/src/
# env DESTDIR=/boot/GENERIC make kernel
# mv /boot/GENERIC/boot/kernel/* /boot/GENERIC
# rm -rf /boot/GENERIC/boot
```

Άέá íá áíááŸŸñέóóáβ áóòüò Ÿ ðòñPŸíáð ððð GENERIC áðü ðŸ freebsd-update, ááŸ έá ðñŸðáέ íá Ÿ÷ŸŸŸŸŸ áβŸíáέ áέέááŸò óóŸŸ áñ÷áβŸŸ ðòέŸβóáüŸŸ ðŸò GENERIC. ÓóŸŸβóóáóáέ áðβóçð ç íáóáάέpðóέóç íá áβŸíáέ ÷ññβò Ūέέáð áŸáέέέéáóŸŸŸŸŸ ðòέŸβóáέò (έáóŪ ðñŸŸòβŸçóç íá έáŸŸŸ ðŸŸ /etc/make.conf).

ΆáŸ ÷ñáέŪáóáέ óç áááñŸŸŸç óóέáŸP íá áðáíáέέéŸŸPóáòá íá ðŸŸ ðòñPŸíáð GENERIC.

ΆβŸíáέ áóŸíáóŸò íé áíáάάέíβóáέð óüóŸŸ óá ίέñŸò ðŸŸŸ έáέ óá íáâŪéáð áέüüóáέð, áβŸŸíóáð óóçŸ áŸŸŸéP freebsd-update ðŸŸ áðέέòŸçòü áñέέŸŸŸ ŸέáŸŸóçð. Άέá ðáñŸŸááέáŸá, ç áέüέŸíòέç áŸŸŸéP έá áíáάάέíβóáέ ðŸŸ óŸóóçŸíá óá FreeBSD 8.1:

```
# freebsd-update -r 8.1-RELEASE upgrade
```

ÍáóŪ óç έPøç óçð áŸŸŸéPð, ðŸŸ freebsd-update έá áŸŸŸéŸŸáPóáέ óçŸ έáóŪóóáóç ðŸò óóóòPŸíáóŸð έáέ ðŸò áñ÷áβŸŸ ðòέŸβóáüŸŸ ðŸò, óá íέá áðüðáέñá íá íáæŸøáέ óέò áðáñáβòçðáð ðέçñŸŸŸññáð áέá óçŸ áíáάŪέíέóç ðŸò óóóòPŸíáóŸð. Íέ ðέçñŸŸŸññáð ðŸò áŸé÷ŸŸŸéáŸ έá áŸíóáίέóóŸŸŸŸŸ óóçŸŸŸŸŸ íá óçŸ ŸñòP íέáð έββóáð áάέáðáóóçŸŸŸŸŸ ðñŸáñáñŸŸŸðüŸŸŸ. Άέá ðáñŸŸááέáŸá:

Looking up update.FreeBSD.org mirrors... 1 mirrors found.
Fetching metadata signature for 8.0-RELEASE from update1.FreeBSD.org... done.
Fetching metadata index... done.
Inspecting system... done.

The following components of FreeBSD seem to be installed:
kernel/smp src/base src/bin src/contrib src/crypto src/etc src/games
src/gnu src/include src/krb5 src/lib src/libexec src/release src/rescue
src/sbin src/secure src/share src/sys src/tools src/ubin src/usbin
world/base world/info world/lib32 world/manpages

The following components of FreeBSD do not seem to be installed:
kernel/generic world/catpages world/dict world/doc world/games
world/proflibs

Does this look reasonable (y/n)? y

Οίη ούιάνι άόου, οί freebsd-update εά εάόάάΰόάε üεά όά άñ÷άβá ðīō άðάέοίγίόάε áεά όçί áίáάΰέιέος. Οά Ìáñééΰò ðáñéðòóáéó, ì ÷ñóóòçð éá èççèáβ íá άðáíòóáé όá áññòóóáéò ó÷:άóééΰ Ìá όί όé éá ááέάόάόάéáβ ð ðùò ðñΰðáé íá ðñī÷ññóáé ç áéááééάόβά.

¼όάί ÷ñçóéìðìéááβόάé ðñīόáñìοίΰñò ððñóíáð, όί ðáñáðΰíù áóíá éá ðñīéáéΰόάé όçί áìòΰίέος όçò ðáñáéΰòù ðñīáéáìðìβçòçð:

WARNING: This system is running a "MYKERNEL" kernel, which is not a kernel configuration distributed as part of FreeBSD 8.0-RELEASE. This kernel will not be updated: you MUST update the kernel manually before running "/usr/sbin/freebsd-update install"

Ìðñáβόά íá ááñóáóá άόòó όçί ðñīáéáìðìβçòçð. Éá ÷ñçóéìðìéάóίόá όίη áíçìáññìΰñí ððñóíá GENERIC ùò áίáéΰίάόí áóíá όçç áéááééάόβά áίáάΰέιέος.

Áοίγ Ìáόáóìòñùéíγί üéá όá patches óόí όìðééù óγóόçía, éá áβíáé éáé ç áðáññáβ όίòð. Ç áéááééάόβά άóòóβ όùò ðΰñáé éβáí ÷ñññí, áΰέíáá Ìá όçí όá÷γóçóά éáé όί όñòóβì όίò Ìç÷:άíóíáðìð. ðáéóá éá áβíáé ç óóã÷óíáóç όùí áñ÷áβùí ñòéìβόáùí. Áόου όί Ìΰñìò όçò áéááééάόβáð άðáéóáβ ðáñΰíááόç όίò ÷ñóóç, éáéòð óá éΰðìéá áñ÷áβá éá ÷ñáέάόáβ ç óóã÷óíáóç íá áβíáé ÷áéñìéβíççóá Ìá όç áñβéáéá éΰðìéíò óóíóΰέòç éáéΰΰñíò. Ì ÷ñóóçð éá áíçìáññíáóáé áéá όí áðìòΰέáόíá éΰéá áðéòð÷çìΰíççð óóã÷óíáóçð éáéòð áñáéβóóáόάé ç áéááééάόβά. Οá ðáñβðòùòç áðìòð÷çìΰíççð óóã÷óíáóçð (β ááíψíççòç όçò), ç áéááééάόβά áίáάΰέιέος éá áéáéìðáβ. Áíáá÷ñΰíùò íá éΰéáóá íá éñáóóóá áíòβáñáόί áóóáéáβáð όίò éáóáéüäìò /etc éáé íá óóã÷:ùíáγóáðá áñáüóáñá (÷:áéñìéβíççóá) éΰðìéá όçíáíóééΰ áñ÷áβá, üðùò όí master .passwd ð όí group.

Όçίáβùòç: Οίη ούιάνι άόου ááí ΰ÷áé áβíáé áéüìá éáíéΰ áééááβ όόí óγóόçía, éáéòð üèç ç áéááééάόβά όçò áíááΰέιέος éáé óóã÷óíáóçð áβíáóáé όá áéáóññáðééü éáòΰéíáí. ¼όάί áóáññìóðìγί áðéòð÷ò üéá όá patches éáé Ìéìéèçñùéáβ Ìá áðéòð÷:βá ç áéááééάόβά όçò óóã÷óíáóçð üéüí όùí áñ÷áβùí ñýéíέος, ì ÷ñóóçð éá ðñΰðáé íá áðéáááéóáé όçí óáéééβ ááéáóΰóáόç.

Ìá όί óΰέíò áóòòð όç áéááééάόβáð, ç áίáάΰέιέος Ìðñáβ íá Ìñéóóééìðìéçéáβ όóí áβóéí, Ìá όç ÷ñóç όçò áéüéìðèçò áίóíéòð:

freebsd-update install

25.2.4 Óŷáēñέόç ÉáóÙóóáóçò ðῖò ÓóóòΠἰάóἰò

Ὀἰ ἁἰçèçðééυ δñúññáἰἰἰá freebsd-update ἰðἰñáβ ἰá ÷ñçóéἰἰðἰéçèáβ áéá ἰá ñéŸáἰáòá ðçἰ éáðÙóóáóç ðçò ááéáóáóðçἰŸἰçò Ÿéáἰóçò ðῖò FreeBSD ðá ð÷Ÿóç ἰá ἰéá áἰúóðΠ éáé ðúóðΠ ááéáðÙóóáóç. Ç áðééἰáΠ áððΠ óðáēñβἰáé éáé áἰéἰἰááβ ðçἰ ðñŸ ÷ἰóá Ÿéáἰóç ðῖἰ ðñἰñáἰἰÙóἰ ὁóóðΠἰáóἰò, ðῖἰ áéáéἰéçèçḗβἰ éáé ðῖἰ ἁñ ÷áβῖἰ ñŷéἰéçòð. Ἄéá ἰá ἰáééἰΠóáðá ðç óŷáēñέόç, áðóðá ðçἰ áéυἰἰòçç áἰóἰἰΠ:

```
# freebsd-update IDS >> outfile.ids
```

ðñἰáéáἰðἰβçç: Ἀἰ éáé ðῖ ὑἰñἰá ðçò áἰóἰἰΠò áβἰáé IDS, ááἰ éá ðñŸðáé ðá éáἰéÙ ðáñβðóóç ἰá éáυñçèáβ ððἰéáðÙóóáðἰ áἰúò ðóóðΠἰáóἰò áἰβ ÷ἰáóóçò áéóáἰἰἰŸá (intrusion detection system) ὑðòò áβἰáé áéá ðáñÙááéáἰá ðῖ security/snort. Éáèðò ðῖ freebsd-update áðἰéçèáŷáé ðá áááἰŸἰá ðῖò ðóἰ áβóéἰ, ððŸñ ÷áé ðŸἰóá ç ðééáἰúóçðá ἰá Ÿ ÷áé áβἰáé áééἰβúóç ðῖòð. Ἀἰ éáé ç ðééáἰúóçðá áððΠ ἰðἰñáβ ἰá ἰáéúéáβ ÷ñçóéἰἰðἰéἰἰáð ðç ñŷéἰéóç kern.securelevel éáé áðἰéçèáŷáἰἰóáð ðá áááἰŸἰá ðçò áἰóἰἰΠò freebsd-update ðá Ÿἰá óŷóðçἰá ἁñ ÷áβῖἰ ἰúñἰ áéá áἰŸáἰúóç, ἰéá áéυἰá éáéŷóáñç éŷóç éá Πóáἰ ἰá óðáēñβἰáðá ðῖ óŷóðçἰá ἰá éŸἰéἰἰ áβóéἰ ðῖò éáυññáβðá ðáἰἰðñá áóóáḗΠ. ἰðἰñáβðá ἰá ÷ñçóéἰἰðἰéἰΠóáðá Ÿἰá áβóéἰ DVD Π Ḹἰá áἰúðáñḗéυ áβóéἰ USB ðῖò ððéÙóóáðá ðá áóóáḗΠ ðἰðἰéáóḗá.

Éá áβἰáé ðβñá ἰéá áðééáβñçóç ðῖò óóóðΠἰáóἰò éáé éá áéðóðñèáβ ἰéá éβóóá áðῖ ἁñ ÷áβá éáé ðéŸŸò hash ðῖò óŷðἰò sha256(1), ðῖἰ ἁéá ðῖ ááéáðáóðçἰŸἰç ὑóἰ éáé áéá ðῖ áἰúóðῖ ὄŷóðçἰá. ἈðáéáΠ ðñúéáéðáé áéá ἰááŸéç éβóðá, ðçἰ áἰáéáðáðéŷἰἰá ðóἰ ἁñ ÷áβἰ outfile.ids. Óðçἰ ἰéυἰç ðῖ éáβἰáñἰ éá ðéἰἰŷóá ðἰéŷ ἁñΠáññá, éáé óŷἰἰñá éá ἁŸἰéá ðçἰ ðñἰóῦñḗἰΠ ἰΠἰç áðáééυἰéóçò ðçò éἰἰóúéáð.

ἰé ἁñáñŸð áðóŸð Ÿ ÷ἰò ἁáἰééÙ ἰááŸéἰ ἰðἰἰò, áééÙ áβἰáé áŷéἰἰ ἰá áðáἰñááóóἰŷἰá ðçἰ Ÿἰñáἰ. Ἄéá ðáñÙááéáἰá, áéá ἰá ááβðá ἰéá éβóðá ὑéυἰ ðῖἰ ἁñ ÷áβῖἰ ðῖò áéáóŸñἰóἰ áðῖ áðóŸ ðçò áðβóçἰçò Ÿéáἰóçò, áðóðá ðçἰ áéυἰἰòçç áἰóἰἰΠ:

```
# cat outfile.ids | awk '{ print $1 }' | more
/etc/master.passwd
/etc/motd
/etc/passwd
/etc/pf.conf
```

Ὀá ðáñáðŸñú áβἰáé ἰúñἰ Ÿἰá ἰŸñἰò ðçò áἰúáἰò, ððŸñ ÷ἰò áéυἰá ðἰééÙ áéáóἰñáðééÙ ἁñ ÷áβá. ÉŸðἰéá áðῖ áðóŸ ðá ἁñ ÷áβá áβἰáé ððóéἰἰáééυ ἰá Ÿ ÷ἰò ðñἰðἰðἰéçèáβ. Ἄéá ðáñÙááéáἰá, ðῖ /etc/passwd Ÿ ÷áé ðñἰðἰðἰéçèáβ, éáèðò Ÿ ÷ἰò ðñἰóðáéáβ ÷ñΠóáð ðóἰ óŷóðçἰá. Ὀá ἰáñééŸð ðáñḗððβóáéð, ἰðἰñáβ ἰá ððŸñ ÷ἰò éáé Ÿééá ἁñ ÷áβá, ὑðòò ð ÷. ἁñḗñβἰáðá ððñβἰá ðá ἰðἰβá áéáóŸñἰóἰ áóἰŷ Ÿ ÷ἰò ἰáçἰáññèáβ ἰŸóù ðçò freebsd-update. Ἄéá ἰá ἁἰáḗñŸóáðá óðáéáñḗἰŸἰá ἁñ ÷áβá Π éáðáéυἰáἰòð, ðñἰóéŸóðá ðá óðçἰ áðééἰáΠ IDSIgnorePaths ðóἰ ἁñ ÷áβἰ ñðéἰβóáἰἰ /etc/freebsd-update.conf.

Ἄéóῦð áðῖ ðçἰ ÷ñΠóç ðῖò ἁἰáéŸñáἰá ðñἰçáἰòŸἰñð, ðῖ óŷóðçἰá áððῖ ἰðἰñáβ ἰá ÷ñçóéἰἰðἰéçèáβ éáé ὑð ðἰΠἰá ἰéáð éáððñáñἰŷð áéááééáóβáð ἁἰááŸéἰéóçò.

25.3 Portsnap: ἰá Ἀñááéáβἰ ἈἰçἰŸñòçò ðçò ÓðééἰáΠò ðῖἰ Ports

Ὀἰ ááóééυ óŷóðçἰá ðῖò FreeBSD ðáñḗéáἰáŸἰáé áðβóçò Ÿἰá ἁἰçèçðééυ δñúññáἰἰá áéá ðçἰ ἁἰçἰŸñòç ðçò ÓðééἰáΠò ðῖἰ Ports. ðñúéáéðáé áéá ðῖ portsnap(8). ¼óáἰ ðῖ áéðáéŸóáðá, éá óðἰááéáβ ðá Ḹἰá áðñáññòóἰŸἰç áéáéñḗéóðΠ, éá áðáéçèáŷóáé ðῖ ééáéáβ ðῖò ðçááβἰò éβáééá, éáé éá éáðááŸóáé Ḹἰá ἰŸἰ áἰóβáñáἰò ðçò ÓðééἰáΠò ðῖἰ Ports. Ὀἰ ééáéáβ ÷ñçóéἰἰðἰéáβðáé áéá ἰá áðáéçèáŷóáé ðçἰ áéáñáéυóçðá ὑéυἰ ðῖἰ ἁñ ÷áβἰ ðῖò ἰáðáóἰñðἰñἰóáé, ἁἰáóóáéβæἰἰóáð ὑóé ááἰ

Ύ ÷ ιοί άέέιέυέάβ έάοΎ οçi ιάοάοιñΎ. Άέά ίά έάοάΎΎοάοά όά όάέάοόάβά άñ ÷ άβά οçò ÓöëïãÐò ουί Ports, áέοάέΎόά όçi áέυέιόεç άίόιέÐ:

portsnap fetch

```
Looking up portsnap.FreeBSD.org mirrors... 3 mirrors found.
Fetching snapshot tag from portsnap1.FreeBSD.org... done.
Fetching snapshot metadata... done.
Updating from Wed Aug 6 18:00:22 EDT 2008 to Sat Aug 30 20:24:11 EDT 2008.
Fetching 3 metadata patches.. done.
Applying metadata patches... done.
Fetching 3 metadata files... done.
Fetching 90 patches....10....20....30....40....50....60....70....80....90. done.
Applying patches... done.
Fetching 133 new ports or files... done.
```

Όι δάñάδΎιñ δάñΎάέέιá äáβ ÷ ίάέ υέέ οϊ portsnap(8) άñÐέá έάέ άδάέÐέάοόά άñέάοΎ patches όά ιόιβá δñΎδάέ ίά άόάñιόοιγί όοι οδΎñ ÷ ιί äΎίόñι ουί ports. Άόου äáβ ÷ ίάέ άδβόçò υέέ οϊ δñüññáιá Ύ ÷ áέ áέοάέΎόάβ έάοΎ οϊ δάñάέυέι. Αί άόδÐ Ðόái ç δñþòç οϊñΎ διò áέοάέιγίόái, έά άβιιόái άδèþò έάοΎάάοιá οçò óöëïãÐò.

¼όái οϊ portsnap(8) áέοάέΎόάέ άδέοδ ÷ þò οç έάέοιόññáβá fetch, ç ÓöëïãÐò ουί Ports έάέ όά άίόβόοιέ ÷ á patches Ύ ÷ ιοί άδιέçέάοδέάβ όοι οιδέέυι όγόόçιá έάέ Ύ ÷ áέ άβίáέ ç άδάέÐέάοδóç οϊοδ. Όçi δñþòç οϊñΎ διò έά áέοάέΎόάόά οϊ portsnap, έά δñΎδάέ ίά ÷ ñçόέιιδιέÐόάόά οϊ extract áέά ίά äáέάόάόóÐόάόά όά άίçιáññιΎίá άñ ÷ άβá:

portsnap extract

```
/usr/ports/.cvsignore
/usr/ports/CHANGES
/usr/ports/COPYRIGHT
/usr/ports/GIDS
/usr/ports/KNOBS
/usr/ports/LLEGAL
/usr/ports/MOVED
/usr/ports/Makefile
/usr/ports/Mk/bsd.apache.mk
/usr/ports/Mk/bsd.autotools.mk
/usr/ports/Mk/bsd.cmake.mk
...
```

Αί Ύ ÷ άόά Ðäç äáέάόάόóçιΎίç οçi ÓöëïãÐò ουί Ports, ÷ ñçόέιιδιέÐόάόά όçi άίόιέÐ portsnap update áέά ίά οçi άίçιΎññοάόά:

portsnap update

Ç äέάάέέάόβá Ύ ÷ áέ δèΎίι ιέιέεçññέάβ, έάέ ιδιñάβόά ίά äáέάόάόóÐόάόά Ð ίά άίάάάέιβόάόά άόάñιáΎò ÷ ñçόέιιδιέþιόάό όçi άίçιáññιΎίç ÓöëïãÐò ουί Ports.

Ìδιñάβόά ίά áέοάέΎόάόά όέο äέάάέέάόβáðò fetch έάέ extract Ð update áέάάι ÷ έέΎ, υδòò όάβίáόάέ όοι δάñάέΎοñ δάñΎάέέιá:

portsnap fetch update

Ç δάñάδΎιñ άίόιέÐ έά έάόάΎΎόάέ όçi όάέάοόάβá Ύέαιόç οçò ÓöëïãÐò ουί Ports έάέ έά άίçιáñþόάέ όά οιδέέΎ άñ ÷ άβά όάο όοι έάόΎέιáι /usr/ports.

25.4 Αίσιάññííôάò ôçí Ôάέιçñßùόç

Αέòùò áðu òí άάόέéù óγόόçíá έάέ ôçí Óðéëĩãþ ðùí Ports, ç ðάέιçñßùόç áðìòάέãß áðßόçò άάόééù ðìðíá áíúð óðóððíáðìò FreeBSD. Αί έάέ ðÛíóá ìðìñáßðά ίά áñάßðά ôçí ðéí ðñùóòάóç ðάέιçñßùόç óôçí άέéððάéþ ðìðìέάóßá ðìò FreeBSD (<http://www.freebsd.org/doc/>), ìñéóìΰíé ðñðόάò βóùð ΰ ðìò άñãþ þ ìç óðάéãñþ óγííáóç ìá ðì Άέάάβéðòì. Αðòð ðð ððÛñ ðìò άñéάòìβ ðñùðìé έέά ίά άίçìáññðáðá ôçí ðάέιçñßùόç ç ìðìβá ðáñΰ ðάάé ìá εÛéá áðßόçìç ΰέάíόç, άέάóçññíðάð ðì άέéù óáð ðìðééù άíðßáñáòì ôçò ðéí ðñùóòάóçò ðάέιçñßùόçò ðìò FreeBSD.

25.4.1 ×ñçóéìðìέðíðáð ðì CVSúþ έέά ôçí Αίσιΰñòóç ôçò Ôάέιçñßùόçò

Ï ðçááβìò έðάέéáð έάέ ðì άάéάðάóóçìΰíí άíðßáñáòì ôçò ðάέιçñßùόçò ðìò FreeBSD, ìðìñíγí ίά άίçìáññúèìγí ìá ôçí άìðéάéá ðìò CVSúþ, ðñçóéìðìέðíðáð ΰíá ìç ðáééòìú ðáññìíéí ìá áðòùí ðìò ðñçóéìðìέáßðάé óòì άάόééù óγόόçíá (άáßðά ðì Ôìðíá 25.7). Ç áíúðçòά áððþ ðáñéãñÛóáé:

- ðùð ίά άáéάðάóóððάðά ðá áñááéáßá ðìò áðάéóìγíóáé έέά ôçí ðάέιçñßùόç, ìá ðá ìðìβá ìðìñáßðά ίά áçìéíðñãþðáðá ôçí ðάέιçñßùόç ðìò FreeBSD ìάέéðíðáð áðu ðìò ðçááβìò ôçò έðáééá.
- ðùð ίά έáðάáÛóáðά ΰíá άíðßáñáòì ðìò ðçááβìò έðáééá ôçò ðάέιçñßùόçò óòì έáðÛéĩãì /usr/doc ðñçóéìðìέðíðáð ðì CVSúþ.
- ðùð ίά άíááçìéíðñãþðáðá ôçí ðάέιçñßùόçò ðìò FreeBSD áðu ðìò ðçááβìò ôçò έðáééá, έάέ ίá ôçí άáéάðάóóððάðά óòì έáðÛéĩãì /usr/share/doc/.

25.4.2 Άέéáééóððíðáð ðì CVSúþ έάέ ôç ÓáéñÛ Άñááéáßúí ôçò Ôάέιçñßùόçò

Ç άíááçìéíðñãá ðçò ðάέιçñßùόçò ðìò FreeBSD áðu ðìò ðçááβìò έðáééá, áðάéòáß ìέά ó ðáééÛ ìááÛέç óéééĩãþ áñááéáßúí. Óá áñááéáßá áðòÛ ááí áβίáé ìΰñìò ðìò άáóééìγ óðóððíáðìò ðìò FreeBSD, έέêðð ðñáéÛæííóáé άñéáðù ðññì óòì áβòéí έάé ááí áβίáé ðñðóéíá óá ðéèòð ðìòð ðñðόάð. Άβίáé ðñðóéíá ìúñì óòìòð ðñðόάð ðìò áó ðééìγíóáé ìá ôç óðáãáñáðþ Ìΰáð ðάέιçñßùόçò έέά ðì FreeBSD, þ ðìò άίçìáñññìò óð ðíÛ ôçí ðìðééþ ðìòð ðάέιçñßùόç ìΰòù ðìò ðçááβìò έðáééá.

¼έά ðá áðάéóìγíóáé áñááéáßá έέάðβéáíóáé ìΰóù ôçò Óðéëĩãþ ðùí Ports. Ôì textproc/docproj áβίáé ðì έýñéí port ðì ìðìβì ΰ ðáé áíáððð ðáß áðu ôçí ÌÛáá Ôάέιçñßùόçò ðìò FreeBSD, έέά ίá áìçðéðάé óôçí άñ ðééþ ááéάðÛóóáç έάέ ðéð ìάέéìðééΰ άíáάéòβóáéð áððñì ðùí άñááéáßúí.

Ôçíáßùόç: Αί ááí áðάéóáßðάé ç áçìéíðñãá ðάέιçñßùόçò óá ììñòΰò PostScript þ PDF, ìðìñáßðά ίά άáéάðάóóððáðá ðì port textproc/docproj-nojadetex. Αððþ ç ΰέάíόç ðùí áñááéáßúí ðáñéΰ ðáé ðá ðÛíóá áέòùò áðu ôçí ìç ðáíþ óðìé ðáéèáóßáð teTeX. Ôì teTeX άβίáé ìέá άñéáðÛ ìááÛέç óéééĩãþ áñááéáßúí, έάé ááí ΰ ðáé ìúçíá ίά ðì άáéάðáóððáðά áί ááí óáð άβίáé áðáñáßòçòç ç ðáñáãùãþ ôçò ðάέιçñßùόçò óá ììñðþ PDF.

Άέά ðáñéóóùðáñáð ðéçñìòìñßáð ó ðáéééÛ ìá ôçí άáéάðÛóóáç έάέ ðñðóç ðìò CVSúþ, ááßðά ôçí άíúðçòά ×ñçóéìðìέðíðáð ðì CVSúþ.

25.4.3 Αίσιάññííôάò ðìò ðçááβìò Έðáééá ôçò Ôάέιçñßùόçò

Ôì άìççòééù ðñùáñáñìá CVSúþ ìðìñáß ίά έáðάáÛóáé ΰíá έάéáñú áíðßáñáòì ðìò ðçááβìò έðáééá ôçò ðάέιçñßùόçò, ðñçóéìðìέðíðáð ðì /usr/share/examples/cvsup/doc-supfile ðð ðñùóððì άñ ðáßì ððéìβóáùí. Ï

ὁ ἄνθρωπος εἶναι ἄριστος ἐστὶν ἡ ἐλευθερία. Ὁ ἄνθρωπος εἶναι ἄριστος ἐστὶν ἡ ἐλευθερία. Ὁ ἄνθρωπος εἶναι ἄριστος ἐστὶν ἡ ἐλευθερία.

```
# cvsup -h cvsup.FreeBSD.org -g -L 2 /usr/share/examples/cvsup/doc-supfile
```

Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία.

Ὁ ἄνθρωπος εἶναι ἄριστος ἐστὶν ἡ ἐλευθερία. Ὁ ἄνθρωπος εἶναι ἄριστος ἐστὶν ἡ ἐλευθερία.

Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία.

Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία.

```
# cd /usr/doc
# make update
```

Ὁ ἄνθρωπος εἶναι ἄριστος ἐστὶν ἡ ἐλευθερία. Ὁ ἄνθρωπος εἶναι ἄριστος ἐστὶν ἡ ἐλευθερία.

```
SUP_UPDATE= yes
SUPHOST?= cvsup.freebsd.org
DOCSUPFILE?= /usr/share/examples/cvsup/doc-supfile
```

Ὁ ἄνθρωπος: Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία.

25.4.4 Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία

Ὁ ἄνθρωπος εἶναι ἄριστος ἐστὶν ἡ ἐλευθερία. Ὁ ἄνθρωπος εἶναι ἄριστος ἐστὶν ἡ ἐλευθερία.

Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία.

```
DOC_LANG
```

Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία. Ἡ ἐλευθερία εἶναι ἡ ἐλευθερία.

FORMATS

ϒ̄ ïñῶP (P íεά έβóά áðü ïñῶYð) óóϒί ïðῐβá έά ðáñá÷έâβ ϒ̄ ïáóáâέùòðέóιYίϒ̄ óâέιϒ̄ñβùóϒ. Óϒ̄ äâññYίϒ̄ óðέâῐP ððῐóðϒ̄ñβæῐῐóáέ íé ïñῶYð html, html-split, txt, ps, pdf έάέ rtf.

SUPHOST

Óῐ ùññá οἴῶ âῐðϒ̄ñáóϒ̄P **CVSup** ðῐῶ έά ÷ñϒ̄óέῐῐðῐέϒ̄έâβ έáóŪ όϒί âϒ̄ìYñùóϒ.

DOCDIR

Ū έáóŪεῐῐῶð óῶῐ ῐðῐβῐ έά äâέáóáóðáέâβ ϒ̄ óâέιϒ̄ñβùóϒ. Ἀðü ðñῐðέῖῐῐP âβῐáέ ῐ /usr/share/doc.

Ἀέά ðáñέóóúðññáð ðέϒ̄ñῐῶῐñβáð ó÷áðέέŪ ïá όέð ïáóáâέϒ̄óŪð ῶῐῶ make ðῐῶ ððῐóðϒ̄ñβæῐῐóáέ ùð äðέῖῐῐYð óðóðPῐáῐῶð óῶῐ FreeBSD, äâβðá όϒί óâέβáá manual ῶῐῶ make.conf(5).

Ἀέά ðáñέóóúðññáð ðέϒ̄ñῐῶῐñβáð έάέ ïáóáâέϒ̄óŪð make ðῐῶ ððῐóðϒ̄ñβæῐῐóáέ áðü ῶῐ óýóóϒῐά ïáóáâέPððέóϒ̄ð όϒ̄ð óâέιϒ̄ñβùóϒð ῶῐῶ FreeBSD, ðáñáέáέῐῶῐññáð όέð Ūϒ̄çâβð όϒ̄ð ḤŪäáð Óâέιϒ̄ñβùóϒð ῶῐῶ FreeBSD äέá ŪYῐῶð Óðññáñáâð (http://www.FreeBSD.org/doc/en_US.ISO8859-1/books/fdp-primer).

25.4.5 ἈäέáóŪóóáóϒ̄ όϒ̄ð Óâέιϒ̄ñβùóϒð ῶῐῶ FreeBSD áðü ῶῐῶ Đçääβῐ ḘPäééá

÷ῐῐóáð áῐϒ̄ῐñPóáέ ῶῐ ῶῐðέéü áῐóβññáῶῐ ῶῐῶ ðçääβῐῶ έPäééá όϒ̄ð óâέιϒ̄ñβùóϒð óῶῐῐ έáóŪεῐῐῶ /usr/doc, âβῐáóðá Yῐῶῖῐῖ έέá όϒί âϒ̄ìYñùóϒ όϒ̄ð ääέáóáóðϒ̄Yίϒ̄ð óâέιϒ̄ñβùóϒð.

Ūðññáβðá ῐá ðñῐ÷ῐñPóáðá óá ðέPñϒ̄ âϒ̄ìYñùóϒ üέῐῐ ðüῐ ãέüóóPῐ ᰃῐῶ ïñβæῐῐóáέ óóϒί äðέῖῐῐP DOC_LANG ῶῐῶ Makefile, ãñŪῶῐῐóáð:

```
# cd /usr/doc
# make install clean
```

Ἀῐ Y÷áðâ ñðέῐβóáέ ῶῐ make.conf ïá όέð óúóðŪð όέῐYð äέá όέð äðέῖῐῐYð DOCSUPFILE, SUPHOST έáέ SUP_UPDATE, ῐðññáβðá ῐá óῶῐäŪóáðá óá âPῐáðá âϒ̄ìYñùóϒð έάέ ääέáóŪóóáóϒ̄ð ῶῐῶ ðçääβῐῶ έPäééá óá Yῐá, ãñŪῶῐῐóáð:

```
# cd /usr/doc
# make update install clean
```

Ἀῐ äðέéðῐâβðá όϒί âϒ̄ìYñùóϒ ïέáð ῐüῐῐ óðäέäñέῐYίϒ̄ð ãέPóóáð, ῐðññáβðá ῐá έáέYóáðá όϒί make(1) óá Yῐá óðäέäñέῐYῐ ῶðῐέáóŪεῐῐῶ ῶῐῶ /usr/doc, ð.÷.:

```
# cd /usr/doc/en_US.ISO8859-1
# make update install clean
```

Ūðññáβðá ῐá έáέῐñβóáðá όϒ̄ ïñῶP όϒ̄ð óâέιϒ̄ñβùóϒð ᰃῐῶ έá ääέáóáóðáέâβ, ñðέῐβæῐῐóáð όϒ̄ ïáóáâέϒ̄óP FORMATS ῶῐῶ make, ð.÷.:

```
# cd /usr/doc
# make FORMATS='html html-split' install clean
```


Προσοχή: Η διαδικασία αυτή είναι απλή, αλλά απαιτείται να έχετε εγκατεστημένο το FreeBSD και να έχετε πρόσβαση στο δίκτυο.

Αν θέλετε να εγκαταστήσετε το FreeBSD, η διαδικασία είναι απλή, αλλά απαιτείται να έχετε εγκατεστημένο το FreeBSD και να έχετε πρόσβαση στο δίκτυο.

```
# pkg_add -r el-freebsd-doc
```

Προσοχή: Η διαδικασία αυτή είναι απλή, αλλά απαιτείται να έχετε εγκατεστημένο το FreeBSD και να έχετε πρόσβαση στο δίκτυο.

25.4.6.3 Εγκατάσταση των Ports στο FreeBSD

Αν θέλετε να εγκαταστήσετε το FreeBSD, η διαδικασία είναι απλή, αλλά απαιτείται να έχετε εγκατεστημένο το FreeBSD και να έχετε πρόσβαση στο δίκτυο.

```
# portupgrade -PP el-freebsd-doc
```

25.5 Ενημέρωση του FreeBSD

Οι ενημέρωσεις του FreeBSD, οι FreeBSD-CURRENT και οι FreeBSD-STABLE. Η διαδικασία είναι απλή, αλλά απαιτείται να έχετε εγκατεστημένο το FreeBSD και να έχετε πρόσβαση στο δίκτυο.

25.5.1 Ενημέρωση του FreeBSD-CURRENT

Η διαδικασία είναι απλή, αλλά απαιτείται να έχετε εγκατεστημένο το FreeBSD και να έχετε πρόσβαση στο δίκτυο.

25.5.1.1 Οδηγίες για το FreeBSD-CURRENT;

Οι οδηγίες για το FreeBSD-CURRENT είναι απλές, αλλά απαιτείται να έχετε εγκατεστημένο το FreeBSD και να έχετε πρόσβαση στο δίκτυο.

άβίάόάέ, άέέÛ ðì áì ðì FreeBSD-CURRENT έά όάò öÛñάέ ðçì έάόάóòñòð ð éÛðìέì ðìέòðùεçòì ÷ άñάέòçñέóòέέù, άβίάέ ðάñέóóòòðáñì εÛά όçð ÷ ãñíέέðò óóέάìðò ðìò έά άðέεÛάòά íá άίάέððóάóά ðìí ðçάáβì έðáέέά!

25.5.1.2 Ðìέìò × ãάέÛæáόάέ ðì FreeBSD-CURRENT;

Ïì FreeBSD-CURRENT άέάόβεάόάέ έάέ άίάέάöÛñάέ έòñβùð óέð ðáñάέÛòù ðñάέò ãÛάò:

1. ìÛέç όçð έìέíùóçόάò ðìò FreeBSD ðìò άìòέάÿìòί άíáñáÛ ðά éÛðìέì ðìðíá ðìò ðçάáβìò έðáέέά, έάέ άέά ðìòð ìðìβìòð ç ðáñάέìέìÛέçόç ðìò FreeBSD-CURRENT άβίάέ άðùέòðά άðáñάβòçόç.
2. ìÛέç όçð έìέíùóçόάò ðìò FreeBSD ðìò άβίάέ άíáñáñìβ testers έάέ άβίάέ ðñùεðìίέ íá άίάέðòìòì ðì ÷ ãñùí ðìòð άέά íá έÿóìòì ðñìάεðíáόά, ðóόά íá άίάóóάέβóìòì ùέó ðì FreeBSD-CURRENT έά ðáñáíáβίάέ ùóì ðì άóíάóùì ðέì óùóòù. Óòìðέùð, óά ìÛέç áðòÛ éÛíòì ðñìòÛóάέò άέά ðìðέέÛ ð áέέάáÛ ð έάέ άέά ðçì άάìέέð έáðάÿέòìòç ðìò FreeBSD, έάέ óðÛέíòì patches άέά ðçì ðñάάìάòìðìβçόç ðìòð.
3. Άóòìβ ðìò άðέðò εÛέìòì íá άéÛðìòì óέð ðάέάðòάβáð άίçìáñðóάέð, ð íá ÷ ãçóέììðìέìÛì ðìí ðάέάðòάβì ðçάáβì έðáέέά ùð άíáóìñÛ (ð.÷. άέά *ìáεÛðç* έάέ ù÷έ άέά άéðÛέάóç). ìÛέç áðòðð όçð ãÛάáð ìðìñάβ áðβóçð ðáñέóóάóέάέÛ íá óòíάέóðÛñìòì ó÷έέά ð έðáέέά.

25.5.1.3 Óέ Άάí Άβίάέ ðì FreeBSD-CURRENT;

1. Άάí άβίάέ Ûάóò áñðáñìòð ðñùðìò íá ðÛñáðά έðáέέά ì ìðìβìò άáí Û÷άέ έóέέìòìñðóάέ áéùìá óά éÛðìέά Ûέáìòç, ìá ðçì áéðβάá ùέó ðáñέÛ÷άέ éÛðìέá íÛά áéðçέóéðέð áóíáóòùóçόά έάέ εÛέáðά íá áβóóά ì ðñðòìòð ðìò óç ÷ ãçóέììðìέέάβ. Άí áβóóά ðñÛάìάóέ ì ðñðòìòð ðìò ðçì ÷ ãçóέììðìέέάβ, έά áβóóά áðβóçð έάέ ì ðñðòìòð ðìò έά óòíάìðóάóá óά íÛά ðñìάεðíáόά έάέ bugs.
2. Άáí άβίάέ Ûάóò áñðáñìòð ðñùðìò άέά íá άίáέððóáóά άéíñεðóáέð ðñìάεçìÛóùì. ÊÛεά íÛά Ûέáìòç ðìò FreeBSD-CURRENT ìðìñάβ íá άέóÛάάέ óùóά íÛά ùóά έάέ áðòÛ ðìò áéíñεðíáέ.
3. Ïì FreeBSD-CURRENT άáí áðìòάέáβ “áðβóçíá ððìóðçñέáùìáñ” έðáέέά. Άí έάέ έáóááÛέέìòìá éÛεά áóíáóð ðñìòðÛέáέíá íá άìçεðóìòìá ùóìòð άíðέìòì “ðñάάìάóέέÛ” óά éÛðìέá áðù óέð ðñάέò ãÛάáð ðìò άíáóÛñáìá, ùóòùóì *ááí Û÷ìòð ðì ÷ ãñùí* íá ðáñÛ÷ìòá óá÷έέð ððìóððñέíç. Άóòù άáí óòìááβίάέ άðáέáð άβíάóá έάέìðéάέð έάέ áÿóέìέίέ έάέ άáí εÛέìòìá íá άìçεÛìá ðìòð áíεñððìòð (άáí έά áβ÷άìά έáí άçìέìòñáðóάέ ðì FreeBSD άí óέáóòùìáóóάί Ûóέé). Ðìέÿ áðéÛ, άáí ìðìñíÿìá íá áðáíóÛìá áέάðììòÛάáð ìçìÿìάόá ðçì çìÛά έάέ óáðóù÷ñìá íá áìòέáÿìòìá óòì FreeBSD! Άí áðóáóá óά ìðìέìáððìòá ìÛέìòð óçð ãÛάáð áíÛððóçìò ðçì áðέέìáð íá áðáíóÛάέ óά ðìέέÛ ð áñùððóáέò ó÷άóέέÛ ìá ðáέñáñáóέέù έðáέέά ð íá áìòέáÿάέ άέά óç άάέòβùóç ðìò FreeBSD, έά άðέεÛάέ óβáìòñá ðì áÿóòáñì.

25.5.1.4 × ãçóέììðìέìÛìóáò ðì FreeBSD-CURRENT

1. Άñάéòáβðá óéóέ èβóðáð freebsd-current (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-current>) έάέ svn-src-head (<http://lists.FreeBSD.org/mailman/listinfo/svn-src-head>). Άáí άβίάέ áðέðð έάέð έáÛά, άβίάέ ááóέέù íá ðì éÛíáðá. Άí άáí áβóóá άñáñìÛñò óóç èβóðά freebsd-current (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-current>), άáí έá άéÛðáðά óά ó÷έέά ó÷άóέέÛ ìá ðçì ðñÛ÷ìòá έáóÛóóáç ðìò óóóððíáðìò áðù ùóìòð ðì ÷ ãçóέììðìέìÛì, έάέ Ûóóé ðέéáðð έá έáóáέðíáðá íá áíóέìáðòðβεáðá ðìέéÛ ðñìάεðíáόά ðìò Ûέέìέ Û÷ìòì ðαç άíάέάέÿóάέ έάέ έÿóáέ. Άéùìá ðέì óçìáíðέéù άβίάέ ùέó έá ÷ Ûíáðá óçìáíðééÛ άíάέìέìðóáέð, ìέ ìðìβáð ìðìñάβ íá άβίάέ έñβóέìáð άέά ðçì άέáððñçóç ðìò óóóððíáðìò óáð óá óάέð éáóÛóóáç.

Ûóóε σóιτõ ÷ ñΠóäå ççί äöεάεñβά ίά äεòÛñïóί äίπçç ó÷ äóεέÛ ίά óά ðññäεΠιάóά ðïõ εά ðññεάέÛóáε ç ðññïäέíυιáίç áεέάäΠ.

Ëά ðñÛðäε ίά ääñäóäðáðä óóçί έäóÛεεççç εβóóά SVN áíÛεíτáά ίά õïí εεÛäï ðïõ ðáñäεíεíεðäðáðä. Äέá ðáñÛäáέäñá, áí ðáñäεíεíεðäðáðä õïí εεÛäï 7-STABLE, ç έäóÛεεççç εβóóά äβίáέ ç svn-src-stable-7 (<http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-7>). Αóòυ έä óäð äðέõñÛðáέ ίά äεÛðäðä óέó έäóá÷ ùñΠóáέð óóί commit log äέá εÛεä äέέάäΠ ðïõ äβίáóáέ, έεεðð έáέ ðεçññïíñβäð äέá ðεέáíÛò ðáñáíÛñäáέäð ðïõ ίðñäβ ίά Û÷ äέ.

Äέá ίά äñäóäðáðä óá äóðÛð, Π óá ïðñέäóäΠðïóä äðυ óέð ððÛñ÷ ïóóäð εβóóäð, äðέóέäðéäðáðä óçί õïðñέäóβá <http://lists.FreeBSD.org/mailman/listinfo> έáέ äðέεÛíòä óç εβóóά óóçί ïðñβá εÛεäðá ίά äβίáðä óóίäññçððð. Ìäçäβäð äέá óçί ððυíεíεðç äέäáέέáóβá εä äñäβðä äðέóυðïõ. Αί óäð áíäέáó Ûñáέ ίά ðáñäεíεíεðäðáðä óέð äέέääÛð óá ùεí õï äÛíðññ ðççááβñò εðäέέá, óäð óóίέóóïγíä ίά ääñäóäðáðä óóç εβóóά svn-src-all (<http://lists.FreeBSD.org/mailman/listinfo/svn-src-all>).

- 2. Αί ðññεäέéóáέ ίά ääεäóäóððáðä Ûíá íÛí óýóóçίá ίä óεíðυ ίá äέðäεäβðä óá ìçίέáβá snapshot ðïõ FreeBSD-STABLE, ðáñäέäέíγíä ίá äεÛäñáðä óçί õïðñέäóβá Snapshots (<http://www.FreeBSD.org/snapshots/>) äέá ðáñέóóóυðäñäð ðεçññïíñβäð. ΑίäέέäðééÛ, äβíáέ äóíäóυí ίá ääεäóäóððáðä õï ðéí ðññóóáóí FreeBSD-STABLE äðυ εÛðíεí mirror site äεíεíðεπíóäð óέð ðáñäεÛðυ ïäçäβäð þóðä ίá áíáäáεìβóáðä õï óýóóçίá óäð óóçί ðεÛí ðññóóäóç Ûέäíóç ðççááβñò εðäέέá ðïõ FreeBSD-STABLE.

Αί äέáέÛðäðä þäç εÛðíεá ðññçäñγíäίç Ûέäíóç ðïõ FreeBSD έáέ äðééðíäβðä ίá áíáäáεíέóðäβðä ïÛóυ ðïõ ðççááβñò εðäέέá, ίðñäβðä äγέíεä ίá ÷ ñçóéíðñεðáðä εÛðíεí mirror site ðïõ FreeBSD. ÕðÛñ÷ ïóί äγí ðññðñέ äέá ίá äβíáέ äóðυ:

- a. × ñçóéíðñεðóðä õï ðññüäñáíä cvsup óá óðíäðáóíυ ίä õï supfile ίä óçί íññáóβá stable-supfile õï ïðñβí εä äñäβðä óóίí έäóÛεíäñ /usr/share/examples/cvsup. ΑóðΠ äβíáέ έáέ ç ðεÛí óóίέóóðñíáç ïÛεíäñò, έεεðð óäð äðέõñÛðäέ ίá áíäέððáðä ùεç óç óðεéíäΠ ίä ίέá εβίçóç, έáέ óðέð äðυíäñäð áíäíäþóáέð εä ðáβññíáðä ùíñ óέð äέέääÛð. ðñεéíβ ÷ ñΠóäð äέðäεíγí õï cvsup ïÛóυ ðïõ cron þóðä ίá εñäóÛíä õï ðççááβñò εðäέέá ðïõ óóóððíäóíð õïτð ðÛíóá áíäíäñíÛñ äóðυíäóá. Èá ðñÛðäέ ίá ðññóäññüóäðä õï óðυäáέäñä ðïõ supfile ðïõ äβññòä ðáñäðÛí, έáέ ίá ñðéìβóáðä õï cvsup äέá õï ðáñέáÛεéí óäð.
- b. × ñçóéíðñεðóðä óçί ððçñäóβá CTM. Αί äáí Û÷ äää äñþäñç έáέ óðçíΠ óýíäáóç ίä õï Internet, äóðΠ äβíáέ ç óóίέóóðñíáç ïÛεíäñò.

- 3. ÌóóέáóðééÛ, áí ÷ ñäéÛäéäðä äñþäñç έáέ έäóÛ äðäβðçóç ðññóäáóç óóίí ðççááβñò εðäέέá, έáέ õï äγññò äþíçð ðçð óýíäáóç äáí äðíðäέäβ ðññüäεçíä, ÷ ñçóéíðñεðóðä õï cvsup Π õï ftp. ÄέáóññäðééÛ, ÷ ñçóéíðñεðóðä õï CTM.
- 4. ðñέí ïäðääεüððóðäðä õï FreeBSD-STABLE, äέäáÛóðä ðññóäéééÛ õï Makefile óóίí έäóÛεíäñ /usr/src. Èá ðñÛðäέ ίá ïäðääεüððóðäðä õï ððñþíá έáέ ùεí õï äáóέéü óýóóçίá (world) óçί ðñþçç õïñÛ, ùð ïÛñò óçð äέäáέέáóβäð áíäáÛέíέóçð. ÄέäáÛäñíóäð óçί çäέðññééΠ εβóóά ðïõ FreeBSD-STABLE (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-stable>) έáέ õï /usr/src/UPDATING εä äβóðä äίçíäññüÛñé äέá íÛäð äέäáέέáóβäð ùóί äóññÛ óçί äέεβíçóç óóί íÛí óäð óýóóçίá. Ìé äέäáέέáóβäð äóðÛð äβíáέ óð÷íÛ äðäñäβðçðäð ùóί ðεççóέÛäéòíä óá ïέá íÛá äðβóçç Ûέäíóç.

25.6 Óóä÷ ññíβäéííðäð õïí ðççááβñò óäð Èþäέέá

ÕðÛñ÷ ïóί äεÛóññé ðññðñέ ίá ÷ ñçóéíðñεðáðä ïέá óýíäáóç Internet (Π email) äέá ίá äίçíäñþñíäð ïðñéäþðïä ðìðíä ðççááβñò εðäέέá ðïõ FreeBSD Project óäð áíäέáó Ûñáέ, Π έáέ ùεä áí õï äðééðíäβðä. Ìé äáóέéÛð ððçñäóβäð ðïõ

Το FreeBSD είναι ένα λειτουργικό σύστημα που βασίζεται στο UNIX και είναι ελεύθερο λογισμικό. Είναι πολύ δημοφιλές και χρησιμοποιείται σε πολλές πλατφόρμες.

Για να εγκαταστήσετε το FreeBSD, πρέπει να έχετε έναν υπολογιστή με τουλάχιστον 256 MB RAM και έναν σκληρό δίσκο με τουλάχιστον 2 GB ελεύθερο χώρο.

- Για να εγκαταστήσετε το FreeBSD, πρέπει να έχετε έναν υπολογιστή με τουλάχιστον 256 MB RAM και έναν σκληρό δίσκο με τουλάχιστον 2 GB ελεύθερο χώρο. (Εάν έχετε έναν υπολογιστή με περισσότερη RAM, τότε μπορείτε να εγκαταστήσετε το FreeBSD σε έναν μεγαλύτερο σκληρό δίσκο.)
- Εάν έχετε έναν υπολογιστή με τουλάχιστον 256 MB RAM και έναν σκληρό δίσκο με τουλάχιστον 2 GB ελεύθερο χώρο, τότε μπορείτε να εγκαταστήσετε το FreeBSD. Εάν έχετε έναν υπολογιστή με περισσότερη RAM, τότε μπορείτε να εγκαταστήσετε το FreeBSD σε έναν μεγαλύτερο σκληρό δίσκο.

Από το FreeBSD, μπορείτε να εγκαταστήσετε το FreeBSD σε έναν υπολογιστή με τουλάχιστον 256 MB RAM και έναν σκληρό δίσκο με τουλάχιστον 2 GB ελεύθερο χώρο. Αυτό γίνεται με τη βοήθεια των εργαλείων buildworld, buildkernel, installkernel, ή installworld.

- Εάν έχετε έναν υπολογιστή με τουλάχιστον 256 MB RAM και έναν σκληρό δίσκο με τουλάχιστον 2 GB ελεύθερο χώρο, τότε μπορείτε να εγκαταστήσετε το FreeBSD. Εάν έχετε έναν υπολογιστή με περισσότερη RAM, τότε μπορείτε να εγκαταστήσετε το FreeBSD σε έναν μεγαλύτερο σκληρό δίσκο.
- Εάν έχετε έναν υπολογιστή με τουλάχιστον 256 MB RAM και έναν σκληρό δίσκο με τουλάχιστον 2 GB ελεύθερο χώρο, τότε μπορείτε να εγκαταστήσετε το FreeBSD. Εάν έχετε έναν υπολογιστή με περισσότερη RAM, τότε μπορείτε να εγκαταστήσετε το FreeBSD σε έναν μεγαλύτερο σκληρό δίσκο.
- Εάν έχετε έναν υπολογιστή με τουλάχιστον 256 MB RAM και έναν σκληρό δίσκο με τουλάχιστον 2 GB ελεύθερο χώρο, τότε μπορείτε να εγκαταστήσετε το FreeBSD. Εάν έχετε έναν υπολογιστή με περισσότερη RAM, τότε μπορείτε να εγκαταστήσετε το FreeBSD σε έναν μεγαλύτερο σκληρό δίσκο.

Εάν έχετε έναν υπολογιστή με τουλάχιστον 256 MB RAM και έναν σκληρό δίσκο με τουλάχιστον 2 GB ελεύθερο χώρο, τότε μπορείτε να εγκαταστήσετε το FreeBSD. Εάν έχετε έναν υπολογιστή με περισσότερη RAM, τότε μπορείτε να εγκαταστήσετε το FreeBSD σε έναν μεγαλύτερο σκληρό δίσκο.

1. make buildworld

Αυτό είναι το πρώτο βήμα για να εγκαταστήσετε το FreeBSD. Θα δημιουργήσει τα αρχεία που χρειάζονται για να εγκαταστήσετε το FreeBSD. Αυτό γίνεται με τη βοήθεια των εργαλείων buildworld, buildkernel, installkernel, ή installworld.

2. make buildkernel

Αυτό είναι το δεύτερο βήμα για να εγκαταστήσετε το FreeBSD. Θα δημιουργήσει τον πυρήνα του FreeBSD. Αυτό γίνεται με τη βοήθεια των εργαλείων buildworld, buildkernel, installkernel, ή installworld.

3. make installkernel

Αυτό είναι το τρίτο βήμα για να εγκαταστήσετε το FreeBSD. Θα εγκαταστήσει τον πυρήνα του FreeBSD στον σκληρό δίσκο. Αυτό γίνεται με τη βοήθεια των εργαλείων buildworld, buildkernel, installkernel, ή installworld.

4. Άέέβιçοç οά έάέοίτññάβá single user.

Ç έάέοίτññάβá single user άέά ÷ έόόίθιέάβ οçi δέέάίυδοç οά ίά Ý ÷ άόά δññίάεΠιάοά άδάέάP άίάάάειβόάοά έΰθιεί δññυάññάιά θίω δñÝ ÷ άέ Pάç. Άβίάέ άδβόçδ θεί άόόάέPδ, άοίγ άά ÷ ñάέΰάέάόάέ ίά δñÝίάόά δέδ άόάññίάÝδ οίω δάέέιγ άάόέειγ όόόδΠιάοίτδ ίά οί ρÝι δδñΠίά.

5. mergemaster -p

Άδού οί άΠιά άίçiλññίάέ οά άθιέγδύδ άάόέέΰ άñ ÷ άβá ñδειβόάυι οίω FreeBSD, άέά ίά λδñÝόάόά ίά άάέάόάόδPόάόά ούόόΰ οί ρÝι άάόέέυ όγόόçιά. Άίçiλññίάέ, άέά δññΰάάέñιά, οç άΰόç ÷ ñçόόβι έάέ ñΰάυι ÷ ñçόόβι οίω FreeBSD. Έΰεά οίñΰ θίω δññίόδβέάόάέ Ýίάδ ρÝιτ ÷ ñPόόçδ όόόδΠιάοίτδ P ίέά ρÝά ñΰάά ÷ ñçόόβι, οί άΠιά installworld οçδ άίάάΰειέοçδ έάññάβ υόέ Ý ÷ άόά Pάç ñδειβόάέ οίωδ ρÝιτδ ÷ ñPόόάδ P δέδ ρÝάδ ñΰάάδ. Άδού άέñέάβδ έΰίάέ οά άδού οί όçiάβι οί άñάάέάβι mergemaster(8).

6. make installworld

Οί άδύιññί άΠιά άβίάέ ίά άάέάόάόδPόάόά οί άίçiλññιÝι άάόέέυ όγόόçιά άδύ οίί έάόΰειάι /usr/obj. Ιάδΰ άδύ άόόυ Ý ÷ άόά δέÝι Ýίά ρÝι δδñΠίά έάέ Ýίά άίçiλññιÝι άάόέέυ όγόόçιά, οί ιθιβι όάέñέΰάέ ίά οίί ρÝι δδñΠίά.

7. mergemaster

ίά άδύ οά όάέάόάβá άΠιάόά άβίάέ ç άίάάΰειέοç ούι άñ ÷ άβύι ñδειβόάυι οίω όόόδΠιάοίτδ. Οί άñάάέάβι mergemaster(8) λδññάβ ίά οάό άιçέPόάέ οά άδού οί άΠιά, άοίγ άίçiλññίάέ οά άñ ÷ άβá ñδειβόάυι έñάόβιόάό έάέ ιθιέάόάPθιόά οίθέέÝδ άέέάάÝδ Ý ÷ άόά έΰίάέ όοι όγόόçιΰ οάό.

8. ΆδάίάέέέιPόάά οί όγόόçιά.

Ιέά όάέάόάβá άδάίάέέβιçοç οίω όόόδΠιάοίτδ οάό άίάόόάέβάέ υόέ οί όγόόçιά ίάέέίΰάέ ίά οί ρÝι δδñΠίά, οί άίçiλññιÝι άάόέέυ όγόόçιά έάέ οά έάέίγñéά άñ ÷ άβá ñδειβόάυι.

Άί ç άίάάΰειέοç θίω έΰίάόά άβίάέ άδύ ίέά Ýέαιόç οίω FreeBSD οά ίέά θεί έάέίγñéά Ýέαιόç οίω βάέίω έέΰαιό άίΰδδóιçδ, δ. ÷. άδύ 7.0 οά 7.1, ούόά ίάñέέΰ άδύ οά άΠιάόά άόδP οçδ άέάάέέάόβáδ λδññάβ ίά ιç ÷ ñάέΰάειόάέ άοίγ άβίάέ έέάυδóññί δέέάίυ ίά όόίάίόPόάόά άόοιάάόυδόçόάδ ίάόάίγ οίω ίάόάάέυδóέόόP όόόδΠιάοίτδ, οίω δδñΠίά, οίω άάόέέιγ όόόδΠιάοίτδ έάέ ούι άñ ÷ άβύι ñδειβόάυι. Ç άίάάΰειέοç οά όÝóίέάδ δññέδθPόάέδ, ίάόάίγ άγí minor άέάυόάυι οίω FreeBSD, βόυδ λδññάβ ίά άβίάέ έάέ ίά οçi δάέέυδóññί άέάάέέάόβá: δñÝ ÷ ιίόάάδmake world έάέ ýóδάñά ίάόάάέυδóβάειόάόά έάέ όδPññίόάδ Ýίά ρÝι δδñΠίά.

¼όάί υιύδ άίάάάειβόάόά οί FreeBSD ίάόάίγ major άέάυόάυι, έάέýόáñά ίά ÷ ñçόέίθιέPόάάά οç άέάάέέάόβá θίω δññέññΰοίτδ άάβ. Άέέεβδ λδññάβ ίά άίόέίάδύδδβόάόά δññίάεΠιάόά άβόά έάόΰ οç άέΰñέάέά οçδ άίάάΰειέοçδ P άοίγ Ý ÷ άέ δέÝι ιειθέçññέάβ.

Έΰθιέάδ άδύ δέδ άίάάάειβόάέδ (δ. ÷. άδύ ίέά Ýέαιόç 4.x οά 5.0) λδññάβ ίά άδάέόιγί ίάñέέΰ ÷ άέñιέβιçόά άΠιάόά (υδύδ οί ίά ίάόάέέίPόάόά P ίά όάPόάόά όδάέάέñέιÝίά άñ ÷ άβá δñέι οί άΠιά installworld). Δñέι άδύ έΰεά άίάάΰειέοç άέάάΰόόά δññίόάέδέέΰ δέδ ιάçάβáδ όόι άñ ÷ άβι /usr/src/UPDATING· άέάέέΰ δέδ ιάçάβáδ όόι όÝέιτδ οίω άñ ÷ άβιτδ, ιέ ιθιβáδ δññέññΰοίτδ άίάέόδέέΰ οçi δññίόάέίυιάιç άέάάέέάόβá άίάάΰειέοçδ.

ΆόδP ç άέάάέέάόβá άίάάΰειέοçδ άίάέβόάόάέ έάέ άέññέβιáόάέ έάέβδ ιέ δññίάññάόέόόÝδ οίω FreeBSD άίάέάέýδθιόί έάέίγñéάδ άίάñδPόάέδ ίάόάίγ ούι όόόάόέέβι οίω όόόδΠιάοίτδ P έΰñιόί άέññέβόάέδ άέά ίά άθιόýάιόί άόοιáάόυδóçόάδ ίάόάίγ ούι άέάόññάδέέβι δθιόόόçιΰδύι. Άέδβάειτδ υόέ οά έάίδñέέΰ άΠιάόά οçδ άέάάέέάόβáδ θίω δññέññΰόάόάέ άάβ άά έά άέέΰñιόί θιέγ άέά άñέάδύ έάέññυ δέÝιι.

Άίάέάόάέάέβññίόάό υέά οά άΠιάόά οά ιθιβá δññέññΰοίτδ δññάδΰίυ, ç δññίόάέίυιάιç άέάάέέάόβá άίάάΰειέοçδ οίω FreeBSD άδύ οίί δçάάβι έβάέέά οίω όόόδΠιάοίτδ άβίάέ:

```
# cd /usr/src
# make buildworld
# make buildkernel
```


ἵαδὸ δὸδεῦδὸ ÷ ñΠρόδος ἐὰ ἐΨεῖς δεῖαίβδὸ ἵα αἰδέανῶθῆς δεῖο ἄνῃῶδὸ CFLAGS ἐπὶ NO_PROFILE ἀδὸ οἱ ἄñ ÷ ἄβι /usr/share/examples/etc/make.conf οἱ /etc/make.conf ἀθάεῖβῖδὸ δᾶδὸ ÷ ñῖῖ ἐπὶ οἱ ὄγῖαῖεῖ οἱ ὄ ÷ ἱεῖβῖδ.

Ἀἵαδὸ ὄα ἐπὶ δεῖο Ἰεῖαδὸ ἱαδᾶῖεῖδὸ (COPTFLAGS, NOPORTDOCS ἐ.ἱ.ε.) ἐπὶ ἀδῖοῖαδὸ αἰ ὄ ÷ ἄδῖαῖεῖδὸ ἱα οἱ ἀδεῖδὸ οἱ ἄεῖα ὄαδ ἀδῖοῖεῖα.

25.7.4 Ἀρχὶ ἰαῖβῖδὸ δᾶ ἄñ ÷ ἄβᾶ οἱ /etc

Ἰ ἐαδὸ Ἰεῖαδὸ /etc δᾶñεΨ ÷ ἄε ἱαῖ Ἰεῖ ἱΨῖδὸ οἱ δῆçῖῖῖῖῖῖῖ ἱγῖεῖδὸ οἱ ὄδὸδῖαδὸ ὄαδ, ἱδὸδὸ ἀδῖδὸ ἐπὶ scripts δῖο ἀεῖδῖαῖεῖδὸ ἐαδὸ ὄç ἱεῖβῖδὸ οἱ ὄδὸδῖαδὸ. Ἰᾶñεῖ ἄδὸ δᾶ scripts ἀδὸ ἄεῖ Ἰεῖ ἄδὸ Ἰεῖαῖεῖδὸ ὄ Ἰεῖαῖεῖδὸ FreeBSD.

Ἰñεῖ Ἰῖα ἄδὸ ὄ ἄñ ÷ ἄβᾶ ἱδῖβῖδὸ ÷ ñçῖῖῖῖῖῖῖ ἱγῖεῖδὸ ἀδῖδὸ ἐαδὸ ὄç ἱεῖçῖῖῖῖ ÷ ñΠρόδ οἱ ὄδὸδῖαδὸ. Οἱ /etc/group ἱβῖῖ Ἰῖα ἄδὸ ἄδὸ.

÷ ἱοῖ ὄδῖῖῖῖ δᾶñεῖδῖαδὸ ὄοῖ δᾶñᾶεῖῖ, ἱδῖδὸ οἱ make installworld ἱγῖῖῖ ἄδὸ δñεῖ ὄç ἱδᾶñç ὄδᾶῖῖῖῖῖῖ ἱγῖῖ ἱῖῖῖ ÷ ñçῖῖῖῖ (usernames) Π ἱῖῖῖ (groups). Ἐαδὸ ὄç ἱεῖῖῖῖῖῖ ὄç ἱῖῖῖῖῖῖ ὄδᾶ ἱῖῖῖῖῖῖ ὄδᾶ ἱῖῖῖῖῖ ÷ ñΠρόδ Π ἱῖῖῖ ἱα ἱç ὄδῖῖ ÷ ἱ. Ἀδὸ ἱç ἱçῖῖῖῖῖῖ ὄδᾶ ἱῖῖῖῖῖ ὄç ἱεῖῖῖῖῖῖ. ὄ ἱῖῖῖῖῖ δᾶñεῖδῖαδὸ, οἱ make buildworld ἐὰ ἱῖῖῖῖ ἱ ὄδῖῖ ÷ ἱοῖ ἱδῖῖ ἱ ἱ ÷ ñΠρόδ Π ἱῖῖῖ.

Ἰεῖ ὄΨῖεῖ δᾶñῖδῖδὸç δᾶñῖδῖῖῖῖῖ ἱδᾶ ἱδῖῖῖῖ ἱ ÷ ñΠρόδ smmsp. Ç ἱεῖῖῖῖῖῖ ἱῖῖῖῖῖῖ ἱδῖῖῖ ÷ ἱῖ ὄ ἱῖῖῖ ÷ ñΠρόδ, ὄç ὄδᾶῖ Π δῖο οἱmtree(8) δñῖδῖῖῖῖ ἱα ἱçῖῖῖῖῖῖ ἱῖ ἱαδὸ ἱῖῖῖ /var/spool/clientmqueue.

Ç ἱγῖδὸ ἱβῖῖ ἱα ἱεῖδᾶΨῖδὸ οἱ mergemaster(8) ὄ ἱαδὸ ὄδᾶç δñῖῖῖῖῖῖῖῖ, ἱβῖῖῖῖ ὄç ἱδῖῖῖῖ -p. Ἀδὸ Π ἐὰ ὄδᾶῖῖῖῖ ἱῖῖ ὄ ἄñ ÷ ἄβᾶ δῖο ἱβῖῖῖ ἱδᾶñᾶβῖδῖῖ ἱεῖ ὄç ἱδῖῖῖ ÷ βᾶ ἱεῖδῖῖῖῖ δῖο buildworld Π οἱ installworld. Ἀἱ Ç Ἰεῖαῖεῖδὸ οἱ mergemaster δῖο Ψ ÷ ἄδᾶ ἱβῖῖῖ δᾶεῖ ἱεῖ ἱῖ ὄδῖῖῖῖῖῖ ὄ -p, ÷ ñçῖῖῖῖῖῖ ὄç ἱῖῖ Ἰεῖαῖεῖδὸ ἄδὸ οἱ ἱῖῖῖῖ ὄδᾶ ἱçῖῖῖῖ ἱῖῖῖ ἱδᾶ ὄç ἱεῖδᾶΨῖδὸ ἱεῖ δñῖδῖ ὄῖῖῖ:

```
# cd /usr/src/usr.sbin/mergemaster
# ./mergemaster.sh -p
```

ὄδᾶῖῖῖῖ: Ἀἱ ἱεῖῖῖῖῖῖ ἱεῖῖῖῖῖῖ δᾶñᾶῖῖῖῖῖ, ἱδῖῖῖῖ ἱα ἱεῖῖῖῖῖ ὄ ὄγῖδῖῖ ὄαδ ἱεῖ ἱα ἱῖῖῖ δῖεῖ ἄñ ÷ ἄβᾶ ἱῖῖῖ ὄç ἱῖῖῖ δῖο ἱδῖῖῖῖῖῖ ἱ ἱεῖῖῖῖῖῖ:

```
# find / -group GID -print
```

Ç δᾶñᾶδῖῖ ἱῖῖῖ ἱα ὄαδ ἱῖῖῖῖ ἱεῖ ὄ ἄñ ÷ ἄβᾶ ὄ ἱδῖῖῖ ἱῖῖῖ ὄç ἱῖῖῖ GID (ἱδῖῖῖῖ ἱα ἱῖῖῖ ἱῖῖῖ ἱῖῖῖῖῖ ἱῖῖῖῖῖῖ ὄç ἱῖῖῖ).

25.7.5 ἱαδᾶῖῖῖῖ ὄ Ἐαδὸ ὄδᾶç Ἀῖῖδ × ñΠρόδ

ἱδὸ δñῖῖῖῖ ἱα ἱαδᾶῖῖῖῖῖῖ ὄ ὄγῖδῖῖ ὄ ἱαδὸ ὄδᾶç Ἀῖῖδ ÷ ñΠρόδ. Ἀεῖδὸ ἄδὸ οἱ δñῖῖῖῖῖ δᾶñῖῖῖῖ ὄç ἱεῖῖῖῖ ἱῖῖῖῖῖῖ ὄ ÷ ὄçῖῖῖ, ç ἱδᾶῖῖῖῖῖῖ ὄ ὄδὸδῖαδὸ ἐὰ ἱδῖῖῖῖῖῖ ἱῖῖῖῖῖ ἱῖῖῖῖῖ ἱῖῖῖῖῖ ἱῖῖῖῖῖ ἱῖῖῖῖῖ ἱῖῖῖῖῖ, δεῖ ἱεῖῖῖῖῖῖ, ὄ ἄñ ÷ ἄβᾶ include ἐ.ἱ. Ἀἱ ὄ ἱεῖῖῖῖῖῖ ἱῖῖ ὄ Ἰῖ ὄγῖδῖῖ ὄ ἱῖ ἱῖῖῖῖῖ ὄ ἱῖῖῖῖῖ (ἐπὶ ἱεῖῖῖῖ ἱ ὄδῖῖ ÷ ἱοῖ ἱῖῖῖῖ ÷ ñΠρόδ ὄç ἱῖῖῖῖῖ ὄδᾶῖῖ), ὄ ÷ ἱῖῖ ἱεῖ ἱδᾶῖῖῖ.


```
# cd /usr/src
# make installworld
```

Όχιαβιός: Αί Υ ÷ άά έάεινβόάέ ιάόάάέçðÝò όόç ãñáìÞ áíδιέβι όιò make buildworld έά ðñÝðáέ ίά έάέινβόάόά όέò βάέάò ιάόάάέçðÝò έάέ όόç ãñáìÞ áíδιέβι όιò make installworld. Άόóυ άάί άβίάέ άðάñáβðçόά áεβέάέά άέά ὐέέάò άðέέιāÝò. Άέά ðáñὐάάέáιá, ç άðέέιāÞ -j άάί ðñÝðáέ ðιòΥ ίά ÷ñçόέιιðίέáβðά ίά όι installworld.

Άέά ðáñὐάάέáιá άί άέðáέÝóáðá:

```
# make -DNO_PROFILE buildworld
```

Έά ðñÝðáέ ίά άάέάόάόðÞóáðá όι άðιòÝέáóιá ÷ñçόέιιðίέβιόάò:

```
# make -DNO_PROFILE installworld
```

άέάóιñáðέέὐ όι make(1) έά ðñιòðáέÞóáέ ίά άάέάόάόðÞóáέ άέάέέιèÞέáò ίά profiling, ðέò ιðίβáò ὐιὐò άάί ιάόάάέὐòðβóáðά έáðὐ όç áέὐñέάέά όçð ðὐóçð make buildworld.

25.7.11 ΑίτσιάñÞóáð ¼όά Άñ ÷ áβá άάί ΑίτσιάñÞέçéáί áðὐ όι make installworld

Ç άðáίáιáόάάέÞóðέόç όιò άáóέέιΥ όóóðÞιáóιò άάί έά άίτσιáñÞóáέ ιñέóιΥίñò έáóáέὐιñòð (άέάέέὐòáñά όιòð /etc, /var έάέ /usr) ίά óá ίΥá Þ áέέάáιΥίá άñ ÷ áβá ñðέιβóáὐι.

Ι άðέιΥóáñιò ðñὐðιò áέá ίά άίτσιáñÞóáðά óá άñ ÷ áβá áððὐ áβίáέ ίά ÷ñçόέιιðίέÞóáðά όι mergemaster(8), άί έάέ ιðιñáβðά ίά όι έὐίáðά έάέ ÷ áέñιέβίççόά άί ðñιòέιὐðá. ¶ó ÷ áðá áðὐ όιñ ðñὐðι ðιò έá ðñιòέιÞóáðά, áááάέὐέáβðά ὐóέ Υ ÷ áðá ðὐñάέ áíðβáñáóι áóóáέáβáð όιò /etc óá ðáñβðòὐóç ðιò έὐðέ ðὐáέ óðñááὐ.

25.7.11.1 mergemaster

Όι áιççέçðέέὐ ðñὐáñáιíá mergemaster(8) áβίáέ Υίá Bourne script όι ιðιβι έá óáð áιççέÞóáέ ίά έáέιñβóáðά ðέð áέáóιñÝð ιáðáίΥ ðὐι ááέáðáóççιΥίñι όóι /etc άñ ÷ áβὐι ñðέιβóáὐι, έάέ ðὐι áíðβóðιέ ÷ ὐι óóι áΥίóñι ðçááβιò έÞáέέá óóι /usr/src/etc. ΆððÞ áβίáέ έάέ ç óðιέóðÞιáίç έΥóç áέá ίά άίτσιáñÞóáðά óá άñ ÷ áβá ñðέιβóáὐι όιò óóóðÞιáóιò ιá ðð ÷ ὐι áέέááÝð ðιò Υ ÷ ιòι áβίáέ óóιñ ίΥι ðçááβι έÞáέέá.

Άέá ίά ιáέέιÞóáðά, áðέÞð áñὐððá mergemaster óóç ðñιòñιðÞ όçð áñáìÞð áíδιέβι έάέ ðáñáέιñέιòèÞóðá όçç έáέÞð έáέóιòñááβ. Όι mergemaster έá áçιέιòñáÞóáέ Υίá ðñιòὐñέñὐ ðáñέáὐέέιñ root, áðὐ όι / έάέ έὐð, έάέ έá όι ááιβóáέ ιá áέὐóιñά άñ ÷ áβá ñðέιβóáὐι όιò óóóðÞιáóιò. ðáέóá έá áβίáέ óÝáέñέóç áððÞι ðὐι άñ ÷ áβὐι ιá óá áíðβóðιέ ÷ á ðιò áñβóέιñóáέ Þáç ááέáðáóççιΥίá óðι óÝóççιá óáð. Όðι óçιáβι áððὐ, έá óáð ááβιáέ óá άñ ÷ áβá ðιò áέáóÝñιòι ιá ññòÞ diff(1), ὐðιò ιέ áñáìÝð ðιò Υ ÷ ιòι ðñιòðιðίέççáβ Þ áβίáέ ίΥáð έá óáβñιíóáέ ιá Υίá +, áñÞ ιá όι - έá óáβñιíóáέ ιέ áñáìÝð ðιò áβðá áóáέñιΥίóáέ áíðáέÞð Þ ðιò áíðέέáέββóáíóáέ áðὐ ιέá ίΥá áñáìÞ. Άáβðá όç óáέβáá manual όιò diff(1) áέá ðáñέóóὐðáñáð ðέççñιòñβáð ó ÷ áðέέὐ ιá όç óÝíóáίç όιò diff(1) έάέ áέá όιñ ðñὐðι ιá όιñ ιðιβι óáβñιíóáέ ιέ áέáóιñÝð ιáðáίΥ ðὐι άñ ÷ áβὐι.

Όι mergemaster(8) έá óáð ááβιáέ Υðáέóá έὐέá άñ ÷ áβι ðιò ðáñιòóέὐáέ áέáóιñÝð, έάέ óóι óçιáβι áððὐ έá Υ ÷ áðá όçç áðιáóὐóççόá áβðá ίá áέááñὐðáðά όι ίΥι άñ ÷ áβι (όι ιðιβι áíáóÝñáóáέ ὐð ðñιòὐñέñὐ άñ ÷ áβι), áβðá ίá ááέáðáóóðÞóáðά όι ðñιòὐñέñὐ άñ ÷ áβι ÷ ὐñβð ίá έὐίáðά óá áððὐ έáιέὐ áέέááÞ, áβðá ίá óðá ÷ ὐιáÝóáðά ðέð áέέááÝð ðὐι áγί άñ ÷ áβὐι, Þ ðÝέιò ίá ίáíáááβðá ðέð áέáóιñÝð ιÝóὐ όçð diff(1).


```
# mkdir /var/tmp/root
# cd /usr/src/etc
# make DESTDIR=/var/tmp/root distrib-dirs distribution
```

Ïé ðáñáðÛíù áíñòéÝð éä áçìéíññáðóíñ ðçí äðáéóíýíáíç áñÞ éäóáéúíññ éäé éä áäéáóáóðóíñ ðá áñ÷áßá. ÌááÛëí ìÝñíò òíñ ððíéáóáéúíñ ðíò Ý÷íñ áçìéíññáçèáß èÛòù áðu òíñ /var/tmp/root áßíáé Ûäáéíé, éäé ðñÝðáé íá áéáññáóíýí. Ì áðéíýóáññò ðññðíò áéá íá áßíáé áðòù, òáßíáðáé ðáñáéÛòù:

```
# cd /var/tmp/root
# find -d . -type d | xargs rmdir 2>/dev/null
```

Áðòù éä áéáññÛðáé ùéíðò òíòð Ûäáéíòð ððíéáóáéúíññ. (Ç Ýñíññò òóÛéíáóíð áíáéáóáðéýíáðáé òðí /dev/null þðá íá íçí ðíòáíßáéíñðáé òðçí ðíùíç ðñíñéáíðíéðóáéð áéá éäóáéúíññ ðíò áññ áßíáé Ûäáéíé.)

Ôþñá, í /var/tmp/root ðáñéÝ÷áé ùéá ðá áñ÷áßá ðíò éä ðñÝðáé íá òíðíéáðçèíýí òá éäóÛéççéäð èÝóáéð èÛòù áðu òíñ /. Éä ðñÝðáé ðþñá íá áéáðñÝíáðá éäéÝíá áðu áðòÛ ðá áñ÷áßá, éäé íá éäéíñßóáðá ðùð éäéÝíá áðu áðòÛ áéáóÝñáé áðu òí áíðßóðé÷í ððÛñ÷í (áäéáóáóðçíÝñ) áñ÷áßí.

Óçíáéððá ùðé èÛðíéá áðu ðá áñ÷áßá ðá ðíðá Ý÷íñ ðíò áäéáóáóðáéáß òðíñ /var/tmp/root Ý÷íñ ðá áñ÷éêÞ “.”. Óç òééáíÞ ðíò áñÛóíñðáé áðòÝð ðé áñññÝð, ðá ìíñá áñ÷áßá òá ðíðá òðíñáßíáé áðòù áßíáé ðá áñ÷áßá áééßíççðð òíò éäéýíñð òðíñ éäóÛéíññ /var/tmp/root/ éäé /var/tmp/root/root/, áí éäé ððíñáß íá ððÛñ÷í éäé Ûééá (áíÛéíñá ìá òí ðùðá áéááÛæáðá òí éáßíáñ). Ááááéúèðáðá ùðé ÷ñçóéíñðíéáßðá ðçí áíññÞ 1s -a áéá íá ðá ááßðá ùéá.

Ï áðéíýóáññò ðññðíò áéá íá òðáéññíáðá áýí áñ÷áßá, áßíáé íá ÷ñçóéíñðíéáßðá ðçí áíññÞ diff(1):

```
# diff /etc/shells /var/tmp/root/etc/shells
```

Ç ðáñáðÛíù áíññÞ éä òáð ááßíáé ðéð áéáóíñÝð ìáðáíý ðíò áñ÷áßíò /etc/shells éäé ðíò ðÝíò áñ÷áßíò /var/tmp/root/etc/shells. ×ñçóéíñðíéáßðá ðéð áéáóíñÝð áðòÝð áéá íá áðíòáóßóáðá áí éä ðñÝðáé íá òá÷á÷áéúíññ ðéð áééááÝð ðíò Ý÷íñ èÛíáé, Þ áðéð íá áíðéáñÛðáðá òí ðáééú òáð áñ÷áßí ðÛíù áðu òí ðÝí.

ÐñíòéÝðáðá ðçí Çíáññíçíßá òðí ¼íñá ðíò ÌÝíò Root Éáóáéúíññ, (/var/tmp/root) çðá íá ððíñáßðá Áýéíéá íá Óðáéññíáðá ÁéáóíññáðééÝð Áéäúóáéð ìáðáíý ðíòð: Áí ìáðááéúððßæáðá ò÷íÛ òí ááóééú óýóðçíá, éä ðñÝðáé áðßóçð íá áíçíáññíáðá òð÷íÛ òíñ éäóÛéíññ /etc, òí ððíñáß ððíñáß íá áßíáé áññ÷éçðééú.

ððíñáßðá íá áðéðá÷ýíáðá áðòÞ ðç áéááééáóßá, ðçñíðáðá Ýíá áíðßáñáðí ðíò ðáéáððáßíò òáð áééááíÝíñí áñ÷áßí ðá ððíñá òðá÷áéúíññ òðíñ éäóÛéíññ /etc. Ç ðáñáéÛòù áéááééáóßá éä òáð áððáé ìéá éáÝá áéá òí ðùð ððíñáß íá áßíáé áðòù:

- 1. Ìáðááéúððßóðá òí ááóééú óýóðçíá ùðò èÛíáðá òðíÞèùð. ¼ðáí èÝéáðá íá áíçíáññóáðá òíñ /etc éäé ðíòð Ûééíòð éäóáéúíññ, áððá òðíñ éäóÛéíññ ðñíñéóíñý Ýíá ùíñá ááóéóíÝíñ òðçí ðñÝ÷íðá çíáññíçíßá. Áí òí èÛíáðá áðòù òðéð 14 Óááñíðáññíò 1998, éä áñÛðáðá èÛðé òáí òí ðáñáéÛòù:

```
# mkdir /var/tmp/root-19980214
# cd /usr/src/etc
# make DESTDIR=/var/tmp/root-19980214 \
  distrib-dirs distribution
```

- 2. Óðá÷áéúíññ ðéð áééááÝð áðu áðòù òíñ éäóÛéíññ, ìá òíñ ðññðí ðíò ðáñéáñÛðáíá ðáñáðÛíù.

Ìçí áéáññÛðáðá òíñ éäóÛéíññ /var/tmp/root-19980214 ùðáí ðáéáéððáðá ìá ðçí ðáñáðÛíù áéááééáóßá.

- 3. ¼ðáí éäóááÛðáðá ðçí ðáéáððáßá Ýéáíóç ðíò ðçááßíò éðáééá éäé òíñ ìáðááéúððßóáðá ðáíÛ, áéíéíðéððá òí áßíá 1. Áðòù éä òáð áððáé Ýíá éäóÛéíññ ðíò ððíñáß íá ðíñÛæáðáé /var/tmp/root-19980221 (áí áíÛíáðá òðéð áýí ìáðááéúððßóáéð ðáñáíáÛééáðáé áéÛóðçíá ìéáð áááñÛááð).

4. Δημιουργήστε αρχείο με το όνομα `diff(1)` που θα περιέχει τις αλλαγές που έχετε κάνει:

```
# cd /var/tmp
# diff -r root-19980214 root-19980221
```

Όσοι έχουν εγκαταστήσει FreeBSD σε άλλους δίσκους ή σε άλλους υπολογιστές, πρέπει να δημιουργήσουν αρχείο με το όνομα `diff(1)` που θα περιέχει τις αλλαγές που έχετε κάνει. Για να δημιουργήσετε το αρχείο, εκτελέστε:

5. Δημιουργήστε αρχείο με το όνομα `diff(1)` που θα περιέχει τις αλλαγές που έχετε κάνει:

```
# rm -rf /var/tmp/root-19980214
```

6. Δημιουργήστε αρχείο με το όνομα `diff(1)` που θα περιέχει τις αλλαγές που έχετε κάνει:

Δημιουργήστε αρχείο με το όνομα `diff(1)` που θα περιέχει τις αλλαγές που έχετε κάνει:

```
# mkdir /var/tmp/root-`date +%Y%m%d`
```

25.7.12 Δημιουργία αρχείου

Το αρχείο `diff(1)` που δημιουργήσατε, θα χρησιμοποιηθεί για να δημιουργηθεί το αρχείο `diff(1)` που θα περιέχει τις αλλαγές που έχετε κάνει.

```
# shutdown -r now
```

25.7.13 Δημιουργία αρχείου

Το αρχείο `diff(1)` που δημιουργήσατε, θα χρησιμοποιηθεί για να δημιουργηθεί το αρχείο `diff(1)` που θα περιέχει τις αλλαγές που έχετε κάνει.

Αν θέλετε να εγκαταστήσετε FreeBSD σε άλλους δίσκους ή σε άλλους υπολογιστές, πρέπει να δημιουργήσουν αρχείο με το όνομα `diff(1)` που θα περιέχει τις αλλαγές που έχετε κάνει. Για να δημιουργήσετε το αρχείο, εκτελέστε:

```
# cd /usr/src/usr.bin/file
# make all install
```

25.7.14 Δημιουργία αρχείου

1. Δημιουργήστε αρχείο με το όνομα `diff(1)` που θα περιέχει τις αλλαγές που έχετε κάνει:

Αν θέλετε να εγκαταστήσετε FreeBSD σε άλλους δίσκους ή σε άλλους υπολογιστές, πρέπει να δημιουργήσουν αρχείο με το όνομα `diff(1)` που θα περιέχει τις αλλαγές που έχετε κάνει. Για να δημιουργήσετε το αρχείο, εκτελέστε:

```
src/games/cribbage/instr.c
src/games/sail/pl_main.c
src/release/sysinstall/config.c
```


Όά àáìέέÛδ àñáìÛÛδ (έάέ áðòùð äáí áβίáέ éáúíáð ðìö éó÷-ýáé ðÛíóá), ç äéáñááóβá ðìö make buildworld
láðááæùðòβæáé ÌÛá áíðβáñáóá ááóέêþí áñááéáβùí (ùðùð óá gcc(1), éáέ make(1)) éáéþð éáέ òùí áéáέéìèèêþí
óðóðþíáðìð. þáέóá áâéáέéòðíóáέ áððÛ óá áñááéáβá éáέ ìé áéáέéìèèèêþò. Όά ÌÛá áñááéáβá éáέ áéáέéìèèèêþò
÷-ñçóέìðìέííóáέ Ûðáéóá áéá Ìá áðáíáíáòááæùðòβóìíóí òìðð ááðòìýð òìðð, éáέ áâéáéβòáíóáέ ÌáÛÛ. Ìεùèèçñì ðì óýóðçíá
(òì ìðìβì ðþñá ðáñéέáíáÛíáé éáέ óá óðíçέéóìÛíá ðñìáñÛìíáóá ÷-ñþóðç ùðùð ðì ls(1) Þ ðì grep(1))
áðáíáíáòááæùðòβæáðáέ ÷-ñçóέìðìέííóáð óá ÌÛá áñ÷-áβá òìö óðóðþíáðìð.

Άí áñβòéáòòá óðì ðáéáððáβì óðÛáέì, ðì ìðìβì éá ðì áñùñβæáðá έìéðÛέìíóáð ðçì Ûíñáì ðìö Û÷-áðá áðìèçéáýóáέ, áβίáέ
ó÷-áðééÛ áóóáέÛ Ìá éÛíáðá:

```
... fix the problem ...
# cd /usr/src
# make -DNO_CLEAN all
```

Ìá òìí ðñùðì áðòù äáí éá áíáέñÛóáððá ðçì áñááóβá ðìö Û÷-áé áβίáέ áðù ðì ðñìçáíýíáñì make buildworld.

Άí ááβòá ðì ìþíóìá:

```
-----
Building everything..
-----
```

óðçì Ûíñáì ðçð áíðìèþð make buildworld, òùðá áβίáέ ìÛεέìí áóóáέÛ Ìá ðñì÷-ùñþóáðá Ìá áðòù òìí ðñùðì.

Άí äáí ááβòá áðòù òì ìþíóìá, Þ áí äáí áβòóá óβáìñìð, òùðá áβίáέ éáéýðáñá Ìá éÛíáðá ðεþñç Ìáðááεþððéóç ðáñÛ Ìá
Ìáðáíέþíáðá áñáùðáñá.

5. ðùð ìðìñþ Ìá áðéóá÷-ýíù ðç Ìáðááεþððéóç ðìö ááóέéíý óðóðþíáðìð;

- ÁéðáéÛóðá ðçì óá éáðÛóóáóç áíùð ÷-ñþóðç.
- ÁÛεðá òìðð éáðáéùáìòð /usr/src éáέ /usr/obj óá áéáóìñáðééÛ óðóðþíáðá áñ÷-áβùí óá ìðìβì áñβóέìíóáέ éáέ óá
áéáóìñáðééíýð óðóέéíýð áβòéìðð. Άí áβίáέ áðíáðùí, áÛεðá áðòìýð òìðð áβòéìðð óá ÷-ùñéóðìýð áεááέðÛδ.
- Áέùíá éáéýðáñá, ìñέñÛóðá áððÛ óá óðóðþíáðá áñ÷-áβùí óá ðìέéáðèíýð áβòéìðð, ÷-ñçóέìðìέííóáð ðì ðñùáñáíá
íáþáçóçð ccd(4) (concatenated disk driver, íáþáçóçð óðíáíùìÛíùí áβòéúí).
- Άðáíáñáðìέííóáð ðì profiling (èÛóðá ðçì Ìáðááεèèþþ "NO_PROFILE=true" óðì /etc/make.conf). Άβίáέ ó÷-áäùí
óβáìñì ùðé äáí ðì ÷-ñáéÛæáóðá.
- Όðì áñ÷-áβì /etc/make.conf, èÛóðá ðì CFLAGS óá éÛðé ùðùð -O -pipe. Ç áâéðéóðìðìèèèçóç -O2 ÷-ñáέÛæáóáέ
áñéáðÛ ðáñéóóùðáñì ÷-ñùíí, éáέ ç áéáóìñÛ áðùáìíóçð Ìáðáíý -O éáέ -O2 áβίáέ óðìþèùð áìáèèðÛá. Όì -pipe
áðéóñÛðáέ óðìí Ìáðááéùððéóðþ Ìá ÷-ñçóέìðìέííóáέ pipes áéá áðééìéúííá áíðβ áéá ðñìóùñέíÛ áñ÷-áβá. Άðòù
éáðáíéþíáé ðáñéóóùðáñç ìþìç, áééÛ ÷-ñçóέìðìέííáβ έέáùðáñì ðì óéèçñù áβòéì.
- ×ñçóέìðìέííóáð ðçì áðééìäþ -jn óðì make(1) þóðá Ìá áéðáéíýíóáέ ðáñÛεéèá ðìέéáðèÛð áéáñááóβáð
Ìáðááεþððéóçð. Άðòù óðìþèùð áñçèÛáέ áέùíá éáέ óá ðáñþððòóç ðìö Û÷-áðá ìç÷-Ûíçíá Ìá Ûíá áðáíáñááóðþ.
- Ìðñáβòá Ìá ðñìóáñðóáðá (Þ Ìá áðáíáðñìóáñðóáðá) ðì óýóðçíá áñ÷-áβùí óðì ìðìβì áβίáέ áðìèçéáðìÛí ðì /usr/src
Ìá ðçì áðééìäþ noatime. Άðòù áðìòñÛðáέ ðçì éáðááñáðþ çìáññçííáðð / þñáð ðñìóááçóçð óðì óýóðçíá áñ÷-áβùí.
ÉáðÛ ðÛóá ðéέáíùðçðá, äáí ÷-ñáέÛæáóðá áððþ ðçì ðèçñìòñííá Ûðóé éáέ áééèþðð.

```
# mount -u -o noatime /usr/src
```

Ðñïáéäïðïßçóç: Õï ðáñÛäáéáíá ðñïúðïëÛóáé ùðé Û÷áðá ðï /usr/src óðï äéêú ðïö óγóðçíá áñ÷áßúí. Áí áðóðú äáí óðíááßíáé (áí áßíáé ìÛñïð ðïö /usr äéá ðáñÛäáéáíá) êá ÷ñáéáóðáß íá ÷ñçóéïðïëðóáðá áðóðú ðï óçíáßí ðñïóÛñóçóç, êáé ù÷é ðï /usr/src.

- Ìðñáßðá íá ðñïóáñðóáðá (P íá áðáíáðñïóáñðóáðá) ðï óγóðçíá áñ÷áßúí ðïð ðáñéÛ÷áé ðï /usr/obj ìá óçí áðééíáP async. Ìá ðïí ðñúðï áðóðú, ïé äááñáðÛð óðï äßóéï êá äßñïðáé áóγá÷ññá. Ìá Ûééá êúáéá, ïé äááñáðÛð óáßíáðáé ùðé ïééçññïðáé Ûíáóá, áñç ç ðñááíáðééP äááñáðP óðï äßóéï äßíáðáé éßáá äáððáñúéáððá áñáúðáñá. Áðóðú áðéðñÛðáé óçí ïááïðïßçóç ðúí äááñáðñï, ðï ïðïßí ìðñáß íá ðñïóÛñáé áñáíáðééP äáéðßúóç áðúáïóçð.

Ðñïáéäïðïßçóç: Ìá Û÷áðá ððúðéí óáð ùðé áððP ç áðééíáP ìðñáß íá êÛíáé ðï óγóðçíá áñ÷áßúí óáð ðïéγ ðéí áðáßóèçðï. Ìá óçí áðééíáP áððP, ððÛñ÷áé áðïçíÛíç ðééáíúðçðá ðï óγóðçíá áñ÷áßúí íá áñáéáß óá ìç áðéóéáðÛóéìç êáðÛóðáóç áí ððÛñíáé äéáéïðP ïáγíáðïð.

Áí ðï óγóðçíá áñ÷áßúí ðáñéÛ÷áé ìúí ðï /usr/obj, ðï ðáñáðÛíú äáí áßíáé ðñúáéçíá. Áí ùóðúðï Û÷áðá êáé Ûééá ðïéγðéíá äááñÛíá óðï ßáéï óγóðçíá áñ÷áßúí, óééïðñáððáßðá ùðé Û÷áðá áíçíáñúíÛíá áíðßáñáðá áðóáéáßáð ðñéí áíáñáðïëðóáðá áððP óçí áðééíáP.

```
# mount -u -o async /usr/obj
```

Ðñïáéäïðïßçóç: ¼ðúð êáé ðñïçáïðïÛíúð, áí ðï /usr/obj äáí áßíáé óγóðçíá áñ÷áßúí áðú ìúí ðïð, áíðééáðáððóáðá ðï óðï ðáñÛäáéáíá ìá ðï ùííá ðïð ðñááíáðééïγ óçíáßíð ðñïóÛñóçóç.

6. Õé íá êÛíú áí êÛóé ðÛáé óðñááÛ;

Õéáñðáððáßðá ùðé ðï ðáñéáÛééïí óáð äáí Û÷áé ððñáßíáðá áðú ðñïçáïγíáíáð ìáðááéðððóáéð. Áðóðú áßíáé áñéáðÛ áðéï.

```
# chflags -R noschg /usr/obj/usr
# rm -rf /usr/obj/usr
# cd /usr/src
# make cleandir
# make cleandir
```

Ìáé, êá ðñÛðáé íá áéðáéÛóáðá ðï make cleandir äγï ðñÛð.

Áðáíáéééìðóáðá Ûðáéðá ùèç óç äéáéééáóßá, ìáééìðïðáð ìá ðï make buildworld.

Áí Û÷áðá áéïúá ðññáéðíáðá, óðáßéðá ðï ìðïðíá êÛéïðð êáé óçí Ûñáï ðïð uname -a óðçí çéáéðññíééP éßðá äáíééðí áñúððóáñí ðïö FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>). Ìá áßóðá ðññáðïéíáðïÛíé íá áðáíðóáðá áðéðéÛíí áñúððóáéð ó÷áðééÛ ìá óçí äáéáðÛóðáóç óáð!

25.8 ÁéáãñáöÞ Ðáñù÷çìÿíuí Áñ÷áßuí, Êáoáëüãuí êáé ÁéâëéìèçêÞ

ÊáoÛ ðçí óðíá÷Þ áíÛðððíç ðìö FreeBSD áßíáé öðóéìéíáéëü êÛðìéá áñ÷áßá êáoÛ êáéñíÿð íá ÷áñáéðçñßæííðáé ùð ðáñù÷çìÿíá. Áððü ìðñáß íá óðíááß áí ÿé êáéðìðñáßð ðìö ðáñáß÷áí ðëìðìéíííðáé ðëÿíí áéáöíñáðéëÛ, áí ÿí ãñéèìùð ÿéáíóçð ðçð áéáéëìèçêÞ ÿ÷áé áéëÛíáé Þ áéüíá êáé áí ÿ÷áé áéáãñáöáß ÿñéóðéëÛ áðü ðì óÿóðçíá. Óðá áñ÷áßá áððÛ ðáñééáíáÛííðáé áðßóçð áéáéëìèçêÞ êáoÛëìéíé ðìö ðñÿðáé íá áéáãñáöíí ùðáí áßíáðáé áíááÛëìéóç ðìö óðóðÞíáðìð. Òì ùðáëìð áéá ðì ÷ñÞóçç áßíáé ùðé ðì óÿóðçíá ðìö ááí ááíßæáé áðü ðáéëÛ áñ÷áßá ðá ÿðìßá êáoáéáíáÛííðì Û÷ñçððì ÷Þñì óðì ÿÿí ãðìéáðéáððóçð êáé óðì backup. Áðéðñüóèáðá, áí êÛðìéá ðáéëÛ áéáéëìèçêÞ áß÷á ðñíáéÞíáðá óðáéáññüóçðáð Þ áóðÛéáéáð éá ðñÿðáé íá ðçí áíáááëìßðáðá áéá íá êñáðÞðáðá ðì óÿóðçíá óáð óðáéðáññü êáé áóðáéÿð. Óá áñ÷áßá, ÿé êáoÛëìéíé êáé ÿé áéáéëìèçêÞ ðìö êáññíííðáé ðáñù÷çìÿíáð óáßííðáé óðì /usr/src/ObsoleteFiles.inc. Ìé ðáñáéÛðù ÿäçáßáð éá óáð áìçèÞðìðí íá áéáãñáöáðá áððÛ ðá áñ÷áßá êáoÛ ðçí áéáéëìéóçð ðìö óðóðÞíáðìð.

Óðìéÿðìðíá ùðé ÷ñçóéìðìéáßðá ðá áÞíáðá ðìö ðáñéáñÛííðáé óðì ÒìÞíá 25.7.1. ÌáðÛ ðçí áðéðð÷Þ áéðÿéóç ðçð áíðìèÞð make installworld êáé ðìö mergemaster ðìö áéìéìèáß, éá ðñÿðáé íá áéÿáíáðá áéá ðáñù÷çìÿíá áñ÷áßá êáé áéáéëìèçêÞ ùððð óáßíáðáé ðáñáéÛðù:

```
# cd /usr/src
# make check-old
```

Áí áñáéìíí ðáñù÷çìÿíá áñ÷áßá, ìðñáßðá íá ðá áéáãñáöáðá ÿá ðéð ðáñáéÛðù áíðìéÿð:

```
# make delete-old
```

Óðüááéíç: Ááßðá ðì /usr/src/Makefile áéá ðáñéóðüðáñáð áíáéáðÿñíðóáð áðééìáÿð ðçð make.

Áéá êÛëá áñ÷áßá ðìö éá áéáãñáöáß, éá óáð æçðçéáß íá áðéááááéÞðáðá ðçí áíÿñááéá. Ìðñáßðá íá ðáñáéáßðáðá ðçí áñÞðçóç êáé íá áðÞðáðá ðì óÿóðçíá íá áéáãñáöáé áððÛ ðá áñ÷áßá áððüíáðá ÷ñçóéìðìéííðáð ðçí ÿáðááéçðÞ ðìö make BATCH_DELETE_OLD_FILES ÿá ðìö ðññüðì ðìö óáßíáðáé ðáñáéÛðù:

```
# make -DBATCH_DELETE_OLD_FILES delete-old
```

Ðñíáéäìðìßçóç: Ç áéáãñáöÞ ðáñù÷çìÿíá áñ÷áßá, éá ðñíéáéÿóáé áðóéáéðìðñáßá ðüì áðáñííáÞì ðìö áíáééìèçêÞ íá ááóßæííðáé óá áððÛ. Áððü óðìááßíáé éáéáßðáñá ðá ðáééÿð áéáéëìèçêÞ. Óðéð ðáñéóðüðáñáð ðáñéððððáéð, éá ðñÿðáé íá áðáíáíáðááëüððßóáðá ðá ðñíáñÛííáðá, ports Þ áéáéëìèçêÞ ðìö ÷ñçóéìðìéííðáð ðçí ðáéëÛ áéáéëìèçêÞ ðñéíí áéðáéÿóáðá ðçí áíðìèÞÞ make delete-old-libs.

Ìðñáßðá íá áñáßðá ðñíáñÛííáðá ðìö áéÿá÷áí ðìö ðéð áíáñðÞðáéð ðüì éìéíü÷ñçóðüì áéáéëìèçêÞ ðçð ÓðëëíáÞ ðüì Ports, óðì sysutils/libchk Þ sysutils/bsdadminsceipts.

Ìé ðáñù÷çìÿíáð éìéíü÷ñçóðáð áéáéëìèçêÞ ðìö ðñíííí íá áçìéìðñáßðìð ðñíáéÞíáðá éüüð óðáéñííðáé ÿá íáÞðáñáð áéáüóáéð. Óá áððÿð ðéð ðáñéððððáéð, éá ááßðáé ÿçííáðá ùððð ðá ðáñáéÛðù:

```
/usr/bin/ld: warning libz.so.4, needed by /usr/local/lib/libtiff.so, may conflict with libz.so.5
/usr/bin/ld: warning: librpcsvc.so.4, needed by /usr/local/lib/libXext.so may conflict with librpcsvc.so.4
```

Áéá íá áðééÿóáðá ðÿðìéìð áßáíðð ðñíáéÞíáðá, áñáßðá ðìéíí port ááéáðÿóççóá ðçí áéáéëìèçêÞ:

```
# pkg_info -W /usr/local/lib/libtiff.so
```


ΈαöÜέαεί 26

DTrace

26.1 Όγίηος

Όι DTrace, άίυόóü άδβόçð ùð Dynamic Tracing, άβιάέ Υίά άñāέάβι ðι ίðιβι áíáððý ÷ èçèā áðu òçí Sun áέα ðίí áίðιðέóιü ðñίāέçíÜðüí áðuāίόçð óā óðóðΠιάóá ðίð ðñüēáέóάέ íá ÷ ñçóέίíðίέçèíýí Π ÷ ñçóέίíðίέçíýíóάέ Πäç óóçí ðāñāāüāΠ. Άái ðñüēáέóάέ áέα áñāέάβι áðίóóάέíÜðóóçð, áέέÜ áέα áñāέάβι áíÜέóóçð ðñāāíáóέέíý ÷ ñüííò, íā ðι ίðιβι íðíñýí íá áíðιðέóóίýí ðñίāέΠιάóá áðuāίόçð έάέ Üέέāð έάóáóóÜóáέð.

Όι DTrace άβιάέ Υίά έáðíÜóέí áñāέάβι profiling έάέ áέαέΥóáέ áíóððüóέáέü ðέΠèð ÷ áñāέóçñέóóέέπí áέα òçí áέÜāíúóç ðñίāέçíÜðüí ðίð óðóðΠιάóíð. Íðíñāβ άδβόçð íá ÷ ñçóέίíðίέçèāβ áέα íá áέðáέΥóáέ áðu ðñέí Υóίέíá scripts, íā óā ίðίβá íðíñāβóā íá áέíáóáέέāðέάβóā έáέýóāñā óέð áðíáðüðçðáð ðίð. Íέ ÷ ñΠóáð íðíñýí áέüíá íá áñÜøíðí έάέ óā áέέÜ ðίðð áíçèçóέέÜ ðñίāñÜííáóá, ÷ ñçóέίíðίέçíýíóáð òçí Άέπóóá D ðίð ðāñÝ ÷ áέ ðι DTrace, έάέ íá ðñíóáñíüóíðí íā áóðü ðίí ðñüðí ðι profiling óóέð áέέÝð ðίðð áíÜέέāð.

Άόíý áέαáÜóáðā áóðü ðι έáöÜέαεί, έá áíññæāðā:

- Όέ άβιάέ ðι DTrace έάέ ðέ áðíáðüðçðáð ðāñÝ ÷ áέ.
- Όέð áέαóíñÝð ðέíðιβçóçð íáðáíý ðίð DTrace ðίð Solaris έάέ ðίð FreeBSD.
- ðüð íá áíāñāíðίέΠóáðā έάέ íá ÷ ñçóέίíðίέΠóáðā ðι DTrace óðí FreeBSD.

ðñέí áέαáÜóáðā áóðü ðι έáöÜέαεί, έá ðñÝðāέ:

- Íá έáóáñíāβóā ááóέέÝð Υíñíέāð ðίð UNIX έάέ ðίð FreeBSD (ΈáöÜέαεί 4).
- Íá áβóðā áñίέέáέüíÝñüð íā óέð ááóέέÝð áέαέέέáóáð ñýέíέóçð έάέ íáðáāέπðóέóçð ðñíóáñíüóíÝñüð ððñΠíá (ΈáöÜέαεί 9).
- Íá áβóðā áñίέέáέüíÝñüð íā òçí áóöÜέáέ έάέ ðίí ðñüðí ðίð áóðΠ ó ÷ áðβæáðáέ íā ðι FreeBSD (ΈáöÜέαεί 15).
- Íá έáóáñíāβóā ðüð íðíñāβóā íá áíáέðΠóáðā ðίí ðçāāβι έπáέéā ðίð FreeBSD έάέ íá ðίí ÷ ñçóέίíðίέΠóáðā πðā íá áðāíáíáðáāέüðóβóáðā ðι óýóççíá óáð (ΈáöÜέαεί 25).

ðñíáέäíðίβçóç: Όç āāāñÝíç óðέāíΠ, ðι DTrace έáññāβóáέ üðέ άβιάέ óā ðáέñāíáóέέü óóÜáεί. ÍñέóíΥíáð áðέέíāÝð íðíñāβ íá ððíέāβðίíóáέ óā έáέðíðñāέέüðçðá, έάέ έÜðίέá ðιΠιάóá βóúð íá íç έáέðíðñāíýí έáέüέíð. Íā òçí ðÜñíāí ðίð ÷ ñüííò, íέ ðāñāðÜíü áðíáðüðçðáð έá έáññçέíýí Υóίέíáð áέα ÷ ñΠóç óā íç ÷ áίΠιάóá ðāñāāüāΠð, έάέ ç ðāñíýóá ðáέíçñβüóç έá áíáíāüέāβ πðā íá áíðέðñíóúðāýáέ áððΠ òçí έáóÜóóáçç.

26.2 ΆέάοϊñÝò óòçί Õëïðίßçòç

Άί έάέ ðί DTrace óòί FreeBSD άβίάέ άñέάòÛ ùñέί ίά άòòù ðίò Solaris, ððÛñ ÷ ðíí έÛðίέάò áέάοϊñÝò ðίò έά ðñÝðáέ ίά óέò άίçāßóίòίά ðñέί óòίá ÷ ßóίòίά. Ç ίάάάέýóάñç áέάοϊñÛ ðίò έά ðáñάóçñßóίòί ίέ ÷ ñßóóάò, άβίάέ ùòέ óòί FreeBSD ðί DTrace ðñÝðáέ ίά άíáñáïðίέçέάß ÷ áέññίέßίçòά. ÕðÛñ ÷ ðíí áέÛòïñάò άðέέíáÝò έάέ άñññßίáóά áέά ðίí ðññßίá ðίò ðñÝðáέ ίά άíáñáïðίέçέíýí ίßóá ðί DTrace ίά έάέóíòñάáß óúóòÛ. Έά άίçāßóίòίά άñáùóάñά άóòÝò óέò ñòèìßóáέò.

Ç άðέέíáß DDB_CTF ðίò ðññßίá ÷ ñçóέííðίέάßóáέ áέά ίά άíáñáïðίέßóáέ ðçί ððίóðññέίç ðññòßίáòίò ðùí áááñÝíùí CTF áðù ðίí ðññßίá έάέ óά άñññßίáóά ðίò. Õί CTF άβίάέ ðί Compact C Type format ðίò Solaris, ðί ίðίßί άíέòέάέßίáέ ίέά áέάóòùÝίç ññòß ðέçññíòñέßί áðίóóáέíÛòòóð (debugging), ùñέά ίά ðί DWARF έάέ óά stabs. ΆóòÛ óά áááñÝíá CTF ðññíóßèáίóáέ óóά áέóáέÝóέίá ìÝóù ðùí άñááέάßùí ctfcconvert έάέ ctfmerge. Õί άίççòçóέέù ðññáñáíίά ctfcconvert άñίçíáýáέ óά ðίßίáóά ðùí DWARF ELF ðίò ðáñέÝ ÷ ðíí ðέçññíòññáò debug (άçίέíòñáýíóáέ áðù ðί ίάóááέùòóέóòß), έάέ ðί ctfmerge óðá ÷ ùíáýáέ óά ðίßίáóά CTF έάέ ELF áðù óά άíóέέάßίáίá óά Ûέέά áέóáέÝóέίá ð éíέíù ÷ ñçóóáò áέάέέíèèέáð. ðáñέóóùòáñáò ðέçññíòññáò áέά ðçί άíáñáïðίßçòç ðùí ðáñάðÛíù ðòç ίάóááέßòóέóç ðίò ðññßίá έάέ ðίò óðóðßίáòίò ðίò FreeBSD, έά áíýíá ðáñάέÛòù.

Õòί FreeBSD έÛðίέίέ ðáññ ÷ áßò άβίάέ áέάοϊñáóέέíß óά ó ÷ Ýóç ίά ðί Solaris. Ì ðéí άίέίóçίáßùòίò άβίάέ ì ðáññ ÷ Ýáò dtmalloc ì ίðίßίò άðέòñÝðáέ ðί tracing ðίò malloc () άίÛέíáá ίά ðίí óýðí ðίò, óòίí ðññßίá ðίò FreeBSD.

Ìùí ì root ìðññáß ίά ÷ ñçóέííðίέßóáέ ðί DTrace óòί FreeBSD. Άóòù ó ÷ áòßæáòáέ ίά áέάοϊñÝò óòçί áóòÛέάέá, έάέðò ðί Solaris áέάέÝóáέ έÛðίέíòð áέÝá ÷ ðíò áóòÛέάέáò ÷ άίçέíý áðέðÝáíò, ίέ ίðίßίέ ááí ððÛñ ÷ ðíí áέùíá óòί FreeBSD. Άέά ðί èùáí áóòù, ç ÷ ñßóç ðçò óðóέáððò /dev/dtrace/dtrace áðááñáýáóáέ áóòóçñÛ áέά ùέíòð ðίòð ÷ ñßóóáò áέóòùò áðù ðίí root.

ÕÝέíò, ðί èíáέóίέέù DTrace άñßóέáóáέ óðù ðçί Ûááέá CDDL ðçò Sun. Ìðññáßòá ίά áέάáÛóáòá ðί έáßίáñ ðçò Ûááέáò Common Development and Distribution License óòί FreeBSD, óòί áñ ÷ áßí /usr/src/cddl/contrib/opensolaris/OPENSOLARIS.LICENSE ð ίά ðί áέάáÛóáòá online ðòç áέáýèðίóç <http://www.opensolaris.org/os/licensing>.

Ç Ûááέá ðóóέáóóέέÛ óçίáßίáέ ùòέ Ýíáò ðññßίáò FreeBSD ίά óέò άðέέíáÝò ðίò DTrace, άíáέíèíòέáß ίά άñßóέáóáέ óðù ðçί Ûááέá BSD. Ûòòùóί ðί CDDL áìðéÝέáóáέ ðç óóέáñß ðίò áβίáóáέ áέáññß ðùí άñññùÛòùí óά äóááέéß ññòß, ð ðç óóέáñß ðίò ðññòßííóáέ.

26.3 Άíáñáïðίßçòç ðçò Õðίóðññέίçò DTrace

Άέά ίά άíáñáïðίέßóáòá ðçί ððίóðññέίç áέά ðί DTrace, ðñíóέÝóóá óέò áέùέíòέáò áñáñÝò óòί áñ ÷ áßí ñòèìßóáùí ðίò ðññßίá:

```
options          KDRTRACE_HOOKS
options          DDB_CTF
```

Õçίáßùòç: Ìέ ÷ ñßóóáò ðçò áñ ÷ έóáέòííέέèðò AMD64 έά έÝέíòί ίά ðñíóέÝóóίòί ðçί áέùέíòέèç áñáñß óòί áñ ÷ áßí ñòèìßóáùí ðίò ðññßίá ðίò:

```
options          KDRTRACE_FRAME
```

Ç άðέέíáß áóòß ðáñÝ ÷ áέ ððίóðññέίç áέά ðç έáέòíòñáßá FBT. Õí DTrace ìðññáß ίά έáέòíòñáßóáέ έάέ ÷ ùññò áóòß. Ûòòùóί, έά ðáñÝ ÷ áέ ðáñέíñέóίÝίç ððίóðññέίç áέά function boundary tracing.

¼ëïð ï ðçääáβïð êþäééäð èá ðñÝðäé íá ìáðáäëùððéóðáβ ìáíÛ ìá ðéð äðéëïãÝð CTF. Áéá íá äβíáé áððü, ìáðáäëùððéóðáβ ìáíÛ ðï FreeBSD ÷ ñçóéïïðïéþíðáð:

```
# cd /usr/src
# make WITH_CTF=1 kernel
```

Ëá ÷ ñáéáóðáβ ìá äðáíáééëíþðáðá ðï óýóçíá.

ÌáðÛ óçí äðáíáééëíþçóç, èáé ìá ðïí íÝí ðñþíá ðïíðü Ûíí ðëÝíí óçç ìíþìç, èá ðñÝðäé íá ðñïéÝóáðá ððïóðñéíç äéá ðï éÝëðïð Korn. Áððü äðáéðáβðáé, èáêþð ðá äñáééáβá DTrace ðáñééáíáÛííðïí äéÛïíñá äíçççðééÛ ðñíáñÛííáðá ðá ïðíβá äβíáé äñáííÝíá ðá ksh. Áäéáðáðððá ðï port shells/ksh93. Ìðñáβðá äðβçð ìá äéðäéÝóáðá áððÛ ðá äñáééáβá èáé ìÝóóð ðïð shells/pdksh þ ðïð shells/mksh.

ÓÝëïð, áíáéðððá óçí ðñÝ÷íðá óáéñÛ äñáééáβíí DTrace. Ç ðáéäððáβá Ýéäíóç äéáðβéáðáé óççí ðïðïéáðá <http://www.opensolaris.org/os/community/dtrace/dtracetoolkit/>. Áéáðβéáðáé èáé ðñüäñáííá ääéáðÛðáðóçð, ðï ïðíβí äáí äβíáé ùððüðïí äðáñáβðçðïí ìá äéðäéÝóáðá ðñïééëíÝííð ìá ÷ ñçóéïïðïéþíðáðá ðá äñáééáβá.

26.4 × ñçóéïïðïéþíðáð ðï DTrace

Ðñéí ÷ ñçóéïïðïéþíðáðá ðéð éäéðïðñáβð ðïð DTrace, èá ðñÝðäé íá ððÛñ÷áé ç áíðβððïé÷ç ððóéäðþ. Áéá íá ðïíðððáðá ðç ððóéäðþ, èá ðñÝðäé íá äþðáðá óçí ðáñáéÛðü äíðïéþ:

```
# kldload dtraceall
```

Ëá ðñÝðäé íá Ý÷áðá ðëÝíí ððïóðñéíç DTrace. Áéá íá äáβðá ùéá ðá probes, èá ðñÝðäé íá äéðäéÝóáðá ùð äéá÷äéñéóðð ðçí ðáñáéÛðü äíðïéþ:

```
# dtrace -l | more
```

¼éç ç Ýíñáð ðáñíÛáé ìÝóóð ðïð äíçççðééíç ðñíáñÛííáððïð more, äéáðñáðééÛ äñþáíñá èá ððáñ÷áβééáð ðçí ðñïóðñéíþ ìíþìç ðçð ìèüíçð. Óðï óçíáβí áððü, èá ðñÝðäé íá èäññçéáβ ùðé ðï DTrace éäéðïðñáβ. Áβíáé ðëÝíí þñá ìá äíáðÛóíðíá áððþ ðç óáéñÛ äñáééáβíí.

Ç óáéñÛ ðüí äñáééáβíí äβíáé ìéá ððéëíþþ áðü Ýðïéíá scripts ðïð äéðäéíçíðáé ìá ðï DTrace þðá ìá ððééÝííðïí ðççñïðñáð ð÷áðééÛ ìá ðï óýóçíá. ÓðÛñ÷íðïí scripts ðïð äéÝá÷íðïí äéá áíééðÛ äñ÷áβá, ðç ìíþìç, ðç ÷ñþç ðçð CPU èáé ðñééÛ áéüñá. ÊÛíðá äíáàñþ ðüí scripts ìá ðçí áéüëíðçç áíðïéþ:

```
# gunzip -c DTraceToolkit* | tar xvf -
```

Ìáðáééíççéáβðá ððïí éáðÛéíáí ðïð ðá äðïððïðéÝóáðá ìá ðçí áíðïéþ cd èáé áééÛíðá ðá äééáéþíðáðá äéðÝéáðçð ðá ùéá ðá äñ÷áβá, ùððü ððá äñ÷áβá ìá ðá ìééñÛ äñÛííáðá, ðá 755.

Ëá ÷ ñáéáóðáβ ìá äβííðïí äééááÝð ððïí ðáñéá÷íáíí ðá ùéá ðá scripts. ¼ðá ðáñéÝ÷íðïí ðï /usr/bin/ksh èá ðñÝðäé íá äééá÷éíçí ðá /usr/local/bin/ksh, ðá Ûééá ðïð ðáñéÝ÷íðïí ðï /usr/bin/sh èá ðñÝðäé íá äééá÷éíçí ðá /bin/sh, èáé ðÝëïð áððÛ ðïð ðáñéÝ÷íðïí ðï /usr/bin/perl èá ðñÝðäé íá äééá÷éíçí ðá /usr/local/bin/perl.

Óçíáíðééü: Óðï óçíáβí áððü äβíáé óçíáíðééü ìá ððáíéðïíðïíðá ððïí áíááíþðçç ùðé ç ððïóðñéíç DTrace ððï FreeBSD äβíáé áðáêþð èáé ðáéñáíáðééþ. ÐñééÛ áðü áððÛ ðá scripts äáí èá èáéðïðñáþðïí, èáêþð äβíáé äβðá ðëý ðñïóáíáðïééðïíá ððï Solaris, þ ÷ ñçóéïïðïéþíç probes ðá ïðíβá äáí ððïóçñíðéíðáé ðç ääáííÝçç ððéäíþ.

Ïç óéëñÐ ðíð ãñÛöííóáé áððÝð ïé ãñãñÝð, ïüíí äýí scripts áðü ðç óáéñÛ ãñãáéáβüí ðíð DTrace ððíóðçñβæííóáé ðëβñüð óðí FreeBSD: ðí hotkernel êáé ðí procsystime. ÁððÛ óá äýí êá ãñãñãðíβðíðíðá óóá áðüíáíá ðíβíáðá áððβð ðçð áíüóðçðáð.

Ïí hotkernel Ý÷ áé ó÷ ääéáóðáβ íá áíááíññβæáé ðíéá óðíÛñðçðç éáóáíáéβíáé ðí ïáááéýðãñí ÷ ñüíí óðíí ððñβíá. Áéðáéβíóáð ðí ððü éáííééÝð óðíéβéáð, éá äáβðá Ýííáí ðáññüíéá ïá ðçí ðáñáéÛðü:

```
# ./hotkernel
Sampling... Hit Ctrl-C to end.
```

Ï áéá÷ áéñéóððð ðíð óðóóβíáðíð êá ðñÝðáé íá ÷ ñçóéííðíéβóáé ðí óðíáóáóíü ðëβððñüí **Ctrl+C** áéá íá óðáíáðβóáé ðç áéáñááóβá. Ïá ðíí ðáñíáðéóíü ðíð, ðí script éá áðáééííβóáé íéá óáéñÛ áðü óðíáñðβóáéð ðíð ððñβíá éáé ðëçñíöíñβáð ó÷÷áðééÛ ïá ðí ÷ ñüíí ðíðð, óáíéíñβíóáð ðéð óá äýííðóá óáéñÛ áíÛéíáá ïá ðí ÷ ñüíí:

kernel`_thread_lock_flags	2	0.0%
0xc1097063	2	0.0%
kernel`sched_userret	2	0.0%
kernel`kern_select	2	0.0%
kernel`generic_copyin	3	0.0%
kernel`_mtx_assert	3	0.0%
kernel`vm_fault	3	0.0%
kernel`sopoll_generic	3	0.0%
kernel`fixup_filename	4	0.0%
kernel`_isitmyx	4	0.0%
kernel`find_instance	4	0.0%
kernel`_mtx_unlock_flags	5	0.0%
kernel`syscall	5	0.0%
kernel`DELAY	5	0.0%
0xc108a253	6	0.0%
kernel`witness_lock	7	0.0%
kernel`read_aux_data_no_wait	7	0.0%
kernel`Xint0x80_syscall	7	0.0%
kernel`witness_checkorder	7	0.0%
kernel`sse2_pagezero	8	0.0%
kernel`strncmp	9	0.0%
kernel`spinlock_exit	10	0.0%
kernel`_mtx_lock_flags	11	0.0%
kernel`witness_unlock	15	0.0%
kernel`sched_idletd	137	0.3%
0xc10981a5	42139	99.3%

Ïí script áððü éáéóíðñãáβ áðβçð ïá áñññβíáðá ðíð ððñβíá. Áéá íá ÷ ñçóéííðíéβóáðá áððü ðí ÷ áñáéðçñéóðééü, áéðáéÝóáð ðí ïá ðçí áðééíáβ -m:

```
# ./hotkernel -m
Sampling... Hit Ctrl-C to end.
^C
MODULE                                COUNT    PCNT
0xc107882e                             1     0.0%
0xc10e6aa4                             1     0.0%
0xc1076983                             1     0.0%
0xc109708a                             1     0.0%
0xc1075a5d                             1     0.0%
```

0xc1077325	1	0.0%
0xc108a245	1	0.0%
0xc107730d	1	0.0%
0xc1097063	2	0.0%
0xc108a253	73	0.0%
kernel	874	0.4%
0xc10981a5	213781	99.6%

Ôí procsystime script óðëëáíáÛíáé éáé óððíáé ðíí ÷ñííí ðíí êêðóáíí óðóðíáóíð ãéá íéá óðäéäéñéíÝíç äéãñáóóá íÝóó ðíð PID P ðíð íííáóíð òçð. Óðí ðáñáéÛò ðáñÛáäéáíá Ý÷íòíá íäééíðóáé íéá íÝá äéãñáóóá ðíð /bin/csh. ÅéðäéÝóáíá ðí procsystime éáé ðí áððóáíá óççí áíáííð éäêðð áñÛóáíá íáñééÝð áíðíéÝð óðí csh ðíð áð÷áíá áííáíáé. ÁððÛ áíáíáé óá áðíðäéÝóíáóá òçð äíêéíðð íáð:

```
# ./procsystime -n csh
Tracing... Hit Ctrl-C to end...
^C
```

Elapsed Times for processes csh,

SYSCALL	TIME (ns)
getpid	6131
sigreturn	8121
close	19127
fcntl	19959
dup	26955
setpgid	28070
stat	31899
setitimer	40938
wait4	62717
sigaction	67372
sigprocmask	119091
gettimeofday	183710
write	263242
execve	492547
ioctl	770073
vfork	3258923
sigsuspend	6985124
read	3988049784

¼ðòð óáíáíáóáé, ç êêðóç ðíð óðóðíáóíð ãéá áíÛáííóç (read()) áíáíáé áððð ðíð éáóáíáéêíáé ðíí ðáñéóóíððáñí ÷ñííí óá íáííáðððáñíéáððá, áíð ðí êéäíððáñí ðíí éáóáíáéêíáé ç êêðóç óðóðíáóíð getpid().

26.5 Ç Äêðóóá D

Ç óáéñÛ áñááéáíáí DTrace, ðáñééáíáÛíáé áñêáðÛ scripts áñáííÝíá óççí áéäéêêð äêðóóá ðíð DTrace. Ç äêðóóá áððð íííÛäáóáé “ç äêðóóá D” óççí ðáêíçñíòóç òçð Sun, éáé áíáíáé áñêáðÛ íííéá íá òç C++. Áíáéððééêð ðáñéãñáóð áðððð òçð äêðóóáð áíáíáé ðÝñá áðí ðíðð óéíðíýð áððíý ðíð éáéíÝííð. ÕðÛñ÷áé áíáñáð óðæððçççç ó÷áðééÛ íá áððð, óçç äéáýèðíóç <http://wikis.sun.com/display/DTrace/Documentation>.

ΕὰοÛεάεί 27

ΌάέñέάέÛò Άδέέίείúίβὰò

27.1 Όύίιθς

Όι UNIX δÛίόιòά òδίοòÞñεαά óάέñέάέÛò άδέέίείúίβὰò. Άέά òςί άέñβάάέά, òά ðñÞòά UNIX ις ÷ άίÞιάòά άάóβæίίòάί óά óάέñέάέÛò άñάñÛò άέά òςί άβóίáí έάέ Ýíáí óòí ÷ ñÞòòς. Όά ðñÛάñάòά ùóòúóí Ý ÷ ίóí áεεÛίáέ ðíεý áðú òέò ιÛñάò ðíò òí óóίςέέóιÛí “òáñιáòέέú” άðíòάεíýíòάί áðú Ýíá óάέñέάέú áεòòðúòÞ 10 ÷ άñάέòÞñúí òí άάòòáñúεάðòí έάέ Ýíá ðεçέòñíεúάέí. Όι έάοÛεάεί άòòú έά έάέýòáέ έÛðίέίòò άðú òίòò ðñúðίòò óάέñέάέÞò άδέέίείúίβὰò ðíò ÷ ñçóέίíðίέίýíòάέ áðú òí FreeBSD.

Άóίý áέάáÛòάòά áòòú òí έάοÛεάεί, έά ιÛñάòά:

- ðúò ίά óóίáÛòάòά òáñιáòέέÛò óòí FreeBSD óýóòςίά óάò.
- ðúò ίά ÷ ñçóέίíðίέíÞòάòά Ýíá modem áέά ίά óóίááέáβòά óά άðñάέñòòíÛí óòóòÞιáòά.
- ðúò ίά άðέòñÛòάòά óά άðñάέñòòíÛí ðòò ÷ ñÞòòάò ίά óóίááέίýí óòí óýóòςίά óάò ιÛòú modem.
- ðúò ίά áέέέíÞòάòά òí óýóòςίά óάò ιÛòú óάέñέάέÞò έίíóúέάò.

ðñέí áέάáÛòάòά áòòú òí έάοÛεάεί, έά ðñÛάέ:

- ίά ιÛñάòά ðúò έά ñòέίβòάòά έάέ έά άáέάòάóòÞòάòά Ýíá ιÛí ðòñÞíá (ΈάοÛεάεί 9).
- ίά έάóάñáβòά òέò Ûάάέáò έάέ áέáñááóβὰò òίò UNIX (ΈάοÛεάεί 4).
- ίά Ý ÷ áòά ðñúóááóς óòí òá ÷ ίέέú áá ÷ áέñβáέí òίò òέέέίý óάò (modem Þ έÛñòά ðíεεάðέÞí óάέñέάέÞí ðòñÞí) ðíò έÛεάòά ίά ÷ ñçóέίíðίέíÞòάòά óòí FreeBSD.

27.2 ΆέóάáùάÞ

ðñιáέάíòíβçóς: Άðú òí FreeBSD 8.0 έάέ ίáòÛ, òά άñ ÷ áβá óòóέáòÞí òúí óάέñέάέÞí έòñÞí ίáòίííÛòòςέάί áðú /dev/cuaðN óά /dev/cuaúN έάέ áðú /dev/ttyðN óά /dev/ttyúN. Íέ ÷ ñÞòòάò òίò FreeBSD 7.X έά ðñÛάέ ίά ðñíòáñιúóíóí òςί ðáñáέÛòú òάέιçñβúóς óýíòúíá ίá òέò ðáñáðÛíú áέέááÛò.

27.2.1 Íñíέίáβá

bps

Bits ΆίÛ Άάòòáñúεάðòí — í ñòέίúò ίáòÛάίòςò òúí áááñÛíúí

Óβιά	ÁêñïäÝέòçò #	ÁêñïäÝέòçò #	Óβιά
DTR	20	óðñäÝáòáέ óðï	DSR
DTR	20	óðñäÝáòáέ óðï	DCD
DSR	6	óðñäÝáòáέ óðï	DTR
DCD	8	óðñäÝáòáέ óðï	DTR

ÐáñáέÛòò óáβñííóáέ äýí äéáòÛñáέò ðñò áβñáέ ðεί éíείÝò óòέò ìÝñáò ìáò.

Ðβñáέáò 27-2. Έάέβäéí Null-Modem DB-9 óá DB-9

Óβιά	ÁêñïäÝέòçò #	ÁêñïäÝέòçò #	Óβιά
RD	2	óðñäÝáòáέ óðï	TD
TD	3	óðñäÝáòáέ óðï	RD
DTR	4	óðñäÝáòáέ óðï	DSR
DTR	4	óðñäÝáòáέ óðï	DCD
SG	5	óðñäÝáòáέ óðï	SG
DSR	6	óðñäÝáòáέ óðï	DTR
DCD	1	óðñäÝáòáέ óðï	DTR
RTS	7	óðñäÝáòáέ óðï	CTS
CTS	8	óðñäÝáòáέ óðï	RTS

Ðβñáέáò 27-3. Έάέβäéí Null-Modem DB-9 óá DB-25

Óβιά	ÁêñïäÝέòçò #	ÁêñïäÝέòçò #	Óβιά
RD	2	óðñäÝáòáέ óðï	TD
TD	3	óðñäÝáòáέ óðï	RD
DTR	4	óðñäÝáòáέ óðï	DSR
DTR	4	óðñäÝáòáέ óðï	DCD
SG	5	óðñäÝáòáέ óðï	SG
DSR	6	óðñäÝáòáέ óðï	DTR
DCD	1	óðñäÝáòáέ óðï	DTR
RTS	7	óðñäÝáòáέ óðï	CTS
CTS	8	óðñäÝáòáέ óðï	RTS

ÓçñäÝáòáέ: ¼ðáí Ýíáò áêñïäÝέòçò óá ìéá Ûέñç ÷ ñáέÛæáòáέ ìá óðñäééáβ ìá äýí áêñïäÝέòçò óòçí Ûέèç, óðñäééò áññíðñä ðñò áêñïäÝέòçò ìáðáý ðñò óòç ìéá Ûέñç ìá Ýíá ìééññ éáέβäéí, éáέ ÷ ñçóéíðñéíýìá Ýíá ìáéñýòáññ éáέβäéí áéá ðçí Ýíúòç ìá ðçí Ûέèç Ûέñç.

Ç ðáñáðÛñ ðéÛðáíç óáβñííóáέ ìá áβñáέ ç ðεί äéáääáñÝíç. Óá ìéá ðáñáééáβ (ðñò áñçááβóáέ óðñ äééβñ Òñ RS-232 ìá ÁðéÛ Áβñáòá), ðñ SG óðñäÝáòáέ óðñ SG, ðñ TD óðñäÝáòáέ óðñ RD, ðá RTS éáέ CTS óðñäÝííóáέ óðñ DCD, ðñ DTR óðñäÝáòáέ óðñ DSR, éáέ áíðβóðññóá.

έΰñòάδ δῖεάδέρπῖ εδñπῖ, üδùδ όέδ BocaBoard 1008 έάέ 2016, üδùδ έάέ δέῖ άδδδδδ έΰñòάδ, üδùδ άδδΎδ δῖο έάδάόέάδΰεῖῖόάέ άδϋ όçῖ Digiboard έάέ όçῖ Stallion Technologies. Ἰ δñῖάδέέάñῖΎῖδ δδñπῖάδ ùδδϋόῖ, άέδάέάβ άῖβ ÷ ίάόόç ἰῖῖῖ άέά όέδ δδδέέΎδ όάέηέέΎδ (COM) έϋñάδ.

Άέά ίά άάβδά άῖ ῖ δδñπῖάδ όάδ άίάάῖññβεάέ ῖδῖεάάπδῖόά άδϋ όέδ όάέηέέΎδ έϋñάδ, δάñάόçñπδóά όά ἰçῖῖῖάόά έάδΰ όç άέΰñέέάά άέέβῖççδδ όῖδδ όδδδπῖάδῖδ, π ÷ ñçóέῖῖδῖεάβδóά όçῖ άῖδῖεπ /sbin/dmesg άέά ίά ίάάάάβδά όά ἰçῖῖῖάόά όῖδδ δδñπῖά έάδΰ όç άέΰñέέάά όçδδ άέέβῖççδδ. Δέῖ όόάέάέñέῖΎῖά, άίάεçδπδóά όά ἰçῖῖῖάόά δῖο ἰάέέῖῖῖῖ ἰά όῖδδ ÷ άñάέδπñάδ sio.

Όδϋάάέῖç: Άέά ίά άάβδά ἰῖῖῖ όά ἰçῖῖῖάόά δῖδδ δάñέΎ ÷ ῖδῖ όç έΎῖç sio, ÷ ñçóέῖῖδῖεάβδóά όçῖ άῖδῖεπ:

```
# /sbin/dmesg | grep 'sio'
```

Άέά δάñΰάάέñῖά, όά Ύῖά όγύόόçῖῖ ἰά δΎΎόόάñέδ όάέηέέΎδ έϋñάδ, όά ἰçῖῖῖάόά όῖδδ δδñπῖά δῖδδ ό ÷ άδβεῖῖόάέ ἰά άδδΎδ όάβῖῖῖόάέ δάñάέΰδδ:

```
sio0 at 0x3f8-0x3ff irq 4 on isa
sio0: type 16550A
sio1 at 0x2f8-0x2ff irq 3 on isa
sio1: type 16550A
sio2 at 0x3e8-0x3ef irq 5 on isa
sio2: type 16550A
sio3 at 0x2e8-0x2ef irq 9 on isa
sio3: type 16550A
```

Άῖ ῖ δδñπῖάδ όάδ άάῖ άίάάῖññβεάέ üέάδ όέδ όάέηέέΎδ όάδ έϋñάδ, δέέάῖῖῖ ίά ÷ ñάέάόδάβ ίά όῖῖ ñδèῖβóάδδ ÷ ñçóέῖῖδῖεάβδóά δῖ άñ ÷ άβῖ /boot/device.hints. Ἰδῖñάβδά άδβóçδδ ίά ἰάδάδñΎδδά όά ό ÷ üέέῖ (π έάέ ίά άέάάñΰδδά δάέάβδδ) άñάῖΎδ δῖο άίάόΎῖῖῖόάέ όά όδδέάδΎδ δῖο άάῖ όδΰñ ÷ ῖδῖ όδῖ όγύόόçῖά όάδ.

Δάñάέέῖῖῖῖά άίάδñΎῖδά όόç όάέβῖάά manual δῖο sio(4) άέά δάñέόóδδάñάδ δέçñῖῖῖῖβδδ ό ÷ άδέέΰ ἰά όέδ όάέηέέΎδ έϋñάδ έάέ όέδ ñδèῖβóάέδ δϋῖ έάñδπῖ δῖεάδέρπῖ όάέηέέέρπῖ εδñπῖ. Άῖ ÷ ñçóέῖῖδῖεάβδóά άñ ÷ άβῖ ñδèῖβóάῖῖ δῖο δñῖΎñ ÷ άδάέ άδϋ έΰδῖεά δάέάέϋδάñç Ύέάῖόç όῖδδ FreeBSD, έά δñΎδάέ ίά άβδóά έάέάβδάñά δñῖóάέδέέῖῖ, έάέπδ έΰδῖεάδ άδϋ όέδ άδέέῖῖΎδ δϋῖ όδδέάδπῖ έάέ ç όγῖῖάῖç δῖδδ Ύ ÷ ῖδῖ άέέΰῖάέ όδδδ ἰάῖδδάñάδ άέäϋόάέδ.

Όçῖάβδóç: Όῖ port IO_COM1 δδῖεάέέόδΰ όῖ port 0x3f8, IO_COM2 άβῖάέ όῖ 0x2f8, IO_COM3 άβῖάέ όῖ 0x3e8, έάέ όῖ IO_COM4 άβῖάέ όῖ 0x2e8. ΆδδΎδ άβῖάέ έάέ ἰέ δέῖ έῖεῖΎδ ñδèῖβóάέδ άέά όέδ δάñάδΰῖϋ έϋñάδ. ἰέ άñάῖΎδ interrupt 4, 3, 5 έάέ 9 άβῖάέ ἰέ δέΎῖῖ όδῖçέέóῖΎῖάδ όδδδ όάέηέέΎδ έϋñάδ. Όçῖάέπδóά άδβóçδδ ἠδέ ἰέ όδῖçέέóῖΎῖάδ όάέñέέΎδ έϋñάδ άάῖ ἰδῖῖῖῖῖῖ ίά ἰῖῖῖΰεῖῖῖόάέ όῖ βεῖῖ interrupt ἰά έΰδῖεά ΰέçç όδδέάδπ ÷ όά όδῖῖῖεάέόδΎδ δῖο άέάέΎδῖῖῖ άβάδῖῖ όγῖδῖο ISA (ἰέ έΰñòάδ δῖεάδέρπῖ εδñπῖ άέάέΎδῖῖῖ άέάέέΰ έδδέρπῖάόά δῖο άδέδñΎδῖῖῖ όά üέά όά 16550Á δῖο ÷ ñçóέῖῖδῖεάβ ç έΰñδά ίά έάέδῖῖδñῖῖῖῖ ÷ ñçóέῖῖδῖεάβδóά ἰῖῖῖ ἰβá π äῖῖ άñάῖΎδ interrupt).

27.2.4 Άέέέέΰ Άñ ÷ άβá Όδδέάδπῖ

Ç δñῖϋάάόç όδδδ δάñέόóδδάñάδ όδδέάδΎδ όῖδδ δδñπῖά, άδέδδά ÷ ΰῖῖάέέ ἰΎóϋ “άέάέέρπῖ άñ ÷ άβῖῖ όδδέάδπῖ”, όά ἰδῖῖβá άñβóέῖῖόάέ όῖῖῖ έάδΰεῖῖῖ /dev/. Όδδδ όδδέάδΎδ sio ç δñῖϋάάόç άδδέδδά ÷ ΰῖῖάέέ ἰΎóϋ δϋῖῖ άñ ÷ άβῖῖ /dev/ttyuw (άέά όδδέάδΎδ άέóϋῖῖῖ, dial-in) έάέ /dev/cuaux (άέά όδδέάδΎδ άῖῖῖῖῖ, call-out). Όῖ FreeBSD δάñΎ ÷ άέ άδβóçδδ

οόόεάδΎδ άñ÷έειδβζοç (/dev/ttyuN .init έάέ /dev/cuauN .init) έάέ οόόεάδΎδ έέάέπιαόιδ (/dev/ttyuN .lock έάέ /dev/cuauN .lock). Ίέ οόόεάδΎδ άñ÷έειδβζοç ÷ñçόειδβζοç έάέ άçί ñýèέόç δúi άñ÷έέπí δάñάíΎδñí άδέείέιύβδδ όδç έýñά, εΰεά οiñΎ δiο άíββάέ. ΟΎοιέάδ δάñΎiάδñiέ άβiάέ δ.÷. οι crtscts άέά όά modems δiο ÷ñçόειδβζοç όçiάδiάiόβά RTS/CTS άέά Ύέάά÷i ñiPδ. Ίέ οόόεάδΎδ έέάέπιαόιδ ÷ñçόειδβζοç έάέ iά έέάέπiόi εΎδiέάδ ñδèιβόάέδ όδέδ έýñάδ, πρόά iά içí iδiñiýí iά άέέά÷έiýí άδú Ύέειτδ ÷ñPόόά P δñiάñΎiάόά. Άέά δέçñiόiñβδδ ό÷÷ άδέέΎδ iά όέδ ñδèιβόάέδ δάñiάδέέπí, όçí άñ÷έειδβζοç έάέ όά έέάέπιαόiά οόόεάδπí, έάέ όç ñýèέόç δάñάíΎδñí όόά δάñiάδέέΎ, άάβδά άiόβδóιέ÷ά όέδ όάέββάδ manual termos(4), sio(4), έάέ stty(1).

27.2.5 Ñδèιβόάέδ Οάέñέάέπí Εόñπí

Ç οόόεάδP ttyuN (P cuauN) άβiάέ ç έάíñέέP οόόεάδP δiο iδiñάβδά iά ÷ñçόειδβζοçPόάόά όδέδ άóάñiάΎδ όάδ. ¼όάí iέά έέάέέέάόβά άíββάέ iέά οόόεάδP, ÷ñçόειδβζοç έΎδiέάδ δñiάδέέάiΎiάδ ñδèιβόάέδ I/O άέά όi δάñiάδέέú. Ίδiñάβδά iά άάβδά άδδΎδ όέδ ñδèιβόάέδ iά όçí άiόiέP:

```
# stty -a -f /dev/ttyul
```

Άí άέέΎiάόά όέδ ñδèιβόάέδ όά άδδP όç οόόεάδP, άδδΎδ έά δάñάíάβiόiΎΎ ÷ñέ όi έέάβδóειñ όçδ όόόεάδPδ. ¼όάí άñέ÷έάβ iάíΎ, έά Ύ÷άέ άδάíΎέέάέ όδέδ δñiάδέέάiΎiάδ ñδèιβόάέδ. Άέά iά άέέΎiάόά όέδ δñiάδέέάiΎiάδ ñδèιβόάέδ, iδiñάβδά iά άíββiάόά έάέ iά άέέΎiάόά όέδ ñδèιβόάέδ όçδ όόόεάδPδ “άñ÷έέPδ έάóΎóόάόçδ”. Άέά δάñΎάάέάiά, άέά iά άíáñáñiέPόάόά όç έάέόiδñάβά CLOCAL, iά iñβδάδά άδέείέiύβá 8bit έάέ Ύέάά÷i ñiPδ iΎóú XON/XOFF άέά όç οόόεάδP ttyu5, άñΎδδά:

```
# stty -f /dev/ttyu5.init clocal cs8 ixon ixoff
```

Ç άñ÷έειδβζοç δúi όάέñέάέπí οόόεάδπí άέά úei όi óýóόçiά, άέΎá÷άόάέ άδú όi άñ÷άβi /etc/rc.d/serial. Οι άñ÷άβi άδδú άδçñάΎάέέ όέδ δñiάδέέάiΎiάδ ñδèιβόάέδ δúi όάέñέάέπí οόόεάδπí.

Άέά iά άδiόñΎδóάδ όçí άέέάáP όδάέάέñέiΎiύi ñδèιβόάúí άδú εΎδiέά άóάñiάP, άέέΎiόά όέδ ñδèιβόάέδ όçδ όόόεάδPδ “έέάέπιαόiδ”. Άέά δάñΎάάέάiά, άέά iά έέάέπiόáδδ όçí όá÷ýδçδά όçδ όόόεάδPδ ttyu5 όόά 57600 bps, άñΎδδά:

```
# stty -f /dev/ttyu5.lock 57600
```

Όπñά, iέά άóάñiάP δiο άíββάέ όç έýñά ttyu5 έάέ άδέ÷άέñάβ iά άέέΎiάέ όçí όá÷ýδçδά όçδ έýñάδ, έά άíáάέάόδάβ iά δάñάíάβiάέ όόά 57600 bps.

ΟόόέέΎ, έά δñΎδάέ iά ñδèιβόάδδ όέδ οόόεάδΎδ άñ÷έειδβζοç έάέ έέάέπιαόiδ, πρόά iά άβiάέ άáñΎδóειάδ iúñí άδú όiñ έiáάñέάóíú όiο root.

27.3 ΟάñiάδέέΎ

Δñiάέáiδiβζοç: Άδú όi FreeBSD 8.0 έάέ iάδΎ, όά άñ÷άβá όόόεάδπí δúi όάέñέάέπí εόñπí iάδiñiΎδóçέáí άδú /dev/cuaδN όά /dev/cuauN έάέ άδú /dev/ttyδN όά /dev/ttyuN. Ίέ ÷ñPόόάδ όiο FreeBSD 7.X έά δñΎδάέ iά δñiόάñiúóíδi όçí δάñάέΎδδú όάέiçñβζοç óýiόúiά iά όέδ δάñάδΎiú άέέάáΎδ.

Όοι Έαοΰεάει 13 άβάια υδέ ϑ έεάναάόβá init άβίαέ οδáyεοίϑ έάέ οίι Ύεάά-ι ούι ΰεεύι έεάναάόεβί, έάέ έάέ οϑί άñ-έειθίβϑόϑ έάόΰ οϑί έέεβίϑόϑ οίθ οδóδΠιάθιδ. Ίέά άδθι οδέδ άñάάόβáδ θιθ έέδάέάβ ϑ init άβίαέ ίά έέάáΰεάέ οί άñ-άβι /etc/ttys έάέ ίά ίάέείΰ ίέά έεάναάόβá getty οά εΰεά έέάέΎοείι οάñιάόέευ. ϑ έεάναάόβá getty άίέάιαΰίάέ ίά έέάáΰόάέ οί υíñá ÷ ñΠóδϑ έάέ ίά ίάέείΠόάέ οί θñυάñáía login.

Άέά ίά ñεείεοόίγί οά οάñιάόέέΰ οόι FreeBSD ούόοϑία οάδ, έά θñΎθάέ ίά έέδάέΎόάδ οά έέυείρεά άΠιάόά υδ root:

1. ΘñιθέΎόά ίέά άñάñΠ οόι /etc/ttys ίά οί υíñá οϑδ οδóδάδΠδ υδθδ οάβίάόάέ οόι έάόΰεάει /dev, άί άάί οδΰñ-έέ Παϑ.
2. Έάειñβόά υδέ έά έέδάέάβόάέ ϑ /usr/libexec/getty οδϑί έύñá, έάέ άδέέΎίθά οίι έάόΰεέϑει ούθι getty άδθι οί άñ-άβι /etc/gettytab.
3. Έάειñβόά οίι θñιάδέέάñΎί ούθι οάñιάόέείγ.
4. ΆίάñαιθίεΠόά οϑ έύñá εΎοίιθάδ οϑί άίόβόθίέ-ϑ άδέείάΠ οόι "on".
5. ΆδέέΎίθά άί ϑ έύñá έά άβίαέ άόόάεΠδ ίά οϑί άδέείάΠ "secure".
6. Άίάίάέΰόάδ οϑί init ίά έέάáΰόάέ ίάΰΰ οί άñ-άβι /etc/ttys.

ΰδ θñιάέñάόέέυ άΠιά, ίθíñάβδά ίά άϑίέιθñάΠόάδά Ύία θñιθάñιθίΎί ούθι getty έάέ ίά οίι ÷ñϑέειθίεΠόάδά οόι άΠιά 2, οδϑί έάόά-ñέόϑ οίθ /etc/gettytab. Οόι έαοΰεάει άδθυ άάί έά οάδ άίϑάΠοίθία θυδ άβίάόάέ άδθυ. Οάδ θñιθñΎίθία ίά έέάáΰόάδά οέδ οάέβáδδ manual οίθ gettytab(5) έάέ getty(8) έάέ θάñέοóυθάñάδ δέϑñιθíñβδδ.

27.3.2.1 ΘñιθέΎοίιθάδ ίέά Έάόά-ñέόϑ οόι /etc/ttys

Όι άñ-άβι /etc/ttys θάñέΎ-έέ ίέά έβόδά υέυι ούι εθñθί οίθ FreeBSD οδóδΠιάθιδ οάδ οδóδ ίθίβáδ εΎεάδά ίά άδέονΎθάόάέ ϑ άβοίθδ οίι ούόοϑία. Άέά θάñΰάέάία, οδΰñ-έέ ίέά έάόά-ñέόϑ οά άδθυ οί άñ-άβι έάέ οϑί θñθϑ έέέίέεΠ έιθούέά ttyv0. ΊΎού άδθΠδ οϑδ έάόά-ñέόϑδ, ίθíñάβδά ίά έέόΎέάδά οόι ούόοϑία άδθ οϑί έιθούέά. Όι άñ-άβι άδθυ θάñέΎ-έέ άδβόϑδ έάόά-ñβόάέδ έάά ΰεεάδ έέέίέέΎδ έιθούέάδ, οάέñέάέΎδ έύñάδ έάέ θάόáυ-οάñιάόέέΰ. Άέά εΰθίέι οάñιάόέέυ θιθ άβίαέ οθίάñΎίθί άδάδεάβáδ οά ίέά οάέñέάέΠ έύñá, άñΰθδά άδεθδ οϑί έάόά-ñέόϑ οϑδ οάέñέάέΠδ οδóδάδΠδ υδθδ οάβίάόάέ οόι έάόΰεάει /dev, ÷ññβδ ίά άñΰθδάδ έάέ οίι έάόΰεάει /dev (έάέ θάñΰάέάία, ϑ οδóδάδΠ /dev/ttyv0 έά έάόά-ñέόέάβ υδ ttyv0).

ϑ θñιάδέέάñΎίϑ άάέάδΰόάόϑ οίθ FreeBSD θάñέΎ-έέ Ύία άñ-άβι /etc/ttys οί ίθίβι δθιθóϑñβάέέ οέδ θñθάδ οΎόόάñεδ οάέñέάέΎδ έύñάδ: ttyu0 υδ έάέ ttyu3. Άί οθίáΎόάδ οάñιάόέέυ οά εΰθίέά άδθ άδóΎδ οέδ έύñάδ, άάί ÷ñάέΰεάόάέ ίά θñιθέΎόάδά ΰεέϑ έάόά-ñέόϑ.

Θάñΰάέάία 27-1. ΘñιθέΠεϑ Έάόά-ññβόάñι έάέ οά Οάñιάόέέΰ οόι /etc/ttys

Άδ οθίεΎοίιθία υδέ εΎείθία ίά οθίáΎοίιθία άγί οάñιάόέέΰ οόι ούόοϑία: Ύία Wyse-50 έάέ Ύία θάέέυ IBM PC 286 οόι ίθίβι έέδάέγίά οϑί άόάñιθάΠ Procomm ίά οϑί ίθίβά άñιθίεβίάόάέ Ύία οάñιάόέέυ ούθιθ VT-100. ΟθίáΎιθία οί Wyse οϑϑ άáγόάñϑ οάέñέάέΠ έύñá έάέ οί 286 οδϑί Ύέοϑ οάέñέάέΠ έύñá (ϑ ίθίβά άñβόέάδάέ οά ίέά εΰñόά θιέεάδεθί εθñθί). Ίέ άίόβόθίέ-άδ έάόά-ññβόάέδ οόι άñ-άβι /etc/ttys έά ίιέΰαιθί ίά οέδ θάñάέΰθυ:

```
ttyu1 ① "/usr/libexec/getty std.38400" ② wy50 ③ on ④ insecure ⑤
ttyu5  "/usr/libexec/getty std.19200" vt100 on insecure
```

- ① Όι θñθθί θάάβι, άβίαέ οθίΠεθδ οί υíñá οίθ έέέέείγ άñ-άβιθ οάñιάόέείγ υδθδ οάβίάόάέ οόι έάόΰεάει /dev.
- ② Όι άáγόάñι θάάβι, άβίαέ ϑ άίθίεΠ θιθ έά έέδάέάόόάβ έάέ άδθΠ οϑ άñάñΠ, ϑ ίθίβά άβίαέ οθίΠεθδ ϑ getty(8). ϑ getty άñ-έειθίέάβ έάέ άñβάέ οϑ άñάñΠ, ñείβεάέ οϑί οá-γóϑά, άιθάίβάέ οϑί θñιθñίθΠ έάέ έέόάάυάΠ ίñιάθιδ ÷ñΠóδϑ, έάέ έέδάέάβ οί θñυάñáía login(1).

Όι δνυάηάηά getty äÝ ÷ áóáé ιέα (δñιάέηάóέέP) δάνΰιáóηι óçç ãñáηιP áίóιέPδ όιò, όηι όýðι όιò getty. Ί όýðιò όιò getty έάέηηβæάέ όά ÷ ãñáέδçñέóóέέÛ όçδ ãñáηιPδ όιò δάñιáóέέéý, υðòδ δ. ÷. όι ñòέιυ ιάóÛáιόçδ όά bps έάέ όçι έóιòέιβά (parity). Όι δñυάηάηά getty áέάáÛæάέ áóδÛ όά ÷ ãñáέδçñέóóέέÛ áðu όι ãñ ÷ áβι /etc/gettytab.

Όι ãñ ÷ áβι /etc/gettytab δάñéÝ ÷ áέ δñέéÝδ έάόά ÷ ùñβόάέδ áέά ãñáηιÝδ δάñιáóέέP, óυóι δάέéÝδ υóι έάέ έάέηιýñέáδ. Óδέδ δάñέóóυδάñάδ áðu áóδÝδ όέδ δάñέδòPóáέδ, ιέ έάόά ÷ ùñβόάέδ διò ιάέέηιý ιά όι έάβιáñι std, έά έάέóιòñáPóιòι áέά áðáðέáβáδ óñíáááιÝíá δάñιáóέέÛ. ÁóδÝδ ιέ έάόά ÷ ùñβόάέδ ááñιýι όçι έóιòέιβά. ÓδÛñ ÷ áέ ιέα έάόά ÷ ðñέóç std áέά έÛέá ñòέιυ ιάóÛáιόçδ, áðu 110 ùδ 115200. ÓóóέέÛ, ιδñáβóá ιά δñιόέÝóáόά όέδ áέéÝδ óáδ έάόά ÷ ùñβόάέδ όά áóδυ όι ãñ ÷ áβι. Ç óáέβáá manual όιò gettytab(5) δάñéÝ ÷ áέ δάñέóóυδάñάδ δέçñιòñβáδ.

¼όάι ñòέιβæáόά όηι όýðι όçδ getty óοι ãñ ÷ áβι /etc/ttys, ááááέυέáβóá υóέ óáέñέÛæιòι ιέ áίóβóóιέ ÷ ÷δ ñòέιβóáέδ áδέειέιύέPι óοι δάñιáóέέυ óáδ.

Όοι δάñÛááέáιá ιάδ, όι Wyse-50 ááι ÷ ñçóέιñδιέáβ έóιòέιβά έάέ óñíáÝáόάέ óóá 38400 bps. Όι 286 PC ááι ÷ ñçóέιñδιέáβ έóιòέιβά, έάέ óñíáÝáόάέ óóá 19200 bps.

- 3 Όι όñβòι δάáβι áβιáέ ι όýðιò όιò δάñιáóέέéý διò óñíáÝáόάέ óòPευδ όά áóδP όç ãñáηιP tty. Άέά έýñáδ áδέέιáέέPι óñíáÝóáñι (dial-up), ç δέιP áóδιý όιò δάáβιò óð ÷ íÛ έá áβιáέ unknown P dialup, έάέPδ ιέ ÷ ñPóóáδ έá ιδñιýι ιά δñáñιáóιδιέPóιòι óýíááόç ιá ιδñιέáPδιòá έιáέóιέέυ P δάñιáóέέυ. Άέά Ûιáόá óñíáñιÝíá δάñιáóέέÛ, ι όýðιò δάñιáóέέéý ááι áέéÛæάέ, Ýóóέ ιδñáβóá ιά áÛέáόá Ýíá δñáñιáóέέυ όýðι δάñιáóέέéý óá áóδυ όι δάáβι, όηι ιδñιβι έá ãñáβóá όόç áÛόç áááñιÝíυι όιò termcap(5).

Άέά δάñÛááέáιá, όι Wyse-50 ÷ ñçóέιñδιέáβ όηι δñáñιáóέέυ όýðι δάñιáóέέéý όιò, áñP όι 286 PC διò áέóáέáβ όι Procomm, Ý ÷ áέ ñòέιέóóáβ ιά áññιέPιáέ δάñιáóέέυ όýðιò VT-100.

- 4 Όι όÝóáñόι δάáβι έάέηηβæάέ áí ç έýñá έá áβιáέ áíáñáP. ΌιδñέáðPíóáδ ááP όç έÝíç on, ç init έá ιάέέιPóáέ όι δñυάηάηά διò áíáóÝñáόáέ óοι ááýóáñι δάáβι, όçι getty. Áí áÛέáόá off óá áóδυ όι δάáβι, ááι έá áέóáέáóóáβ ç getty, έάέ Ýóóέ ááι έá ιδñιáβ ιά áβιáέ áβóιáιò óοι óýóόçιá áðu όç óóáέáñέíÝíç έýñá.
- 5 Όι óáέáóóáβι δάáβι ÷ ñçóέιñδιέáβóáέ áέá ιά έάέηηβóáέ áí ç έýñá áβιáέ áóóáέPδ. Áí ÷ ãñáέóçñβóáόá ιέα έýñá ùδ áóóáέP, óçιáβιáέ υóέ όçι áðέóóáýáóóá áñέáðÛ Póóá ιά áðέóñÝðáόá όçι áβóιáιò όιò root ιÝóυ áóδPδ (P ιδñιέíóáPδιòá έιááñέáóιý ιá ID 0). Ááι áðέóñÝðáόáέ ç áβóιáιò όιò root óá ιέα έýñá διò Ý ÷ áέ ÷ ãñáέóçñέóóáβ ιç-áóóáέPδ. Óá ιç-áóóáέáβδ έýñáδ, ιέ ÷ ñPóóáδ δñÝðáέ ιά áέóÝñ ÷ íóáέ ÷ ñçóέιñδιέPíóáδ Ýíá óóιçέέóιÝíι έιááñέáóιυ ÷ ñPóóç, έάέ ιά ÷ ñçóέιñδιέéýι όçι áίóιέP su(1) P Ûέέι áíóβóóιέ ÷ ι ç ÷ áíέóιυ áέá ιά áðιέðPóιòι δñιíυιέá δðáñ ÷ ñPóóç.

Óáδ óñιέóóιýιá áíáðέóýéáέóá ιά ÷ ñçóέιñδιέPóáόá όç ñýèιέóç "insecure", áέυιá έάέ áέá δάñιáóέέÛ διò áñβóέιñóáέ óá έéáέáυιÝíá áυιÛέá. Άβιáέ áñέáðÛ áýέιέι ιά áέóÝέéáόá ùδ έáñíέέυδ ÷ ñPóóçδ έάέ ιά ÷ ñçóέιñδιέPóáόá όçι áίóιέP su áí ÷ ñáέÛæáóóá δñιíυιέá δðáñ ÷ ñPóóç.

27.3.2.2 ÁíáíáέÛóóá όçι init ιά ιáíáέéááÛóáέ όι /etc/ttys

÷ ííóáδ έÛíáέ όέδ áðáñáβóçδáδ áέéááÝδ óοι ãñ ÷ áβι /etc/ttys, έá δñÝðáέ ιά óðáβέáóá óPιá SIGHUP (hangup) óόçι áέáñááóβá init áέá ιά όçι áíááέÛóáόá ιά áέááÛóáέ íáíÛ όι ãñ ÷ áβι ñòέιβóáυι όçδ. Άέά δάñÛááέáιá:

```
# kill -HUP 1
```

Όçιáβúç: Ç init áβιáέ δÛíóιòá ç δñPóç áέáñááóβá διò áέóáέáβóáέ óá Ýíá óýóόçιá, έάέ Ýóóέ έá Ý ÷ áέ δÛíóιòá όηι áñέέιυ áέáñááóβáδ (PID) 1.

Αί ùεάò ìε ñòεìβόάεò άβίάε ουόόΥò, óά εάεßáεά άβίάε óçç èÝçç òìòò, εάε óά óáñíáóεéÙ άβίάε άíáñáÙ, εά áεòáεάóóáß ç getty óá éÙεά óáñíáóεéù, εάε óòì óçìáβì áòòù εά äáβòá òçì ðñìòñìðß áεóúäìò (login) óòεò ìεùíáò óùì óáñíáóεéßì óáò.

27.3.3 Αίòείλâòððέóç ðñìáεçìÙòùì Óýíäáóçò

Áεùíá εάε άì áßóáòá ìáãÙεç ðñìòì÷ß óóεò εάðòñÝñáεáò, ðÙíóá ìðìñáß íá ðÙáε éÙòε óòñááÙ ùóáí ñòεìβáεáòá Ýíá óáñíáóεéù. Άáß εά áñáβòá ìεά εβóóá áðù óòìðòìáóá εάε óòìεóðìáíáò áεíñεßóáεò.

27.3.3.1 Άáí Αìóáíβáεáóáέ ðñìòñìðß Αέóúäìò (login)

Άáááεùεάβòá ùòε òì óáñíáóεéù άβίáε óòìááìÝíí óòì çεάεòñεéù äβέòòì εάε άíáñáíðìέçìÝíí. Αί άβίáε ðñìòùððéεùò òðìεíáεóòðò ðìò áíáñááß ùò óáñíáóεéù, ááááεùεάβòá ùòε áεòáεáß εíáεóìεéù áñìíìβòóçò óáñíáóεéíý óóçì óùóòð óáέñέáεß εýñá.

Άáááεùεάβòá ùòε òì εάεßáεí άβίáε εάεÙ óòìááìÝíí óùóì óòì óáñíáóεéù, ùóì εάε óòìí òðìεíáεóòð ðìò áεòáεáß FreeBSD. Άáááεùεάβòá ùòε άβίáε òì óùóòù äβáìò εάεùäβìò.

Άáááεùεάβòá ùòε òì óáñíáóεéù εάε òì FreeBSD óòìòùííýí ùóì áóìíñÙ òεò ñòεìβóáεò òçç óá÷-ýòçòáò ìáòÙáìòçç εάε εóìòεìβáò. ΆεÝáìòá òç òùòáεíúòçóá εάε òçì áìòβεάóç òçç ìεùíç ðìò óáñíáóεéíý, εάε áóìßóóá òεò άì ÷ñáέÙæáóáε. Αί ðñìúεάεóáε áεá óáñíáóεéù ìá áεòòðùòð (÷ññβò ìεùíç), ááááεùεάβòá ùòε áεáεÝóáε áðÙñεάéá ÷áñóεíý εάε ìáεáíεíý.

Άáááεùεάβòá ùòε áεòáεáβòáε ç áεááεéáóáá getty ðìò áìòðçñáòáß òì óáñíáóεéù. Άέá íá äáβòá ìεά εβóóá ìá òεò áíáñáÝò áεááεéáóáð getty, ÷ñçóεíðìέßóá òçì áíòìεß ps:

```
# ps -axww|grep getty
```

Έá ðñÝðáε íá äáβòá ìεά εáóá÷ñέóç áεá òì óáñíáóεéù óáò. Άέá ðáñÙááεáìá, ç áεùεíòεç ìεùíç äáβ÷íáε ùòε ç áεáñááóáá getty áεòáεáβòá óçç äáýóðáñç óáέñέáεß εýñá ttyul εάε ÷ñçóεíðìέáß òçì εáóá÷ñέóç std.38400 óòì áñ÷áβì /etc/gettytab:

```
22189 dl Is+ 0:00.03 /usr/libexec/getty std.38400 ttyul
```

Αί äáí áεòáεáβòáε εáìεÙ áεáñááóáá getty, ááááεùεάβòá ùòε Ý÷áòá áíáñáíðìέßóáε òç εýñá óòì /etc/ttys. Άðβóçò εòìçεάβòá íá áεòáεÝóáòá òçì áíòìεß kill -HUP 1 ìáòÙ òçì ðñìòðìβççç òìò áñ÷áβìò ttys.

Αί áεòáεáβòáε ç áεáñááóáá getty áεεÙ òì óáñíáóεéù áíáείεíòεáß íá ìç äáβ÷íáε ðñìòñìðß áεóúäìò, ð áì äáβ÷íáε ðñìòñìðß áεεÙ äáí óáò áðεòñÝðáε íá ññÙòáòá, βòùð òì óáñíáóεéù óáò ð òì εάεßáεí íá ìçì áðεòñÝðìòì óòìáíúççç ìÝóù òεééíý (hardware handshake). ΆíεéìÙóóá íá áεεÙíáòá òçì εáóá÷ñέóç óòì áñ÷áβì /etc/ttys áðù std.38400 óá 3wire.38400 (εòìçεάβòá íá áεòáεÝóáòá òçì áíòìεß kill -HUP 1 ìáòÙ òçì ðñìòðìβççç òìò /etc/ttys). Ç εáóá÷ñέóç 3wire άβίáε áìòβóóìε÷ç ìá òçì std, áεεÙ ááíñáß òì hardware handshaking. Ìðìñáß άðβóçò íá ÷ñáεáóóáß íá ìáεßóáðá òì ñòεìù óçìáóìáìòβáð (baud) εάε íá áíáñáíðìέßóáòá òìí Ýεáá÷ì ñìðò ìÝóù εíáεóìεéíý ùóáí ÷ñçóεíðìέáßòá òì 3wire, ðñìéáεíÝíò íá áðìýááòá òðáñ÷áβέóç òçç ðñìòñέìðò ììðìçò (buffer overflow).

27.3.3.2 Αί ΆεÝðáòá Óεíòðβáéá Αίòß áεá ðñìòñìðß Αέóúäìò

Άáááεùεάβòá ùòε òì óáñíáóεéù εάε òì FreeBSD óòìòùííýí óòì ñòεìù bps εάε óòεò ñòεìβóáεò εóìòεìβáò. ΆεÝáìòá òεò áεáñááóáð getty áεá íá ááááεùεάβòá ùòε áεòáεáβòá òì óùóòù óýðì getty. Αί áòòù äáí óòìááβίáε, áðáíáñááóóáβòá

οι άν÷άβι /etc/ttys εάέ άέδάέΎδά όγι άίόιēP kill -HUP 1.

27.3.3.3 Ίέ ×άηάέδPηάο Άιόάίβæηιόάέ Άέδëιβ, οι Password Άιόάίβæάάέ έάδÜ όγι Δέçêðñīēüāçόç

ΆέëÜηά όç ηýèιέόç ηιό δάηιάόέειý (P ηιό δñīāñÜηιάόηι άññιβυόç δάηιάόέειý) άδñ “half duplex” P “local echo” ό “full duplex”.

27.4 Οδçñάόβá Άέóüäiō ιΎού ΆδέëīäéêPò Óýiäáόçò (dial-in)

Δñīäéäiōιβçόç: Άδñ ηι FreeBSD 8.0 εάέ ιάδÜ, δά άñ÷άβι όδóέάδπí όñι όάέηέάέπí έδñπí ιάδññÜόδçέάί άδñ /dev/cuadN όά /dev/cuauN έάέ άδñ /dev/ttydN όά /dev/ttyuN. Ίέ ÷ñPόδάδ ηιό FreeBSD 7.X έά δñŸδάέ ιά δñιόάññιüόιόι όγι δάñάέÜδñ όάέιçñιβυόç óýiüηιά ιά δέδ δάñάδÜñιü áééääŸ.

Ç ηýèιέόç ηιό FreeBSD όδóδPιάόηιό όád áέά άβιόñι ιΎού άδéειäéêPò óýiäáόçò, άβιáέ άñêäóÜ ùñéá ιά όç óýiäáόç δάηιáόέέπí, áέδñδ άδñ ηι ääññüδ ùδé ÷ñçóειηδñιέýιόάέ modems άίδβ áέά δάηιáόέéÜ.

27.4.1 ΆñüðáñéêÜ έάέ ΆóüðáñéêÜ Modems

Όά άñüðáñéêÜ modems άβιáέ ιÜέειη δει άñééÜ áέά άδéειäéêŸδ έέPόάέδ, έάέPò ιέ δáñéóóüðáñäð ññèιβόáéδ ηιόδ ιδññιý ιά άδñéçéäδéιýι ιññιá όδç ιP-δδçδéêP ηιPιç RAM δñι áέáέŸόιόι. Όά άñüðáñéêÜ modems áέáέŸόιόι όδñPèüð òüðáέiŸδ άñáβñáéδ δñι áάβ ÷ññι όγι έáδÜόδáόç óçιáíδéέπí óçìÜδñι ηιό RS-232. Póüð δά òüðÜέéá δñι áñáññóáβñιόι ιά άíóδδñóéÜæιόι ηιόδ άδéóéŸδäð, áéëÜ άβιáέ άδβóçò ÷ñPóέιá áέá ιά óάβñáόáέ δñüð ηι modem έáέδñññááβ óúóδÜ.

Όά άóüðáñéêÜ modems όδñPèüð ááι áέáέŸόιόι άδóP όç ηιPιç RAM, έáέ Ÿóóé ιέ ññèιβόáéδ ηιόδ δáñéññιβæñιόáέ ιññι óόçι áééääP èŸόç όά èÜδñιéιð äéáéüðδäð ññèιβóáññι (DIP switches). Άί ηι άóüðáñéêÜ óád modem áέáέŸόáέ òüðáέiŸδ áñáβñáéδ, ιÜέειη έá άβιáέ άýóέηει ιά δέδ áάβä ùóáι ηι èÜέóññá ηιό óóóδPιáόηιό όád άβιáέ óçç èŸόç ηιό.

27.4.1.1 Modems έάέ ΈάéPáéá

Άί ÷ñçóειηδñιέάβä άñüðáñéêÜ modem, έá ÷ñáέáóðάβä óóóéêÜ ηι óúóδñ έάéPáéι. ÓñPèüð áδáñéááβ ηι όδδñδñιéçιŸñι έάéPáéι RS-232C, άóüññι áέáέŸόáέ óññáŸόáéδ áέá ùéá δά óñçééóιŸñιá óPιáóá:

Δβιáέáδ 27-4. Ίññáóβäð ÓçìÜδññι

Άêññιýñιá	Ίññιáóá
RD	ËPçç ÄáññŸññι (Received Data)
TD	ΆδñóóñēP ÄáññŸññι (Transmitted Data)
DTR	Όáηιáόééü ÄáññŸññι óá Άδñιéñüççóá (Data Terminal Ready)
DSR	Óýññι ÄáññŸññι óá Άδñιéñüççóá (Data Set Ready)
DCD	Άιβ÷íáδóç ÖŸññιóññιð ÓPιáóññιð (Data Carrier Detect).
	Άιβ÷íáδóç óýññáόçò όçò äñáññPò RS-232C
SG	Άάβñóç ÓPιáóññιð (Signal Ground)

Άεήυίγίεά

RTS
CTS

Ίριυιάόά

Άβδός ΆδιόοιρεΠδ (Request to Send)
Άοιετιυδόςά εέα ΆδιόοιρεΠ (Clear to Send)

Οι FreeBSD ÷ νάεΰεάόάε όά όβιάόά RTS εάε CTS εέα Ύεάã÷ι νιπδ όά όá÷ύδόςόδδ δΰιύ άδύ 2400 bps, όι όβιά CD εέα ίά άίε÷ιάύάε δυόά Ύ÷άε άδáiόεεάβ ίεά έεΠός Π δυόά ε ανάιπ Ύ÷άε έεάβόάε, εάε όι όβιά DTR εέα ίά άδáiάΎήνάε όι modem όόεί αν÷έεΠ όιό έάόΰόόάός ίάόΰ όε εΠε ίεάό όύιάάόεδ. Ιάνεέΰ εάεπάεά άάί εεάεΎόιόι υέα όά άδáiάβδόςά όβιάόά, Ύόόε άί Ύ÷άόά δñiάεΠιάόά ίά όι όάñiάόέόιυ όεδ όόίάάñβάδ έέόυιαιό ίά όι έεάβόέι όεδ ανάιπδ, δέεάιυί ίά άόεýíάόάε όι εάεπάει διό ÷ñεόειñδιεάβδά.

¼δύδ εάε ΰεά εάέόιόñάεέΰ όόόόβιάόά όýόιό UNIX, όι FreeBSD ÷ñεόειñδιεάβ όά όβιάόά όιό όέέειý εέα ίά άίόέεεόεάβ δυόά Ύ÷άε άδáiόεεάβ ίεά έεΠός, εάεπδ εάε εέα όιό όάñiάόέόιυ όεδ εάε όεί άδáiάόιñΰ όιό modem όόεί αν÷έεΠ όιό έάόΰόόάός ίάόΰ όι όΎειό όεδ. Οι FreeBSD άδiόάýάάε ίά όόΎεíάε άίόιρεΎδ όόι modem Π ίά δάñáειρεiόεάβ άίάόιñΎδ έάόΰόόάός άδύ άόόυ. Άί άβδόά άñiεεάεúñΎñδ ίά όόíáΎόάέδ modems όά BBS (Bulletin Board Systems) διό άάόβαιíόάε όά PC, άόόυ ίδññάβ ίά όάό όάíάβ ΰáει.

27.4.2 Έέέεπιάόά ΟάεήεάεΠδ Άέάόýíάάόε

Οι FreeBSD όδiόόεñβεάε όά έέέεπιάόά άδέέιεíυίεβί διό άάόβαιíόάε όόά NS8250, NS16450, NS16550, εάε NS16550A εάε EIA RS-232C (CCITT V.24). Ίε όόόεάΎδ 8250 εάε 16450 Ύ÷iόí άίάεΰiάόε ίiΠε (buffer) ίάάΎεiόδ άíυδ ÷άñáέδΠñά. Ε όόόεάΎδ 16550 εάεΎόάε άíάεΰiάόε ίiΠε 16 ÷άñáέδΠñúí, ε iόiβά άδέόñΎδάε όεί εάέýόάñε άδύαιόε όεδ. (Έυάυ δñiάεçíΰδúí όόε ό÷άάβάός όιό 16550, άάί άβiάε άóíáδΠ ε ÷ñΠός άόδΠδ όεδ ίiΠε, άί άβiάε άóíáόúí ÷ñεόειñδιεΠόδά όά 16550Á). Έάεπδ iε όόόεάΎδ διό εάεΎόιόí άíάεΰiάόε ίiΠε άíυδ ÷άñáέδΠñά άδάέόíýí δάñέόóυόάñε άñάάόβά άδύ όι εάέόιόñάεέυ όýόόçíá όά ό÷Ύόç ίά άόδΎδ διό εάεΎόιόí 16 ÷άñáέδΠñάδ, όóíβόόάíόάε εάέάβδάñά iε όόόεάΎδ διό άάόβαιíόάε όόí 16550Á. Άί όι όýόόçíá όάό Ύ÷άε δiεεΎδ άíάñáΎδ όάεήεάεΎδ δυñόάδ, Π δñúέάέόάε ίά εάέόιόñάΠόάε εΰδύ άδύ άάñý óñδóí, iε εΰñδάδ διό άάόβαιíόάε όόí 16550A άβiάε εάέýόάñάδ, εάεπδ δάñΎ÷iόí άδέέιεíυíβá ίά iεέñúδάñi ñδέiυ όόάειΰδúí.

27.4.3 Άñβáιñε Άδέόεüδός

¼δύδ εάε ίά όά όάñiάόέεΰ, ε init άέδάεάβ ίεά εέάñáάόβá getty εέα εΰεά όάεήεάεΠ εýñά διό Ύ÷άε ñδέiεόόάβ εέα εέόάñ÷úíάíάδ άδέεiρεέΎδ όóíáΎόάέδ. Άέα δάñΰάάεáíá, άί Ύ÷άόά όóíáΎόάε Ύíά modem όόε εýñά /etc/ttyu0, ε άίόιρεΠ ps ax εά άάβiάε εΰόε όάí όι δάñáεΰδúí:

```
4850 ?? I      0:00.09 /usr/libexec/getty V19200 ttyu0
```

¼όάί εΰδiεiό ÷ñΠόόεδ εάεΎόάε όόε ανάιπ άόδΠ εάε όι modem όóíáάέάβ, άíάñáñδiεάβδάε άδύ όι modem ε ανάιπ CD. Ί δονΠiάδ δάñάόεñάβ υόε Ύ÷άε άίε÷iάόεάβ όΎñí όβiά, εάε iεiεεçñβiάε όε εέάάεέάόβá άñβáíáόiό όεδ εýñάδ άδύ όι modem. Το getty όόΎεíάε ίεά δñiόñiδΠ login: όόεί άδύ δñéí εάειñέóíΎίç αν÷έεΠ όá÷ύδόςά όεδ εýñάδ. Οι getty δάñáειρεiόεάβ εέα ίά άάε άí εάiáΰñíόάε Ύάεόñiε ÷άñáέδΠñάδ, εάε όόεί όδδέεΠ ñýéìέός, άí άíάεάέýθάε υόε εάiáΰíάε óειόδβáεά (δέεάíπδ ευάυ εέάόιñΰδ όόεί όá÷ύδόςά όýíάάόεδ όιό modem όά ό÷Ύόç ίά όεί όá÷ύδόςά όιό getty), δñiόδάεάβ ίá ñδέiβόάε όεί όá÷ύδόςά όεδ ανάιπδ iΎ÷ñé ίá εΰάάε όόόεiρεiεέiýδ ÷άñáέδΠñάδ.

Άόíý i ÷ñΠόόεδ άέόΰάάε όiυ έυάέευ όiό, όi getty άέόάεάβ όi /usr/bin/login, όi iόiβi εάε iεiεεçñβiάε όε εέάάεέάόβá άέόυaiό, εçόβiόάδ άδύ όi ÷ñΠόόε όiυ έυάέευ όiό, εάε iάέεíβiόάδ Ύδάέόά όi εΎέόóiό όiό.


```
#
# Fast dialup terminals, 2400/1200/300 rotary (can start either way)
#
D2400|d2400|Fast-Dial-2400:\
        :nx=D1200:tc=2400-baud:
3|D1200|Fast-Dial-1200:\
        :nx=D300:tc=1200-baud:
5|D300|Fast-Dial-300:\
        :nx=D2400:tc=300-baud:
```

Άί Ý ÷ âðã modem ðççüðãñçð ðá ÷ ýðçðáð, ðεέáíúí íá ÷ ñáέáóðãß íá ðñíðèÝóáðã íéá έáóá ÷ þñέóç óðí /etc/gettytab. ÐáñáέÛðù òáßíáðáέ íéá έáóá ÷ þñέóç ðíð ðñíðãß íá ÷ ñçóέíðíεçέãß áέá modem 14.4 Kbps íá ðíãέóðç ðá ÷ ýðçðá óáέñέάέßð εýñáð 19.2 Kbps:

```
#
# Additions for a V.32bis Modem
#
um|V300|High Speed Modem at 300,8-bit:\
        :nx=V19200:tc=std.300:
un|V1200|High Speed Modem at 1200,8-bit:\
        :nx=V300:tc=std.1200:
uo|V2400|High Speed Modem at 2400,8-bit:\
        :nx=V1200:tc=std.2400:
up|V9600|High Speed Modem at 9600,8-bit:\
        :nx=V2400:tc=std.9600:
uq|V19200|High Speed Modem at 19200,8-bit:\
        :nx=V9600:tc=std.19200:
```

Άððù εá Ý ÷ áé ùð áðíðÝεáóíá óðíáÝóάέð 8bit ÷ ùñßð εóíðέίßá.

Ïí ðáñáðÛíù ðáñÛááεáíá, íáέέíÛ ðí ñðèìù áðέέιέíúíßáð óðá 19.2 Kbps (άέá íéá óýíááóç V.32bis), έáέ Ýðáέóá ìíέέíÛεáέ έðéέέέÛ óðá 9600 bps (άέá V.32), 2400 bps, 1200 bps, 300 bps, έάέ ðßóù óðá 19.2 Kbps. ΆóðP ç έðéέέέß ñíáέέáãP ñðèìý áðέððã ÷ Ûíáðáέ ðá ççí έέáíúðçðá nx= (“next table”). ÊÛεá íéá áðì ðέð áñáíìÝð ÷ ñçóέíðíεãß íéá έáóá ÷ þñέóç tc= (“table continuation”) áέá íá áñáέ ðέð ððüέíέðãð “ðððíðíεçíÝíáð” ñðèìßóáέð áέá έÛðíεí óðáάέñέέíÝíí ñðèìì ðáðÛáííóç ñááñíÝíúí.

Άί Ý ÷ âðã modem 28.8 Kbps þ/έάέ εÝéáðá íá áðùðáέçέãßðá áðì ççí óðèðßáóç áíúð modem 14.4 Kbps, εá ðñÝðáέ íá ÷ ñçóέíðíεßðáðã ñðèìù áðέέιέíúíßáð ðááέýóãñíí áðì 19.2 Kbps. ÐáñáέÛðù òáßíáðáέ Ýíá ðáñÛááεáíá íéá έáóá ÷ þñέóçð ððí gettytab ðíð ðáέέíÛáé áðì óá 57.6 Kbps:

```
#
# Additions for a V.32bis or V.34 Modem
# Starting at 57.6 Kbps
#
vm|VH300|Very High Speed Modem at 300,8-bit:\
        :nx=VH57600:tc=std.300:
vn|VH1200|Very High Speed Modem at 1200,8-bit:\
        :nx=VH300:tc=std.1200:
vo|VH2400|Very High Speed Modem at 2400,8-bit:\
        :nx=VH1200:tc=std.2400:
vp|VH9600|Very High Speed Modem at 9600,8-bit:\
        :nx=VH2400:tc=std.9600:
vq|VH57600|Very High Speed Modem at 57600,8-bit:\
```

:nx=VH9600:tc=std.57600:

Άί Ύ÷άδσ ανάνι άδάνάνάσδδP P ιάαΰέι σινδβι, έάέ δι όύόδçiά όάδ άάί άέάέΎδάέ όάέηέέέΎδ έύνάδ διό ίά άάόβειίόάέ όδι 16550Α, βδδδ έΰάάδσ έΰέç sio “silo” όδά 57.6 Kbps.

27.4.4.2 /etc/ttys

÷ιόια Pαç έάέύθάέ όç ηύέιέόç διό αν÷άβιδ /etc/ttys όδι Δάνΰάάέαιά 27-1. Ç ηύέιέόç άέά modems άβίάέ δάνιιέά, άέέΰ δñΎδάέ ίά άβιόια άέάοιηάδέέυι ηέέόιά όδçi getty έάέ ίά έάέιηβόιόια άέάοιηάδέέυι όύδι δάνιαδέέί. Ç άάίέέP ιιηδP όιόι άέά έέάέάιιΎίç υόι έάέ άέά ίάδάάέçδP όά÷ύόçδά άβίάέ ç δάνάέΰδδ:

ttyu0 "/usr/libexec/getty xxx" dialup on

Όι δηρδι δάαβι όόçi δάνάδΰιυ ανάνιP άβίάέ δι άέάέέυι αν÷άβι όδδδδδδδ άέά άδδP όçί έάδά÷ηέόç — δι ttyu0 άίόέόδιέ÷άβ όδι αν÷άβι /dev/ttyu0 δι ιδιβι έάέ έά δάνάέέιέιόέάβ ç getty. Όι άάύόάνι δάαβι, "/usr/libexec/getty xxx" (δι xxx έά Ύ÷άέ όçί αν÷έέP όέiP έέάίυόçόάδ διό gettytab), άβίάέ ç έέάνάάόβά διό έά άέδδΎάέ ç init όδç όδδδδδδδ. Όι όηβδι δάαβι, dialup, άβίάέ ι δηιάδέέάιΎιυ όύδι δάνιαδέέί. Ç όΎόάνδç δάνΰιάδδδδ, on, άάβ÷ίάέ όόçi init υδέ ç ανάνιP άβίάέ όά έάέοιηάέέP έάδΰόδάόç. Ιδιηάβ ίά δδΰñ÷άέ έάέ ίέά δΎιδδç δάνΰιάδδδδ, ç secure, άέέΰ έά δñΎδάέ ίά ÷ηçόέιιδιέάβδάέ ιυι άέά δάνιαδέέΰ όδά ιδιβά ç όδδδδδδ δηυόάάόç άβίάέ άόόάέδδ (υδδδ άβίάέ ç έίίόυέά διό όδδδδδδδδ).

Ι δηιάδέέάιΎιυ όύδι δάνιαδέέί (dialup όδι δάνάδΰιυ δάνΰάάέαιά) ιδιηάβ ίά άέέΰιάέ άίΰειάά ίά όέδ δηιόέιPόάέδ όάδ. Όι dialup άβίάέ ι δάνάάιόέάέυδ όύδι δάνιαδέέί άέά άδέέιέάέΎδ ανάνιΎδ. Ιέ ÷ηPόδδδ ιδιηίΎί Ύόόέ ίά δηιόάνιυάέιόι όά scripts όύίάάόçδ διδδ Pόδά ίά άίάάιηηβειόι δι dialup έάέ ίά ηδδδβειόι άδδδδδδδ δι όύδι δάνιαδέέί. ΰόδδδδ, άβίάέ ιΰέειί άδέειυδάνι ίά έάέιηβδάδδ δι vt102 υδ όι δηιάδέέάιΎιυ όύδι δάνιαδέέί, έάέηδ ίέ ÷ηPόδδδ ÷ηçόέιιδιέίΎί όδιPδδδ άηιιβυόç VT102 όδά άδηιάέηδδδΎίά διδδ όδδδδδδδδ.

Άόίϋ έΰίάδσ όέδ άέέάάΎδ όδι /etc/ttys, ιδιηάβδσ ίά όδδδβέδδσ όδç έέάνάάόβά init Ύίά όPιά HUP άέά ίά ίάίάάέάΰόάέ δι αν÷άβι. Ιδιηάβδσ ίά ÷ηçόέιιδιέPόδδδ όçί δάνάέΰδδ άίόιέP άέά άδδδ δι όέιδδ:

kill -HUP 1

Άί άδδP άβίάέ ç δηPόç σιηΰ διό ηδδδβέάδδδ δι όύόδçiά όάδ, βδδδ έΎέάδσ ίά δάνειΎίάδσ ιΎ÷ηέ ίά ιειέέçηPόδδδ δέPηδδ όç όύίάάόç έάέ ηύέιέόç διό modem όάδ δñεί όδδδβέάδδ όPιά όόçi init.

27.4.4.2.1 Νύέιέόç άέά ΈέάέάιιΎίç Όά÷ύόçδά

Άέά έάέόιηάβά όά έέάέάιιΎίç όά÷ύόçδά, έά δñΎδάέ ç έάδά÷ηέόç όάδ όδι ttys ίά δάνΎ÷άέ όόçi getty ίέά έάδά÷ηέόç όδδδδδδδ όά÷ύόçδά. Άέά Ύίά modem ιά όά÷ύόçδά έύνάδ έέάέάιιΎίç όδά 19.2 Kbps, ç έάδά÷ηέόç ttys έά ιιέΰάέ ίά όçί δάνάέΰδδ:

ttyu0 "/usr/libexec/getty std.19200" dialup on

Άί δι modem όάδ άβίάέ έέάέάιιΎίι όά άέάοιηάδέέυι ηέέιυ άάανΎιυι, άίδέέάδάόδPόδδ ίά όçί έάδΰέέçç όέiP δι std.19200 όόçi έάδά÷ηέόç std.speed. Άάάάέυέάβδδ υδέ ÷ηçόέιιδιέάβδδ Ύίά Ύάέοηι όύδι, υδδδ ιηβέάδάέ όδι /etc/gettytab.

27.4.4.2 Νύειός αέα λἀάαέçð Ð á÷ ýðçόά

Όά ιέα δΪδία νύειός, ç έάδἀ÷þñέόç σάδ αέα όι ttys έά δñΪδία ίά αίαöΪñάόάέ σόçí άñ÷έέÐ “auto-baud” (sic) έάδἀ÷þñέόç όιð /etc/gettytab. Άέα δάñÛάάεία, άί δñιόέΪόάδἀ όçí δάñάδÛíú όδίαέόþíáíç έάδἀ÷þñέόç αέα modem ίά λἀάάέçðð όά÷ýðçόάδ όάέñέάέðð, έάέ ίά άñ÷έέÐ όά÷ýðçόά όά 19.2 Kbps (όçí έάδἀ÷þñέόç gettytab διð δάñέΪ÷άέ ùδ όçíάþí άέέþίçόçδ όι V19200), ç έάδἀ÷þñέόç σάδ όδί ttys έά ίñέÛάέ ίά όçí δάñάέÛδù:

```
ttyu0 "/usr/libexec/getty V19200" dialup on
```

27.4.4.3 /etc/rc.d/serial

Όά modems δøçèðð όά÷ýðçόάδ, ùδùδ όά V.32, V.32bis έάέ V.34, άδάέόιγί Ϊέάä÷í ñíðð ίΪού όέέέιγί (RTS/CTS). Ìðñάβδά ίά δñιόέΪόάδ άίόιεΪδ stty όοί /etc/rc.d/serial αέα ίά έΪόάδά όοί δδñþíά όιð FreeBSD όçí έάöÛέèçç δάñÛíáðñι Ϊέάä÷íò ñíðð ίΪού όέέέιγί δùí έðñþí modem.

Άέα δάñÛάάεία, αέα ίά έΪόάδά όçí άδέείäþ termios όόçí όείð crtscts όόέδ όδóέäðΪδ άñ÷έέίðíþçόçδ όçδ ääýδάñçð όάέñέάέðð έýñάδ (COM2) αέα άδέείäέέΪδ έèþóάέδ άέóúäιð έάέ άíúäιð, έά δñΪδία ίά δñιόέΪόάδ όέδ δάñάέÛδù άñάιΪδ όοί άñ÷άþí /etc/rc.d/serial:

```
# Serial port initial configuration
stty -f /dev/ttyul.init crtscts
stty -f /dev/cuau1.init crtscts
```

27.4.5 Νδèιβόάέδ ίíþιçð

Άί Ϊ÷άδ άΪά modem όοί ίðíþι ìðñάβδά ίά άðíèçέäýόάδά όέδ δάñάιΪðñιðð ίúíέίά σόçí ίç-ðççóέέþ RAM διð αέαέΪόάέ, έά δñΪδία ίά ÷ñçóείðíέþóάδ άΪά δñúáñάιú όáñιáóέέιγί (ùδùδ όι **Telix** ίΪού όιð MS-DOS þ όιð tip όοί FreeBSD) αέα ίά ñδèιβόάδά όέδ δάñάιΪðñιðð. Όδίαάέάβδά όοί modem ÷ñçóείðíέþíðάδ όçí þάέα άñ÷έέþ όά÷ýðçόά άδέέιέíñíβάδ ίά áððþ διð Ϊ÷άδ άçèþάέ ùδ άñ÷έέþ όά÷ýðçόά όόçí getty, έάέ ñδèιβόάδ όέδ δάñάιΪðñιðð σόç ίíþιç όιð þððά ίά όάέñέÛάειðí ίά όέδ δάñάέÛδù άδάέðþάέδ:

- Όι σþíá CD έά άþíάέ άíáñáú ùδάί όι modem άþíάέ σóíáñΪí
- Όι σþíá DTR έά άþíάέ άíáñáú έάðÛ όç έάέóιðñάþά. Άδάíáñáðíþçόç όιð DTR έέάþíάέ όç áñάιþ έάέ άδάíáóΪñάέ όι modem όόçí άñ÷έέþ όιð έάðÛόδάόç.
- Όι CTS έά ÷ñçóείðíέþóάέ αέα Ϊέάä÷í ñíðð ίάδάέέäüíáíúí äáñΪíúí
- Ì Ϊέάä÷íò ñíðð XON/XOFF έά άþíάέ άíáíáñáúð
- Όι RTS έά ÷ñçóείðíέþóάέ αέα Ϊέάä÷í ñíðð èçðèΪίóúí äáñΪíúí
- ¹ óð÷ç έάέóιðñάþά (Quiet mode, ÷ññðð άðίόóιέþ èüάέèþí άðίðάέáóíÛδúí)
- Äáí έά άþíáδάέ echo δùí άίόíέþí

Έά δñΪδία ίά αέαáÛόάδά όçí δάέιçñβùç όιð modem σάδ αέα ίά άñάβδά όέδ άίόιεΪδ διð δñΪδία ίά άðíóάþέάδά. ºóùð άððçðð ÷ñάέáóδáþ ίά έέéÛíáδά όç έΪόç èÛðίέúí ñδèιέóέέèþí έάέειððþí (dip switches).

Άέα δάñÛάάεία, αέα ίά ñδèιβόάδά όέδ δάñάδÛíú δάñάιΪðñιðð όά Ϊίά άíúðáñέέü modem U.S. Robotics® Sportster® 14,400, έά Ϊðñάðά ίά óάþέäðά όέδ δάñάέÛδù άίόιεΪδ όοί modem:

έáíáÛíáðá ðçí ðñíðñíðP login: , äíééíÛóðá íáðÛ áðu éβáí íá óðáβéáðá Ýíá BREAK. Áí êÛíáðá êéÞóç áðu Ýíá modem ðççêÞð ðá÷-ýðçðáð, äíééíÛóðá íáíÛ, áðíý ééáéäÞóðáð ðçí ðá÷-ýðçðá äðééíéíúíβáð ððíéíáéððP — modem áðu ðí ððíβí ééáéáβðá (íÝóú ð.÷. ðçð AT&B1 óá Ýíá U.S. Robotics Sportster modem).

Áí ááí ððíñáβðá áéúíá íá êÛíáðá ðñíðñíðP login: , äéÝáíðá íáíÛ éáé íáíÛ ðí áñ÷áβí /etc/gettytab.

- Õí ùíñá ðçð áñ÷éêÞð ééáíúðçðáð ðíð éáéíñβæáðáé óðí áñ÷áβí /etc/ttys áéá ðç áñáñìP ðñÝðáé íá óáéñéÛæáé ðí ðí ùíñá ðçð ééáíúðçðáð óðí /etc/gettytab
- ÊÛëá éáðá÷Þñéóç nx= óáéñéÛæáé ðí ðí ùíñá íéáð áíóβððíé÷çð ééáíúðçðáð óðí gettytab
- ÊÛëá éáðá÷Þñéóç tc= óáéñéÛæáé ðí ðí ùíñá íéáð áíóβððíé÷çð ééáíúðçðáð óðí gettytab

Áí êÛíáðá êéÞóç áéêÛ ðí modem óðí FreeBSD óýóðçíá ááí áðáíðÛáé, ááááéúéáβðá úðé ðí modem áβíáé ððéíéóíÝíí íá áðáíðÛáé ðçí ðççáðúíéêÞ áñáñìP úðáí áíáñáíðíéáβðáé ðí óÞíá DTR. Áí ðí modem óáβíáðáé íá áβíáé ððéíéóíÝíí óúóðÛ, áðáéççéáýóðá úðé ç áñáñìP DTR áβíáé áíáñáÞ äéÝá÷ííðáð ðéð óúðáéíÝð áíááβíáðéð ðíð modem (áf ððÛñ÷íðí).

Áí Ý÷áðá äéÝáíáé ðá ðÛíðá ðíééÝð óíñÝð, éáé áéúíá ááí óáβíáðáé íá áñβóéáðá ðç éýóç, êÛíðá Ýíá äéÛéäéíá éáé ðñíððáêÞðá íáíÛ áñáúðáñá. Áí áéúíá ááí éáéðíðñááβ, βúðð áβíáé éáéÞ éáÝá íá óðáβéáðá Ýíá ðÞíðá óðçí ççééðñíéêÞ éβððá ááíéêÞí áñúðÞóáúí ðíð FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>) ðáñéáñÛóíðáð ðí ðñúáéççíá óáð éáé ðí modem óáð, éáé íé éáéíβ Ûíéñúðíé ðíð ðáñáéíéíðéíýí ðçí éβððá éá ðñíððáêÞðíðí íá óáð áíçêÞðíðí.

27.5 Õðçñáóβá ÄðééíáéêÞð Óýíááóçð

ðñíáéáíðíβçòç: Áðu ðí FreeBSD 8.0 éáé ðáðÛ, ðá áñ÷áβá óðóéáðÞí ðúí óáéñéáéÞí éðñÞí ðáðíííÛóðçéáí áðu /dev/cuadN óá /dev/cuauN. Ìé ðñÞðóðáð ðíð FreeBSD 7.X éá ðñÝðáé íá ðñíðáñíúðíðí ðçí ðáñáéÛòú ðáéíçñβúóç óýíðúíá ðá ðéð ðáñáðÛíú áééááÝð.

ðáñáéÛòú éá áñáβðá êÛíéáð ððíáíðéÝð áéá íá ððíñÝóáðá íá óðíáÝóáðá ðíð ððíéíáéððP óáð ðÝóú modem óá êÛíðíéí Ûééí ððíéíáéððP. Ìá ðíð ðñúðí áððú, ððíñáβðá íá áçíéíðñáÞóðáð óýíááóç ðáñíáðééíý ðñíð Ýíá áðñáéñðóíÝíí ððíéíáéððP.

Ç ððçñáóβá áððP ðñçóéíáýáé áðβçðð áéá íá óðíááéáβðá óá ðéá BBS.

Áððú ðí áβáíð óýíááóçð ððíñáβ íá óáíáβ áíáéñáðééÛ ðñÞóéíí áéá íá ðÛñáðá êÛíéíí áñ÷áβí áðu ðí Internet áí Ý÷áðá ðñúáéççíá óýíááóçð ðÝóú PPP. Áí èÝéáðá íá ðÛñáðá êÛòé ðÝóú FTP éáé ááí ððíñáβðá íá óðíááéáβðá ðÝóú PPP, óðíááéáβðá ðÝóú ðáñíáðééíý óá Ýíá Ûééí ððíéíáéððP, éáé éáðááÛóðá óá áððúí ðí áñ÷áβí ðÝóú FTP. ðáéðá, ðñçóéíðíéÞðá ðí ðñúðúéíééí zmodem áéá íá ðí ðáðáóÝñáðá óðíð ððíéíáéððP óáð.

27.5.1 Õí óýððíð Hayes Modem ðíð ááí Õðíóðçñβæáðáé, Õé ððíñÞ íá ÊÛíú;

Óðçí ðñáñíáðééúðçðá, ç óáéβáá manual ðçð tlp ááí áβíáé áíçíáñúíÝíç. ÕðÛñ÷áé Þäç éáðÛéççéí ááíééú ðñúáñáíá éêÞóçð áéá modems ðçð Hayes. ÁðêÞð ðñçóéíðíéÞðá ðçí éáðá÷Þñéóç at=hayes óðí áñ÷áβí /etc/remote.

Õí ðñúáñáíá íäÞäçðð Hayes ááí áβíáé áñéáðÛ Ýíððí Þóðá íá áíááíñβæáé êÛíéíá áðu ðá ðñí÷ùñçíÝíá ðñáéðçñéóðéÛ ðúí íáÞðáñúí modems. Ìðíñáβ íá ððáñáðððáβ áðu ðçíýíáðá ðððð óá BUSY, NO DIALTONE, Þ

CONNECT 115200. Έά δñÝδάέ ίά άδάρáñáñíδιεΠρόάδδ άδδΰ όά ίçíγíάόά üδái ÷ñçóεñíδιεάβδδάέ όçí tip (όδÝεñíόάδ όçí áíδiεΠ ATX0&W).

Άδβόçδ, όì ìÝάέόδì ÷ñíεέü äéÜόçíá όì ðδìβì δáñεìÝíáέ ç tip áβíáέ 60 ääδδáñüéäδδά. Όì modem óád έά δñÝδάέ ίά Ý ÷ áé íéèñüδáñì ÷ñíεέü δáñεèρñéì, áεεèρδ ç tip έά ðñβæáέ üδé δδΰñ ÷ áé δñüäεçíá άδέειέιύβδδ. Άíεéìΰόάδ όçí áíδiεΠ ATS7=45&W.

27.5.2 Δυδδ Όδiδβέάδάέ ¼δé έά Όδάβέü Άδδΰδ όέδ ΆΌ Áíδiεΰδ;

ΆçíεíδñáΠρόάδ άδδü δiδ ðñíÜæáδάέ “άδäδèάβδδ” έάδά ÷ ðñέόç óδì áñ ÷ áβì /etc/remote. Άέά δáñÜäáéáìá, áí όì modem óád áβíáέ όδiáñì Ýí ò όçí δñρδç óáεñéáέΠ έýñá, /dev/cuau0, δñíδèÝόδä όçí áéüεíδèç áñáñìΠ:

```
cuau0:dv=/dev/cuau0:br#19200:pa=none
```

Όόçí έέáíüδçδá br, ÷ñçóεñíδιεΠρόάδ όìí δρçéüδáñì ðδèìü bps δiδ δδiόδçñβæáέ όì modem óád. δάέδá, δέçéδñíεíáΠρόάδ tip cuau0 έáέ έá όδiáñäèάβδδä ìá όì modem óád

¹ ÷ñçóεñíδιεΠρόάδ όçí cu ùδ root, áβñíδóád όçí áéüεíδèç áíδiεΠ:

```
# cu -lline -sspeed
```

Όì line áβíáέ ç óáεñéáέΠ έýñá (δ. ÷. /dev/cuau0) έáέ όì speed áβíáέ ç óá ÷ ýδçδá (δ. ÷. 57600). ¼δái óáεáερδδä ìá όέδ áíδiεΰδ ΆΌ, áñÜδδä ~. áéá ίά δáñiáδβδδä δç óýíáäόç.

27.5.3 Όì Óýíáíεí @ όçδ έέáíüδçδád ðñ Äáí Έáέδiδñááβ!

Όì óýíáíεí @ όçδ έέáíüδçδád όççäδüíεéíý áñéèíý (pn, phone number) íäçááβ όçí tip ίá áéááÜόάέ όì áñ ÷ áβì /etc/phones áéá Ýíá όççäδüíεéü áñéèìü. ΆέéÜ όì óýíáíεí @ áβíáέ άδβόçδ Ýíád áéáééüδ ÷ áñáéδΠñád óá áñ ÷ áβá έέáñíδΠδüí üδüδ όì /etc/remote. Έά δñÝδάέ ίά ÷ñçóεñíδιεΠρόάδä όçí áíÜδiäç èÜéäδì áéá ίá äçερδδä üδé ááí áδéèδiáβδδä ίá Ý ÷ áé áδβáñáόç áéáééíý ÷ áñáéδΠñá:

```
pn=\@
```

27.5.4 Δυδδ ìδiñρ ίά Έáéΰδü ðá Όççäδüíεéü Áñéèìü Άδü όçí ΆñáñìΠ Áíδiερì;

ΆÜéδä íéá “ááíéèΠ” έάδä ÷ ðñέόç óδì áñ ÷ áβì /etc/remote. Άέά δáñÜäáéáìá:

```
tip115200|Dial any phone number at 115200 bps:\
    :dv=/dev/cuau0:br#115200:at=hayes:pa=none:du:
tip57600|Dial any phone number at 57600 bps:\
    :dv=/dev/cuau0:br#57600:at=hayes:pa=none:du:
```

δάέδá ìδiñáβδδä ίá áβíáδä áíδiεΰδ üδüδ:

```
# tip -115200 5551234
```

Áí δñíδèìΰδä όçí cu áíδβ áéá όçí tip, ÷ñçóεñíδιεΠρόάδ íéá ááíéèΠ έάδä ÷ ðñέόç áéá όçí cu:

```
cu115200|Use cu to dial any number at 115200bps:\
    :dv=/dev/cuau1:br#57600:at=hayes:pa=none:du:
```

êää ðëçëðñÿÿÿäÞóðä:

```
# cu 5551234 -s 115200
```

27.5.5 Ðñÿðää íá ÐëçëðñÿÿÿäÞ ðÿ Ñöèù bps ÊÛëä ÖÿñÛ ðÿð ðÿ ÊÛÿù Áðöù;

Ëá ðñÿðää íá ðñÿöÿóáðä íéá êáðä÷þñéç tip1200 Þ cu1200, äëÛ ïðÿñáßðä íá äÛëäðä ççí äéèÞ óäð äðéèðÿçðÞ ðéÿÞ óðçí ééáíùðçðä br. Ç áíðÿÞ tip èäùñáß ùðé óá 1200 bps áβíáé íéá êáèÞ ðñÿäðéÿÿäÞ, êää äéá ðÿ èüäÿ áðöù øÛ÷íáé íá ãñáé íéá êáðä÷þñéç tip1200. Äáí ÷ñáèÛæáðäé ùðöùóÿ íá ÷ñçóéÿÿðÿéÞóðäðä óá÷ýçðä 1200 bps.

27.5.6 ÷ù Ðñüðääóç óá ÿá Áñèèù Öðÿÿÿééðÿí Ìÿóù Áíùð ÇñáðçðÞ Öáñÿáðééþÿ

Áíðß íá ðáñéÿÿíáðä ïÿ÷ñé íá óíáæäððä êää íá ðëçëðñÿÿÿäÞðä CONNECT host êÛëä öÿñÛ, ÷ñçóéÿÿðÿéÞóðä ççí ééáíùðçðä cm ðÿð tip. Äéá ðáñÛäéäÿ, äáßðä ðéð ðáñáèÛðù êáðä÷ùñßðäéð óðÿ /etc/remote:

```
pain|pain.deep13.com|Forrester's machine:\
      :cm=CONNECT pain\n:tc=deep13:
muffin|muffin.deep13.com|Frank's machine:\
      :cm=CONNECT muffin\n:tc=deep13:
deep13:Gizmonics Institute terminal server:\
      :dv=/dev/cuau2:br#38400:at=hayes:du:pa=none:pn=5551234:
```

Öÿ ðáñáðÛÿù, éá óäð äðéðñÿðääé íá ãñÛðáðä tip pain Þ tip muffin äéá íá óðÿÿáððä óðÿðð ððÿÿÿééðÿíÞð pain Þ muffin, êää tip deep13 äéá íá óðÿÿáððä óðÿí áíùðçñáðçðÞ öáñÿáðééþÿ.

27.5.7 ïðÿñáß ç Tip íá ÄÿéèÛöáé Ðáñéóóüðáñáð Áðü íéá Áñáÿÿò äéá êÛëä Óÿíáðç;

Áðöù ðÿ ðñÿäéçÿá óðÿÞèð ïðáíßæáðäé óá ÿÿá ðáíáðéóðÞÿÿÿ ðÿð ÿ÷áé áñéáðÿð ãñáñÿÿò äéá modem, äëÛ êää ÷ééèÛäðð ðÿéçðÿð ðÿð ðñÿððáéÿÿí íá ðéð ÷ñçóéÿÿðÿéÞóðÿí.

ÄçÿÿÿðñáÞóðä íéá êáðä÷þñéç äéá ðÿ ðáíáðéóðÞÿÿÿ óäð óðÿ /etc/remote êää ÷ñçóéÿÿðÿéÞóðä ðÿ @ óðçí ééáíùðçðä pn:

```
big-university:\
      :pn=\@:tc=dialout
dialout:\
      :dv=/dev/cuau3:br#9600:at=courier:du:pa=none:
```

ðáéðä, äçÿÿÿðñáÞóðä íéá èßðä ïá ðÿðð áñéèÿÿð ççéáðÞÿÿÿ ðÿð ðáíáðéóðçÿÿÿðð óðÿ /etc/phones:

```
big-university 5551111
big-university 5551112
big-university 5551113
big-university 5551114
```

Ç tip èá äÿéèÛöáé êÛëä ïßá, ïá çç óáéñÛ ðÿð ïðáíßæáÿÿðäé, êää èá óðáíáðÞóðäé. Áí èÿèáðä íá óðÿÿá÷ßæáé ççí ðñÿðÛëäéá, áèðäèÿóðä ççí tip ïÿóá óá ÿÿá ãñüä÷ÿ while.

27.5.8 Άέάοβ ΔñÝðáέ ίά ΔέΎού Ctrl+P Άγί ΟϊñÝð áέά ίά Οόαβέù οϊ Οοϊάοάοιù Ctrl+P ίέα ΟϊñÛ;

Ï οοϊάοάοιùδ δεβέδññί Ctrl+P άδϊοάέάβ οϊí δññάδέέάñÝñ ÷ άñάέδPñά “άίάίάάέάοιγ (force)”, έάέ ÷ ñçόέιιθϊέάβόάέ áέά ίά έάοάέÛάάέ ç tip υόέ ι άδññάññ ÷ άñάέδPñάδ έά δñÝðáέ ίά ÷ ñçόέιιθϊέέçέάβ υδñδ άβίάέ. Ïδññάβδά ίά έΎόάδδ οϊí ÷ άñάέδPñά άίάίάάέάοιγ όά ιθϊέίάPδϊοά Ûέέι ÷ άñάέδPñά, ÷ ñçόέιιθϊέβϊόάδ όçί áέιέιθέβά áέάοδάPδ ~s, ç ιθϊβά όçίάβίάέ “ñýèιέόά ίέα ίάοάάέçδP”.

ΔέçέδññιέιάPδδά ~sforce=single-char έάέ όδϊά ÷ βδδά ίά Ύίά ÷ άñάέδPñά ίΎάδ άññìPδ. Òι single-char άβίάέ ιθϊέιόάPδϊοά ιññδ ÷ άñάέδPñάδ. Άί άδPδδδά έάññ οϊ single-char, ι ÷ άñάέδPñάδ άίάίάάέάοιγ έά άβίάέ ι nul, οϊí ιθϊβι ιθññάβδά ίά δέçέδññιέιάPδδδά ÷ ñçόέιιθϊέβϊόάδ οϊ οοϊάοάοιùδ δεβέδññί Ctrl+2 P Ctrl+Space. Ïέα άñέάδÛ έάέP όέιP áέά οϊ single-char άβίάέ οϊ Shift+Ctrl+6, δϊθ ÷ ñçόέιιθϊέάβδδάέ ιññί όά έÛθϊέιθδ άιθδçññάδçδΎδ δάññιάδέέβϊ.

Ïδññάβδά ίά ιñβδδδά οϊ ÷ άñάέδPñά άίάίάάέάοιγ όά υθϊέίί άόάβδ άδέέδññάβδδά, ίά όçί áέιέιθέç έάδδ ÷ ðñέόç όοί άñ ÷ άβι \$HOME/.tiprc:

```
force=single-char
```

27.5.9 ΙάοϊέέÛ ¼δέ ΆñÛδù Άιόάίβæάδάέ ίά Έάοάέάβά ΆñÛιιάόά!!

ÏÛέέιι Ύ ÷ δδά δέΎόάέ Ctrl+A, δϊθ άβίάέ ι “ ÷ άñάέδPñάδ άίγθδδόçδ” όçδ tip, έάέ άβίάέ ό ÷ άάέάοιΎñδ áέάέέÛ áέά υοιθδ Ύ ÷ ιθϊ δññάέçιά ίά οϊ δεβέδññί CAPS LOCK. ×ñçόέιιθϊέέPδδά όçί άίθϊέP ~s δϊθ άάβιάίά δάñάδÛñ, áέά ίά έΎόάδδ ίέα ιέιέέP όέιP όδç ίάδδάάέçδP raisechar. Óόçί δññάιάδέέέυδçδά, ιθññάβδδά ίά έΎόάδδ όçί βάέά όέιP ίά οϊí ÷ άñάέδPñά άίάίάάέάοιγ, άί άάι όέιθάγάδδ δϊθΎ ίά ÷ ñçόέιιθϊέPδδάδ έÛθϊέά άδñ άδδΎδ δέδ άοιάδδδδδδ.

ΔάñάέÛδδ δάβιάδδάέ Ύίά όδññάέάιά άñ ÷ άβιθ .tiprc, οϊ ιθϊβι άβίάέ δΎέάέι áέά ÷ ñPδδδδδδ οϊθ Emacs δϊθ ÷ ñάέÛæάδάέ ίά δέçέδññιέιάγίγί όδ ÷ ίÛ Ctrl+2 έάέ Ctrl+A:

```
force=^^
raisechar=^^
```

Ï ÷ άñάέδPñάδ ^^ άβίάέ ι Shift+Ctrl+6.

27.5.10 Δùδ Ïθñð ίά ίάδδάδΎñù Άñ ÷ άβά ίά όçί tip;

Άί άδέέιέιγίάβδδά ίά Ûέέι UNIX όγόδçιά, ιθññάβδδά ίά όδάβέάδδά έάέ ίά έÛάάδδά άñ ÷ άβά ίά δέδ άίθϊέΎδ ~p (put) έάέ ~t (take). Ïέ άίθϊέΎδ άδδΎδ άέδδάέγίγί δέδ cat έάέ echo όδϊ άδññάέñδδδδδδϊññί όγόδçιά áέά ίά έάιάÛññϊθϊ έάέ ίά όδΎέññϊθϊ άñ ÷ άβά. Ç όγίόάιç οϊθδ άβίάέ:

```
~p οϊθέέέυ-άñ ÷ άβι [άδññάέñδδδδδδϊññί-άñ ÷ άβι]
```

```
~t άδññάέñδδδδδδϊññί-άñ ÷ άβι [οϊθέέέυ-άñ ÷ άβι]
```

Ïέ δάñάδÛñ άίθϊέΎδ άάι áέάέΎοιθϊ Ύέάά ÷ ι έάέβϊ. Έά άβίάέ έάέγδδάñι ίά ÷ ñçόέιιθϊέέPδδδδδδ έÛθϊέι Ûέέι δññδδδδδδδδδδ, υδñδδδδδ οϊ zmodem.

27.5.11 Èùò Ìðññ Ìá ÄêöäëÝòò òí zmodem Ìá ôçí tíρ;

Äέά Ìá εÙάάòä åñ÷áβá, ÌáέéíΠòðä òí ðññáñáìá áðìòéíεòð òòíí áðñáéñòòíÝíí òðñíεáέòð. Ðáέòä ðεçέòñíεíáΠòðä ~c rz áέá Ìá ÌáέéíΠòðäðä ôçí òíðéέΠ εΠεç.

Äέá Ìá òðáβεáðä åñ÷áβá, ÌáέéíΠòðä òí ðññáñáìá εΠεçð òòíí áðñáéñòòíÝíí òðñíεáέòð. Ðáέòä ðεçέòñíεíáΠòðä ~c sz files áέá Ìá òðáβεáðä ðá åñ÷áβá òòíí áðñáéñòòíÝíí òýòðçíá.

27.6 Ñýεíέòç ôçò ÓáέñέάέΠð Èííòüέáð

Ðñíáέáíðñβòç: Áðö òí FreeBSD 8.0 έάέ ÌáðÙ, ðá åñ÷áβá òðòέάòðí òúí òáέñέάέðí εòññí ÌáðñííÙòðçέáí áðö /dev/ttydN óä /dev/ttyuN. Ìέ ÷ñΠòðäð òíò FreeBSD 7.X έá ðñÝðáέ Ìá ðñíòáñíüòíòí ôçí ðáñáέÙðð òáέíçñβòç òýíòüíá Ìá ðέð ðáñáðÙú äέέáÝð.

27.6.1 Äέòáåüñ

Ôí FreeBSD Ý÷áé ôçí εέáíüðçòä Ìá äέέéíΠòðäέ òá Ýíá òýòðçíá òí Ìðññ ùð εíñòüέá áέáέÝðáέ Ýíá “εíòòù” òáñíáðέέü òñíáñíÝíí òá Ìέá òáέñέáέΠ εýñá. ÁðòΠ ç Ñýεíέòç áβíáέ ÷ñΠòðéç òá áýí εáðçäññβáð áñεñððñí: áέá÷áέñέóðÝð òðòòçíÙòñí ðñò áðεέòñíýí Ìá äáέáðáòðòíòí FreeBSD òá Ìç÷÷áíΠíáðá òá Ìðññá äáí áέáέÝðòíòí ðεçέòñíεüáέí Π Ìεúíç, έάέ ðññáñáìáðέóðÝð ðñò áðéèòñíýí Ìá äέòðáέíáðññíòí òíí ðòñΠñá Π Ìäçáíýð òðòέáðñí.

¼ðùð ðáñéåññÙòðáέέ òòí ÊäöÙεάεí 13, òí FreeBSD ÷ñçòéíñðñέáβ òýòðçíá äέέβíççòçð ðñεñí òðááβñí. Óá ðñΠðá áýí òðÙáέá áβíáέ òòñí εραέέá òíò boot block, Ì Ìðññòð áðñεçέáýáðáέέ òðçí åñ÷áβ òççð εáðÙòíççòçð (slice) òíò äβòέíò äέέβíççòçð òíò FreeBSD. Ôí boot block εáðñðéé òññðñíáέ έάέ äέðáέáβ òíí òññòñðΠ äέέβíççòçð (/boot/loader) ùð εραέέá òíò ðñβòíò òðááβñí.

Äέá Ìá áñáñáñíòñéΠòðäð ôçí òáέñέáέΠ εíñòüέá, εá ðñÝðáέ Ìá ðñèññòáðä òíí εραέέá òíò boot block, òí òññòñðΠ äέέβíççòçð, έάέ òíí ðòñΠñá.

27.6.2 Ñýεíέòç ÓáέñέáέΠð Èííòüέáð (Óýíòíñç εáíòçç)

Ç áñúðçòä áðòΠ òðñέÝðáέ úé òέíðáýáðä Ìá ÷ñçòéíñðñέáðä òέð ðñíáðéέáñíÝíáð ðñèññòáέð, έάέ εÝέáðä áðεð Ìέá äñβáññç áðέòéüðççð ôçð áέááέέáðβáð Ñýεíέòçð ôçð òáέñέáέΠð εíñòüέáð.

1. ÓñíáÝòðä òí òáέñέáέü έáεραέí òðçí COM1 έáέ òòí ðáñíáðέέü.
2. Äέá Ìá äáβðä üέá òá Ìçýíýáðá äέέβíççòçð òðçí òáέñέáέΠ εíñòüέá, áðòðá ôçí ðáñáέÙðð áíòñεΠ ùð ððåñ÷ñΠòðçð:


```
# echo 'console=comconsole' >> /boot/loader.conf
```
3. Áðáíñáñáðóðáβðä òí /etc/ttys έάέ áέéÙíðä òí off òá on έάέ òí dialup òá vt100 áέá ôçí εáðá÷ññέòç ttyu0. ÄέáññáðέéÜ, äáí εá ÷ñáέÜæáðáέ éüäέéüð ðññòááòçð áέá ôç òýíááòç ÌÝòñ òççð òáέñέáέΠð εíñòüέáð, òí Ìðññ ððñðáέáβ ðééáíñú éáíñú áòòáέáβáð.
4. ÁðáíñáέέéíΠòðä òí òýòðçíá áέá Ìá äáβðä áí βò÷òóáí Ìέ áέéáÝð.

Áí ÷ñáέÜæáðä äέáññáðέéÝð ðñèññòáέð, εá äñáβðä éäðòñÝñáέáð áέá ôçí Ñýεíέòç òòí Ôðñá 27.6.3.

27.6.3 Νῦεέόç ΟὰέñεάέPδ Είίόεάδ

1. ΔñíáðéíṰóðά Ṳίá οὰέñεάέυ έάεPάεί.

Εά ÷ ñáέáóðáβδά áβδά Ṳίá έάεPάεί óýðíð null-modem, áβδά Ṳίá ðððíðéçíṲíí οὰέñεάέυ έάεPάεί έάέ Ṳίá ðñíóáñííáṲίá null-modem. Ἀάβδά ðí ὈíPíá 27.2 áέá έáððíñṲñáέáð ó÷-áðέέṲ íá ðá áβáç ðúí οὰέñεάέPí έάέυáβñí.

2. ἈðíóðíáṲóðά ðí ðεçέðñíεṲάεί óáð.

Ὀά ðáñέóóúðáñá PC øṲ ÷ ñíðí áέá ðí ðεçέðñíεṲάεί έáðṲ ðçí áέṲñέάά ðúí áέááñúóðέέPí áέέβίçóçð (POST, Power On Self Test), έάέ έá áíáðṲñíðí óóṲéíá áí ðí ðεçέðñíεṲάεί ááí áβíáέ óðíááíṲíí. ÍáñέέṲ íç÷-áíPíáðá ðáñáðííéíýíðáέ ç÷çñṲ áέá ðçí Ṳέέáέøç ðεçέðñíεṲáβíð, έάέ ááí óðíá÷βæíðí ðçí áέέβίçóç íṲ ÷ ñέ íá ðí óðíáṲóðά.

Ἀí í ððíεíáέóðPð óáð ðáñáðííéṲáέ áέá ðí εṲéíð, áέεṲ íáέείṲ Ṳóóέ έάέ áέέεPð, ááí ÷ ñáέṲæáðáέ íá εṲíáðá ðβðíðá έάέáβðáñí áέá áððú. (ÍáñέέṲ íç÷-áíPíáðá íá BIOS ðçð Phoenix, εṲíá áðέPð Keyboard Failed έάέ óðíá÷βæíðí ðçí áέέβίçóç έáñíéέṲ.)

Ἀí í ððíεíáέóðPð óáð áñíáβðáέ íá áέέείPóáέ ÷ ùñβð ðεçέðñíεṲάεί, έá ðñṲáέ íá ñðéíβóáðá ðí BIOS Póðá íá ááñáβ ðí εṲéíð (áí áβíáðáέ). Ὀðíáñéáððáβðá ðí áá÷-áέñβáεί ðçð íçðñέέPð óáð áέá έáððíñṲñáέáð ó÷-áðέέṲ íá áððP ðç áέáάέέáóβá.

Ὀðúááείç: Ṳðéíβóðá ðí ðεçέðñíεṲάεί óá “Not installed” óðí BIOS. Ç ñῦεέόç áððP áðέPð áðíðñṲáέ ðí BIOS áðú ðí íá áíé÷-íáýáέ ðí ðεçέðñíεṲάεί ðççí áέέβίçóç, έάέ ááí ðñúέáέðáέ íá óáð áíðíáβóáέ íá ðí ÷ ñçóέííðíéPóáðá έáñíéέṲ. Íðíñáβðá íá áðPóáðá ðí ðεçέðñíεṲάεί óðíááíṲíí áέúíá έάέ úðáí Ṳ÷-áðá áíáñáíðíéPóáέ ðç ñῦεέόç “Not installed”. Ἀí ááí ððṲñ÷-áέ ç ðáñáðṲíú ñῦεέόç óðí BIOS, øṲíðá áέá ðççí áðέéíáP “Halt on Error”. ἈέέṲíðá ðç óá “All but Keyboard” P áέúíá έάέ óá “No Errors”, έάέ έá Ṳ÷-áðá ðí βáεί áðíðṲéáðíá.

Ὀçíáβúóç: Ἀí ðí óýóðçíá óáð áέáέṲáέέ ðííðβέé óýðíð PS/2®, ðέέáíúí íá ðñṲáέ íá ðí áðíóðíáṲóðά έάέ áððú. Ὀá ðííðβέéá óýðíð PS/2 Ṳ÷-íðí εṲðíéá έðέέPíáðá έίείṲ íá ðí ðεçέðñíεṲάεί, áááííúð ðíð íðíñáβ íá ðñíéáέṲóáέ óýá÷-óçç óðí ðñúáñáííá áíβ÷-íáðóçç ðíð ðεçέðñíéṲáβíð. ΕṲðíéá óðóðPíáðá, úðúð ðí Gateway 2000 Pentium 90 MHz íá AMI BIOS, óðíðáñέóṲñííðáέ íá áððú ðíí ðñúðí. Ὀá ááíέέṲð áñáííṲð, áððú ááí áβíáέ ðñúáέçíá έáέPð ðí ðííðβέé Ṳóóέ έάέ áέέéPð ááí áβíáέ ÷ ñPóέíí ÷ ùñβð ðí ðεçέðñíεṲάεί.

3. ὈðíáṲóðά Ṳίá έíððú ðáñíáðέέṲ ðççí COM1 (sio0).

Ἀí ááí Ṳ÷-áðá έíððú ðáñíáðέέṲ, íðíñáβðá íá óðíáṲóðά Ṳίá ðáέέṲ PC/XT íá Ṳίá ðñúáñáííá áέá modem, P íá ÷ ñçóέííðíéPóáðá ðç οὰέñεάέP έýñá óá Ṳίá Ṳέéí íç÷-Ṳíçíá UNIX. Ἀí ááí Ṳ÷-áðá οὰέñεάέP έýñá COM1 (sio0), ááñṲóðá íέá. Ὀç áááñṲíçç óóέáíP ááí ððṲñ÷-áέ ðñúðíð íá áðέéṲíáðá Ṳέέç έýñá áέðúð áðú ðççí COM1, ÷ ùñβð íá áðáíáíáðááέúððβóáðá óá boot blocks. Ἀí ÷ ñçóέííðíéáβðá Páç ðççí COM1 áέá εṲðíéá Ṳέέç óðóέáðP, έá ðñṲáέ íá ðççí áóáέñṲóðá ðñíóúñéíṲ, έάέ íá ááέáðáóðPóáðá íṲí boot block έάέ ððñPíá, íúέéð óðíááέáβðá óðí FreeBSD. (ὈðíéṲóíðíá úðέ ç COM1 έá áβíáέ Ṳóóέ έάέ áέέéPð áέáέṲóέíç óá Ṳίá áíððçñáðçðP áñ÷-áβñí/ððíεíáέóíPí/ðáñíáðέέPí. Ἀí ðñáñíáðέέṲ ÷ ñáέṲæáðóðá ðççí COM1 áέá εṲðέ Ṳέéí (έάέ ááí íðíñáβðá áððú ðí εṲðέ Ṳέéí íá ðí íáðáέείPóáðá ðççí COM2 (sio1)), íṲέéíí ááí έá Ṳðñáðá íá áó÷-íεçέáβðá έáέέúéíð íá úéí áððú ðí εṲíá).

4. Ἀáááέúέáβðá úðέ ðí áñ÷-áβí ñðéíβóáñí ðíð ððñPíá óáð Ṳ÷-áέ ðéð έáðṲέέçéáð áðέéíáṲð (flags) áέá ðççí COM1 (sio0).

Íé ó÷-áðέέṲð áðέéíáṲð áβíáέ:

0x10

Άίáñáñιθιέάβ όçι όθιόδβñέίç εϊίóυεάδ áεά áóδβ όç εýñá. Άί ááí óáεάβ áóδβ ç áδέεϊάβ, óá όδυεϊέδá flags áεά όçι εϊίóυεά ááí εáíáÛñίóáε όδύóεϊ. Όç áááñÛίç óδéáìβ, ç όθιόδβñέίç εϊίóυεάδ ìðñáβ íá áβίáé áíáñáñιθιέçÛίç ìñíí óá íεά εýñá. Ç ðñβóç ðιό εáεìñβæáóáé óοι áñ÷áβì ñðεìβóáυì, áβίáé εáé áóδβ ðιό εá ðñιόείçεáβ. Άδύ ìιιç όçò, ç áδéεϊάβ áóδβ ááí εá áíáñáñιθιέβóáé όçι εϊίóυεά óòç óóáéáεñεϊÛίç óáéñέáéβ εýñá. Εά ðñÛðáé íá εÛóáóá όι ðáñáéÛòυ ð flag β íá ÷ñçóεïιθιέβóáóá όçι áδéεϊάβ -ñ ðιό ðáñεáñÛóáóáé ðáñáéÛòυ, ìáæβ ìá áóòυ όι flag.

0x20

ΆίáíááεÛááé όç óóáéáεñεϊÛίç εýñá íá áβίáé ç εϊίóυεά (áεòυò áí όðÛñ÷áé Ûεεç εϊίóυεά όøçευòáñçò ðñιðáñáευìóçóáò) Ûó÷áóá ìá όçι áδéεϊάβ -ñ ðιό ðáñεáñÛóáóáé ðáñáéÛòυ. Εά ðñÛðáé íá ÷ñçóεïιθιέβóáóá όι flag 0x20 ìáæβ ìá όι flag 0x10.

0x40

Ðáñáεñáóááβ όç óóáéáεñεϊÛίç εýñá (óá óóíáóáóιυ ìá όçι 0x10) εÛñίóáò όçι ìç áεáéÛóείç áεά εáñίεéβ ðñυóááóç. Άáí εá ðñÛðáé íá εÛóáóá áóδβ όçι áδéεϊάβ óòç óáéñέáéβ εýñá ðιό óεìðáýáóá íá ÷ñçóεïιθιέβóáóá ùò óáéñέáéβ εϊίóυεά. Ç ìιιç ÷ñβóç áóòιý όιò flag, áβίáé íá εáεìñβóáóá ùóé ç εýñá εá ÷ñçóεïιθιέçεáβ áεά áðñáεñóοιÛίç áεóóáεìÛòυóç όιò ððñβíá (kernel debugging). Άáβóá Όι Άέáεβì όιò Ðñιáñáñìáíáóéóóβ (http://www.FreeBSD.org/doc/e1_GR.ISO8859-7/books/developers-handbook/index.html) áεά ðáñεóóυòáñáò εáððñÛñáεáò ó÷áóééÛ ìá όçι áðñáεñóοιÛίç áεóóáεìÛòυóç.

ÐáñÛááεáìá:

```
device sio0 flags 0x10
```

Άáβóá όç óáεβáá manual sio(4) áεά ðáñεóóυòáñáò εáððñÛñáεáò.

Άί ááí Û÷ιòι εáεìñέóóáβ flags, εá ðñÛðáé íá áεòáεÛóáò όι UserConfig (óá áεáóìñáóééβ εϊίóυεά) β íá áðáíáìáóááευòóðβóáóá όι ððñβíá.

- 5. Άçìεìñáβóá όι áñ÷áβì boot.config óοιí ñεáεéυ εáòÛεϊáí όçò εáòÛòιçóçò á όιò áβóεìò áεéβίçóçò.

Όι áñ÷áβì áóòυ εá εáóáðεýíáé όιí εβáεéá όιò boot block ó÷áóééÛ ìá όι ðυò εÛεáóá íá áεéείβóáé όι óýóççíá. Άεά íá áíáñáñιθιέβóáóá όçι óáéñέáéβ εϊίóυεά, εá ÷ñáεáóááβóá ìá β ðáñεóóυòáñáò áδύ óéò ðáñáéÛòυ áδéεϊáÛ—áí εÛεáóá íá ðñιόáεìñβóáóá ðιεεáðεÛò áδéεϊáÛ, εá ðñÛðáé íá óéò ðáñεéÛááóá ùεáò óóçι βáεά áñáìβ.

-h

ΆíáεεÛóóáé ìáóáίý όçò áóυòáñεéβð εáé όçò óáéñέáéβð εϊίóυεáò. Άεά ðáñÛááεáìá, áí ìáéείβóáóá áδύ όçι áóυòáñεéβ εϊίóυεά (ìευίç), ìðñáβóá íá ÷ñçóεïιθιέβóáóá όçι áδéεϊάβ -ñ áεά íá εáóáðεýíáóá όι όιñòυðβ áεéβίçóçò εáé όιí ððñβíá íá ÷ñçóεïιθιέβóíοι όç óáéñέáéβ εýñá ùò óóóéáòβ εϊίóυεáò. ΆíáεεáéóééÛ, áí áεéείβóáóá ìÛóυ όçò óáéñέáéβð εýñáò, ìðñáβóá íá ÷ñçóεïιθιέβóáóá όçι áδéεϊάβ -ñ áεά íá εáóáðεýíáóá όι όιñòυðβ áεéβίçóçò εáé όιí ððñβíá íá ÷ñçóεïιθιέβóíοι όçι εáñίεéβ εϊίóυεά áíòβ áεά όç óáéñέáéβ.

-D

ΆíáεεÛóóáé ìáóáίý όçò áðεβð εáé όçò áεðεβð εϊίóυεáò. Όóçι ñýεìóç áðεβð εϊίóυεáò, εá ÷ñçóεïιθιέçεáβ áβóá ç áóυòáñεéβ εϊίóυεά (áðáéευιέóç óá ìευίç) áβóá ç óáéñέáéβ εýñá, áíÛεϊáá ìá όι ðυò Û÷áé óáεáβ ç áδéεϊάβ -ñ ðιό áíáòÛóáìá ðáñáðÛì. Óá ðáñβðòυóç áεðεβð εϊίóυεáò, εá áíáñáñιθιέçεϊýí óáóòυ÷ñíá óυοι ç áóυòáñεéβ υοι εáé ç óáéñέáéβ εϊίóυεά, Ûó÷áóá áδύ όç ñýεìóç όçò áδéεϊάβð -ñ. Όçìáεβóá ùóóυοι ùóé ç ñýεìóç áεðεβð εϊίóυεáò ìðñáβ íá áíáñáñιθιέçεáβ ìñíí εáòÛ όçι áεéβίçóçò, υοι áεòáεáβóáé όι boot block.

Ίεέδ αϊεάβ ι Ύεάα÷ιò óðι òιñòυòÐ áέεβίççò, ç ιιίαέεÐ εϊιούεά ðιò ðáñáιΎίáε áβίαé áδòÐ ðιò έάεϊñβæάðάé áδυ όçί άδέεϊάÐ -h.

-P

Άϊάñáñιðιέάβ όçί áιβ÷íáòόç ðεçέòñιεϊάβιò ðιò boot block. Άί ááí áñáεάβ ðεçέòñιεϊάεϊ, áϊάñáñιðιέϊύόάé áδòυιáόά ίé άδέεϊάΎδ -D έάé -h.

Όçίáβυόç: Έυáυ ðáñέϊñέóιπí ÷þñιò óðçί ðñΎ÷ιòóá Ύέáιόç ðυι boot blocks, ç άδέεϊάÐ -P ιðιñáβ ίá áίé÷íáγóάé ιυñí áέòáðáιΎίá (extended) ðεçέòñιεϊάéá. ðεçέòñιεϊάéá ίá έέáυòáñá áδυ 101 ðεþέòñá (έáé ÷υñβò ðá ðεþέòñá **F11** έáé **F12**) βóυò ίá ιçί áίé÷íáðεϊýí. Άίáέòβáð áðóιý ðιò ðáñέϊñέóιιý, áβίαé ðέέáιυ ίá ιçί áίé÷íáðεϊý έáé έΰðιέá ðεçέòñιεϊάéá òιñçòþι ððιέϊáέóòþι. Άί óðιááβίáé áδòυ óðι óγóðçίá óáð, έá ðñΎðáé ίá óðáιáðþóáðá ίá ÷ñçóέιιðιέáβóá όçί άδέεϊάÐ -P. Άðóðò÷þò, ááí ððΎñ÷áé έΰðιέιò ðñυðιò ίá ðáñáέΰιòáðá áδòυ ðι ðñυáέçίá.

×ñçóέιιðιέþóáá áβóá όçί άδέεϊάÐ -P áéá ίá άδέéΎίáòá όçί εϊιούεά áδòυιáόά, Þ όçί άδέεϊάÐ -h áéá ίá áϊάñáñιðιέþóáá όç óáέñέáεþ εϊιούεά.

Ίðιñáβòá áðβóçð ίá ðáñέéΎááòá έáé Ύεéáð άðέεϊάΎδ ðιò ðáñέáñΎòιιόáé óðç óáέβáá manual ðιò boot(8).

¼éáð ίé άδέεϊάΎδ áέεβίççòç, áέòυð όçð -P, έá ðáñΎóιòι óðι òιñòυòÐ áέεβίççòç (/boot/loader). Ί òιñòυòÐ ðò áέεβίççòç έá έáεϊñβóáé áί ç εϊιούεά έá áçιέιòñáçέáβ óðçί ιευιç Þ óðç óáέñέáεþ έýñá, áóιý áïáðΎóáé ιυñí όçί άðέεϊάÐ -h. Άðòυ όçίáβίáé υòέ áί έáεϊñβóáòá όçί άðέεϊάÐ -D áεéΎ υ÷é όçί άðέεϊάÐ -h óðι /boot.config, έá ιðιñáβòá ίá ÷ñçóέιιðιέþóáá όçί óáέñέáεþ έýñá υò εϊιούεά ιυñí έáðΎ όçί áέðΎέáόç ðιò boot block. Ί òιñòυòÐ ðò áέεβίççòç υιυð έá ÷ñçóέιιðιέþóáé όçί áóυðáñέéþ εϊιούεά (ιευιç).

6. Άέέεϊþóáá ðι ιç÷Ύίçίá.

¼óáί ίáέεϊþóáá ðι FreeBSD ιç÷Ύίçίá, óá boot blocks έá ááβñιòί óá ðáñέá÷υιáίá ðιò /boot.config óðçί εϊιούεά. Άέá ðáñΎááέáιá:

```
/boot.config: -P
Keyboard: no
```

Ç ááýóáñç áñáιιþ έá áιòáίέóòáβ ιυñí áί áΎεáðá όçί άðέεϊάÐ -P óðι /boot.config, έáé ááβ÷íáé áί ððΎñ÷áé Þ υ÷é óðιááιΎι ðεçέòñιεϊάεϊ. Óá ιçίýιáóá áðòΎ έáðáðεýñιíðáé óðçί óáέñέáεþ Þ óðçί áóυðáñέéþ εϊιούεά, Þ áέυιá έáé óóέð áýι, áίΎεϊáá ίá όçί άðέεϊάÐ ðιò Ύ÷áé áβίáé óðι /boot.config.

ΆðέεϊáΎò	Όι ιþιòιá áιòáίβæáðáé óðçί
έáιιβá	áóυðáñέéþ εϊιούεά
-h	óáέñέáεþ εϊιούεά
-D	áóυðáñέéþ έáé óáέñέáεþ εϊιούεά
-Dh	óáέñέáεþ έáé áóυðáñέéþ εϊιούεά
-P, ðεçέòñιεϊάéι óðιááιΎι	áóυðáñέéþ εϊιούεά
-P, ÷υñβò ðεçέòñιεϊάéι	óáέñέáεþ εϊιούεά

ΊáðΎ óá ðáñáðΎιυ ιçίýιáóá, έá ððΎñíáé ίéá ίέéñþ ðáýόç ðñέι óá boot blocks óðιá÷βóιòι òιñòþñιíðáð ðι òιñòυòÐ áέεβίççòç, έáé ðñέι áιòáίέóòιýι ðáñέóóυðáñá ιçίýιáóá óðçί εϊιούεά. Óðυ έáñιέéΎð óðιèþéáð, ááí ÷ñáéΎæáðáé ίá áέáέυòáðá óá boot blocks, áεéΎ βóυò èΎεáðá ίá ðι έΎίáðá áðòυ áéá ίá ááááέυéáβðá υòέ υέá áβίáé ðòέιέóιΎίá óυóðΎ.

ΔέΥδὸά ἰδῖέραΠδῖοά δέΠέδῖἰ ἄέδῖδὸ ἀδῖ οἱ **Enter** ὀδί εἰρῖούέα ἄέα ἰά ἄέαέϋθᾶδᾶ ὀς ἄέαἄέέαόβᾶ ἄέέβῖςόçð. Ὀά boot blocks ἔᾶ ὀάδ ἠῖδὸΠδῖοἰ ἄέα δᾶἠέόόϋδᾶἠᾶδὸ δέçἠῖοἰἠᾶδ. Ἐᾶ δἠῖΥδᾶέ ἰά ἠᾶβῖᾶ εὔδὸέ ὑδῖδὸ οἰ δᾶἠᾶέὔδῖ:

```
>> FreeBSD/i386 BOOT
Default: 0:ad(0,a)/boot/loader
boot:
```

Ἀδᾶέçἔᾶϋόδᾶ ὑδὸέ οἰ δᾶἠᾶδὔῖῖ ἰΠῖοἰᾶ ἠῖοᾶἰβᾶέᾶδᾶέ ἠβῖᾶ ὀç ὀᾶέἠέᾶέΠ εἰρῖούέα, Π ὀδί ἠούδᾶἠέΠ εἰρῖούέα Π ἔᾶέ ὀδὸέ ᾶῖ, ἠῖὔεἰᾶᾶ ἰᾶ ὀέδ ἠδῖεἰᾶΥδ δῖο ῖ ÷ ᾶδᾶ ἠὔεᾶέ ὀδῖ ἠἠ ÷ ᾶβῖ /boot.config. Ἀἰ οἰ ἰΠῖοἰᾶ ἠῖοᾶἰβᾶέᾶέ ὀδί ὀούδὸΠ εἰρῖούέα, δέΥδὸά **Enter** ἄέα ἰά ὀδῖᾶ ÷ βῖᾶδᾶ ἰᾶ ὀς ἄέαἄέέαόβᾶ ἄέέβῖςόçð.

Ἀἰ ἠδῖεἰᾶβῖᾶ ὀᾶέἠέᾶέΠ εἰρῖούέα, ἠέὔ ᾶᾶἰ ἠέΥδᾶᾶ ὀç δἠῖοἠῖδᾶ ὀᾶ ἠδὸΠῖ, ὀδὔἠ ÷ ἠέ εὔδῖεἰ εὔὔεἰδ ὀδὸέ ἠῖἠῖβῖᾶέδ. Ὀοἰ ἰᾶὀᾶῖ, ἠἠὔθῖᾶ -h ἔᾶέ δέΥδὸά **Enter Π Return** (ἠἰ ἠβῖᾶὀᾶέ) ἄέα ἰά δᾶβῖᾶ ὀοἰ boot block (ἔᾶέ ῖᾶὀᾶἔὀᾶ ὀοἰ ὀἠἠῖδὸΠ ἠέέβῖςόçð ἔᾶέ ὀἰ δῖἠᾶἰᾶ) ἰᾶ ἠδῖεἰᾶῖ ὀς ὀᾶέἠέᾶέΠ ἔῖἠᾶ ἠᾶ ὀçỰ εἰρῖούέα. ἰῖἔδ ὀἰ ὀῖὀὀçỰ ἰᾶἔἰΠῖᾶἔ, εἰἔδὔῖᾶ ἰᾶὔ ὀέδ ἠῖἠῖβῖᾶέδ ἠᾶ ἰᾶ ἠᾶἠῖᾶ δῖο ἠβῖᾶἔ ὀἰ εὔὔεἰδ.

ἰᾶὀὔ ὀç ὀἠἠῖδὸç ὀἰῖ ὀἠἠῖδὸΠ ἠέέβῖςόçð, ἠἠβῖᾶᾶὀᾶ ὀοἰ δἠἠῖὀἰ ὀὀὔᾶἔỰ ὀçð ἠᾶἠᾶἔᾶᾶὀβᾶδ ἠᾶἠῖςόçð ἔᾶέ ῖ ÷ ᾶὀᾶ ἠᾶἠῖᾶ ὀç ἠῖᾶὀᾶὀὀçỰ ἰᾶ ἠδῖεἰᾶῖᾶὀᾶ ἰᾶὀᾶῖ ὀçð ἠούδᾶἠέΠδ ἔᾶέ ὀᾶἠῖᾶἔΠδ εἰρῖούέαδ, εῖὔἠῖὀᾶδ ὀέδ ἔᾶὀὔἔἔᾶὀ ἰᾶὀᾶἠᾶἔçð ῖᯘ δᾶἠᾶᾶὔἔἰἠῖὀἰ ὀοἰ ὀἠἠῖδὸΠ ἠᾶἠῖςόçð. Ἀᾶβῖᾶ ὀἰ ὈἰΠᾶ 27.6.6.

27.6.4 Δᾶἠῖḡḡçç

Ἀᾶᾦ ἔᾶ ἠᾶἠῖᾶ ἰᾶᾶ δᾶἠῖḡḡçç ὀἠỰ ἠᾶὔὀἠῖỰ ἠδῖεἰᾶᾦᾦ δῖο δᾶἠῖὀὀἔὔὀὀçỔᾶἰ ὀᾶ ἠδὸΠ ὀçỰ ἠῖỰὀçỰᾶ, ἔᾶέ ὀçỰ εἰρῖούέα δῖο ἠδῖεἰᾶ ῖᯘἔᾶ ὀᾶἔἔὔ.

27.6.4.1 1ç Δᾶἠῖδῖὀᯘç: ῖ ÷ ᾶὀᾶ ἔῖᯘᾶ ὀἰ Flag 0x10 ἠᾶᾶ ὀç ἔῖᯘᾶ sio0

```
device sio0 flags 0x10
```

Ἀδῖεἰᾶῖᯘ ὀοἰ /boot.config	ἔἰρῖούέα ἔᾶὀᯘ ὀç ἠᾶὔἠᾶἔᾶ ὀἠỰ boot blocks	ἔἰρῖούέα ἔᾶὀᯘ ὀç ἠᾶὔἠᾶἔᾶ ὀἰᯘ ὀἠἠῖδὸΠ ἠᾶἠῖςόçð	ἔἰρῖούέα ὀοἰỰ δῖἠᾶἰᾶ
ἔᾶἰβᾶ	ἠούδᾶἠᾶἔΠ	ἠούδᾶἠᾶἔΠ	ἠούδᾶἠᾶἔΠ
-h	ὀᾶἠῖᾶἔΠ	ὀᾶἠῖᾶἔΠ	ὀᾶἠῖᾶἔΠ
-D	ὀᾶἠῖᾶἔΠ ἔᾶἔ ἠούδᾶἠᾶἔΠ	ἠούδᾶἠᾶἔΠ	ἠούδᾶἠᾶἔΠ
-Dh	ὀᾶἠῖᾶἔΠ ἔᾶἔ ἠούδᾶἠᾶἔΠ	ὀᾶἠῖᾶἔΠ	ὀᾶἠῖᾶἔΠ
-P, δῖçἔὀἠῖỰỰᾶἔἰ ὀἰᾶᾶἰ ῖᯘỰ	ἠούδᾶἠᾶἔΠ	ἠούδᾶἠᾶἔΠ	ἠούδᾶἠᾶἔΠ
-P, ÷ ὔἠἠḡδ δῖçἔὀἠῖỰỰᾶἔἰ	ὀᾶἠῖᾶἔΠ ἔᾶἔ ἠούδᾶἠᾶἔΠ	ὀᾶἠῖᾶἔΠ	ὀᾶἠῖᾶἔΠ

27.6.4.2 2ç Δᾶἠῖδῖὀᯘç: ῖ ÷ ᾶὀᾶ ἔῖᯘᾶ ὀἰ Flag 0x30 ἠᾶᾶ ὀçỰ ἔῖᯘᾶ sio0

```
device sio0 flags 0x30
```

Ἀδῖεἰᾶῖᯘ ὀοἰ /boot.config	ἔἰρῖούέα ἔᾶὀᯘ ὀç ἠᾶὔἠᾶἔᾶ ὀἠỰ boot blocks	ἔἰρῖούέα ἔᾶὀᯘ ὀç ἠᾶὔἠᾶἔᾶ ὀἰᯘ ὀἠἠῖδὸΠ ἠᾶἠῖςόçð	ἔἰρῖούέα ὀοἰỰ δῖἠᾶἰᾶ
---------------------------	--	---	----------------------

ÁðéëíäÝò óóí /boot.config	Ëííóüëá éáòÛ ôç äéÛñéáéá òúí boot blocks	Ëííóüëá éáòÛ ôç äéÛñéáéá óíò òíñòòòβ âêêβíçòçò	Ëííóüëá óóíí ððñÞíá
êáíβá	áóòòðñéêÞ	áóòòðñéêÞ	óáéñéáêÞ
-h	óáéñéáêÞ	óáéñéáêÞ	óáéñéáêÞ
-D	óáéñéáêÞ éáé áóòòðñéêÞ	áóòòðñéêÞ	óáéñéáêÞ
-Dh	óáéñéáêÞ éáé áóòòðñéêÞ	óáéñéáêÞ	óáéñéáêÞ
-P, ðëçêðñíëüäëí óðíááíÝíí	áóòòðñéêÞ	áóòòðñéêÞ	óáéñéáêÞ
-P, ÷-ùñβð ðëçêðñíëüäëí	óáéñéáêÞ éáé áóòòðñéêÞ	óáéñéáêÞ	óáéñéáêÞ

27.6.5 ÓóíáííðëÝò äéá ôçí ÓáéñéáêÞ Ëííóüëá

27.6.5.1 Ñýëíéóç íáááëýðáñçò Óá÷ýççòáð äéá ôç ÓáéñéáêÞ Ëýñá

Íé ðñíáðééááíÝíáð ñðëíβóáéð ôçð óáéñéáêÞð éýñáð áβíáé: 9600 baud, 8 bits, ÷-ùñβð éóíðéíβá (parity), 1 stop bit. Áí èÝéáðá íá äéëÛíáðá ôçí ðñíáðééááíÝíç óá÷ýççòáð ôçð êííóüëáð, Ý÷-áðá ðéð ðáñáéÛòò áðéëíäÝò:

- Áðáíáíáðááëüððβóáð óá boot blocks èÝóííðáð ôç íáðááççòÞ BOOT_COMCONSOLE_SPEED äéá íá ññβóáðá ôçí íÝá óá÷ýççòá êííóüëáð. Áñβóá òí ÒíÞíá 27.6.5.2 äéá èáðòíñáñáβð íäçáβáð ó÷-áðééÛ íá ôç íáðááççòððéóç éáé äéáðÛóðáóç íÝíí boot blocks.

Áí ç áíáñáíðíβçòç ôçð óáéñéáêÞð êííóüëáð ááí áβíáðáé íÝòò ôçð áðéëíäÞð -h, P áí ç óáéñéáêÞ êííóüëá ðíò ÷ñçóéíðíéáβóáé áðu òíí ððñÞíá áβíáé äéáóíñáðéêÞ áðu áððÞ ðíò ÷ñçóéíðíéáβóáé áðu óá boot blocks, éá ðñÝðáé áðβçð íá ðñíðéÝóáðá ôçí ðáñáéÛòò áðéëíäÞð óóíí áñ÷-áβí ñðëíβóáíí òíò ððñÞíá, éáé íá íáðááëüððβóáðá Ýíá íÝí ððñÞíá:

```
options CONSPEED=19200
```

- Óðéð áðéëíäÝò âêêβíçòçð òíò ððñÞíá, ÷ñçóéíðíéðóáð òí -s. Íðíñáβáð áðβçð íá ðñíðéÝóáðá ôçí áðéëíäÞð -s óóí /boot.config. Ç óáéβáá manual boot(8) ðáñéÝ÷-áé íéá èβóáð òúí ððíóççñéæüíáíúí áðéëíäÞð, éáé ðáñéáñÛóáé ðùð íá ðéð ðñíðéÝóáðá óóíí áñ÷-áβí /boot.config.

- Áíáñáíðíéðóáð ôçí áðéëíäÞð comconsole_speed óóíí áñ÷-áβí /boot/loader.conf.

Ãéá íá èáéóíñáÞóáé áððÞ ç áðéëíäÞð, éá ðñÝðáé áðβçð íá èÝóáðá ðéíÝò äéá ðéð áðéëíäÝò console, boot_serial, éáé boot_multicons óóíí βáéíí áñ÷-áβí, òí /boot/loader.conf. ÐáñáéÛòò óáβíáðáé Ýíá ðáñÛááéáíá ÷ñÞçòð òíò comconsole_speed äéá äééáñÞ óá÷ýççòáð ôçð óáéñéáêÞð êííóüëáð:

```
boot_multicons="YES"
boot_serial="YES"
comconsole_speed="115200"
console="comconsole,vidconsole"
```

27.6.5.2 ×ñçóéíðíéðíóáð ÓáéñéáêÞ Ëýñá Áêòùð ôçð sio0 äéá ôçí Ëííóüëá.

Èá ðñÝðáé íá áðáíáíáðááëüððβóáðá èÛðíéá ðñíáñÛíáðá äéá íá ÷ñçóéíðíéðóáðá ùð êííóüëá íéá óáéñéáêÞ èýñá áêòùð ôçð sio0. Áí äéá ððíéáÞðíóá èüáí èÝéáðá íá ÷ñçóéíðíéðóáðá Ûëçç óáéñéáêÞ èýñá, éá ðñÝðáé íá áðáíáíáðááëüððβóáðá óá boot blocks, òí òíñòòòβ âêêβíçòçð éáé òíí ððñÞíá, íá òíí ðñúðí ðíò óáβíáðáé ðáñáéÛòò.

1. ΆίάέδΠρόά οίι δçάάβι έπáέéά οίö δδñΠία. (Άάβδδά οί Έαοΰεάει 25)
2. Άδáiñááóδδβδδά οίι άñ÷άβι /etc/make.conf éáé èΎóδδ όçí άδέειiäΠ BOOT_COMCONSOLE_PORT óδç áéáyèδíoç όçδ èϋñád δίö èΎéδδά ίά ÷ñçóéiñδiέΠδδδδ (0x3F8, 0x2F8, 0x3E8 or 0x2E8). Ìðññáβδδά ίά ÷ñçóéiñδiέΠδδδδ ìúñí δéδ èϋñád si00 ùδ si03 (COM1 ùδ COM4). ÈÛñδδδ δiεéáδèπí èδñπí, áái δñüéáéδáé ίά éáéδiñδäΠóιí. Άái ÷ñáéÛæáδáé ίά ñδèìβδδδδά όçí δéiΠ οίö interrupt.
3. ÄçìéiñδäΠδδδά Ύία άñ÷άβι ñϋéiέóçδ δñiρáñiñiöiΎñö δδñΠία, éáé δñiρéΎóδδά δά éáδÛèççéá flags áéá όç óáéñéáéΠ èϋñá δiö áδéèδiáβδδά ίά ÷ñçóéiñδiέΠδδδδ. Άéá δáñÛááéáì, áí èΎéδδά ç si01 (COM2) ίά áβiáé ç éiñóüéá:

```
device si01 flags 0x10
```

Π

```
device si01 flags 0x30
```

Άái éá δñΎδáé ίά èΎóδδά flags éiñóüéád áéá δéδ Ûèèδδ óáéñéáéΎδ èϋñád.
4. Ìáδááèùδδβδδά éáé ááéáδáóδΠδδδά ίáiÛ δά boot blocks éáé οίι öiñδùδΠ áéèβiçóçδ:

```
# cd /sys/boot
# make clean
# make
# make install
```
5. Άδáiáìáδááèùδδβδδά éáé ááéáδáóδΠδδδά οίι δδñΠία.
6. ΆñÛδδδά δά boot blocks óδiñ áβöéi áéèβiçóçδ ÷ñçóéiñδiέπiδáδ όçí bsdlable(8) éáé áéèéiΠδδδά ìá οίι iΎi δδñΠία.

27.6.5.3 Άβóíiäö óδiñ DDB Debugger ìΎóù όçδ ÓáéñéáéΠδδ ΆñáñΠδδ

Άí èΎéδδά ίά áéóΎèèáδδά óδiñ debugger δiö δδñΠία áδü όçí óáéñéáéΠ éiñóüéá (èÛδé δiö áβiáé ÷ñΠóéiñ áéá ίá áéδáéΎóδδά áéááñüóδéÛ áδü áδñiáèñöóíΎiç öiðiεáδóβá, áèèÛ áδβóçδ éáé áδééβiáδñí áí óδáβèáδδά éáδÛ èÛèiö BREAK ìΎóù όçδ óáéñéáéΠδδ èϋñád!) éá δñΎδáé ίá δáñéèÛááδδά όçí δáñáéÛδù áδééiäΠ óδiñ δδñΠία óád:

```
options BREAK_TO_DEBUGGER
options DDB
```

27.6.5.4 ΔñiñδñiδΠ Άéóüäiö óδçí ÓáéñéáéΠ Èiñóüéá

Άí éáé áδδü áái áβiáé áδáñáβδçδi, βòùδ ίá èΎéδδά ίá Ύ÷áδδ δñiñδñiδΠ áéóüäiö (login) ìΎóù όçδ óáéñéáéΠδδ áñáñΠδδ, όπñá δiö ìðññáβδδά δèΎiñ ίá ááβδδά δά ìçíϋiáδá áéèβiçóçδ éáé ίá áéóΎèèáδδά óδiñ debugger δiö δδñΠία ìΎóù όçδ óáéñéáéΠδδ éiñóüéád. Ç áéááééáδóβá δáñéáñÛδáδáé δáñáéÛδù.

Ìá èÛδiéiñ óδiñÛèδç éáéiΎñö, áñβiδá οίι άñ÷άβι /etc/ttys éáé áñáβδδά δéδ áñáñÛδδ:

```
ttyu0 "/usr/libexec/getty std.9600" unknown off secure
ttyu1 "/usr/libexec/getty std.9600" unknown off secure
ttyu2 "/usr/libexec/getty std.9600" unknown off secure
ttyu3 "/usr/libexec/getty std.9600" unknown off secure
```

Ìé éáδá÷ññβδδáéδ áδü ttyu0 ùδ ttyu3 áiδéóδié÷iϋi óδéδ COM1 ùδ COM4. ΆèèÛiδá οίι off óá on áéá όçí èϋñá δiö áδéèδiáβδδά. Άí Ύ÷áδδ áèèÛiáé όçí δá÷ϋόçδά όçδ óáéñéáéΠδδ èϋñád, éá ÷ñáéáδδáβ ίá áèèÛiáδδά οίι std.9600 πδδδά ίá óáéñéÛæáé ìá όçí δñΎ÷iñδá ñϋéiέóç, δ.÷. std.19200.

Ίΰεει έά εΎεάοά ίά άεεΎίάοά έάε οίι όγδί οίο οάηιάόεέιγ, άδύ unknown όοίι δηάηιάόέεε όγδίο οίο οάέηέάέιγ οάο οάηιάόεέιγ.

Άοίγ άεεΎίάοά όέο ηδείοβόάέδ, έά δηΎδάέ ίά άέοάέΎόάοά όγί άίόιεP kill -HUP 1 ηρόά ίά άίάηιδieceγί.

27.6.6 ΆεεάαP Έίίούεάο ιΎού οίο ΟίηούδP Άέέβίόόο

Οά δηίγαιγίάιό άίύόόάδ, δάηέαηΎοάίά δύο ίά ηδείοβόάοά όγί οάέηέάέP έίίούεά άεεΎαίόάδ όέο ηδείοβόάέδ οίο boot block. Οόγί άίύόόά άόδP, αάβ -ηίοίά δύο ιδηάβόά ίά έάειηβόάοά όγί έίίούεά αβηίόάδ εΎδieceά άίόιεΎδ έάέ ιάόάάεόΎδ δάηέάΎεειίόιο όοίι οίηούδP άέέβίόόο. Έάεηδ ι οίηούδP άέέβίόόο έάέάβόάέ άδύ οί οηβόι όδΎάει όγδ έάάάέέάόβάδ άέέβίόόο, έάέ ιάόΎ οί boot block, ιέ ηδείοβόάέδ οίο οίηούδP άέέβίόόο δδάηέό-γίόι οά ό-Ύόγ ιά άόδΎδ οίο boot block.

27.6.6.1 Νύειέόγ όγδ ΟάέηέάέP Έίίούεάο

Ιδηάβόά άγείεά ίά έάειηβόάοά υόέ έά -ηγόειηieceάβ γ οάέηέάέP έίίούεά όοίι οίηούδP άέέβίόόο έάέ όοίι δδηβία δίο έά οίηούεάβ, αηΎοίόάδ άδεηδ ιέά αηάηP όοί /boot/loader.conf:

```
console="comconsole"
```

Γ ηγείέόγ άόδP έά άίάηιδieceάβ, Ύό-άόά ιά οί boot block δίο όόαγδPόάίά όόγί δηίγαιγίάίγ άίύόόά.

Άβίαέ έάέγδάηά γ αηάηP άόδP ίά άβίαέ γ δηηόγ όοί αη-άβι /boot/loader.conf, ηρόά ίά άέΎδάοά όά αη-έέΎ ιγίγίάόά άέέβίόόο όόγ οάέηέάέP έίίούεά.

Ιά οίι βάει δηύδ, ιδηάβόά ίά έάειηβόάοά όγί άούδάηέέP έίίούεά υδ:

```
console="vidconsole"
```

Άί αάρ έάειηβόάοά όγ ιάόάάεόP δάηέάΎεειίόιο console, ι οίηούδP άέέβίόόο (έάέ Ύδάέόά ι δδηβίαδ) έά -ηγόειηieceόιοι ιδieceάPδίοά έίίούεά Ύ-άόά έάειηβόάέ όοί boot block ιά όγί άδέειάP -h.

Ιδηάβόά ίά έάειηβόάοά όγ έίίούεά όοί /boot/loader.conf.local P όοί /boot/loader.conf.

Άάβόά οί loader.conf(5) άέά δάηέόόύδάηδ δέγηίοηβάδ.

Όγίάβύόγ: Όγ αάαηίγίγ όόέαηP, ι οίηούδP άέέβίόόο αάρ Ύ-άέ άδέειάP άίόβόόίέ-γ ιά όγί -P οίο boot block, έάέ αάρ δδΎη-άέ εΎδieceό δηύδίο ίά άβίαέ άόούιάόγ άδέειάP ιάόάίγ άούδάηέέP έάέ οάέηέάέP έίίούεά άίΎεειά ιά όγί δάηίόόβά δέγέδηίέιβίδ.

27.6.6.2 ×ηηόγ ΟάέηέάέP Έγνάδ Άέούδ όγδ sio0 άέά όγί Έίίούεά

Έά δηΎδάέ ίά άδάίάίάόάευδδβόάοά οί οίηούδP άέέβίόόο ηρόά ίά -ηγόειηieceόάέ ιέά οάέηέάέP εγνά έάέοηηάόέP άδύ όγί sio0 άέά όγ οάέηέάέP έίίούεά. ΆείεηδPόά όγ έάάάέέάόβά δίο δάηέαηΎόάόάέ όοί ΟίPία 27.6.5.2.

27.6.7 ΔέέάΎδ Δάάβää

Ç äáíέεP éáΎά áβίάέ íá áδέονΎδääé óá üóíòð òí áδέέòííγί, íá äçíέíòñāPóíòí äíäéääéäòí Ύííòð äíðçñāòçòΎð ðíò äáí áðάέóíγί éÛñòäð äñáóέέβί éáé ðεçεòñíεüäéá. Äðóòð÷βð, áí éáé óá ðñέóóüòäñá óðóðPíáóá éá óáð áδέονΎφíòí íá äéέéíPóáòä ÷ùñβð ðεçεòñíεüäéí, óá ðíεý εβää éá ìðíñΎóáòä íá äéέéíPóáòä ÷ùñβð éÛñóá äñáóέέβί. Óá ìç÷áíPíáóá ìá BIOS òçð AMI ìðíñíγί íá ñòèìέóòíγί ìá áóòü òíí òñüðí, áðεβð áεεÛæíóáð òçí áðέéíäP “graphics adapter” óðéð ñòèìβóáéð òíò CMOS óá “Not installed.”

Óá ðñέóóüòäñá ìç÷áíPíáóá ùóòüóí äáí òðíóçñβæíòí áóòP òçí áðέéíäP, éáé éá äñíçέíγί íá äéέéíPóíòí áí äáí äÛéäðä ìéá éÛñóá äñáóέέβί. Óðá ìç÷áíPíáóá áóòÛ éá ðñΎðáé íá áòPóáòä ìéá óòíé÷áέβäç (áéüìá éáé ìííü÷ñüìç) éÛñóá äñáóέέβί, áí éáé äáí áβίáé áðñáβòçòí íá óóíáΎóáòä éáé ìèüíç. Ìðíñáβòä äðβòçð íá äíééíÛóáòä íá ääéáóáóðPóáòä BIOS òçð AMI.

ΈαöÜεάεί 28

PPP εάέ SLIP

28.1 Óýñïç

Ôï FreeBSD εέάέÝοάέ ðεΡεïð ðñüðuí εέα ðç óýíääóç áíüð ððτεíεέοðP íá Ýía Üεεï. Άέα íá áðέóγ÷άοά óýíääóç ðÝòò modem óðï Internet P óá Ýía Üεεï áβέððï, P εέα íá áðέðñÝðáðá óá Üεεïτð ðá óðíááεíγí ðÝòò ðïτò óðóðΠíáðïτò óάð, áðάέðáβόάέ ç ðñPóç PPP P SLIP. Ôï έαöÜεάεί áðòò ðáñεάñÜòáε έáððñáñðð ðïí ðñüðïí ðýεìέóçð ðúí ðáñáðÜü ððçñάóεðí εέα ðñPóç ðÝòò modem.

Áóïγ εέαáÜóáðá áðòò ðï έαöÜεάεί, εά ðñÝðáá:

- Dùð íá ððèìβóáðá ðï PPP ðñPóç (User PPP).
- Dùð íá ððèìβóáðá ðï PPP ððñPía (Kernel PPP, ðúñí εέα FreeBSD 7.X).
- Dùð íá ððèìβóáðá ðï PPPoE (PPP ðÝòò Ethernet).
- Dùð íá ððèìβóáðá ðï PPPoA (PPP ðÝòò ATM).
- Dùð íá ððèìβóáðá Ýía ðáεÜðç εέα áíððçñάðçðP SLIP (ðúñí εέα FreeBSD 7.X).

Ðñεί εέαáÜóáðá áðòò ðï έαöÜεάεί, εά ðñÝðáá:

- Íá áβóðá áñεέάεüÝíτð ðç ááóέεP ðñτεíáβá ðúí εέέðγüí.
- Íá εάðáñáβðá ðεð ááóέéÝð Ýíτεάð εάέ ðï óεíðü ðúí áðέεíεέðí óðíáÝóáñí εέα ðïτò PPP εάέ/P SLIP.

Ìðñáβ íá áíáñðóεÝððá ðíεά áβίáε ç ááóέεP εέαóïñÜ ðáðáíγ ðïτò PPP ðñPóç εάέ ðïτò PPP ððñPía. Ç áðÜíðçççç áβίáε áðεP: ðï PPP ðñPóç áðáíáñáÜεάðáέ óá áááñÝía εέóúáíτò εάέ áíüáíτò ðÝòò ðññáñáñÜðúí ðñPóç (userland) áíðβ εέαíÝóíτò ðïτò ððñPía ðïτò εάέóíτñεέéγ. Άðòò ðñíεάεάβ εÜðíεáð áðέááñýíóáέð εüáñ ðçð áíðέáñáððð áááñÝíúí ðáðáíγ ðïτò ððñPía εάέ ðçð áðáññáðð ðñPóç, áεεÜ áðέðñÝðáε εáðÜ ðτéγ ðεí ðεíγóεά (áðü Üðñççç áðíáðïðPðúí) ðεíðñβççç ðïτò PPP ðñüðïíεüεεïτò. Ôï PPP ðñPóç ðñçóέññðíεάβ ðç óðóέáðP tun εέα ðçí áðέέíεíúíβá ðá ðñí Ýñü εüóñ, áñð ðï PPP ððñPía ðñçóέññðíεάβ ðçí óðóέáðP ppp.

Óçíáβúòç: Óá üεï ðï έαöÜεάεί, ðï PPP ðñPóç εά áíáðÝñáðáé áðεÜ ðð **ppp** áεðüð εάέ áí ðñáέÜεάðáé íá áβίáε áεÜεñέóç óá ó÷Ýóç ðá Üεεï εíáεóíéεü PPP üðòð ðï **pppd** (ðúñí εέα ðï FreeBSD 7.X). Άεðüð áí áíáðÝñáðáé εέαóïñáðéεÜ, üεáð ðε áíðíεÝð ðïτò áíçáíýíóáé óðï έαöÜεάεί áðòò εά ðñÝðáé íá áεðáεíγíðáé ðð root.

28.2.1.2 Άδουιιάδς Νύειέος PPP

Όυίί όι ppp υίίί έάέ όι pppd (ς όειδιβςός όιό PPP όά άδβδάαι δονπία, ιυίί όόι FreeBSD 7.X) ÷ ηςόείιδιείγί όά άñ÷άβá ηδελβόαιί όόιί έάδὺέιαι /etc/ppp. Ιδιñάβόά ίά άñάβόά δάñάάβáιάόά άέά όι ppp ÷ ηπόδς όόιί έάδὺέιαι /usr/share/examples/ppp/.

Η ηύειέος όιό ppp άδάέόάβ όςί όñιδιδιβςός άφύδ άñέειγί άδύ άñ÷άβá, άίὺέιαι ίά όέδ άδάέδπόάέδ όάδ. Όι όέ έά άὺέάόά όά άδδὺ, άίάñδὺόάέ όά Υίά διόιόου άδύ όι άί ί ISP όάδ άδρβάάέ όάόέέΥδ έέάδελγίόάέ IP (άςέ. όάδ δάñΥ÷άέ ίέά έέάγελόίς IP ς ίδιβá άίί έέέὺάέ) P άοίάέέΥδ (άςέ. ς IP έέάγελόίς όάδ έέέὺάέ έὺέά όñὺ διό όόίάΥάόά όόιί ISP όάδ).

28.2.1.2.1 PPP έάέ ΌάάέέΥδ Άέάδελγίόάέδ IP

Έά ÷ ηάέάόάβ ίά όñιδιδιέπόάόά όι άñ÷άβί ηδελβόαιί /etc/ppp/ppp.conf. Έά δñΥδάέ ίά ηέὺάέ ίά άδδύ διό όάβίάόάέ δάñάέὺδ:

Όςίάβυός: Ιέ άñάιὺδ διό όάέάέπρίίί ίά : ίάέείγί όόςί δñπός όδπός (άñ÷P όςό άñάιὺδ) — υέάδ ίέ ὺέέάδ άñάιὺδ έά δñΥδάέ ίά όόίέ÷έόείγί ίά όιί όñυδι διό όάβίάόάέ, ίά ός ÷ ηπός έάίβί P όόςέίέάδβί.

```

1 default:
2     set log Phase Chat LCP IPCP CCP tun command
3     ident user-ppp VERSION (built COMPILATIONDATE)
4     set device /dev/cuau0
5     set speed 115200
6     set dial "ABORT BUSY ABORT NO\\sCARRIER TIMEOUT 5 \
7             \\\" AT OK-AT-OK ATDT1Q0 OK \\dATDT\\T TIMEOUT 40 CONNECT"
8     set timeout 180
9     enable dns
10
11 provider:
12     set phone "(123) 456 7890"
13     set authname foo
14     set authkey bar
15     set login "TIMEOUT 10 \\\" \\\" gin:--gin: \\U word: \\P col: ppp"
16     set timeout 300
17     set ifaddr x.x.x.x y.y.y.y 255.255.255.255 0.0.0.0
18     add default HISADDR
    
```

Άñάιὺ 1:

Άίάάιñβάέ όςί δñιδέέάιΥίς έάόά÷ηέός. Ιέ άίόίεΥδ όά άδδP όςί έάόά÷ηέός έέόάέιγίόάέ άδδύιιάόά, υδái έέόάέάβόάέ όι ppp.

Άñάιὺ 2:

Άίάñάιδιέάβ όςί έάόάάñάδP (logging) δύι δάñάιΥδñύι. ¼όάί ίέ ηδελβόάέδ διό Υ ÷ ίόί άβίάέ έάέόιδñάγί έέάιδιέόέέὺ, ς άñάιὺ άδδP έά δñΥδάέ ίά ίέέñγίάέ όόςί δάñάέὺδ:

```
set log phase tun
```

άέά ίά άδδύάδ ÷ έίγί ίάάὺέά ίάάΥές όόά άñ÷άβá έάόάάñάδP.

Άñάιπ 3:

ΈΥάέ όοι PPP ðò ò á á á á Ḃñάέ ðεçñιḂιḂάð áέά όιí áάóòυ όιḂ όóçí Ḃέεç òάñέḂ όçð όύíáάóçð. Ç áέάάέέάόβá áóðḂ άβíáόάέ áí όι PPP Ḃ ð-άέ ðñüάέçíá όóçí áέάðñáñḂḂóáðόç έάέ íεḂεḂḂñòç όçð όύíáάóçð, ðáñḂ ð-ííðáð ò á á óðòυ όιí όñüðι ðεçñιḂιḂάð όóιí áðñíάέñóóι Ḃñí áέά ð-άέñέόóð. Ἰέ ðεçñιḂιḂάð áóðḂ ð ò ðñíáβ íá άβíάέ ð-ñḂóέíáð όóçí áðβέόóç όιḂ ðñíάέḂíáóιð.

Άñάιπ 4:

Άíáñññβáέ έç όóóέáðḂ όóçí íðíβá άβíάέ όóíáñḂḂḂί όι modem. Ç όóóέáðḂ COM1 άβíάέ ç /dev/cuau0 έάέ ç COM2 άβíάέ ç /dev/cuau1.

Άñάιπ 5:

Έάειñβáέ έçí ðá ð-ýðçóá íá έçí íðíβá áðέέðíáβðá íá όóíááέáβðá. Άí ááí έάέóιḂñááβ ç όέíḂ 115200 (ç íðíβá ðñḂḂáέ íá έάέóιḂñááβ ò έḂέá ó ð-áóέέḂ όύá ð-ññíí modem), äíέειḂḂóðá ò 38400.

Άñάιπ Ḃ & 7:

Όí áέóáñέèìçóέέυ ðιḂ έá ð-ñçóέíḂðíέçέáβ áέά έçí έέḂόç. Όι PPP ð-ñḂóç ð-ñçóέíḂðíέááβ όύíóáíç expect-send ðáñññíέá ò á á óðḂ ðιḂ ð-ñçóέíḂðíέááβ όι ðñüáññáñá chat(8). Άáβðá έç óáέβáá manual áέá ðεçñιḂιḂάð ó ð-áóέέḂ ò òέó áóíáóυέçóáð áóðḂð έçð áεḂóáð.

ΌçíáεḂóá úóέ áóðḂ ç áíóíεḂ óóíá ð-βáέέ όóçí áðñíáíç áñάιπ áέá έüáñðó áíáññóέíḂóçóáð. Άóòυ òðñíáβ íá άβíάέ óá έḂέá áíóíεḂ όιḂ ppp.conf, áóöíí όι \ άβíάέ í ðáέáðóáβíð ð-áñáέðḂñáð έçð áñάιπð.

Άñάιπ 8:

Έάειñβáέ όι ð-ññíí ðáññáóέóιíý έüáñ ááñḂíáέáð έçð όύíáάóçð. Όá 180 ááðóáññüέáððá άβíάέ ç ðñíáðέέáñḂḂḂίç ç όέíḂ, Ḃóóέ ç áñάιπ áóðḂ άβíάέ ááḂ έάέáñḂḂ áέάέíóíçóέέḂ.

Άñάιπ 9:

ΈΥάέ όοι PPP íá ñòðḂóáέ έçí Ḃέεç ðéáðñḂḂ áέá íá áðέáááάεḂóáέ óέð όιðέέḂ ðñèìβóáέð όιḂ resolver. Άí áέóáέáβðá όιðέέυ áέάέñέóðḂ íñḂḂóυí (DNS), έá ðñḂḂáέ íá íáóáðñḂḂáð áóðḂ έç áñάιπ óá ó ð-üέέí Ḃ íá έçí áóáέñḂḂóáð.

Άñάιπ 10:

ΈáíḂ áñάιπ Ḃóðá ç áíḂáññóç όιḂ áñ ð-áβíḂ íá άβíάέ ðεί áýέíεç. Ἰέ έáíḂ áñάιπ Ḃ ááññíýíóáέ áðυ όι PPP.

Άñάιπ 11:

Άíáñññβáέ έçí έáóá ð-ññέóç áññò ðáññí ð-Ḃá íá όι ùññá "provider". Ἰðñíáβðá ááḂ íá ð-ñçóέíḂðíέḂóáðá όι ùññá όιḂ ISP óáð, Ḃóðá áñáññóáñá íá íáέέíḂḂá έç όύíáάóç óáð ò έçí áðέέéíḂ load ISP.

Άñάιπ 12:

ΈΥóáέ όιí áñέέèì έέḂóçð áέá áóòυ όιí ðáññí ð-Ḃá. Ἰðñíáβðá íá έάειñβóáðá ðíέéáðéíýð áñέέèíýð έέḂóçð ð-ñçóέíḂðíέḂíóáð Ḃñ-έḂḂò ðáέáβá (:) Ḃ όιí ð-áñáέðḂñá (|) ùð áέá ð-ññέóóέέυ. Ç áέάóíñḂ Ḃáóáý ðυí áýí áέá ð-ññέóóέέḂí ðáñέáñḂḂóáóáέ όóι ppp(8). ðáñέεçðóέέḂ, áí έḂέáðá íá áñέέḂáññíóáέ έðέέέέḂ ùέíέ íέ áñέέèìβ, ð-ñçóέíḂðíέḂóáð έçí Ḃñ-έḂḂò ðáέáβá. Άí έḂέáðá íá áβíáóáέ ðḂíóíðá áðñíáέñá έέḂóçð όιḂ ðñḂóíð áñέέèíý έάέ íέ óðñέíéðíέ íá áñέέḂáññíóáέ ùññí áí í ðñḂóíð áðíóý ð-áέ, ð-ñçóέíḂðíέḂóáð όι ð-áñáέðḂñá ðáññí ð-Ḃáðóçð. Ἰá áñḂḂóáðá ðḂíóíðá ùέí όι όýññέ ðυí óçέáóυíέέḂí áñέέèìḂí ò όιí όñññí ðιḂ óáβíáóáέ.

Άί ί άνεέιυδ όçεάορπύο δάνεÛ ÷ άέ έαιÛ, έά δñÛδαέ ίά οίί δάνεέεάβόάοά όά άέόάαυάεέÛ ("). Ç δάνÛεάέοç όίοδ, άί έάέ άβίάέ άδευ όóÛείά, ίδñάβ ίά δñίεάέÛόάέ δñίάεΠιάόά δίο άάί ίδñίύί ίά άίόιδεόόίύί άýείεά.

ΆñάñÛδ 13 & 14:

Άίάάññβάέέ όί υίñά ÷ ñΠόόç έάέ όίί ευάέέυ όίο. ¼όάί όόίáÛάόόά ÷ ñçόείñδίέπύόάδ δñίόññδΠ όýδύο UNIX, ίέ όείÛδ άόδÛδ άίάόÛññίόάέ άδύ όçί άίόίεΠ set login ÷ ñçόείñδίέπύόάδ όέδ ίάόάάεçδÛδ \U έάέ \P. ¼όάί όόίáÛάόόά ίά ÷ ñΠόόç PAP Π CHAP, ίέ όείÛδ άόδÛδ ÷ ñçόείñδίέπύόάέ όçί πñά όçδ δέόόίδύβçόçδ όάόδύόçόάδ όίο ÷ ñΠόόç.

ΆñάñΠ 15:

Άί ÷ ñçόείñδίέάβόά PPP Π CHAP, άάί έά δδÛñ ÷ άέ όόί όçίάβί άόδύ δñίόññδΠ άέόύάίό (login), έάέ έά δñÛδαέ ίά ίάόάδñÛόάό όç άñάñΠ άόδΠ όά ό ÷ υέέί Π ίά όçί άόάέñÛόάόά. Άάβόά όçί Δέόόίδύβçόç PAP έάέ CHAP έάά δñέόόύόδñάδ έάδδñÛñάέάδ.

Όί άέόάñέιçδóέέυ άέόύάίό ÷ ñçόείñδίέάβ όύίόάίç δάνύñίέά ίά όί chat(8), υδύδ όόίάάβίάέ έάέ ίά όί άέόάñέιçδóέέυ έέΠόçδ. Όόί δάνÛάάέάñά ίάδ, όί άέόάñέιçδóέέυ ÷ ñçόείñδίέάβόάέ άέά ίέά δδçñάόβά όόçί ίδύβά ç όόίάññά άέόύάίό ñέÛάέ ίά όçί δάνάέÛδύ:

```
J. Random Provider
login: foo
password: bar
protocol: ppp
```

Έά ÷ ñάέάόόάβ ίά άέέÛίάόά άόδύ όί script άíÛείάά ίά όέδ άíÛέάδ όάδ. ¼όάί άñÛόάόά άόδύ όί script όçί δñπόç όñÛÛ, άάάάέυέάβόά υόέ Û ÷ άόά άίάñάñδίέΠόάέ όί άñ ÷ άβί έάόάάñάόΠδ άέά όί "chat" πόόά ίά ίδññάβόά ίά δñίόάέñβόάόά άί ç άέάάέέάόβά άίάάñπñέόçδ δññ ÷ ññÛάέ όυόδÛ.

ΆñάñΠ 16:

ΈÛόάέ όί ÷ ñññί άñÛίάέάδ (όά άάδóάññυέάδδóá) άέά όç όύίάάόç. Άάπ, ç όύίάάόç έά έέάβόάέ άόδύñάόά άί άάί δδÛñ ÷ άέ έβίçόç άέά 300 άάδóάññυέάδδóá. Άί άάί έÛέάόά ίά άβίάόάέ δñÛδ άññάδóέόíυδ όçδ όύίάάόçδ ευάυ άññÛίάέάδ, έÛόάά άόδΠ όç όείΠ όά ίçäÛί, Π ÷ ñçόείñδίέΠόόά όçί άδέείάΠ -dial όόç άñάñΠ άίόίεΠδ.

ΆñάñΠ 17:

ΈÛόάέ όç άέάýέδύόç όçδ άέάδάόΠδ. Όί άέόάñέιçδóέέυ x.x.x.x έά δñÛδαέ ίά άίόέέάδóάόάέάβ ίά όç άέάýέδύόç IP δñó όάδ Û ÷ άέ άδñάñέάβ άδύ όίί δάνñ ÷ Ûά όάδ. Όί άέόάñέιçδóέέυ y.y.y.y έά δñÛδαέ ίά άίόέέάδóάόάέάβ ίά όçί άέάýέδύόç IP δñó Û ÷ άέ έάέññβόάέ ί ISP όάδ υδ δýέç (gateway, όί ίç ÷ Ûίçίά όόί ίδύβί όόίáÛάόόá). Άί ί ISP όάδ άάί όάδ Û ÷ άέ άπóάέ άέάýέδύόç δýέçδ, ÷ ñçόείñδίέΠόόά όçί 10.0.0.2/0. Άί δñÛδαέ ίά ÷ ñçόείñδίέΠόόάά ίέά IP άέάýέδύόç δñó Û ÷ άόά "ίάίόÛόάέ", άάάάέυέάβόά υόέ Û ÷ άόά άçίέίόññάΠόάέ ίέά έάόά ÷ πñέόç όόί /etc/ppp/ppp.linkup όýíöúíά ίά όέδ ñäçάβάδ άέά όί PPP έάέ ΆόίάίέÛÛ IP Άέάόέýíόάέδ. Άί δñάñέάβόάόά άόδΠ όç άñάñΠ, όί ppp άάί έά ίδññάβ ίά άέόάέάόόάβ όά έάδÛόόάόç -auto.

ΆñάñΠ 18:

ΔññίόέÛόά ίέά δññάδέέάñÛÛίç έέάάñññΠ (default route) δññδ όί ίç ÷ Ûίçίά δýέçδ (gateway) όίó ISP όάδ. Ç άέάέέΠ έÛίç HISADDR άίόέέάέβόόάόάέ ίά όçί άέάýέδύόç δýέçδ δñó έάέññβάέάόάέ όόç άñάñΠ 17. Άβίάέ όçίάίόέέυ ç άñάñΠ άόδΠ ίά άñόάñβάέάόάέ ίάδÛ όçί άñάñΠ 17, άέάόññάóέέÛ όί HISADDR άάί έά Û ÷ άέ άέυñά εÛάάέ άñ ÷ έέΠ όείΠ.

Άί άάί άδέέόñάβόά ίά άέόάέÛόάόά όί ppp όά έάδÛόόάόç -auto, έά δñÛδαέ ίά ίάόάέέίΠόόάά άόδΠ όç άñάñΠ όόί άñ ÷ άβñ ppp.linkup.

Άάί άβιάέ άδάνάβδçοί ίά δñïòέÝóάδå έάόά÷þñέóç óοί άñ÷άβì ppp . linkup üοάί Ý÷άδå óόάέέP άέάýέδíoç IP έάέ άέόάέάβδå οί ppp óå έάόÜóόάóç -auto. Óόçí δάνβδδòóç άóδP, ίέ έάόά÷ùnβóάέδ óόó óοίí δβίαέά άññüέüάçóçδ άβίαέ óóóóÝδ δñέí έάí óóíάάέάβδå. ρòòü ùóóóοί ίά έÝέάδå ίά άçíέíòñāPóάδå ίέά έάόά÷þñέóç άέά ίά άέδåέÝóάδå έÜδñέά δññāñüάά ίάδÜ όçí άδñέάόÜóόάóç όçδ óýíάάóçδ. Έά όí άíçāPóíòíå άóδü άññüóάñå óå Ýíά δάνÜάάέάíå ίå όí sendmail.

Ìδññåβδå ίά άññåβδå δάνάάάβåíάάά άñ÷άβüí ñδèìβóάüí óοίí έάόÜέíñí usr / share / examples / ppp /.

28.2.1.2.2 PPP έάέ ΆóíάíέέÝò Άέάδèýíóάέδ IP

Άί í δάνñ÷Ýάδ óόó άάí άβίαέ óόάóέέÝδ άέάδèýíóάέδ, όí ppp ίδññåβ ίά ñδèìέóόάβ ίά άέάδññάñíάόάýóάέέ όçí όíδέέP έάέ όçí άδññέñòíÝíç άέάýέδíoç. Άóδü άβñάóάέ “ñάíóάýííóάó” ίέά άέάýέδíoç IP, έάέ άδέóñÝδñíóάó óοί ppp ίά όçí έÝóάέ Ýδåέóά óóóóÜ, ÷ñçóέíñδñέþíóάó όí δññüòüέíέέí IPCP (IP Configuration Protocol) ίάδÜ όç óýíάάóç. Óí άñ÷άβì ñδèìβóάüí ppp . conf άβίαέ όí βåíí üδòδ έάέ óοί PPP έάέ ÓόάóέέÝδ Άέάδèýíóάέδ IP, ίå όçí δάνάέÜòü ïüíí άέέάåP:

```
17 set ifaddr 10.0.0.1/0 10.0.0.2/0 255.255.255.255 0.0.0.0
```

¼δòδ έάέ δññçåíòíÝñòδ, άάí δñÝδåέ ίά δάνέέÜάάóå όíí άñέέüñ άñññðδ. Άδåέóåβδóάέ άóí÷P άñüδ όíòέÜ÷έóóíí έάññý άέάóóðñάóíò.

ΆñññP 17:

Ì άñέέüò ίάδÜ όí ÷άñåέδPñå / άβίαέ όí δèPèòδ óüí bits όçδ άέάýέδíoçδ άέά όí íðìβì έå άδέíåβίαέ όí ppp. ρòòü έÝέάδå ίά ÷ñçóέíñδñέþíóάóά άñέέñýò IP δέí έάόÜέέçέíòδ άέά όçí δάνβóόάóç, άέέÜ όí δάνÜάάέάíå όíó άβñíòíå δάνάδÜñü έå έάέóíòñāPóåέ δÜíóά.

Óí óåέάδóάβì üñέóíå (óí 0.0.0.0) έÝάέ óοί PPP ίά άñ÷βóåέ óέδ άέάδññάñíάόάýóάέέ ίå όçí άέάýέδíoç 0.0.0.0 άíòβ άέά όçí 10.0.0.1. Άóδü άβñåέ άδάνάβδçοί óå ïñέóíÝñòδ ISP. Ìç ÷ñçóέíñδñέþíóάóå όí 0.0.0.0 ùδ δñþóí üñέóíå óόçí set ifaddr, έάέþδ έå άíδñåβóåέ όçí PPP ίά ñδèìβóάέ όçí άñ÷έέP άέάάñññP óόçí έάόÜóόάóç -auto

Άί άάí ÷ñçóέíñδñέåβδå όçí άδέέññāP -auto, έå ÷ñåέάóóάβ ίά άçíέíòñāPóάδå ίέά έάόά÷þñέóç óοί άñ÷άβì /etc/ppp/ppp . linkup. Óí άñ÷άβì ppp . linkup ÷ñçóέíñδñέåβδóάέ ίάδÜ όçí άδñέάóÜóόάóç όçδ óýíάάóçδ. Óóí óçíåβì άóδü, όí ppp έå Ý÷åέ Pçç άδñåþóåέ άέάýέδíoç óόçí άέάδåðP έάέ έå άβίαέ δèÝíí άóíåóñí ίά δññòέÝóάδå óέδ έάόά÷ùnβóάέδ óοίí δβίαέά άñññüέüάçóçδ:

```
1 provider:
2 add default HISADDR
```

ΆñññP 1:

Ìå όçí άδñέάóÜóόάóç όçδ óýíάάóçδ, όí ppp έå øÜíåέ άέå ίέά έάόά÷þñέóç óοί ppp . linkup óýñüñå ίå όíòδ δάνάέÜòü έάñññåó: Άñ÷έέÜ έå δññíóðåþóåέ ίå óåέñέÜíåέ όçí δñþóç άδέέÝóά όíó Ý÷åέ ÷ñçóέíñδñέçέåβ óοί άñ÷άβì ppp . conf. Άí άóδü άδñíóý÷åέ, έå øÜíåέ άέå ίέά έάόά÷þñέóç άέå όçí άέάýέδíoç IP όçδ δýέçδ. Ç έάόά÷þñέóç άóδP άβίαέ ίέå άδέέÝóά íññöðδ IP άέάýέδíoçδ, ίå óÝóóåñέδ íèðÜååð. Άí άάí Ý÷åέ áέüñå άññååβ ç óóóóðP έάόά÷þñέóç, έå άβίαέ άíβ÷íåóóç άέå όçí έάόά÷þñέóç MYADDR.

ΆñññP 2:

Ç άñññP άóδP έÝάέ óοί ppp ίά δññòέÝóάέ ίέå δñññδέέάññÝíç άέάάñññP ç íðìβå ίå ååβ÷íåέ óοί HISADDR. Óí HISADDR έå άíóέέάóάóóåέåβ ίå όç άέάýέδíoç IP όçδ δýέçδ üδòδ άóδP άδññüέçέå íÝóü όíó δññòñüέüέíò IP.

Άάβθά όçί έάόά÷ñέόç pmdemand όόά άñ÷άβά /usr/share/examples/ppp/ppp.conf.sample έάέ /usr/share/examples/ppp/ppp.linkup.sample άέά Ýía ðεί έάððññÝð ðáñÛääéäía.

28.2.1.2.3 Έβθç Άέόάñ÷üiáüi Έέβόáüi

¼όάί ñòèìβæáðá òì ppp íá έáíáÛíáέ áέόáñ÷üiáíáð έέβόáέð όά Ýía íç÷Ûíçíá ðñó όóíáÝáðáέ όά Ýía òñðéèü áβéðòì (LAN), έá ðñÝðáέ íá áðñóáóβóáðá áí èÝéáðá íá ðññüèñýíðáέ ðáéÝóá ðññð áðòü. Áí íáέ, έá ðñÝðáέ íá áðñáβóáðá όòì íç÷Ûíçíá íέá áέáýèðíόç IP ç ðññíβá íá áñβéáέ όòì βáεί ððñáβéðòì íá òì LAN, έάέ íá ÷ñçóέññðñέβóáðá όçí áíðñέβ enable proxy όòì áñ÷άβñ /etc/ppp/ppp.conf. Έά ðñÝðáέ áðβόçð íá áðέääáέβóáðá üéé òì áñ÷άβñ /etc/rc.conf ðáñéÝ÷áέ όá ðáñáέÛòù:

```
gateway_enable="YES"
```

28.2.1.2.4 ðñεί getty;

Ç áññóçόά Õðçñáóβá Άέóüáñò ìÝóù Άðέέñáέέβð Óýíááóçð (dial in) ðáñÝ÷áέ íέá έάέβ ðáñéñáñáð Ó÷÷áðέÛ ìá όçí áññáññññçόç ððçñáóέβñ áðέέñáέέβñ έέβóáññ ÷ñçóέññðñέβñóáð όçí getty(8).
Íέá áñáéääéðέέβ όóçí getty áβñáέ ç mgetty (http://mgetty.greenie.net/) (áðü òì ðáéÝðñ comms/mgetty+sendfax), íέá ðεί Ýñððç Ýέáñóç όçð getty, ç ðññíβá Ý÷áέ ó÷ääéáóóáβ áέá íá έáíáÛíáέ ððññέí óéð áðέέñáέέÝð áñññÝð.
Óá ðéáññáéðñíáðá όçð mgetty áβñáέ üéé áðέέñéññññβ áññáÛ ìá óá modem, òì ðññíβñ óçíáβñáέ üéé áí ç èýñá áβñáέ áðáññáñññññçñíçñíççí óòì /etc/ttys, òñ modem óáð ááí έá áðáíðβóáέ όóçí έέβóç.
ÌáðáááñÝóóáññáð áéäüóáέð όçð mgetty (áðü όçí 0.99beta έάέ ìáðÛ) ððññóçññβæññí áðβóçð áðòüññáðç áññ÷íáðόç PPP streams, áðéðñÝñññóáð óòñð ðáéÛðáð óáð ðññüóááóç óòññ áññðçññáðçð ÷ññβð ÷ñβóç scripts.
ΆέääáÛóáð όçí áññóçόά Mgetty έάέ AutoPPP áέá ðáñéóóüðáññáð ðççññññññβáð ó÷÷áðέÛ ìá όçí mgetty.

28.2.1.2.5 ñááéáð áέá òì PPP

ÕðóέñéñáέέÛ, ç áéðÝéáóç όçð áñññέβð ppp ðñÝðáέ íá áβñáðáέ üé ÷ñβóçð root. Áí ñóðññññññéÝéáðá íá áðéðñÝðáðá όçí áéðÝéáóç ðññ ppp óá έáðÛóóáóç áññðçññáðçð ÷ññβóçð (ìá ðññ ðñññññññ ðññ ðáñéñáñÛóáðáέ ðáñáέÛòù) έá ðñÝðáέ íá áβóáðá óá áðòü òì ÷ñβóçð óá έáðÛéççéá áέέáέβñáðá áέá íá áéðáéáβ òì ppp, ðñññéÝðññóáð òññ óóçí ññÛáá network óòì áñ÷άβñ /etc/group.

Έά ðñÝðáέ áðβóçð íá ðññð áβóáðá ðññüóááóç óá Ýía β ðáñéóóüðáññá ðñññáðá òññ áñ÷άβññ ñòèìβóáññññ, ÷ñçóέññðñέβñóáð όçí áñññέβ allow:

```
allow users fred mary
```

Áí ÷ñçóέññðñέβñóáðá όçí áðέέñáβ áðòβ óòì ðñññá default, έá áβóáðá óá áðòññò ðññð ÷ñβóáðá ðññüóááóç óá üéáð óéð ñòèìβóáέð.

28.2.1.2.6 Έáéýóç PPP áέá ×ñβóáðá ìá ΆðññáééÛ IP

Άçñéñññáβóáðá Ýía áñ÷άβñ ìá òì üññá /etc/ppp/ppp-shell òñ ðññññ íá ðáñéÝ÷áέ óá ðáñáέÛòù:

```
#!/bin/sh
IDENT=echo $0 | sed -e 's/^\.*-\(.*\)$/\1/'
CALLEDAS="$IDENT"
```

```
TTY='tty'

if [ x$IDENT = xdialup ]; then
    IDENT='basename $TTY'
fi

echo "PPP for $CALLEDAS on $TTY"
echo "Starting PPP for $IDENT"

exec /usr/sbin/ppp -direct $IDENT
```

Οἱ script ἀδού έά δñÝðáέ ίά ἀβίάέ έέόάέÝόέη. ἈçίέιõñāÞóόά όÞñά Ýίά όðìāíέέέú äáóìú ðìõ ίά íñŪæáόάέ ppp-dialup ÷ñçόέηðìέÞíόάό όέó ðāñάέŪóù áíóíεÝò:

```
# ln -s ppp-shell /etc/ppp/ppp-dialup
```

Έά δñÝðáέ ίά ÷ñçόέηðìέÞóόάά άδού όι script ùò όι εÝέóóìð áέά úέìòð όìòð dialup ÷ñÞóόάð. Ἄþ óάβίáόάέ Ýίά ðāñŪäáέáíá όìõ /etc/passwd áέά Ýίά ÷ñÞóόç dialup íå ùññá pchilds (έòìçέåßòá ùόέ äáí δñÝðáέ ίά όñìðìέáßòá Ūíáόά όι äñ÷åßì óùí έùäέéÞí, áέέŪ íÝóù όçð áíóíεÞò vipw(8)).

```
pchilds:*:1011:300:Peter Childs PPP:/home/ppp:/etc/ppp/ppp-dialup
```

ἈçίέιõñāÞóόά Ýίά έáóŪέíāí /home/ppp ðñíóáŪόέηí áέά áíŪāíùóç áðú úέìòð, ì ðìβìòð έά ðāñέÝ÷έέ óά ðāñάέŪóù έáíŪ äñ÷åßá:

```
-r--r--r-- 1 root wheel 0 May 27 02:23 .hushlogin
-r--r--r-- 1 root wheel 0 May 27 02:22 .rhosts
```

όά ðìβá äìðìäβæìóí όçí äìõŪίέόç όìõ íçýíáόìð áðú όι äñ÷åßì /etc/motd.

28.2.1.2.7 Έάέýόç PPP áέά ×ñÞóόáð íå Óόάόέέú IP

ἈçίέιõñāÞóόά όι äñ÷åßì ppp-shell ùðùð óάβίáόάέ ðāñáðŪíù, έάέ áέά έŪέå έíāñέάόìú íå óόάόέέú IP, äçίέιõñāÞóόά Ýίά όðìāíέέέú äáóìú ðñìð όι ppp-shell.

Ἄέά ðāñŪäáέáíá, áí Ý÷έáðά όñάέó ðāέŪóáð dialup, όìòð fred, sam, έάέ mary, όóìòð ðìβìòð áέóáέåßòá äññìέúāçόç /24 CIDR, έά δñÝðáέ ίά äñŪóáðά όά ðāñάέŪóù:

```
# ln -s /etc/ppp/ppp-shell /etc/ppp/ppp-fred
# ln -s /etc/ppp/ppp-shell /etc/ppp/ppp-sam
# ln -s /etc/ppp/ppp-shell /etc/ppp/ppp-mary
```

Ἄέά έŪέå έíāñέάόìú ÷ñÞóόç dialup, έά δñÝðáέ ίά ñòέìέóόåß όì έÝέóóìð óóì όðìāíέέέú äáóìú ðìõ äçίέιõñāÞέçέå ðāñáðŪíù (áέά ðāñŪäáέáíá ì óðìāíέέέúð äáóìúð áέά όì έÝέóóìð όìõ ÷ñÞóόç mary έά δñÝðáέ ίά ἀβίάέ ì /etc/ppp/ppp-mary).

28.2.1.2.8 Ñýèìέόç όìõ ppp.conf áέά ×ñÞóόáð íå Ἄóíáíέέú IP

Οἱ äñ÷åßì /etc/ppp/ppp.conf έά δñÝðáέ ίά ðāñέÝ÷έέ έŪóέ áíóßóóìέ÷ì íå όι ðāñάέŪóù:

```
default:
    set debug phase lcp chat
```

```

set timeout 0

ttyu0:
set ifaddr 203.14.100.1 203.14.100.20 255.255.255.255
enable proxy

ttyul:
set ifaddr 203.14.100.1 203.14.100.21 255.255.255.255
enable proxy

```

Όχιάβύος: Ç óðïß÷έός άβίαέ όçιάίðέέß.

Άέά έÛεά όóíáñßá, òïñòþíáðáέ ç áíúòçóá default : . Άέά έÛεά ãñáñß dialup ðïò áíáñáñðíεάβóáέ όðï /etc/ttys, έά ðñÝðáέ íá áçíεíðñáßóáðá íεά έáðá÷þñέός ùñíεά íá áðòß ðïò óáβíáðáέ ðáñáðÛú ãέά òï ttyu0 : . ΈÛεά ãñáñß έά ðñÝðáέ íá ðáβñíáέ íεά ïíááέέß áέáýεðίός IP áðu òï áðuεáíá ðùí IP áέáðεýίόáúí ðïò ðñññßæíίόáέ áέά òïð ðóíáíέέéýð ÷ñßóáð.

28.2.1.2.9 Ñýèìέός òïð ppp.conf áέά ×ñßóáð ìá Óóáðέέü IP

Άέòüð áðu óá ðáñεά÷ùíáíá òïò ððíááβáíáðüð /usr/share/examples/ppp/ppp.conf έά ðñÝðáέ íá ðñíóεÝóáðá íεά áíúòçóá áέά έáεÝíá áðu òïð ÷ñßóáð dialup óðïð ïðíβíð Ý÷áέ áðíáíεáß óóáðέέü IP. Έά όóíá÷βóíðíá ìá òï ðáñÛááέáíá íáð ìá òïð ÷ñßóáð fred, sam, έάέ mary.

```

fred:
set ifaddr 203.14.100.1 203.14.101.1 255.255.255.255

sam:
set ifaddr 203.14.100.1 203.14.102.1 255.255.255.255

mary:
set ifaddr 203.14.100.1 203.14.103.1 255.255.255.255

```

Όí ãñ÷áβí /etc/ppp/ppp.linkup έά ðñÝðáέ áðβóçð íá ðáñεÝ÷áέ ðεçñíòíñßáð ãññíεüáçóçð áέά έÛεά ÷ñßóç ìá óóáðέέü IP (áí áðáέðáβóáέ). Ç ðáñáέÛò ãñáñß έά ðñíóεÝóáέ íεά áέááññß ðñíð ðç áέáýεðίός áέέðýíð 203.14.101.0/24 ìÝóú ðçð óýíááçóçð ppp òïð ðáέÛðç.

```

fred:
add 203.14.101.0 netmask 255.255.255.0 HISADDR

sam:
add 203.14.102.0 netmask 255.255.255.0 HISADDR

mary:
add 203.14.103.0 netmask 255.255.255.0 HISADDR

```

28.2.1.2.10 mgetty έάέ AutoPPP

Ïi port comms/mgetty+sendfax, Ýñ ÷ áóáέ íá ðñíáðέέάáí Ýίç òçí áðέέíãP AUTO_PPP, áðέóñ Ýðñíóáð Ýóóέ óçí mgetty íá áίέ ÷ íáýáέ òçí öÛóç LCP ðñí óðíáÝóáñí PPP έάέ íá áέðáέáß áððñíáóá Ýíá έÝέöðò ppp. Ûóðñóí, έάέðð íá áððñí òñ ðññðñí ááí áíáñáñðñíέáßóáέ ç ðñíáðέέάáí Ýίç áέññíòεβá ñññáðñð ÷ ñPóçç έάέ έñáέέñ, áβíáέ áðñáñáßòçñí íá áβíáέ ðέóðñðñíβçç ðñí ÷ ñççóðñí íá òç ÷ ñPóç P PAP P CHAP.

Ç áññóçóá áððP ðñññðñíέÝóáέ ùóέ ñ ÷ ñPóççð Ý ÷ áέ ñòèìβóáέ, íáðááèùòðβóáέ έάέ ááέáóáóðPóáέ íá áðέóð ÷ βá òñ port comms/mgetty+sendfax óðñ óýóóçíá òñ.

Ááááέέñέáβóá ùóέ òñ áñ ÷ áβí óáð /usr/local/etc/mgetty+sendfax/login.config ðññέÝ ÷ áέ óá ðñáñέÛò:

```
/AutoPPP/ - - /etc/ppp/ppp-pap-dialup
```

Áððñí έá ðáέ óçí mgetty íá áέðáέÝóáέ òñ script ppp-pap-dialup áέá óέð PPP óðíáÝóáέð ðñí áίέ ÷ íáýέçέáí.

ÁçñíέññáPóðá Ýíá áñ ÷ áβí íá òñ ùññá /etc/ppp/ppp-pap-dialup òñ ðññíβí έá ðññέÝ ÷ áέ óá áέùέñòεά (òñ áñ ÷ áβí έá ðñÝðáέ íá áβíáέ áέðáέÝóέñ):

```
#!/bin/sh
exec /usr/sbin/ppp -direct pap$IDENT
```

Áέá έÛέá ññáñP dialup ðñí áβíáέ áíáñáñðñíέçíÝίç óðñ /etc/ttys, áçñíέññáPóðá íέá áíóβóðñíέ ÷ ç έáóá ÷ ññέóç óðñ áñ ÷ áβí /etc/ppp/ppp.conf. Ç έáóá ÷ ññέóç áððP ðñññáß íá óðñððÛñ ÷ áέ ÷ ùñβð ðñññáέçíá íá áððÝð ðñí ñβóáíá ðñáñáðÛñ.

```
ppp:
    enable pap
    set ifaddr 203.14.100.1 203.14.100.20-203.14.100.40
    enable proxy
```

ËÛέá ÷ ñPóççð ðñí áέóÝñ ÷ áóáέ íá áððñí òñ ðññðñí, έá ðñÝðáέ íá áέáέÝóáέ ùññá ÷ ñPóçç/έñáέέñ óðñí áñ ÷ áβí /etc/ppp/ppp.secret. ÁíáέέáέðέέÛ, ðñññáßóá íá ðññíóέÝóáðá òçí ðñáñέÛò ðññέíãP Póðá íá áβíáðáέ ðέóðñðñíβçç ðñí ÷ ñççóðñí ÝÛò PAP íá áÛóç óá óðñíέ ÷ áβá ðñí áñ ÷ áβíñ /etc/passwd.

```
enable passwdauth
```

Áí έÝέáðá íá áðñáPóðá óáóéέñ IP óá έÛðñíέñð ÷ ñPóççð, ðñññáßóá íá έáέññáßóáðá òçí áέáýέðñíóç ùð ðññðñí ùñέóíá óðñí áñ ÷ áβí /etc/ppp/ppp.secret. Áέá ðñáñáááβáñíáóá, ááβóá òñ áñ ÷ áβí /usr/share/examples/ppp/ppp.secret.sample.

28.2.1.2.11 ÁðáέóÛóáέò MS

Áβíáέ áðñíáðñí íá ñòèìβóáðá òñ PPP Póðá íá ðñáñÝ ÷ áέ áέáðέýíóáέð DNS έάέ NetBIOS έáðÛ áðáβòçç.

Áέá íá áíáñáñðñíέPóðáá áððÝð ðέð áðáέóÛóáέð íá òçí Ýέáñíóç 1.x òñ PPP, έá ðñÝðáέ íá ðññíóέÝóáðá ðέð ðñáñέÛò ðñáñÝð òðñí ó ÷ áðέέñ òñPñá ðñí /etc/ppp/ppp.conf.

```
enable msxt
set ns 203.14.100.1 203.14.100.2
set nbns 203.14.100.5
```

Áέá òñ PPP áðñí òçí Ýέáñíóç 2 έάέ ðÛñ:

```
accept dns
set dns 203.14.100.1 203.14.100.2
set nbns 203.14.100.5
```

Ïι δάνάδÛñ èά άίçìāñþράέ ðιòð δάέÛðάð áέά ðιí έýñέι έάέ äāððāñāýñιðά äιððçñāðçðP DNS, έάέ áέά ðιí äιððçñāðçðP ïññÛðιí NetBIOS.

Άðñ ðçí Ýέäιòç 2 έάέ δÛñ, άί δάνάέάέðέåß ç āñāñP set dns, ðι PPP έά ÷ñçðέιðιέPράέ ðέð āñāñÝð ðιò èά āñάέ ðιí /etc/resolv.conf.

28.2.1.2.12 Δέόðιðιβçç P AP έάέ CHAP

ËÛðιέιέ ISP ñðèìβæιòι ðά ððððPιάðά ðιòð ιā ðÝðιέι ðññðι, þððά ðι έìñÛðέ ðçð ðýñāðçðð ðιò áó÷ιέåßðάέ ιā ðçí ðέððιðιβççð ðιò ÷ñPððç ιά äβιāðάέ ιÝòù ðιí ιç÷ιέίþι PAP P CHAP. Άί ððιāáβιāέ áððù ððç äέέP ðάð δāñβððùðç, ι ISP ðάð äāí èά ðάð ððåßέåέ ðñιðñιðP login ùðάí ððιāååßðά, áέέÛ èά āñ÷Pðάέ áðððååßðð ðç ιāðÛäιòç PPP.

Ïι PAP äβιāέ έέäñðāñι áóðάέÝð áðñ ðι CHAP, áέέÛ ç áóðÛέάέ äāþ äāí äβιāέ ðιòι ððιðäáβι èÝιā, έάèðð ιέ èñäέέιβ (άί έάέ ððÝέñιðάέ ùð έáñιέέñ èåßιāñι) ιāðäáβιñιðάέ ïññ ιÝòù ðάέñέάέPð āñāñPð. þðέ äāí ððÛñ÷ιέ ðñāñιäðέέP äðιäðùðçðά ðιí crackers ιά “èñððáέιýðιðι”.

×ñçðέιðιέPιðάð ùð áιáðññÛ ðέð äιñιðçðάð PPP έάέ ÓðáðέέÝð Äέäðέýιðάέð IP P PPP έάέ ÄðιäιέέÝð Äέäðέýιðάέð IP, èά ðñÝðάέ ιά äβñðι ιέ δάνάέÛðù äέέäáÝð:

```
13      set authname MyUserName
14      set authkey MyPassword
15      set login
```

ÄñāñP 13:

Ç āñāñP áððP έäέññβæάέ ðι ùññā ÷ñPððç áέά ðά PAP/CHAP. Έά ÷ñάέáððåß ιά äέðÛäāðά ðçí ðùððP ðέιP áέά ðι MyUserName.

ÄñāñP 14:

Ç āñāñP áððP έäέññβæάέ ðιí èñäέέñι äέά ðά PAP/CHAP. Έά ÷ñάέáððåß ιά äέðÛäāðά ðçí ðùððP ðέιP áέά ðι MyPassword. ðùðð èÝέäðά ιά ðñιðέÝððάð ιέά áέñιā āñāñP, ùðñð ðçí δάνάέÛðù:

```
16      accept PAP
P
16      accept CHAP
```

äέά ιά äβιāέ ðáíññP ç ðññέäðç ðάð, ùððùðι ðιòι ðι PAP ùðι έάέ ðι CHAP äβñιðάέ ääέðÛ áðñ ðññäðέέιñP.

ÄñāñP 15:

Ï ISP ðάð äāí èά áððáððåß ðððέιñιέέÛ ιά äέðÝέäðά ððιí äιððçñāðçðP άί ÷ñçðέιðιέåßðά PAP P CHAP. Äέά ðι èññι áððù, èά ðñÝðάέ ιά áððáñññιðιέPðάðά ðι äέðñäέέιçðέέñι “set login”.

28.2.1.2.13 Άέέὺάειόάδ Πιάόά όέδ Ἴδèιβόάέδ όιδ ppp

Άβιάέ άοιάόυι ίά άδέειέιυιΠόάόά ίά όι δñüāñāiá ppp έάέδδ άέόάέάβόάέ όόι δάñάόέΠεί, άέέὺ iuyí άί Ḃ ÷ άόά ñèιβόάέ ίέά έάδὺέέçç έέάñüóóέέΠ έýñά έέά άόδύ όι όέιδύ. Άέά ίά όι έὺίάόά άόδύ, δñiόέḂόά όçί δάñάέὺδύ āñāiΠ όόέδ ñèιβόάέδ όάδ:

```
set server /var/run/ppp-tun%d DiagnosticPassword 0177
```

Άόδύ iāçāāβ όι PPP ίά “άέιýάέ” όόι έάέiñέόιḂί UNIX socket όιδ όñḂά, έάέ ίά ñüδὺάέ όιδδ δάέὺδάδ άέά όι έüάέέü όιδ Ḃ ÷ άέ έάέiñέόάάβ δñéí άδέόñḂάέ όçί δñüóááóç. Όι %d όόι üñiá, áíóέέάέβóóάόάέ ίά όιí āñέέiü όçδ όóóέάδΠδ tun όιδ ÷ ñçóέiüδiέάβóάέ.

Άδύ όç όóέāiΠ δiδ ñèιβέόάάβ όι socket, όι δñüāñāiá pppct(8) iδñāβ ίά ÷ ñçóέiüδiέçέāβ óå scripts ίά óá iδiβά άδέέóìāβóά ίά έέά ÷ άέñέóóάάβóά όι δñüāñāiá ppp όι iδiβi έέóάέāβóάέ Πāç.

28.2.1.3 ×ñçóέiüδiέβiόάó όç Άóíáóüδóçóά ίáóὺñáóçò Άέάóέýiόáüí (NAT) όiδ PPP

Όι PPP Ḃ ÷ άέ όçί έέáñüóçóά ίά ÷ ñçóέiüδiέΠóάέ áέέü όiδ áóüδāñέéü NAT, ÷ ùñβδ ίά áδάέóýiýiόάέ iέ έέáñüóçóáδ áíáέáóāýèδiόçδ όiδ δδñΠiá. Iδñāβóá ίá áñāñāiδiέΠóáóá άóδΠ όç έáέóíðñāβá ίá όçί áέüéiðèç āñāiΠ όóí /etc/ppp/ppp.conf:

```
nat enable yes
```

Άíáέέáéóέέὺ, όι NAT όiδ PPP iδñāβ ίá áñāñāiδiέçέāβ ίá όçί άδέéiāΠ -nat όóçí āñāiΠ áíóíεβi. Iδñāβóá áέüiá ίá áὺέáóά όçί άδέéiāΠ ppp_nat όóí āñ ÷ āβi /etc/rc.conf. Ç άδέéiāΠ áóδΠ āβiáέ áñāñāiδiέçiḂίç áδü δñiáδέéiāΠ.

Άí ÷ ñçóέiüδiέΠóáóá άóδý όι ÷ āñáέóçñέóóέéü, iḂééií έá āñāβóá ÷ ñβóéiáδ έάέ όέδ δāñáέὺδύ άδέéiāḂδ áέá όι /etc/ppp/ppp.conf, ίá όέδ iδiβāδ áñāñāiδiέáβóάέ ç δñiβèçóç áέóāñ ÷ üiñüí óóíāḂóáüí:

```
nat port tcp 10.0.0.2:ftp ftp
nat port tcp 10.0.0.2:http http
```

Π áí āñ áiðéóóāýāóá έáέüéið όi áñüδāñέéü āβéóóí:

```
nat deny_incoming yes
```

28.2.1.4 ÓāέέéḂδ Ἴδèιβόάέδ ÓóóδΠiáíðið

÷ áóá δέḂí ñèιβόάέ όι ppp, áέέὺ óδḂñ ÷ iði íāñέéὺ áέüiá δñḂāiáóá όiδ δñḂáέ ίá έὺíáóá δñéí ίá āβiáέ Ḃóíéií áέá έáέóíðñāβá. ¼έá δāñééáiāḂíñið όçί áδāñāñāáóβá όiδ āñ ÷ āβið /etc/rc.conf.

Iáέéβiíóáδ áδü όçí āñ ÷ Π όiδ āñ ÷ āβið áóóiy, āāááéüèāβóá üðé āβiáέ iñέóíḂίç ç āñāiΠ hostname=, δ. ÷.:

```
hostname="foo.example.com"
```

Άí i ISP óáδ δāñḂ ÷ áέ óóáóééΠ IP áέáýèδiόç έάέ üñiá, āβiáέ iḂééií έáέýóāñi ίá ÷ ñçóέiüδiέΠóáóá άóδý όι üñiá üð üñiá áέá όi iç ÷ Ḃiçiá óáδ.

ØḂiðā áέá όç íáóáāéçδΠ network_interfaces. Άí èḂéáóá ίá ñèιβóáóá όi óýóóçiá óáδ ίá έáέāβ όi ISP óáδ έáδὺ áδāβóçóç, āāááéüèāβóá üðé óδḂñ ÷ áέ óóç έβóóá ç óóóéáδΠ tun0, áέáóññāóééὺ áóáéñḂóá όçí.

```
network_interfaces="lo0 tun0"
```

ifconfig_tun0=

Όγιάρβύος: **Ç** ιάράαέçòP ifconfig_tun0 έά ðñÝðáέ ίά άβίάέ ΰääέά, έάέ έά ðñÝðáέ ίά äçíείòñāçεάρβ Ύίά άñ÷άβί ίά ùííá /etc/start_if.tun0. Όί άñ÷άβί άóòü έά ðñÝðáέ ίά ðñéÝ÷έέ ðçí ðñāέΰòü άñáíìP:

ppp -auto mysystem

Όί script άóòü άέòääέάρβóάέ έάóΰ ðç äéΰñέάέά ñýεíέóçò ðíò áέέòýíò, ίάέέίPíóáò Ύóóέ ðí άάβίίίά ppp óá έάóΰóóáóç άóòüíáðçò έάέóíòñāβáò. Άί άέάέΎóáòá έΰòίέí ðíðέέü άβέòòí (LAN) áέά ðí ίòñíí ðí ίç÷ΰίçíά άóòü Ύ÷έέ ðí ñüéí ðçò ðýççò, βóòü ίά έΎέάóá άðβóçò ίά ÷ñçóέííðίέPóáòá ðçí άðέέíāP -alias. Άάρβóά ðç óáέβáά manual áέά ðñéóóüòáñáò έáðòñÝñάέáò.

Άάάέüέάρβóá üóέ ç ιάράαέçòP áέά ðí ðñüñāñíá router Ύ÷έέ ðáέάρβ óòí NO ιΎóü ðçò άðüíáίçò άñáíìPò óòí /etc/rc.conf:

router_enable="NO"

Άβίάέ óçíáíóέέü ίά ίçí ίάέέίPóáέ ί άάβίίίáò routed, ι ίðñíβíò óòíPεüò áέάññΰóáέ óέð ðñíáðέέάñΎίáò ðέíΎò ðéíò ðβίάέά άññíεüüáçóçò ðíò äçíείòñāíýíóáέ áðü ðí ppp.

Άβίάέ ιΰέεíí έάέP έáΎά ίά áíáóóáέβóáòá üóέ ç άñáíìP sendmail_flags άáí ðñéέάíáΰίáέ ðçí άðέέíāP -q, áέάóíñáðέέü ðí sendmail έá ðñíóðáέάρβ έΰέá ðüóí ίά έΰίáέ áíáεPòççò ðíò áέέòýíò, ίá ðέέáíü áðíò Ύέáóíá ðí ίç÷ΰίçíά óáò ίά áέòáέάρβ ðçέáòüíέέP óýíááóç (dial out). Ιðññáβóá ίά áíέέíΰóáòá:

sendmail_flags="-bd"

Όí ίάέííΎέóçíά ðíò ðñááðΰíü, άβίάέ üóέ ðñÝðáέ ίά áíáíáääέΰóáòá ðí sendmail ίά áðáíáíáòΰóáέ ðçí íòñΰ ðüí ίçíòíΰóúí, έΰέá óíñΰ ðíò áðíέáέβóóáóáέ ç óýíááóç ppp, άñΰóííóáò:

/usr/sbin/sendmail -q

εóòüò έΎέáòá ίά ÷ñçóέííðίέPóáòá ðçí áíóίέP !bg óòí ppp.linkup áέά ίά άβίáóáέ ðí ðñááðΰíü άóòüíáóá:

```
1 provider:
2 delete ALL
3 add 0 0 HISADDR
4 !bg sendmail -bd -q30m
```

Άί άóòü άáí óáò άñΎóáέ, άβίάέ áðíáóüí ίá ñèìβóáòá Ύίά “dfilter” ðí ίðñíβí ίá áðíέüðóáέ ðçí έβίççòç SMTP. Άάρβóά óá ðñíáβáíáóá áέά ðñéóóüòáñáò έáðòñÝñάέáò.

Όí íüñí ðíò ιΎίáέ άβίάέ ίά áðáíáέέέíPóáòá ðí ίç÷ΰίçíά. Ιáòΰ ðçí áðáíáέέέβίççòç, ίðññáβóá άβóá ίά άñΰóáòá:

PPP

έάέ Ύðáέóá dial provider áέά ίά ίάέέίPóáòá ðç óóíáññá PPP, P áί έΎέáòá ðí ppp ίά áðíέáέέóòΰ óέð óóíáññáò άóòüíáóá έΰέá óíñΰ ðíò ððΰñ÷έέ έβίççòç ðñíò ðí áñüðáñέέü άβέòòí (έάέ άáí Ύ÷έέ äçíείòñāPóáέ ðí script start_if.tun0) ίðññáβóá ίά άñΰóáòá:

ppp -auto provider

28.2.1.5 Δάñβέçøç

Άέά ίά άάέάάέάέάέπόιόά, όά δάñάέŪόò άΠιάόά άβίάέ άδάñάβόçόά üόάί άάέάέόóŪόά όι ppp άέά δñβόç öñŪ:

Άδὺ όç ίάñέŪ όιò ίç÷ άΠιάόιò-δάέŪόç:

1. Άάάάέüέάβόά üέέ δάñέέάίάŪίάόάέ όóιí δδñΠιά όάò ç όóóέάδP tun.
2. Άάάάέüέάβόά üέέ δδŪñ÷ άέ όι άñ÷ άβι όçò όóóέάδPò tunN όóιí έάóŪέιáí /dev.
3. ΆçίέιòñάPóóά ίέά έάόά÷ñέόç όóιí άñ÷ άβι /etc/ppp/ppp.conf. Ūí δάñŪάάέάίά άέά όι pmdemand έά δñŸδάέ ίά άβίάέ άδάñέŸò άέά όιòδ δάñέóóüόάñιòδ ISPs.
4. Άί Ÿ÷ άóά άóίάίέέP άέάŸέóίόç IP, άçίέιòñάPóóά ίέά έάόά÷ñέόç όóιí /etc/ppp/ppp.linkup.
5. Άίçíáñβóóά όιí άñ÷ άβι /etc/rc.conf.
6. ΆçίέιòñάPóóά όιí script start_if.tun0 άί ÷ñάέŪάάóóά έέPόç έάóŪ άδάβόçόç.

Άδὺ όç ίάñέŪ όιò άíòδçñάόçόP:

1. Άάάάέüέάβόά üέέ δάñέέάίάŪίάόάέ όóιí δδñΠιά όάò ç όóóέάδP tun.
2. Άάάάέüέάβόά üέέ δδŪñ÷ άέ όι άñ÷ άβι όçò όóóέάδPò tunN όóιí έάóŪέιáí /dev.
3. ΆçίέιòñάPóóά ίέά έάόά÷ñέόç όóιí /etc/passwd (÷ñçóέííðίέPίόάò όιí δñüññáíá vipw(8)).
4. ΆçίέιòñάPóóά Ÿíá άñ÷ άβι profile όóιí δñιούðέέü έάóŪέιáí όιò ÷ñPόç, όιí ðíβι ίά άέóάέάβ όçí άίóíέP ppp-direct direct-server P έŪðίέά άίóβóóίέ÷ç.
5. ΆçίέιòñάPóóά ίέά έάόά÷ñέόç όóιí /etc/ppp/ppp.conf. Ūí δάñŪάάέάίά άέά όιí direct-server έά δñŸδάέ ίά άβίάέ άδάñέŸò.
6. ΆçίέιòñάPóóά ίέά έάόά÷ñέόç όóιí /etc/ppp/ppp.linkup.
7. Άίçíáñβóóά όιí άñ÷ άβι /etc/rc.conf.

28.3 ×ñçóέííðίέPίόάò όιí PPP όιò ΔóñΠιά

Δñíάέάíðίβçόç: Ç άíüòçόά áóóP άβίάέ Ÿάέòñç έάέ ðíñάβ ίά áóáñιíóóάβ íüíí óá óóóóPιáóά FreeBSD 7.X.

28.3.1 Ñöèìβæííóáò όιí PPP όιò ΔóñΠιά

Δñεί ίάέέPóóάóά ίά ñöèìβæííóáò όιí PPP όóιí ίç÷ Ūίçíá όáò, άάάάέüέάβόά üέέ όιí pppd άñβóέάάόάέ όóιí έάóŪέιáí /usr/sbin έάέ üέέ δδŪñ÷ άέ í έάóŪέιáíò /etc/ppp.

Ūí pppd Ÿ÷ άέ äŸí έάόάóóŪóάέò έάέóιòñάβáð:

1. Ūò δάέŪóçò (“client”) — üόάί έŸέάóά ίά óóíáŸóáóá όιí ίç÷ Ūίçíá όáò íá όιí Ÿíü έüóιí íŸóü óáέñέάέPò óŸíááóçò óŸíááóçò P áñáñPò modem.


```

        kill ${pid}
    fi
    pgrep -l kermit
    pid=`pgrep kermit`
    if [ "X${pid}" != "X" ] ; then
        echo 'killing kermit, PID=' ${pid}
        kill -9 ${pid}
    fi

    ifconfig ppp0 down
    ifconfig ppp0 delete

    kermit -y /etc/ppp/kermit.dial
    pppd /dev/tty01 19200

```

Ïï ãñ÷ãßï /etc/ppp/kermit.dial ãßíáé Ýíá script ãéá ðï **Kermit** ðï ïðïßï êÛíáé ôçí êêðóç έáé ôçí ðéóóïðïßçóç ðïð ÷ñðóç óðïí áðñáêñðóïÝíï ððïëïãéóðð (óðï ðÝëïð áððïý ðïð áããñÛóïð, έá ãñãðá Ýíá ðãñÛááéãíá ãéá Ýíá ðÝðïéí script).

×ñçóéïðïéðóá ðï ðãñáéÛò ð script /etc/ppp/pppdown ãéá íá áðïóóíáÝóáðá ôçí ãñãñð PPP:

```

#!/bin/sh
pid=`pgrep pppd`
if [ X${pid} != "X" ] ; then
    echo 'killing pppd, PID=' ${pid}
    kill -TERM ${pid}
fi

pgrep -l kermit
pid=`pgrep kermit`
if [ "X${pid}" != "X" ] ; then
    echo 'killing kermit, PID=' ${pid}
    kill -9 ${pid}
fi

/sbin/ifconfig ppp0 down
/sbin/ifconfig ppp0 delete
kermit -y /etc/ppp/kermit.hup
/etc/ppp/ppptest

```

ÃéÝáíðá áí êéðáéãðóáé áéïíá ðï pppd, êéðáéðíðáð ðï /usr/etc/ppp/ppptest, ðï ïðïßï έá ïéÛæáé íá ðï ðãñáéÛò:

```

#!/bin/sh
pid=`pgrep pppd`
if [ X${pid} != "X" ] ; then
    echo 'pppd running: PID=' ${pid-NONE}
else
    echo 'No pppd running.'
fi
set -x
netstat -n -I ppp0
ifconfig ppp0

```

Ãéá íá êéãðóáðá ôçí ãñãñð, êéðáéÝóá ðï /etc/ppp/kermit.hup, ðï ïðïßï έá ðñÝðáé íá ðãñéÝ÷áé:

```
set line /dev/tty01 ; put your modem device here
set speed 19200
set file type binary
set file names literal
set win 8
set rec pack 1024
set send pack 1024
set block 3
set term bytesize 8
set command bytesize 8
set flow none
```

```
pau 1
out +++
inp 5 OK
out ATH0\13
echo \13
exit
```

Ìέα áíáέέάέδóέέP ìÝέíáíð ðíð ÷ ñçóέíðíέάß ðí chat áíðß áέα ðí kermit:

Óά ðáñáέÛòù äýí áñ÷áßá äðáñέíýí áέα ðç äçέíðñáßá íέαð óýíááóçð pppd.

/etc/ppp/options:

/dev/cuad1 115200

```
crtscts # enable hardware flow control
modem # modem control line
connect "/usr/bin/chat -f /etc/ppp/login.chat.script"
noipdefault # remote PPP server must supply your IP address
    # if the remote host doesn't send your IP during
    # IPCP negotiation, remove this option
passive # wait for LCP packets
domain your.domain # put your domain name here

: # put the IP of remote PPP host here
    # it will be used to route packets via PPP link
    # if you didn't specified the noipdefault option
    # change this line to local_ip:remote_ip

defaultroute # put this if you want that PPP server will be
    # your default router
```

/etc/ppp/login.chat.script:

Óçíáßúóç: Òí ðáñáέÛòù έá ðñÝðáέ íá ãñáðáß óá íέα ìúíí ãñáíìP.

```
ABORT BUSY ABORT 'NO CARRIER' "" AT OK ATDTphone.number
CONNECT "" TIMEOUT 10 ogin:-\\r-ogin: login-id
TIMEOUT 5 sword: password
```

Ïüέέδ òñüðüíέÉΠóάά έάέ άάέάόάóδΠóάά óúóóÛ óά δñάδÛüü άñ÷άβά, òü üüüü ðüð ÷ñάέÛæάóάέ íá έÛüáδά άβίάέ íá άέóάέÛóάά όçí áíóüέΠ pppd, ìά òüü òñüðüí ðüð óάβίáóάέ δñάάέÛóú:

```
# pppd
```

28.3.3 ×ñçóέüüðüέÉΠóάό òü pppd ùò ÁüðçñάóçδΠ

Ïüü /etc/ppp/options έά δñÛðáέ íá δñάέÛ÷άέ έÛóέ áíóβóóüέ÷üü ìά òü δñάάέÛóú:

```
crtstcts                # Hardware flow control
netmask 255.255.255.0   # netmask (not required)
192.114.208.20:192.114.208.165 # IP's of local and remote hosts
                                # local ip must be different from one
                                # you assigned to the Ethernet (or other)
                                # interface on your machine.
                                # remote IP is IP address that will be
                                # assigned to the remote machine

domain ppp.foo.com     # your domain
passive                 # wait for LCP
modem                   # modem line
```

Ïüü script /etc/ppp/pppserv ðüð óάβίáóάέ δñάάέÛóú, έά δάέ óüü **pppd** íá έάέóüüññάβóάέ ùò áüðçñάóçδΠ:

```
#!/bin/sh
pgrep -l pppd
pid=`pgrep pppd`
if [ "X${pid}" != "X" ] ; then
    echo 'killing pppd, PID=' ${pid}
    kill ${pid}
fi
pgrep -l kermit
pid=`pgrep kermit`
if [ "X${pid}" != "X" ] ; then
    echo 'killing kermit, PID=' ${pid}
    kill -9 ${pid}
fi

# reset ppp interface
ifconfig ppp0 down
ifconfig ppp0 delete

# enable autoanswer mode
kermit -y /etc/ppp/kermit.ans

# run ppp
pppd /dev/tty01 19200
```

×ñçóέüüðüέÉΠóάό òü δñάάέÛóú script /etc/ppp/pppservdown áέά íá óóáüáóδΠóάά òüü áüðçñάóçδΠ:

```
#!/bin/sh
pgrep -l pppd
pid=`pgrep pppd`
```

```

if [ "X${pid}" != "X" ] ; then
    echo 'killing pppd, PID=' ${pid}
    kill ${pid}
fi
pgrep -l kermit
pid=`pgrep kermit`
if [ "X${pid}" != "X" ] ; then
    echo 'killing kermit, PID=' ${pid}
    kill -9 ${pid}
fi
ifconfig ppp0 down
ifconfig ppp0 delete

kermit -y /etc/ppp/kermit.noans

```

Όι δάνάέÛού script άέα οι **Kermit** (/etc/ppp/kermit.ans) ιδιñάβ ίά άίάñāñιδιέάβ έάέ ίά άδάίάñāñιδιέάβ όçi έάέόιθñāβά άόδóüάόçδ άδÛίόçόçδ όδñ modem όάδ.

```

set line /dev/tty01
set speed 19200
set file type binary
set file names literal
set win 8
set rec pack 1024
set send pack 1024
set block 3
set term bytesize 8
set command bytesize 8
set flow none

pau 1
out +++
inp 5 OK
out ATH0\13
inp 5 OK
echo \13
out ATS0=1\13 ; change this to out ATS0=0\13 if you want to disable
                ; autoanswer mode

inp 5 OK
echo \13
exit

```

Όδñ άδñάέñόιÛñ òδñέάέόδP, ÷ñçóέñιδιέάβόάέ οι script /etc/ppp/kermit.dial άέα έέPόç έάέ δέόόιθñβçόç όñ ÷ñPόç. Έά δñÛάέ ίά οι δñιθñιέPόάά όγñουά ίά δέδ άÛάέάδ όάδ. ΆÛέόά οι úñά ÷ñPόç έάέ όñ έúάέú όάδ όά άόδú οι script. Έά ÷ñάέάόάβ άδβόçδ ίά άέέÛίάόά όçi āñāñP άέα όçi āβóññ (input) άÛέñā ίά δέδ άδάίόPόάέδ δñ āβñάέ οι modem όάδ έάέ ι άδñάέñόιÛñ òδñέάέόδPò.

```

;
; put the com line attached to the modem here:
;
set line /dev/tty01
;
; put the modem speed here:

```

```

;
set speed 19200
set file type binary          ; full 8 bit file xfer
set file names literal
set win 8
set rec pack 1024
set send pack 1024
set block 3
set term bytesize 8
set command bytesize 8
set flow none
set modem hayes
set dial hangup off
set carrier auto              ; Then SET CARRIER if necessary,
set dial display on          ; Then SET DIAL if necessary,
set input echo on
set input timeout proceed
set input case ignore
def \%x 0                      ; login prompt counter
goto slhup

:slcmd                          ; put the modem in command mode
echo Put the modem in command mode.
clear                          ; Clear unread characters from input buffer
pause 1
output +++                     ; hayes escape sequence
input 1 OK\13\10               ; wait for OK
if success goto slhup
output \13
pause 1
output at\13
input 1 OK\13\10
if fail goto slcmd            ; if modem doesn't answer OK, try again

:slhup                          ; hang up the phone
clear                          ; Clear unread characters from input buffer
pause 1
echo Hanging up the phone.
output ath0\13                 ; hayes command for on hook
input 2 OK\13\10
if fail goto slcmd            ; if no OK answer, put modem in command mode

:sldial                          ; dial the number
pause 1
echo Dialing.
output atdt9,550311\13\10      ; put phone number here
assign \%x 0                   ; zero the time counter

:look
clear                          ; Clear unread characters from input buffer
increment \%x                  ; Count the seconds
input 1 {CONNECT }
if success goto sllogin

```

```

reinput 1 {NO CARRIER\13\10}
if success goto sldial
reinput 1 {NO DIALTONE\13\10}
if success goto slnodial
reinput 1 {\255}
if success goto slhup
reinput 1 {\127}
if success goto slhup
if < \%x 60 goto look
else goto slhup

:sllogin                                ; login
assign \%x 0                            ; zero the time counter
pause 1
echo Looking for login prompt.

:slloop
increment \%x                            ; Count the seconds
clear                                     ; Clear unread characters from input buffer
output \13
;
; put your expected login prompt here:
;
input 1 {Username: }
if success goto sluid
reinput 1 {\255}
if success goto slhup
reinput 1 {\127}
if success goto slhup
if < \%x 10 goto slloop                  ; try 10 times to get a login prompt
else goto slhup                          ; hang up and start again if 10 failures

:sluid
;
; put your userid here:
;
output ppp-login\13
input 1 {Password: }
;
; put your password here:
;
output ppp-password\13
input 1 {Entering SLIP mode.}
echo
quit

:slnodial
echo \7No dialtone. Check the telephone line!\7
exit 1

; local variables:
; mode: csh
; comment-start: "; "
```

```
; comment-start-skip: "; "
; end:
```

28.4 Αίόειάορδεός ΔñĩäëçĩÛôúi óå ÓóĩäÝóåέò PPP

Δñĩäëäĩðĩßçòç: Άδὺ ðĩ FreeBSD 8.0 έάέ ιάδὺ, ðĩ δñũäñäĩä ιäPäçòçð sio(4) αίðέέάδåðÛέçêä áδὺ ðĩ uart(4). Óå ιĩüĩäåä óðóέäðĩ ðúi óάέñέάέπĩ έèñπĩ Ý÷ĩðĩ äέέÛĩäέ áδὺ /dev/cuaðN óä /dev/cuaυN έάέ áδὺ /dev/ttyðN óä /dev/ttyυN. ĩέ ÷ñPóðåð ðĩø FreeBSD 7.X έά δñÝðäέ ιä δñĩóäñĩüóĩðĩ óέð δäñäέÛðũ ιäçäPåð óýĩðüĩä ιä äððÝð óέð äέέääÝð.

Ç áñũðçðä äððP έäέýððäέ ιäñέέÛ áδὺ óä δñĩäέPĩäåä ðĩø ιðñĩäß ιä δäñĩðóέäóðĩýĩ üðäĩ äßĩäðäέ ÷ñPòç ðĩø PPP ιÝóũ óýĩäåóçð modem. Άέä δäñÛääέäĩä, έä δñÝðäέ ιä ιÝñäåä ιä äέñPäåέä óä ιçĩýĩäåä äέóũäĩð ðĩø έä äĩòäĩPóäέ ðĩ óýóðçĩä ðĩ ιðñĩ äέäåßðä. ĩäñέέĩß ISP äßĩðĩ ðçĩ δñĩðñĩðP ssword, äP Ûέέĩέ äßĩðĩ ðçĩ password. Αĩ ääĩ Ý÷äåä äñÛðäέ óũððÛ ðĩ script äέä ðĩ ppp, ç äðũðäέñä äέóũäĩð έä äðĩðý÷äέ. ĩ ðέĩ óóĩçέέóĩÝñð ðñũðĩð ιä äέóðäέĩäðPóäðä ιέä óýĩäåóç ppp, äßĩäέ ιä óðĩääέäßðä ÷äέñĩέßĩçðä. ĩέ ðέçñĩðñĩßäð ðĩø äĩòäĩPäñĩðäέ δäñäέÛðũ, έä óäð ιäçäPóĩðĩ äPĩä ðñĩð äPĩä óðç ÷äέñĩέßĩçðç äðĩέäðÛóðäóç ðçð óýĩäåóçð.

28.4.1 ÄéÝäĩðä óä Äñ÷äßä Óóóέäðĩ

Αĩ ÷ñçóέĩðĩέäßðä δñĩóäñĩüóĩÝñ ððñPĩä, ääääέüðäßðä üðέ Ý÷äåä δäñέέÛääέ ðçĩ δäñäέÛðũ äñäñP óðĩ äñ÷äßĩ ðòèĩPóäüĩ ðĩø δðñPĩä óäð:

```
device    uart
```

Αĩ ÷ñçóέĩðĩέäßðä ðĩ δðñPĩä GENERIC, ääĩ ÷ñäέÛäåðäέ ιä εÛĩäðä εÛðĩέä äέέääP, έäèðð ç óðóέäýç uart δäñέέäĩäÛĩäåä Päç óä äððüĩ. Άðèðð äéÝäĩðä óä ιçĩýĩäåä ðçð dmesg äέä ðçĩ óðóέäðP modem, ÷ñçóέĩðĩέPĩðäð ðçĩ δäñäέÛðũ äĩðĩèP:

```
# dmesg | grep uart
```

Έä δñÝðäέ ιä ääßðä εÛðĩέä Ýñäĩ ó÷äðέèP ιä óέð óðóέäðÝð uart. Δñũέäέðäέ äέä óέð έýñäð COM ðĩø ÷ñäέäæüĩäåðä. Αĩ ðĩ modem óäð έäέóĩðñääß ùð ðððĩðĩέçĩÝĩç óäέñέäèP έýñä, έä δñÝðäέ ιä ðĩ ääßðä ιä äĩäüÝñäðäέ ùð uart1, P COM2. Αĩ óðĩääßĩäέ äððũ, ääĩ ÷ñäέÛäåðäέ ιä äðäĩäĩäåðäæüððóðäðä ðĩ δðñPĩä óäð. Αĩ ç óäέñέäèP έýñä ðĩø äĩðέóðĩέ÷äß óðĩ modem óäð äßĩäέ ç uart1 P COM2 óðĩ DOS, ç äĩðßððĩέ÷ç óðóέäðP modem έä äßĩäέ ç /dev/cuaυ1.

28.4.2 ×äέñĩέßĩçðç Óýĩäåóç

Ç ÷äέñĩέßĩçðç óýĩäåóç óðĩ Internet ιä ÷ñPòç ðçð ppp, äßĩäέ Ýĩäð äñPäñĩð èäέ äýέĩèð ðñũðĩð ιä äĩðĩðßðäðä ðð÷ĩ ðñĩäέPĩäåä óýĩäåóçð, P äðèðð ιä ðÛñäðä ðέçñĩðñĩßäð ó÷äðέέÛ ιä ðĩ ðũð ĩ ISP óäð äĩðέĩäðũðßäέð óέð óðĩäÝóåέð δäέäðπĩ ppp. Έä ĩäέέĩPóĩðä ðçĩ äðäñĩäP PPP áδὺ ðçĩ äñäñP äĩðĩèPĩ. ÓçĩäέPóäð üðέ óä üέä ιäð óä δäñäääßäĩäåä, έä ÷ñçóέĩðĩέýĩä ðĩ example ùð ðĩ üñĩä ðĩø ððĩèĩäέóðð ðĩø äέðäέäß ðĩ PPP. ĩðñĩäßðä ιä ĩäέέĩPóäðä ðĩ ppp, äñÛðĩðäð äðèðð ppp:

```
# ppp
```

÷ϊόια όβηά ίάέείΠόάέ οι ppp.

```
ppp ON example> set device /dev/cuau1
```

ΈΥόιοια ός όόόέάδΠ modem. Όοι όάνὐάάέαιά ίάδ, άβίάέ ς cuau1.

```
ppp ON example> set speed 115200
```

ΈΥόιοια όςί όά÷ύόόά όύίαάόόδ, όά άδδΠ όςί όάνβδδούός ÷ηόόείηδϊέίγία 115,200 kbps.

```
ppp ON example> enable dns
```

ΈΥία όοι ppp ίά ηδδèιβόάέ οη resolver έάέ δηιόέΥόιοια όέό έάόὐέέçέάδ άηάηὐδ άέά οι άέάέηέόδΠ ηηὐδουί όοι /etc/resolv.conf. Άί οι ppp άά ίδηηάβ ίά έάέηηβόάέ οι υηηά οη άέάέηέόδΠ, ίδηηγία ίά οι έάέηηβόιοια ίά ÷άέηηέβίόη όηυδϊ άηάυόάηά.

```
ppp ON example> term
```

Άέέὐάηιοια όά έάόὐόόάός “terminal” βόόά ίά ίδηηγία ίά άέὐάηιοια οι modem ÷άέηηέβίόά.

```
deflink: Entering terminal mode on /dev/cuau1
type '~h' for help
```

```
at
OK
atdt123456789
```

×ηόόείηδϊέίγία οι at άέά ίά άη ÷έείδϊέΠόιοια οι modem, έάέ Υδάέόά ÷ηόόείηδϊέίγία οι atdt έάέ οη άηέέηυ οη ISP άέά ίά ίάέείΠόιοια ός άέάέέέάόβά όςδ έέΠόόδ.

CONNECT

Άαη Υ ÷ιοια άδέάάάάβυός όςδ όύίαάόόδ. Άί Υ ÷ιοια δηηάέΠιαόά όύίαάόόδ όά ηδηβά άά ό ÷άδβάηιόάέ ίά οι όέέέυ ίάδ, άαη άβίάέ οι όςίάβη δη δηὐδάέ ίά δηιόδάέΠόιοια ίά όά άδέέγιοιοια.

```
ISP Login:myusername
```

Ç δηηόηηδΠ άδδΠ άβίάέ άέά ίά άβόιοια οι υηηά ÷ηΠόός. ×ηόόείηδϊέΠόόά οι υηηά ÷ηΠόός δη όάδ Υ ÷άέ άηέάβ άδυ οη ISP όάδ.

```
ISP Pass:mypassword
```

Ç δηηόηηδΠ άδδΠ άβίάέ άέά οη έυάέέυ δηυόάάόόδ. ΆδάηόΠόόά ίά οη έυάέέυ δη όάδ Υ ÷άέ άηέάβ άδυ οη ISP όάδ. Ἰ έυάέέυδ άδδυδ άά έά άηόάηέόδάβ όόςί ηέυης όάδ, υδυδ άέηέάβδ όοηάάβίάέ έάέ ίά οη έυάέέυ όάδ υδάί οη άηὐόάόά όόςί δηηόηηδΠ άέόυάηη όη Freebsd όόόδΠιαόηδ όάδ.

```
Shell or PPP:ppp
```

Άὐέηηά ίά οη ISP όάδ, ίδηηάβ ίά ης ίά άάβδά έάέ έάέυηηό όςί δάηάδὐηυ δηηόηηδΠ. Όόςί δάηάδὐηυ δάηβδδούός ίάδ ηυδὐάέ ά ίάδέέδηηγία ίά άέδάέΥόιοια εὐδηέη εὐέέοηδ (shell) όοι ης ÷ὐηςία οη όάηη ÷ὐά, Π ά ί έὐέηηηά ίά άέέέηΠόιοια οι ppp. Όοι όάνὐάάέαιά ίάδ άδέέὐηηά ίά ÷ηόόείηδϊέΠόιοια ppp έάέβδ έὐέηηηά ίά όόηάάέηγία όοι Internet.

```
Ppp ON example>
```

ΔανάοçñΠρόα̂ υέέ οοί δάνὔάέαιά̂ οί δñρδ̂ι p̂ άβίάέ έάοάέάβ̂ι. Άδου̂ άάβ÷ íάέ υέέ Ḃ÷ ιο̂ιá̂ οοίάάέάβ̂ άδέοδ̂÷ ρδ̂ ιά̂ οί̂ ISP.

PPP ON example>

÷ ιο̂ιá̂ δέοοίδ̂ιέçέάβ̂ ιά̂ άδέοδ̂÷ βά̂ άδ̂υ̂ οί̂ ISP ιά̂δ̂, έάέ δ̂άνειḂ ι̂ι̂ο̂ιá̂ íá̂ ιά̂δ̂ άδ̂ιαιέάβ̂ άέάγέοίος̂ IP.

PPP ON example>

÷ άέ δέḂ ι̂ι̂ έάέι̂νεοοάβ̂ άέάγέοίος̂ IP, έάέ Ḃ÷ ιο̂ιá̂ ι̂ι̂έέçñρδ̂άέ οç ογίάαός̂ ιά̂ άδέοδ̂÷ βά̂.

PPP ON example>add default HISADDR

Άρ̂ δñι̂οέḂ ι̂ο̂ιá̂ οç ι̂ι̂άδέέάάιḂ Ḃίç̂ άέάάññ̂P̂ (default route). Ὀ̂ι̂ άβ̂ιá̂ άδου̂ άβίάέ άδ̂ανάβ̂οçοί̂ δñεί̂ ιδ̂ιñḂ ι̂ο̂ιá̂ íá̂ άδέέι̂έι̂ι̂P̂οί̂ο̂ιá̂ ιά̂ οί̂ Ḃί̂υ̂ έυ̂οί̂ι, έάέρδ̂ οç άάññḂ Ḃίç̂ οοέάι̂P̂ ç̂ ι̂ι̂ç̂ ογίάαός̂ δ̂ι̂ο̂ Ḃ÷ ιο̂ιá̂ άβίάέ ιά̂ Ḃίá̂ οδ̂ιαιέοδ̂P̂ άδ̂υ̂ οç ι̂ι̂έç̂ ιά̂νεḂ οçδ̂ άñάñ̂P̂δ̂. Άί̂ οί̂ δ̂ανάδ̂Ḃ ι̂ι̂ άδ̂ι̂ογ̂÷ άέ άδ̂άέάP̂ οδ̂Ḃñ̂÷ ι̂ο̂ι P̂αç̂ έάέι̂νεοί̂ Ḃίá̂δ̂ άέάάññ̂Ḃ, ιδ̂ιñάβ̂οά̂ íá̂ άḂέάοά̂ Ḃίá̂ έάοιá̂οδ̂έέυ̂ ! ιδ̂ñι̂οδ̂Ḃ άδ̂υ̂ οί̂ add. Άίáέέάέοδ̂έḂ, ιδ̂ιñάβ̂οά̂ íá̂ έḂίá̂οά̂ άδ̂οP̂ οç ñγέιέος̂ δñεί̂ άδ̂έ÷ άέñ̂P̂οά̂ οç ογίάαός̂, έάέ έά̂ άβίάέ άδ̂οι̂ιá̂οά̂ άέάδ̂ñάι̂Ḃ οδ̂άοç̂ οçδ̂ íḂ άδ̂ άέάάññ̂P̂δ̂.

Άί̂ υέά̂ δ̂P̂άι̂ έάέḂ, έά δñḂάέ̂ ορ̂ñά̂ íá̂ Ḃ÷ άδ̂ά̂ άίáñάP̂ ογίάαός̂ ιά̂ οί̂ Internet, οç ι̂ι̂βá̂ ιδ̂ιñάβ̂οά̂ íá̂ ιά̂οάέέι̂P̂οά̂ οοί̂ δ̂ανάοέP̂ίεί̂ ÷ ñç̂οέι̂δ̂ι̂έP̂ι̂οά̂δ̂ οί̂ οοί̂άοάοι̂υ̂ δ̂έP̂έδ̂ñ̂ι̂ CTRL+ẑ. Άί̂ δ̂ανάοçñ̂P̂οά̂δ̂ οί̂ PPP íá̂ άβίá̂οάέ̂ ιá̂ι̂Ḃ PPP, ç̂ ογίάαός̂ Ḃ÷ άέ άέάει̂δ̂άβ̂. Ιά̂ οί̂ι̂ οñυ̂δ̂ι̂ άδ̂οι̂ ιδ̂ιñάβ̂οά̂ íá̂ δ̂ανάέ̂ι̂ε̂ι̂οδ̂έάβ̂οά̂ οç ι̂ι̂ έάδ̂Ḃ οδ̂άοç̂ οçδ̂ ογίάαός̂ οάδ̂. Ὀά̂ έά̂οάέάβá̂ P̂ άάβ÷ ι̂ι̂ο̂ι υέέ δ̂δ̂Ḃñ̂÷ άέ ογίάαός̂ ιά̂ οί̂ ISP άί̂P̂ οά̂ ιέέñ̂Ḃ p̂ άάβ÷ ι̂ι̂ο̂ι υέέ άέά̂ έḂδ̂ι̂έ̂ι̂ έυ̂άι̂ ç̂ ογίάαός̂ Ḃ÷ άέ ÷ άέάβ̂. Ὀ̂ι̂ PPP Ḃ÷ άέ ι̂ι̂ι̂ άδ̂Ḃ Ḃδ̂ έέδ̂ άγ̂ι̂ έάδ̂άοδ̂Ḃ οάέδ̂.

28.4.2.1 Αί̂οέι̂άοδ̂έος̂ δñι̂άέç̂ι̂Ḃ οί̂

Άί̂ Ḃ÷ άδ̂ά̂ άδ̂άδ̂έάβ̂άδ̂ άñάñ̂P̂ έάέ̂ άάι̂ οάβίá̂οάέ̂ íá̂ ιδ̂ιñάβ̂οά̂ íá̂ άδ̂ι̂έάδ̂άοδ̂P̂οά̂δ̂ οç ογίάαός̂, άδ̂άí̂άñάι̂δ̂ι̂έP̂οά̂ οί̂ Ḃέάά÷ ι̂ñ̂P̂δ̂ ιḂ ού̂ δέέέι̂γ̂ (CTS/RTS) ÷ ñç̂οέι̂δ̂ι̂έP̂ι̂οά̂δ̂ οç ι̂ι̂ άδ̂έέι̂āP̂ set ctsrts off̂. Ὀ̂ι̂ δ̂ανάδ̂Ḃ ι̂ι̂ οοί̂άάβίáέ̂ οοί̂P̂εὺδ̂ άί̂ άβ̂οά̂ οοί̂άάι̂ Ḃι̂δ̂ οά̂ έḂδ̂ι̂έ̂ι̂ άι̂δ̂δ̂çñάδ̂οçδ̂P̂ δ̂άñι̂άδ̂έέP̂ι̂ ιά̂ άοί̂άοδ̂οçδ̂ά̂ PPP, υ̂δ̂ι̂ο̂ οί̂ PPP οοάι̂άοḂ Ḃέά̂ íá̂ άδ̂ι̂εñβίá̂οάέ̂ υ̂δ̂άí̂ δñι̂οδ̂άέάβ̂ íá̂ άñḂP̂άέ̂ άάññ̂Ḃ Ḃίá̂ οδ̂ ογίάαός̂ οάδ̂. Ὀδ̂ç̂ δ̂άñβ̂δ̂οδ̂οç̂ άδ̂οP̂, οοί̂P̂εὺδ̂ δ̂άñεί̂Ḃ Ḃίáέ̂ άέά̂ έḂδ̂ι̂έ̂ι̂ οP̂ιá̂ CTS (Clear To Send) οί̂ ι̂ι̂β̂ι̂ άάι̂ Ḃñ̂÷ άδ̂άέ̂ δ̂ι̂οḂḂ. Άί̂ υ̂δ̂οδ̂οί̂ ÷ ñç̂οέι̂δ̂ι̂έP̂οά̂δ̂ά̂ άδ̂οP̂ οç ι̂ι̂ άδ̂έέι̂āP̂, έά δñḂḂάέ̂ άδ̂β̂οçδ̂ íá̂ ÷ ñç̂οέι̂δ̂ι̂έP̂οά̂δ̂ά̂ έάέ̂ οç ι̂ι̂ άδ̂έέι̂āP̂ set accmap ç̂ ι̂ι̂βá̂ άί̂ά̂ ÷ ñḂḂι̂υ̂δ̂ άδ̂άέδ̂άβ̂οάέ̂ άέά̂ íá̂ άδ̂ι̂ι̂ι̂ε̂άβ̂ οί̂ δ̂έέέυ̂ δ̂ι̂ο̂ άί̂άñδ̂Ḃ οάέ̂ άδ̂υ̂ οç ιάδ̂Ḃ άι̂ος̂ οδ̂άέάñεί̂Ḃ Ḃί̂ι̂ ÷ άñάέδ̂P̂ñ̂ι̂ άδ̂υ̂ οç ιέá̂ Ḃέñç̂ οδ̂ç̂ Ḃέçç̂, οοί̂P̂εὺδ̂ ιḂ ού̂ οί̂ XON/XOFF. Άάβ̂οά̂ οç οάέβ̂άá̂ manual̂ οί̂ο̂ PPP(8) άέά̂ δ̂άñέοδ̂οδ̂άñάδ̂ δ̂έçñι̂οññ̂β̂άδ̂ ο÷ άδ̂έέḂ ιά̂ άδ̂οP̂ οç ι̂ι̂ άδ̂έέι̂āP̂ έάέ̂ δ̂υδ̂ ιδ̂ιñάβ̂οά̂ íá̂ οç ι̂ι̂ ÷ ñç̂οέι̂δ̂ι̂έP̂οά̂δ̂ά̂.

Άί̂ άέάέḂ Ḃοά̂ά̂ Ḃίá̂ δ̂άέάέυ̂δ̂άñ̂ι̂ modem, β̂οὺδ̂ ÷ ñάέάοδ̂άβ̂ íá̂ ÷ ñç̂οέι̂δ̂ι̂έP̂οά̂δ̂ά̂ οç ι̂ι̂ άδ̂έέι̂āP̂ set parity even̂. Ç̂ δñι̂άδ̂έέάάι̂ Ḃίç̂ ñγέιέος̂ άβίáέ̂ íá̂ ιç̂ι̂ οδ̂Ḃñ̂÷ άέ̂ έοί̂οέι̂βá̂ (parity none), άέέḂ̂ οά̂ δ̂άέέḂ̂ modems (έάέ̂ οά̂ έḂδ̂ι̂έ̂ι̂οδ̂ ISP) ÷ ñç̂οέι̂δ̂ι̂έάβ̂οάέ̂ άέά̂ Ḃέάά÷ ι̂ι̂ έάέP̂ι̂ (ç̂ ÷ ñP̂οç̂ οçδ̂ δñι̂έάέάβ̂ υδ̂οδ̂οί̂ ιά̂άḂḂέç̂ άγί̂ç̂ος̂ οδ̂ç̂ ιάδ̂άέβίç̂ος̂ άάññ̂Ḃ Ḃί̂ι̂). Ὀ̂οὺδ̂ ÷ ñάέάοδ̂άβ̂οά̂ άδ̂οP̂ οç ι̂ι̂ άδ̂έέι̂āP̂, άί̂ ι̂ ISP οάδ̂ άβίáέ̂ ç̂ Compuserve.

Ὀ̂ι̂ PPP β̂οὺδ̂ íá̂ ιç̂ι̂ άδ̂άí̂Ḃ έάέ̂ οδ̂ç̂ι̂ έάδ̂Ḃ οδ̂άοç̂ άí̂οί̂έP̂ι̂, οί̂ ι̂ι̂β̂ι̂ άβίáέ̂ οοί̂P̂εὺδ̂ οḂḂέι̂ά̂ άέάδ̂ñάάι̂Ḃ οδ̂άοç̂οçδ̂, έάέP̂δ̂ ι̂ ISP δ̂άñεί̂Ḃ Ḃίáέ̂ άδ̂υ̂ οç άέέP̂ οάδ̂ ιά̂νεḂ Ḃίá̂ íá̂ íáέέí̂P̂οάέ̂ οç άέάδ̂ñάάι̂Ḃ οδ̂άοç̂. Ὀ̂οί̂ οç̂ιá̂β̂ι̂ άδ̂οδ̂, ç̂ ÷ ñP̂οç̂ οçδ̂ άí̂οί̂έP̂δ̂ ~P̂ έά̂ άί̂άí̂άέḂ Ḃοάέ̂ οί̂ PPP íá̂ άñ÷ β̂οάέ̂ íá̂ οδ̂ḂḂίáέ̂ οδ̂έδ̂ δ̂έçñι̂οññ̂β̂άδ̂ ο÷ άδ̂έέḂ ιά̂ οç ñγέιέος̂.

Άί̂ άάι̂ δ̂ḂḂάδ̂ά̂ δ̂ι̂οḂ δñι̂οññ̂P̂ άέοὺάι̂ο̂, οί̂ δ̂έέάí̂υδ̂άñ̂ι̂ άβίáέ̂ íá̂ δñḂḂάέ̂ íá̂ ÷ ñç̂οέι̂δ̂ι̂έP̂οά̂δ̂ά̂ δ̂έοοί̂δ̂ι̂β̂ç̂ος̂ PAP P CHAP άί̂οβ̂ άέά̂ οç ι̂ι̂ ογ̂δ̂ι̂ο̂ UNIX δ̂έοοί̂δ̂ι̂β̂ç̂ος̂ δ̂ι̂ο̂ δ̂άñέάñḂḂP̂οάí̂ά̂ οοί̂ δ̂ανάδ̂Ḃ ι̂ι̂ δ̂άñḂḂάέάí̂ά̂. Άέά̂ íá̂ ÷ ñç̂οέι̂δ̂ι̂έP̂οά̂δ̂ά̂ PAP P CHAP άδ̂έP̂δ̂ δñι̂οέḂ Ḃοά̂ά̂ οδ̂έδ̂ δ̂άñάέḂ Ḃοὺδ̂ άδ̂έέι̂āḂ οδ̂ç̂ι̂ άοάññ̂ι̂āP̂ PPP δñεί̂ άñάέάβ̂οά̂ οά̂ έάδ̂Ḃ οδ̂άοç̂ δ̂άñι̂άδ̂έέι̂γ̂:

PPP ON example> set authname myusername

Έά̂ δñḂḂάέ̂ íá̂ άί̂οέέάδ̂άοδ̂P̂οά̂δ̂ά̂ οί̂ myusernamê ιά̂ οί̂ υ̂ññá̂ ÷ ñP̂οç̂ δ̂ι̂ο̂ οάδ̂ Ḃ÷ άέ̂ άι̂ε̂άβ̂ άδ̂υ̂ οί̂ ISP οάδ̂.

```
ppp ON example> set authkey mypassword
```

Έά δñÝðáέ ίά αίόέέάόάόόΠόάόά οί mypassword ίά οίί έυάέέυ ÷ ñΠρόç ðίϑ ράό Ý ÷ áέ äèâß áðu οίί ISP ράο.

Άί ροίáÝáόόά έάνίέέÛ, áέÛ áái ράβίáόάέ ίά ίðñâßðá ίά áðέέίέíñíΠόάόά ίά έáíέÛ áέáýèðίόç, ðñíóðáèΠόάόά ίά ÷ ñçόέíðíéΠόάόά όçί αίóíèΠ ping(8) ίά ίέά áέáýèðίόç IP áέά ίά äâßðá áί έά εÛááòá áðÛίόçόç. Άί áéÝðáòá áðèáέά ðáéÝðúí 100%, οί ðéí ðέέάíñ áβίáέ úóé áái Ý ÷ áòá έáèññβóáέ έÛðíέά ðññáðééááíÝίç áέááññΠ. ΆéÝáíòá ίáíÛ úóé Ý ÷ áòá ñòèìβóáέ όçί áðέέíñâΠ add default HISADDR έáóÛ όç áéÛñéáέά όçò óýíááόçò. Άί ίðñâßðá ίά áðέέίέíñíΠόάόά ίά ίέά áðñáèñòóíÝίç áέáýèðίόç IP, οί ðέέάíñòáñí áβίáέ úóé áái Ý ÷ áòá áÛέáέ όç áέáýèðίόç έÛðíέίϑ áέáéñéóòΠ íñÛòúí οóí áñ ÷ áβí /etc/resolv.conf. Οί áñ ÷ áβí áóòú έá δñÝðáέ ίά ñéÛáέé ίά οί ðáñáέÛòú:

```
domain example.com
nameserver x.x.x.x
nameserver y.y.y.y
```

¼ðíϑ ρά x.x.x.x έáέ y.y.y.y έá δñÝðáέ ίά αίόέέάόάόόάέίýí ίά όέò áέáðéýíóáέò IP ðúí áέáéñéóòΠí DNS οίϑ ISP ράο. Άíáá ÷ ñÝíùò íé ðεçñíϑññâð áóòÝð ίά ράό Ý ÷ íϑí äèâß έáóÛ όçί ááñáóΠ ράο όçί ððçñáóβá. Άί ù ÷ έ, έá ίðñÝóáòá ίά όέò áñâßðá áýέíέά ίά Ýίá όçέáðñίçía οóíί ISP ράο.

Ïðñâßðá áðβόçò ίά áíáñáíðíéΠόάόά όçί έáóááñáóΠ ρóíáÛíóúí áέά όçί PPP óýíááόç ράο, ίÝóú οίϑ syslog(3). Άðèðò ðñíóéÝóóá:

```
!ppp
*. * /var/log/ppp.log
```

οóí /etc/syslog.conf. Óέò ðáñéóóúóúáñáò οíñÝð, áóòΠ ç έáέóíϑñáβá òðÛñ ÷ áέ Πáç.

28.5 × ñçόέίíðíéΠίóáò PPP ίÝóú Ethernet (PPPoE)

Ç áñíóçòά áóòΠ ðáñéáñÛóáé ðùò ίά ñòèìβóáòά ίέά óýíááόç PPP ίÝóú Ethernet (PPPoE).

28.5.1 Νýèìέόç οίϑ ððñΠίá

Άái áðáέòáβóáέ ðéÝíí áέáέèΠ ñýèìέόç οίϑ ððñΠίá áέá όç έáέóíϑñáβá PPPoE. Άί í ððñΠίáò ράο áái ðáñééáíáÛíáέ όçί áðáñáβóçόç ððíóðññέίç netgraph, οί ppp έá όçί οíñòðóáέ áóòúíáóá ùò Ûñèñùíá.

28.5.2 Νýèìέόç οίϑ ppp.conf

ðáñáέÛòú ράβίáόάέ Ýίá òðúááέáíá áñ ÷ áβíϑ ppp.conf:

```
default:
    set log Phase tun command # you can add more detailed logging if you wish
    set ifaddr 10.0.0.1/0 10.0.0.2/0

name_of_service_provider:
    set device PPPoE:x11 # replace x11 with your Ethernet device
    set authname YOURLOGINNAME
    set authkey YOURPASSWORD
    set dial
```

```
set login
add default HISADDR
```

28.5.3 ΆέὐΎέάόç òĩò ppp

ὐὀ ÷ ñÞóçò root, ìðĩñáßòá íá áέὐάέΎόάὐά:

```
# ppp -ddial name_of_service_provider
```

28.5.4 Άέέβίçόç òĩò ppp έάὐὐ òçí Άέέβίçόç

ÐñĩóέΎόά ðέὀ ðάñáέὐὐὐ ãñáñĩΎò óὀĩ áñ ÷ áβĩ /etc/rc.conf:

```
ppp_enable="YES"
ppp_mode="ddial"
ppp_nat="YES" # if you want to enable nat for your local network, otherwise NO
ppp_profile="name_of_service_provider"
```

28.5.5 × ñÞόç íέάὐ ΆόέέΎόάὐ Õðçñáόßάὐ PPPoE

ÌáñέέΎò òĩñΎò έά ÷ ñάέάόὐάß íá ÷ ñçóέĩðĩέçÞóáὐά ìέά áðέέΎόά òðçñáόßάὐ (service tag) áέά òçí áðĩέάὐὐόάόç òçò óýíááόçò óάð. Ìέ áðέέΎόά òðçñáόέßĩ ÷ ñçóέĩðĩέçĩýíóάέ áέά òĩĩ áέά ÷ ùñέὐĩ ìáὐáíý áέά òĩñáόέέßĩ áĩòðçñáόçòßĩ PPPoE ðĩò áñßόέĩíόάέ óὀĩ βάέĩ áβέðὀĩ.

Ç òάέìçñßùç ðĩò óάð Ύ ÷ áέ áÞόάέ ì ISP óάð, έά ðñΎðáέ íá Ύ ÷ áέ ðέð áðάέὐĩýíáíáð ðέçñĩòĩñßáð áέά òçí áðέέΎόά òðçñáόßάὐ ðĩò ÷ ñάέὐάέόά. Άí ááí ìðĩñáßòá íá òçí áñáßòá, ñùðÞóá òçí áĩòðçñΎόççð ðáέάðßĩ òĩò ISP óάð.

ὐὀ òάέάὐὐάβá έýç, έά ìðĩñĩýóάὐά íá áĩέέĩὐόάὐά òçí ìΎέĩáĩ ðĩò óὀĩβόάόάέ óὀĩ ðñũáñáñĩá Roaring Penguin PPPoE (<http://www.roaringpenguin.com/pppoe/>) òĩ ìðĩβĩ ìðĩñáßòá íá áñáßòá òðçí ÓðέέĩáÞ ðũĩ Ports. Ìá Ύ ÷ áðά òðũçç óάð, ùðέ áðὐũ ìðĩñáß íá áðĩðñĩáñáñĩáόßόάέ έάέ íá á ÷ ñçóðáýóάέ òĩ modem óάð, Ύðέέ óέάòòáßòá òĩ έάέὐ ðñέĩ òĩ έὐĩάðá. Άðέßð ááέάόáóðÞóá òĩ ðñũáñáñĩá ðĩò áβĩάέ ì ðáñĩ ÷ Ύά òáð ìάæß ìá òĩ modem. Þáέóá, áέóΎέέάὐά óὀĩ ìáñĩý System òĩò ðñĩáñὐĩáὐĩð. Άέάß έά ðñΎðáέ íá áβĩάέ òĩ ùñĩá òĩò ðñĩòβέ óάð. ÓðĩÞέὐð áñὐὐάέ ISP.

ὐὀ ùñĩá òĩò ðñĩòβέ (áðέέΎόά òðçñáόßάὐ) έά ÷ ñçóέĩðĩέçέáß óðçí έάὐά ÷ Þñέόç áέά òçí ñýèìέόç òĩò PPPoE óὀĩ áñ ÷ áβĩ ppp.conf, ùð òĩ òĩÞĩά ðĩò áçèßĩάέ òĩ ðáñĩ ÷ Ύά òççí áĩðĩέÞ set device (ááßòá òç óάέßáá manual òĩò ppp(8) áέά ðέÞñáέ òáððñĩΎñάέð). έά ááß ÷ íάέ ùðὐ òĩ ðáñáέὐὐ:

```
set device PPPoE:x11:ISP
```

Ìçĩ ìá ÷ Õόάὐά íá áέέὐĩáðá òĩ x11 ìá òç òùóðÞ òðóέáòÞ ðĩò áĩóέóὀĩέ ÷ áß óðçí έὐñὐά Ethernet ðĩò ÷ ñçóέĩðĩέάßòá.

Ìçĩ ìá ÷ Õόάὐά íá áέέὐĩáðá òĩ ISP ìá òĩ ðñĩòβέ ðĩò áñÞέάðá ðáñáðὐĩ.

Άέά ðáñέóὐὐðáñáð ðέçñĩòĩñßáð, ááßòá:

- Öççĩðáñáð ΆðñòæũíέέΎò ÓðĩáΎόάέð ìΎὐὐ FreeBSD óá ΆñáñĩÞ DSL (<http://renaud.waldura.com/doc/freebsd/pppoe/>) áðũ òĩĩ Renaud Waldura.
- Nutzung von T-DSL und T-Online mit FreeBSD (<http://www.ruhr.de/home/nathan/FreeBSD/tdsl-freebsd.html>) áðũ òĩĩ Udo Erdelhoff (óðá Άáñĩáíέέὐ).

28.5.6 Õι PPPoE όά Modem 3Com® HomeConnect® ADSL Dual Link

Άδδου οι modem άάι άειρειοέάβ οι RFC 2516 (<http://www.faqs.org/rfcs/rfc2516.html>) (έάά ίΎεινιό άέά ίάδÛάιόç PPP ίΎού Ethernet (PPPoE), άñάιιΎίι άδδου όιόδ L. Mamakos, K. Lidl, J. Everts, D. Carrel, D. Simone, έάέ R. Wheeler). Άίόβέάόά, ÷ñçóειιόιεάβ άέάοιñάόέειύδ όύδίοδ έυάέβρι άάέΎούι άέά όά άέάβόέά Ethernet. Δάñάέάειύίά ίά άέονÛόάόά όά άñÛόίίά όάό όόçί 3Com (<http://www.3com.com/>) άί ññβάάόά υόέ έά άñΎάέ ίά όδινιόυέάβ ίά όέδ άñίέάάñάόΎδ όιό PPPoE.

Άέά ίά ίδινάβ οι FreeBSD ίά άδέέιεύίάβ ίά άόδP όç όόέάόP, έά άñΎάέ ίά όάέάβ Ύίά έάδÛέέçει sysctl. Άόδου ίδινάβ ίά άβίάόάέ άόδουιόά έάδÛ όçί άέέβίçόç, ίά όçί άίçίΎñòόç όιό άñ÷άβιό /etc/sysctl.conf:

```
net.graph.nonstandard_pppoe=1
```

P ίδινάβ ίά άβίάέ Ûιόάό ίά όçί άίόιεP:

```
# sysctl net.graph.nonstandard_pppoe=1
```

Άόόόδ÷βδ, άδάέάP άñυέάέόάέ άέά ίέά ñΎέιεόç άιό άδçñάÛάέ ίέυιέέçñι όι όύόόçίά, άάί άβίάέ άοίάόυι ίά άδέέιεύίάβόά όάόδου ÷ñίίά ίά Ύίά έάñίέέυ άέέÛόç P άιόδçñάόçόP PPPoE έάέ ίά Ύίά ADSL modem 3Com HomeConnect®.

28.6 ×ñçóέιιόιερίόάό PPP ίΎού ATM (PPPoA)

¹ άιυόόά άιό άειρειοέάβ, άñέέñÛόάέ άυό ίά ñέιβόάόά οι PPP άέά έάέοιñάβά ίΎού ATM (PPPoA). Õι PPPoA άβίάέ ίέά άçίπóέέPδ άδέέιεP όοιόδ άñι÷άβδ όδçñάόέβι DSL όόçί Άόñβç.

28.6.1 ×ñçóέιιόιερίόάό PPPoA ίά οι Alcatel SpeedTouch™ USB

Ç όδίοδPñέιç PPPoA άέά άόδP όç όόέάόP, άñΎ÷άόάέ υό port όοι FreeBSD, έάέβδ οι firmware όçδ όόέάόPδ άέάίΎιόάέ όδδ όçί Ûάάέά Alcatel's license agreement (http://www.speedtouchdsl.com/disclaimer_lx.htm) έάέ άάί ίδινάβ ίά έέάίάιçέάβ άέάΎέάñά ίά οι άάόέέυ όύόόçίά όιό FreeBSD.

Άέά ίά άάέάόάόPόάόά οι έιñέοιέέυ, άδèÛ ÷ñçóειιόιεPόάόά όçί ÓόέειñP όυι Ports. ΆάέάόάόPόάόά οι port net/pppoa έάέ άειρειοέPόάόά όέδ ίäçάβάδ άιό άñέέάίáÛίιόάέ όά άόδου.

¼δδου άίέέΎδ όόέάόΎδ USB, οι Alcatel SpeedTouch™ ÷ñάέÛάάόάέ ίά έάόάáÛόάέ οι firmware όιό άδδου όιό όδειñέόόP όοι ίδινάβ άβίάέ όδίαñΎίι, άñίέάέίΎίιό ίά έάέοιñάPόάέ όυόόÛ. Ç έέάάέέάόβά άόδP ίδινάβ ίά άόδñάόιόιεçέάβ όοι FreeBSD, βόόά ç ίάόάοιñÛ ίά άβίάόάέ έÛέά όιñÛ άιό όδίαΎιόάέ ç όόέάόP όόç έΎñά USB. Ìδινάβόά ίά άñιόέΎόάόά όέδ άñάέÛόδ δέçñιοιññάδ όοι άñ÷άβι /etc/usbd.conf άέά ίά άίñάñιόιεPόάόά όçί άόδουιόόç ίάόάοιñÛ όιό firmware. Έά άñΎάέ ίά άδάñάñάάόδάβόά άόδου όι άñ÷άβι υό ÷ñPόόçδ root.

```
device "Alcatel SpeedTouch USB"
    devname "ugen[0-9] +"
    vendor 0x06b9
    product 0x4061
    attach "/usr/local/sbin/modem_run -f /usr/local/libdata/mgmt.o"
```

Άέά ίά άίñάñιόιεPόάόά οι usbd, οι άάβιίίά USB, άñιόέΎόά όçί άñάέÛόδ άñάñP όοι άñ÷άβι /etc/rc.conf:

```
usbd_enable="YES"
```

Ἰδῖνᾱβ ᾱδβόçð íá ñðèῖβóᾱðᾱ òῖ **ppp** βóðᾱ íá ᾱέðᾱᾱᾱβ ᾱðòῖῖᾱðᾱ ἔἔβóç έᾱðῖ ὁçῖ ᾱἔἔβῖççðç òῖð òðòðβῖᾱðῖð. Ἄἔᾱ íá ᾱβῖᾱἔ ᾱðòῖ, ðñῖóἔÝóðᾱ òἔð ðᾱñᾱἔῖῖòῖ ᾱñᾱῖῖÝð òðῖ /etc/rc.conf. Ἐᾱ ðñÝðᾱἔ έᾱἔ ðῖἔἔ íá ᾱἔðᾱἔÝóðᾱðᾱ ὁç ᾱἔᾱἔἔᾱðᾱ ᾱððβ ùð root.

```
ppp_enable="YES"
ppp_mode="ddial"
ppp_profile="adsl"
```

Ἄἔᾱ íá ἔᾱἔòῖðñᾱβóᾱἔ òῖðòðῖ òῖ ðᾱñᾱðῖῖ, ἔᾱ ðñÝðᾱἔ íá ῖ ÷ ᾱðᾱ ÷ ñçóἔῖῖðῖἔβóᾱἔ òῖ ððῖᾱἔᾱῖᾱ òῖð ᾱñ ÷ ᾱβῖð ppp.conf òῖ ῖðῖβῖ ðᾱñÝ ÷ ᾱðᾱἔ ἰᾱ òῖ port net/pppoa.

28.6.2 × ñçóἔῖῖðῖἔβῖðᾱð òῖ mpd

Ἰδῖνᾱβðᾱ íá ÷ ñçóἔῖῖðῖἔβóᾱðᾱ òῖ **mpd** ᾱἔᾱ íá òῖᾱᾱἔᾱβðᾱ òᾱ ῖᾱῖ ðἔβῖðð ððçñᾱóἔβῖ, έᾱἔ ᾱἔᾱἔἔῖðᾱñᾱ ððçñᾱóβᾱð PPTP. Ἰδῖνᾱβðᾱ íá ᾱñᾱβðᾱἔð òῖð ὁçῖ Óðἔἔῖᾱβ òῖῖ Ports, òðῖ net/mpd. ðῖἔἔῖ ADSL modem ᾱðᾱἔðῖῖ ὁç ᾱçῖἔῖðñᾱβᾱ ᾱῖῖð PPTP òῖῖᾱἔ ἰᾱðᾱῖῖ òῖð modem έᾱἔ òῖð ððῖἔῖᾱἔóðð. ῖᾱ òÝðῖἔῖ modem ᾱβῖᾱἔ òῖ Alcatel SpeedTouch Home.

ðñβóᾱ ðñÝðᾱἔ íá ᾱᾱἔᾱðᾱóðβóᾱðᾱ òῖ port, έᾱἔ ἰᾱðῖ ἰδῖνᾱβðᾱ íá ñðèῖβóᾱðᾱ òῖ **mpd** βóðᾱ íá ἔᾱἔῖððᾱἔ òἔð ᾱðᾱἔðβóᾱἔð òᾱð έᾱἔ òἔð ñðèῖβóᾱἔð òῖð ðᾱñῖ ÷ ῖᾱ ὲᾱð. Òῖ port ᾱᾱἔᾱἔἔóðῖ ἔῖῖἔᾱ ᰄᾱñᾱᾱβᾱῖᾱðᾱ ᾱñ ÷ ᾱβῖῖ ñðèῖβóᾱῖῖ òðῖῖ ἔᾱðῖἔῖῖῖ *PREFIX/etc/mpd/*. Óᾱ ᾱñ ÷ ᾱβᾱ ᾱððῖ ðᾱñἔῖ ᰄῖῖ ᾱñἔᾱðῖ ἔᾱἔβ ðᾱἔῖçñβῖðç òῖῖ ñðèῖβóᾱῖῖ. Óçῖᾱἔβóðᾱ ᾱᾱβ, ῖðἔ òῖ *PREFIX* ᾱβῖᾱἔ ῖ ἔᾱðῖἔῖῖῖð òðῖῖ ῖðῖβῖ ᾱᾱἔᾱἔβóðᾱῖðᾱἔ òᾱ ports, έᾱἔ ᾱðῖ ðñῖᾱðἔἔῖῖᾱβ ᾱβῖᾱἔ ῖ /usr/local/. Ἰᾱðῖ ὁçῖ ᾱᾱἔᾱἔβóðᾱἔðç òῖð port, ἔᾱ ᾱñᾱβðᾱ ῖᾱῖ ðἔβñç ῖᾱçᾱῖ ᾱἔᾱ ὁç ñῖῖἔἔçç òῖð **mpd** òᾱ ῖῖñðβ HTML. Ç ðᾱἔῖçñβῖðç ᾱᾱἔᾱἔβóðᾱἔðᾱἔ òðῖῖ ἔᾱðῖἔῖῖῖῖ *PREFIX/share/doc/mpd/*. ðᾱñᾱἔῖῖòῖ ὲᾱβῖᾱðᾱἔ ῖᾱ ὲðῖᾱἔᾱῖᾱ ñðèῖβóᾱῖῖ ᾱἔᾱ òῖᾱᾱóç òᾱ ἰἔᾱ ððçñᾱóβᾱ ADSL ῖῖῖòῖ òῖð **mpd**. ἰἔ ñðèῖβóᾱἔð ÷ ùñβᾱῖῖðᾱἔ òᾱ ᾱῖῖ ᾱñ ÷ ᾱβᾱ, ðñβóᾱ ᾱᾱβ ÷ ῖῖðῖᾱ òῖ mpd.conf:

```
default:
    load adsl

adsl:
    new -i ng0 adsl adsl
    set bundle authname username ❶
    set bundle password password ❷
    set bundle disable multilink

    set link no pap acfcomp protocomp
    set link disable chap
    set link accept chap
    set link keep-alive 30 10

    set ipcp no vjcomp
    set ipcp ranges 0.0.0.0/0 0.0.0.0/0

    set iface route default
    set iface disable on-demand
    set iface enable proxy-arp
    set iface idle 0

open
```

❶ Òῖ ῖῖῖᾱ ÷ ñββóç ἰᾱ òῖ ῖðῖβῖ ᾱβῖᾱðᾱἔ ç ðἔóðῖðῖβçççç òðῖῖ ISP òᾱð.

❷ Ì èùάέεùδ ìά òίí ìðίβì áβίάóάέ ç ðέóòìðίβçόç óòίí ISP óάδ.

Ôί áñ÷áβì mpd.links ðáñέÝ÷άέ ðέçñíòíñβάδ ó÷άóέÛ ìά òç óýíάάόç P ðέδ òòíáÝóάέδ ðìð έά ðñááìáòìðìέçείýí. Άέά ðáñÛάάέáìá, òì mpd.links ðìð óòííάάýάέ òì ðáñάðÛíù ðáñÛάάέáìá, òάβίάóάέ ðáñάέÛòù:

```
adsl:
  set link type pptp
  set pptp mode active
  set pptp enable originate outcall
  set pptp self 10.0.0.1 ❶
  set pptp peer 10.0.0.138 ❷
```

❶ Ç áέάýèðìόç IP òìð FreeBSD ððìεíñάέóðP óάδ, óòίí ìðίβì έά ÷ñçóέììðìέPóάòά òì mpd.

❷ Ç áέάýèðìόç IP òìð ADSL modem óάδ. Άέά òì Alcatel SpeedTouch Home, ç áέάýèðìόç áððP áβίάέ áðì ðñíáðέέìáP ç 10.0.0.138.

Άβίάέ áòìáòìù ìά áñ÷έέìðìέPóάòά òç óýíάάόç áýείεά, áβííóáð òçì ðáñάέÛòù áíòìεP ùð root:

```
# mpd -b adsl
```

Ìðìñáβòά ìά ááβòά òçì έáðÛóðάόç òçð óýíάάόç ìά òçì ðáñάέÛòù áíòìεP:

```
% ifconfig ng0
ng0: flags=88d1<UP,POINTOPOINT,RUNNING,NOARP,SIMPLEX,MULTICAST> mtu 1500
  inet 216.136.204.117 --> 204.152.186.171 netmask 0xffffffff
```

Ôì mpd áðìðάέáβ òίí óòìέóðìáìí ðñùðì óýíάάόç òìð FreeBSD ìά ìέά ððçñάóβά ADSL.

28.6.3 ×ñçóέììðìέPìóáð òì pptpclient

Ìðìñáβòά áðβόç ìά ÷ñçóέììðìέPóάòά òì FreeBSD áέά ìά óòìάάέáβòά óά Ûέέáð ððçñάóβάð PPPoA ÷ñçóέììðìέPìóáð òì net/pptpclient.

Άέά ìά ÷ñçóέììðìέPóάòά òì net/pptpclient áέά ìά óòìάάέáβòά óά ìέά ððçñάóβά DSL, ááέάóáóðPóáð òì port P òì ðάέÝòì, έάέ áðáíáñááóòáβòά òì áñ÷áβì /etc/ppp/ppp.conf. Έά ÷ñáέάóóðáβ ìά áβòά root áέά ìά έÛíáòά έάέ ðέð áýì ðáñάðÛíù áέάάέέáóβáð. ðáñάέÛòù òάβίáóάέ Ýíá ðáñÛάάέáìá ìέáð áíùòçóáð òìð ppp.conf. Άέά ðáñέóóùðáñáð ðέçñíòíñβάδ ó÷άóέÛ ìά ðέð áðέέìáÝð òìð ppp.conf, ááβòά òç óάέβáá manual òìð ppp, ppp(8).

```
adsl:
  set log phase chat lcp ipcp ccp tun command
  set timeout 0
  enable dns
  set authname username ❶
  set authkey password ❷
  set ifaddr 0 0
  add default HISADDR
```

❶ Ôì ùíñá ÷ñPóç áέά òίí εíñáñέάóìù óάð óòίí ðáñì÷Ýá DSL.

❷ Ì èùάέεùδ áέά òίí εíñáñέάóìù óάð.

Δνιέάειδιδίςος: Έάεπο έά δνΎδαέ ίά ανÛδαάδ ήϊ έυάέέυ όάό ιιñòP άδείΎ έάείΎιιό όδι αν÷άβϊ ppp.conf, έά δνΎδαέ ίά άάάάέυέάβδά υόέ έάίΎίαό Ûέειò άάί έά ιδινάβ ίά έάάάÛόάέ όά δάνέα÷υιιάίά άόδιΎ όιò αν÷άβϊ. Ιά όέό δάνάέÛόυ άίόιέΎ, ιδινάβδά ίά άίάόόάέβδάόά υόέ όι αν÷άβϊ έά ιδινάβ ίά έάάάάόάβ ιυϊϊ ιΎόά άδύ όι έϊάάñέάόιυ όιò root. Άάβδά όέό όάέβάάό manual όυϊ chmod(1) έάέ chown(8) άέά δάνέόόύόδάνάό δέçñiññβάό.

```
# chown root:wheel /etc/ppp/ppp.conf
# chmod 600 /etc/ppp/ppp.conf
```

Άόδυ έά άνβιέέ Ύίά όιΎιέ έάέ ίέά όόίάανβά PPP ιά όι DSL αννιέιέçòP όάό. Όά DSL modem όΎδιò ethernet Ύ÷ιόί ίέά δνιέάειñέόιΎίç έέάΎέόίόç IP όοι όιδέέυ όάό άβέόοι, όόçι ιδινάβ ιδινάβδά ίά όόίάάέβδά. Όόçι δάνβδδυόç όιò Alcatel SpeedTouch Home, ç έέάΎέόίόç άόδP άβιέέ 10.0.0.138. Ç όάέιçñβδυόç διò έέάέΎόάέ ι αννιέιέçòP όάό, έά άίάόΎñάέ διέά έέάΎέόίόç ÷ñçόέιιδιδιέάβ ç όόόέάδP όάό. Άέά ίά άνβιέάόά όι όιΎιέ έάέ ίά ίάέείPόάόά ίέά όόίάανβά PPP, άέόάέΎόάό όçι άέυιέιόέç άίόιέP:

```
# pptp address adsl
```

Όδυάάείç: Άβιέά έάέP έάΎά ίά δνιόέΎόάόά Ύίά "&" όοι όΎέιò όçό δñçāιΎιέίçό άίόιέP, έέάόιñάέέÛ όι **pptp** άάί έά όάό άδέόόñΎάέ όιΎ Ύέάά÷ι (δñiññδP) όιò δάνιάόέέΎ όάό.

Έά άçιέιòñάçέάβ ίέά όόόέάδP tun (άέέιέέέυ όιΎιέ) έάά όçι άέέçέάδβñάόç ιάόάΎ όυϊ έέάñάάόέP **pptp** έάέ **ppp**. Ιυέέό άδέόόñΎάέ ç δñiññδP όοι δάνιάόέέυ όάό, P όι **pptp** άδέάάάέPόάέ όç όΎιάάόç, ιδινάβδά ίά άίάόÛόάόά όι όιΎιέ ιά όιò δñυδι διò όάβιέάέ δάνάέÛόυ:

```
% ifconfig tun0
tun0: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 1500
    inet 216.136.204.21 --> 204.152.186.171 netmask 0xfffffff0
    Opened by PID 918
```

Άί άάί ιδινΎόάόά ίά όόίάάέβδά, άέΎάίόά όέό ñόειβόάέό όιò αννιέιέçòP όάό, ίέ ιδινάό όόιPέυδ άβιέά δνιόάÛόέιάό ιΎόυ **telnet** P ιΎόυ έÛδιέιό όέέñάόñçòP. Άί άέυιά άάί ιδινάβδά ίά όόίάάέβδά, έά δνΎδαέ ίά άίάόÛόάόά όçι Ύιαι όçό άίόιέP pptp έάέ όά δάνέα÷υιιάίά όιò αν÷άβϊ έάόάάνάόP όιò **ppp**, /var/log/ppp.log άέά δέέάιÛ όόιέ÷άβ.

28.7 ×ñçόέιιδιδιέPιόάό όι SLIP

Δνιέάειδιδίςος: Ç άιυόçόά άόδP άόάνιυάάάέ έάέ άβιέά Ύάέόñç ιυϊϊ όά όόόδPιάόά FreeBSD 7.X.

28.7.1 ñόειβέιιόάό Ύίά ΔάέÛόç SLIP

ΔάνάέÛόυ δάνιόόέÛέιόιά Ύίά όñυδι ίά ñόειβόάόά Ύίά ιç÷Ûίçιά FreeBSD υò δάέÛόç SLIP όά Ύίά άβέόοι ιά όόάόέΎδ έέάόέΎιόάέό. Άέά ιç÷άPιάόά όά ιδινά έάίάÛιñi υñιά άόίάέέÛ (ç έέάΎέόίόç όιòδ έέέÛάέ έÛέά όιñÛ διò όόίάΎιόάέ), δέέάιυι ίά ÷ñάέάόάβ ίά έÛιάόά δέι διέΎδεδιέάό ñόειβόάέό.

Άñ ÷ έέŪ, έά δñŸδαέ ίά έάέιñβόάόά όά δīέά όάέñέάέP έγñά άβίάέ όδīάάŸí δī modem όάδ. Άñέάδīβ ÷ ñPόόάδ άçίέíοñάíŸί Ÿίά όδīάíέέέú άάόíú δ. ÷. /dev/modem, δī íδīβí άάβ ÷ ίάέ όόçí δñάάíάόέέP όδóέάδP /dev/cuadm. Άδóú όάδ άδέόñŸδαέ ίά όδīά ÷ βόάόά ίά ÷ ñçόέííδīέάβόά δī βάέí úñíά όδóέάδPδ, áέúíά έάέ άí ίάόάέέíPόάόά δī modem όά έέάόíñάόέέP έγñά. Άβίάέ íŪέέí Ūάρεí ίά δñŸδαέ ίά áέέŪíάόά δέPέíδ άñ ÷ άβíí όόí /etc έάέpδ έάέ όά άñ ÷ άβά .kermrc όά úέí δī όύόόçíά!

Όçíάβúόç: Ōí /dev/cuad0 άβίάέ ç COM1, δī /dev/cuad1 άβίάέ ç COM2, έ.í.έ.

Άάάάέúέάβόά úδέ δī άñ ÷ άβí ñδèíβόάúí όíδ δδñPíά όάδ δάñέŸ ÷ άέ όά δάñάέŪδú:

device sl

Ōí δάñάδŪíú δάñέέάíáŪíάόάέ όόíí δδñPíά GENERIC, έάέ άí άάí δī Ÿ ÷ άδά έέάάñŪόάέ, άάí έά Ÿ ÷ άδά δñúάέçíά.

28.7.1.1 Ñδèíβόάέό δīδ έά × ñάέάόάββ ίά ΈŪíάόά íñí ίέά ŌíñŪ

1. ΔñíδéŸόά δī íç ÷ Ūíçíά όάδ, όçí δŸέç (gateway) έάέ δīδδ άέάέñέόόŸδ íñŪδúí (nameservers) όόí άñ ÷ άβí /etc/hosts. Ōδī δάñŪάέάíά ίάδ, δī άñ ÷ άβí άδóú íέŪάέέ ίά δī δάñάέŪδú:

```
127.0.0.1          localhost localhost
136.152.64.181    water.CS.Example.EDU water.CS water
136.152.64.1      inr-3.CS.Example.EDU inr-3 slip-gateway
128.32.136.9      ns1.Example.EDU ns1
128.32.136.12     ns2.Example.EDU ns2
```

2. Άάάάέúέάβόά úδέ ç άíúδçδά files άñβόέάόάέ δñέí δī dns όόçí άíúδçδά hosts: δīδ άñ ÷ άβíδ /etc/nsswitch.conf. Άí άάí δδŪñ ÷ íδí άδóŸδ íέ δάñŪíάδñíέ, íδñάβ ίά άíδάίέόόíŸí δάñŪíάíά όδīδδpíάά.

3. ŌñíδīδīέPόάά δī άñ ÷ άβí /etc/rc.conf.

1. Íñβόάά δī úñíά όíδ όδīέíάέόδP όάδ, όñíδīδīέPíόάδ όç άñάíP δīδ άñŪδάέ:

```
hostname="myname.my.domain"
Έά δñŸδαέ άάp ίά όíδīέάδPόάάά δī δέPñάδ úñíά όíδ όδīέíάέόδP όάδ.
```

2. Íñβόάά όíí δñíάδéέάάŸíí άñíñέíάçδP, áέέŪάéíόάδ όç άñάíP:

```
defaultrouter="NO"
όά:
defaultrouter="slip-gateway"
```

4. ΆçίέíοñάPόάά Ÿíά άñ ÷ άβí /etc/resolv.conf δī íδīβí έά δάñέŸ ÷ άέ:

```
domain CS.Example.EDU
nameserver 128.32.136.9
nameserver 128.32.136.12
```

¼δúδ íδñάβόά ίά άάβόά, δī δάñάδŪíú íñβάέέ δīδδ άέάέñέόόŸδ DNS. ŌδóέέŪ, όά δñάάíάόέέŪ íñíάόά έάέ íέ άέάδéŸíόάέδ óúí δñŸúí άíάñδpíόάέ άδú δī δάñέάŪέέí όάδ.

5. Ñδèíβόάά έúάέέú δñúόάάόçδ άέά δīδδ ÷ ñPόόάδ root έάέ toor (έάέpδ έάέ άέά úóíδδ Ūέέíδδ έíάάñέάόíŸíδ άάí Ÿ ÷ íδí έúάέέú).

6. ΆδάíάέέέíPόάά δī íç ÷ Ūíçíά όάδ, έάέ άάάάέúέάβόά úδέ Ÿ ÷ άέ δάέάβ όúόóŪ δī úñíά όδīέíάέόδP.

28.7.1.2 Άγιέιθῆπρίοάδ ίέα Όγίαάοç SLIP

1. Ìáδὺ όçί έέπóç, ἄñὺθóðᾶ όçί ἄίότῆπ slip όóçί θῆñίθῆñίθῆπ, ἄñὺθóðᾶ όί ὑῆñᾶ όίτῶ ìç÷ ἄίπιαόίτῶ όάδ έάέ όίí έὺἄέέυ. Όί όέ ἄέñέἄπð ÷ ñἄέὺἄέόἄέ ίᾶ ἄñὺθóðᾶ, ἄίᾶñóὺόἄέ ἄδὺ όί θᾶñέἄὺέεήί όάδ. Ἄί ÷ ñçóέίῆθῆέἄἄóᾶ όί **Kermit**, ìθῆñᾶἄóᾶ ίᾶ ÷ ñçóέίῆθῆέἄἄóᾶ Ἰᾶ script ὑδὺò όί ἄέϋέίθῆί:

```
# kermit setup
set modem hayes
set line /dev/modem
set speed 115200
set parity none
set flow rts/cts
set terminal bytesize 8
set file type binary
# The next macro will dial up and login
define slip dial 643-9600, input 10 =>, if failure stop, -
output slip\x0d, input 10 Username:, if failure stop, -
output silvia\x0d, input 10 Password:, if failure stop, -
output ***\x0d, echo \x0aCONNECTED\x0a
```

Όδóέέὺ, έᾶ θῆἸᾶέ ίᾶ ἄέέὺἰᾶόᾶ όί ὑῆñᾶ ÷ ñπóóç έάέ όίí έὺἄέέυ πóðᾶ ίᾶ óἄέñέὺἄέί ίᾶ óᾶ ἄέέὺ όάδ. Ìáδὺ ἄδὺ ἄδóϋ, ìθῆñᾶἄóᾶ ἄδῆπð ίᾶ θῆçέðῆñῆῆᾶπóᾶóᾶ slip όóçί θῆñίθῆñίθῆπ όγίαάóçδ όίθ **Kermit**.

Όçίᾶἄϋóç: Ç ὃᾶñῆç όίθ έὺἄέέήγ όάδ óᾶ ἰῆñð ἄδῆγ έἄέίγῆῆθ óᾶ ἰθῆῆᾶπθῆῆθᾶ όçίᾶἄῆ ἄίϋò óóóðπιαόίτῶ ἄñ÷ ἄἄῆί, ἄἄίᾶέ ἄἄίέέὺ έἄέῆπ έἄἸᾶ. θῆñί÷ ὑῆñóᾶ ἰᾶ ἄέέῆπ όάδ ἄδῆγίç.

2. Ἄóπóðᾶ όί **Kermit** ἄέἄἄ (ìθῆñᾶἄóᾶ ίᾶ όί óðἄἄἄóᾶ óóί θᾶñᾶóέῆπῆί ÷ ñçóέίῆθῆέῆπῆίόᾶδ óᾶ θῆπῆθῆñᾶ **Ctrl-z**) έάέ ὑò root, ἄñὺθóðᾶ:

```
# slattach -h -c -s 115200 /dev/modem
```

Ἄί ìθῆñᾶἄóᾶ ίᾶ έὺἰᾶόᾶ ping óᾶ θῆῆῆᾶέóóἸδ όóçί Ἰέέç ἰᾶñέὺ όίθ ἄñῆῆῆᾶçðπ, ἄἄóᾶ óóᾶἄἸῆῆ! Ἄί ἄóðϋ ἄἄῆ ἄῆῆῆῆῆῆῆ, ἄῆῆῆῆῆῆῆ όçί ἄδῆῆῆᾶπ -a ἄίðἄ ἄέᾶ όçί -c ὑò ὑῆέóᾶ όóçί slattach.

28.7.1.3 θὺò ίᾶ Όᾶñῆᾶóἄóᾶóᾶ όçί Όγίαάοç

Έὺῆᾶ óᾶ ἄέϋέῆθῆᾶ:

```
# kill -INT `cat /var/run/slattach.modem.pid`
```

ἄέᾶ ίᾶ óᾶñῆᾶóἄóᾶóᾶ όί slattach. Έóῆçέᾶἄóᾶ ὑòέ θῆἸᾶέ ίᾶ ἄἄóᾶ root ἄέᾶ ίᾶ ἄέðᾶέἸóᾶóᾶ όί θᾶñᾶðὺῆ. θᾶέóᾶ ἄðᾶἸῆῆῆῆῆῆ όóί kermit (ἄέðᾶῆπῆίόᾶδ όçί fg ἄί όί ἄἄ÷ ἄóᾶ óðἄἄἄέ όóί θᾶñᾶóέῆπῆί) έάέ óᾶñῆᾶóἄóᾶóᾶ όί (θῆἸᾶῆῆῆῆῆ q).

Ç óᾶῆἄᾶ manual όίθ slattach(8) ἄίᾶóἸῆᾶέ ὑòέ ìθῆñᾶἄóᾶ ίᾶ ÷ ñçóέίῆθῆέῆπóᾶóᾶ όçί ἄίότῆπ ifconfig s10 down ἄέᾶ ίᾶ ἄέᾶέϋθᾶóᾶ όç όγίαάóç, ἄέέὺ ἄóðϋ ἄἄῆ óᾶἄῆᾶέ ίᾶ Ἰ ÷ ἄέ έᾶἸᾶ ἄðῆῆῆῆῆῆ. (To ifconfig s10 ἄίᾶóἸῆᾶέ όί ἄᾶῆῆ θῆἸᾶἄᾶ.)

ÌᾶñέέἸδ όῆñἸδ, όί modem óáð ìθῆñᾶἄ ίᾶ ἄñῆçᾶἄ ίᾶ έῆᾶἄóᾶέ όç ἄñᾶἰπ. Όóέð θᾶñῆððπóᾶέð ἄóðἸδ, ἰᾶἄῆῆπóᾶ ἰᾶἸὺ όί kermit έάέ óᾶñῆᾶóἄóᾶóᾶ όί ἰᾶἸὺ. Όç ἄᾶγóᾶñç όῆñὺ óóῆπῆῆð θᾶóð÷ ἄἄῆᾶέ.

28.7.1.4 Αίόειάὸβδέος ΔñĩäēçìŪòùĩ

Αί οĩ δάνάδŪĩũ ääĩ έάέοĩñāβόάέ, ñùòβρόά όόç έβόόά freebsd-net (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-net>). ÌññέέŪ άδũ όά όόίçέέοĩŸĩά δñĩäēβιáόά όά ιδĩβá Ÿ÷ĩòĩά ιŸ÷ñέ όόέäìβò áíόέĩάòùδβόάέ:

- Íá ιçĩ Ÿ÷äέ ÷ñçόέĩδĩέçέäβ ç äðέέĩäβ -c β -a όόçĩ slattach (Άδòũ έáñĩέέŪ ääĩ äβĩάέ έñβόέĩ όòŪέĩά, äέέŪ ìäñέέĩβ ÷ñβόόäò áíŸòäñáĩ ùέέ áδòũ Ÿέέóá όά δñĩäēβιáόά όĩòð.)
- ×ñβόç όĩò s10 áíòβ äέá s10 (ç äέáóĩñŪ ìδĩñäβ íá äβĩάέ δĩëŸ ìέέñβ όá ìäñέέŸò äñäĩäóĩóáέñŸò).
- ÄĩέέĩŪóóä όçĩ áíóĩēβ ifconfig s10 äέá íá ääβòä όçĩ έáóŪóóáόç όçò äέáðáòβò. Äέá δάνŪäáέäĩá, ìδĩñäβ íá ääβòä όĩ δάνáέŪòù:

```
# ifconfig s10
s10: flags=10<POINTOPOINT>
    inet 136.152.64.181 --> 136.152.64.1 netmask fffffff0
```

- Αί ç áíóĩēβ ping(8) äβĩάέ ιçĩŸĩáόá no route to host, βóòð δòŪñ÷äέ δñũäέçĩá ìä όĩí δβĩάέä äññĩέüäçόç όáò. Ìδĩñäβòä íá ÷ñçόέĩδĩέβóáόä όçĩ áíóĩēβ netstat -r äέá íá ääβòä όçĩ όñŸ÷ĩòóá äññĩέüäçόç:

```
# netstat -r
Routing tables
Destination          Gateway              Flags          Refs          Use  IfaceMTU      Rtt      Netmasks:

(root node)
(root node)

Route Tree for Protocol Family inet:
(root node) =>
default              inr-3.Example.EDU  UG              8      224515  s10 -          -
localhost.Exampl    localhost.Example. UH              5       42127  lo0 -          0.438
inr-3.Example.ED    water.CS.Example.E UH              1           0  s10 -          -
water.CS.Example    localhost.Example. UGH             34  47641234  lo0 -          0.438
(root node)
```

Όá δάνάδŪĩũ δάνáääβäĩáόá äβĩάέ άδũ Ÿĩá ó÷äòέέŪ áðáó÷ĩέçĩŸĩí όŸóόçĩá. Ìέ äñέέĩβ έä äέáóŸñĩóĩ όóĩ όŸóόçĩá όáò, áíŪέĩäá ìä όç äñäóδçñέüòçóá όĩò äέέòŸĩò.

28.7.2 Ñöèìβæĩĩóáò Ĵá Äĩòδçñäòçòβ SLIP

Όĩ έäβĩäñ áδòũ δάνŸ÷äέ έŪδĩέäò δδĩääβĩäέð äέá όç ñŸèìέόç áíũð FreeBSD όóóòβιáóĩò ùð äĩòδçñäòçòβ SLIP. ΌððέέŪ áδòũ όçĩäβĩáέ ùέέ όĩ όŸóόçĩá όáò έä ñöèìέóóäβ ìä ìäέέĩŪ áδòũĩáόá όέð όóĩäŸóáέò ìäòŪ όçĩ äβóĩäĩ äðñäέñóóĩŸĩũ δäέáòβĩ SLIP.

28.7.2.1 ΔñĩüðĩèŸóáέò

Ç áíũòçóá áδòβ äβĩάέ έäέäβòäñä όä÷ìέέβò όŸóáòð, έáέ äέá όĩ έüäĩ áδòũ áðáέóäβóáέ íá Ÿ÷äòä όέð áíòβóóĩέ÷äò äĩβóáέð äέá íá όçĩ έáóáñĩβóáòä. ΌðĩèŸòĩòĩä ùέέ Ÿ÷äòä ìέä äĩέέäβòóç ìä όĩ δñùðüèĩέēĩ TCP/IP έáέ äέäέέüðäñä ìä όç äέäðέóĩóéĩäüòçόç έüìäüĩ, όέð ìŪóέäð äέέóŸüĩ, óá δδĩäβέðóá, όç äññĩέüäçόç έáέ óá δñùðüèĩέēä äññĩέüäçόç ùðòð όĩ RIP. Ç ñŸèìέόç óüĩ óðçñäóέβĩ SLIP óá Ÿĩá äĩòδçñäòçòβ äðέéĩäέέβĩ óóĩäŸóáüũ áðáέóäβ äĩβόç áδòβĩ óüĩ äĩñĩέβĩ, έáέ áí ääĩ äβóóä äññέäέüũŸĩò ìä áδòŸò, óáò δάνáέäéĩŸĩá ìä äέäáŪóáòä äβòä όĩ TCP/IP Network Administration όĩò Craig

Hunt (έέάιούάέδ O'Reilly & Associates, Inc, Άñέέιιὸ ISBN 0-937175-82-X) ϐ εὔθιέι άδὺ όά έέέέβά όιὸ Douglas Comer ό÷άόέέὔ ιά όι δñòòüέέέέ TCP/IP.

Άδέέέὔι, όθιέὔόιόιά üέέ ϐαϑ ὔ÷άά ñέιβόάέ όι modem όάδ έάέ ὔ÷άά όñιθιέέέόάέ όά έάδὔέεϑά άñ÷άβá ñέιβόάι όιὸ όόόόβιάόιὸ ϐόόά ιά άδέόñὔθάόάέ ϑ άβόιιιὸ όόι όύόόϑιά ιὔόὺ όὺι modem. Άι άάι ὔ÷άά άέüιά δñιόιέιὔόάέ όι όύόόϑιά έάά άδου, δάñάέάειγιά άάβόά όι Ὀιβιá 27.4 έάά έάδóñὔñάέάδ ό÷άόέέὔ ιά όϑ ñýέιέόϑ όὺι άδέέιέέέβι όόιáὔόάι. Άíάá÷ñὔιὺδ ιά έὔέάόά άδβόϑδ ιά άάβόά όέό όάέβáάδ manual όϑδ sio(4) έάά δέϑñιὸιñβáδ ό÷άόέέὔ ιά όι δñüáñáιá ιáϐáϑόϑδ όϑδ όάέñέάέϐδ έýñάδ, όά ttys(5), gettytab(5), getty(8), έάά init(8) έάά δέϑñιὸιñβáδ όιὸ ό÷άόβáειόάέ ιά όϑ ñýέιέόϑ όιὸ όόόόβιáόιὸ ϐόόά ιά äὔ÷άόάέ άβόιιá ÷ñϑόβι ιὔόὺ modem, έάέ βόὺδ έάέ όϑ stty(1) έάά δέϑñιὸιñβáδ ό÷άόέέὔ ιά όέό δάñáὔόñιὸδ όάέñέάέβι έδñβι (üθὺδ όϑι local έάά όάέñέάέὔδ έέάδάόὔδ όιὸ άβιáέ άδáδέάβáδ όόιáñὔιáδ).

28.7.2.2 Άñβáιñϑ Άδέόέüδϑόϑ

Ὀδδέέὔ, ὔιáδ άίόδϑñáόϑόϐδ SLIP όιὸ ÷ñϑόέιιθιέάβ FreeBSD έάέόιὸñááβ ιά όιί άίϐδ όñüθι: ὔιáδ ÷ñϐόϑδ SLIP έάέάβ όιί άίόδϑñáόϑόϐ SLIP, έάέ άέόὔñ÷άόάέ όόι όύόόϑιá ιὔόὺ άíὺδ έέάέειγύ áíáñüñέόδέειγύ áέóüáρι έάά όι SLIP. Ὀι έὔέόόιὸ όιὸ ÷ñϐόϑ άβιáέ όι /usr/sbin/sliplogin. Ὀι δñüáñáιá sliplogin έάάὔὔάέ όι άñ÷άβι /etc/sliphome/slip.hosts έάά ιá άñáέ ιέá áñáñᐐ όιὸ ιá όάέñέὔάέ ιά όιί ÷ñϐόϑ, έάέ áí όδὔñ÷άέ, όόιáὔάέ όϑι όάέñέάέϐ áñáñᐐ όá ιέá έέάέὔέίϑ έέάδáόϐ SLIP έάέ ὔθάέόά έέόάέάβ όι script όιὸ έάέýόιὸδ /etc/sliphome/slip.login έάά ιá ñέιβόάέ όϑ έέάδáόϐ SLIP.

28.7.2.2.1, ιá δάñὔáάέáιá Άέóüáιὸ όá Άίόδϑñáόϑόϐ SLIP

Άέá δάñὔáάέáιá, έάά ὔιá ÷ñϐόϑ SLIP ιá ID Shelmerg, ϑ áίόββóιέ÷ϑ έάόá÷ñέόϑ όόι /etc/master.passwd έá ὔιέάάá ιá όϑι δάñáέὔδ:

```
Shelmerg:password:1964:89::0:0:Guy Helmer - SLIP:/usr/users/Shelmerg:/usr/sbin/sliplogin
```

¼όáι áέόὔέέάέ i Shelmerg, όι sliplogin έá ϐὔιáέ όι /etc/sliphome/slip.hosts έάά ιέá áñáñᐐ ιá ID ÷ñϐόϑ όιὸ ιá όάέñέὔάέ. Άέá δάñὔáάέáιá, ιθιñáβ ιá όδὔñ÷άέ ιέá áñáñᐐ όόι /etc/sliphome/slip.hosts όιὸ ιá áñὔάέ:

```
Shelmerg          dc-slip sl-helmer          0xfffffc00          autocomp
```

Ὀι sliplogin έá áñáέ όϑ áñáñᐐ áόόϐ, έá όόιáὔάέ όϑ όάέñέάέϐ áñáñᐐ όόϑι áδñüáιϑ έέάέὔέίϑ έέάδáόϐ SLIP, έάέ ὔθάέόά έá έέόάέὔάέ όι /etc/sliphome/slip.login üθὺδ όάβιáόάέ δάñáέὔδ:

```
/etc/sliphome/slip.login 0 19200 Shelmerg dc-slip sl-helmer 0xfffffc00 autocomp
```

Άí üέá δὔιá έάέὔ, όι /etc/sliphome/slip.login έá έέόάέὔάέ ιέá áíόιέϐ ifconfig έάά όϑ έέάδáόϐ SLIP όόϑι ιθιβá ὔ÷άέ όόιáέάβ ϑ sliplogin (ϑ έέάδáόϐ 0 όόι δάñáδὔιὺ δάñὔáάέáιá, ϑ δñβόϑ δάñὔιáόñιὸδ όϑδ έββόάδ όιὸ áβιáόάέ όόι slip.login) ϐόόά ιá ñέιέόόιγί ϑ όιθέέϐ έέάýέόιόϑ IP (dc-slip), ϑ άδñáέñόόιὔίϑ έέάýέόιόϑ IP (sl-helmer), ϑ ιὔόέá έέέόýιὸ έάά όϑ έέάδáόϐ SLIP (0xfffffc00), έάέ ιθιέάόáϐθιόá δñüόέάόáδ άδέέιáὔδ (autocomp). Άí εὔόέ δὔάέ όδñááὔ, έá ιθιñὔάόá ιá όι áíόιθβόάόá áδὺ όá άñ÷άβá έάόááñáόϐ όϑδ sliplogin. ϑ sliplogin έάόááñὔάέ όá ιϑίγíáόá ÷ñϑόέιιθιέέίόáδ όι ááβιιá **syslogd** i ιθιβιὸ όόιϐέὺδ ÷ñϑόέιιθιέάβ όι άñ÷άβι /var/log/messages (άáβόá όέό όάέβáάδ áιϐέάέáδ έάά όá syslogd(8) έάέ syslog.conf(5) έάέ áíáá÷ñὔιὺδ áέ ὔáñόá όι /etc/syslog.conf έάά ιá ááβόá όϑι όιθιέáόβá έάέ όι άñ÷άβι όιὸ ÷ñϑόέιιθιέάβ όι **syslogd** έάά όϑι έάόááñáόϐ).

28.7.2.3 Νύειέος οίο Δοηρία

Ί δνιιδέεάι Ύίηδ δοηρίαδ οίο FreeBSD (i GENERIC) έάέ Ύόάέ άίούιάούι Ύίς οδίοδΠήεις SLIP (sl(4)). Οδςί δάνβδδούος διτ εΎεάοά ίά άείιειοηάΠρόάοά δνιιόάνιι οί Ύίη δοηρία, δνιιόεΎόοά οςί δάηάέΰδου άηάηΠ οδι άη÷άβι ηδειβόάηι οίο δοηρία οάο:

```
device sl
```

Οί FreeBSD, άδη δνιιδέειάΠ, άάί δνιιέάβ δάέΎόά. Άί εΎεάοά ι άίοδςηάοςδΠδ οάο ίά άίάηάάβ ηδ άηιηειάςδΠδ, έά δνΎδάέ ίά άδάηάηάοόάβδά οί άη÷άβι /etc/rc.conf έάέ ίά άεεΎίάοά ος ηύειέος οςδ ίάοάάέςδΠδ gateway_enable οά YES. Ίά οηί οηύδη άδου, έά άβίάέ οβάιτδηι υδές ς άδέειάΠ οςδ άηιηειυάςοςδ έά έάάοςηςέάβ ίάδΰ άδη ίέά άδάίάέβίςος. Έά δνΎδάέ Ύδάέοά ίά άδάίάέέειΠρόάοά έάέ ίά άίάηάηιέςειΎί ίέ ίΎάδ ηδειβόάέδ.

Άέά ίά άοάηιυόάδ άδΎδ οέδ ηδειβόάέδ Ύίάοά, ιδηηάβδά ίά έέοάεΎόάοά οςί δάηάέΰδου άίοιέΠ ηδ root:

```
# /etc/rc.d/routing start
```

ΔάηάέειΎίά άάβδά οί Έαοΰεάει 9 έέά δάηέοόυδάνάδ δέςηιιηβάδ ο÷άδέέΰ ίά οςί ηύειέος οίο δοηρία οίο FreeBSD.

28.7.2.4 Νύειέος οίο Sliplogin

¼δου άίάΎηέςέά έάέ δηεί, οδΎη÷ιτδ οηβά άη÷άβά οδηί έάδΰειάι /etc/sliphome οά ιδηβά ÷ηςοείηδηειΎίόάέ οςδ ηύειέος οίο /usr/sbin/sliplogin (άάβδά έάέ ος οάέβάά manual οίο sliplogin(8)): οί slip.hosts, οί ιδηβι ηηβάέ οίτδ ÷ηΠρόάδ SLIP έάέ οέδ άίόβδδίε÷άδ IP έέάδΎίόάέδ οίτδ, οί slip.login οί ιδηβι οδίΠεδ ηδειβάέ άδΰ οςί έέάδΰ SLIP, έάέ δνιιέηάδΰ οί slip.logout, οί ιδηβι άίάέηάβ οέδ έέέάΎδ οίο slip.login υδάί δάηιάδβδάέ ς οάέηέάέΠ οΎίάός.

28.7.2.4.1 Νύειέος οίο slip.hosts

Οί /etc/sliphome/slip.hosts δάηεΎ÷άέ άηάηΎδ ίά οΎόοάηά δάάβά διτ ÷ηηβειίόάέ ίάοάΎ οίτδ ίά έάρΰ έέάοδΠιάδά:

- Οί άίάάηηέοδΰέεηι έέόυάιτδ οίτδ ÷ηΠρόος SLIP
- Οςί οίδΰέΠ έέάΎέδίος (οίδΰέΠ ηδ δνιτδ οηί άίοδςηάοςδΠδ SLIP) οςδ έέάόΎίάάοςδ SLIP
- Οςί άδηάέηδδΰίΎίς έέάΎέδίος οςδ έέάόΎίάάοςδ SLIP
- Ος ιΰόέά οίο έέέδΎιτδ

ς οίδΰέΠ έάέ ς άδηάέηδδΰίΎίς έέάΎέδίος, ιδηηάβ ίά άβίάέ ηιιιάοά οδηειάέοδΠι (οά ιδηβά ίά ίάοάοηΎδηίόάέ οά έέάδΎΎίόάέδ IP ιΎού οίο /etc/hosts Π ιΎού οίο DNS, άίΎειάά ίά οέδ έάοά÷ηηβδάέδ διτ οδΎη÷ιτδ οδι άη÷άβι /etc/nsswitch.conf), έάέ ς ιΰόέά έέέδΎιτδ ιδηηάβ ίά άβίάέ Ύίά υηηά οί ιδηβι ίά ιδηηάβ ίά έέάδΰηειέοδάβ ιΎού άίάάΠδόςοςδ οδι /etc/networks. Οά Ύίά άηέειάοδΰέηι οΎόοςίά, οί /etc/sliphome/slip.hosts ηέΎάέ ίά οί δάηάέΰδου:

```
#
# login local-addr      remote-addr      mask                opt1      opt2
#                               (normal,compress,noicmp)
#
Shelmerg dc-slip        sl-helmerg        0xfffffc00         autocomp
```

Οδι οΎειτδ οςδ άηάηΠδ, άηβδΰειίόάέ ίέά Π δάηέοόυδάνάδ άδη οέδ δάηάέΰδου άδΰειάΎδ:

- normal — ÷ ùñβὸ ὀοἰδβᾶὸς ὀοἰ ἄδῆέἄὀἄῆβᾶἰ
- compress — ἰᾶ ὀοἰδβᾶὸς ὀοἰ ἄδῆέἄὀἄῆβᾶἰ
- autocomp — ἰᾶ ὀοἰδβᾶὸς ὀοἰ ἄδῆέἄὀἄῆβᾶἰ, ἄἰ ἄδῆὸñÝðᾶὀἄῆ ἄδῆ ὀἰἰ ἄδῆἰἄῆñὀὀἰÝἰ ὀδῆῆᾶῆὀὀ
- noicmp — ἄδᾶἰἄñᾶἰδῆβᾶὸς ὀοἰ δᾶῆÝὀἰ ICMP (ἰᾶ ὀἰ ὀñῆδῆ ἄὀὀ ὀᾶ δᾶῆÝὀᾶ “ping” ῆᾶ ἄδῆññβδὀἰὀᾶῆ ἄἰβ ἰᾶ ῆᾶἰᾶῆῆἰὀἰ ὀἰ ἄἡñἰδ ᾶῆἰçð ὀçð ὀἡἰᾶᾶὀçð ὀᾶὀ)

ἰῆ ἄδῆῆᾶÝð δῆὀ Ý ÷ ᾶὀᾶ ἄῆᾶ ὀῆὀ ὀἰδῆῆÝð ῆᾶῆ ἄδῆἰἄῆñὀὀἰÝἰᾶὀ ἄῆᾶὀῆἰὀᾶὀ ὀἰ SLIP ὀἰἰᾶÝὀᾶἰ ὀᾶὀ, ἄἰᾶñὀῆὀᾶῆ ἄδῆ ὀἰ ἄἰ ðñῆἠᾶῆὀᾶῆ ἰᾶ ἄὀῆᾶñῆὀᾶᾶ Ýἰᾶ ὀδῆᾶβῆὀἰ TCP/IP ᾶ ἄἰ ðñῆἠᾶῆὀᾶῆ ἰᾶ ÷ ñçὀῆἰὀἰῆᾶὀᾶᾶ “proxy ARP” ὀἰ SLIP ἄἰὀδçñᾶὀçðᾶ ὀᾶὀ (ἄἰ ἄβἰᾶῆ “ðñᾶἰᾶὀῆῆῆ”) proxy ARP, ἄῆῆῆ ὀὀçἰ ἄἡὀὀὀᾶ ἄὀὀᾶ ὀñῆῆñῆὀᾶὀᾶῆ ἰᾶ ἄὀὀ ὀἰ ὀñῆῆ). ἄἰ ἄἰ ἄβὀᾶ ὀβᾶἰὀñὀ δῆῆᾶ ἰÝῆἰᾶ ἰᾶ ἄδῆῆÝἰᾶὀᾶ ᾶ ὀἰ ἰᾶ ἄδῆᾶᾶᾶᾶ ἄῆᾶὀῆἰὀᾶὀ IP, δᾶñᾶῆῆῆἰᾶ ἰᾶἰᾶñÝἰᾶ ὀᾶ ἄῆᾶῆᾶ ὀἰ TCP/IP δῆὀ ἰᾶἰᾶÝñἰὀᾶῆ ὀὀῆὀ ὀñῆἰὀἰῆÝὀᾶὀ SLIP (ὀἰᾶ 28.7.2.1) ᾶῆῆ ὀἰἰᾶῆᾶὀὀᾶὀ ὀἰ ἄῆᾶ ÷ ἄῆῆὀὀ ἄῆὀῆὀ ὀᾶὀ.

ἄἰ ðñῆἠᾶῆὀᾶῆ ἰᾶ ÷ ñçὀῆἰὀἰῆᾶὀᾶᾶ ἰᾶ ÷ ùñῆὀὀỀ ὀδῆᾶβῆὀἰ ἄῆᾶ ὀἰὀὀ SLIP δᾶῆῆὀᾶὀ ὀᾶὀ, ῆᾶ ÷ ñᾶῆᾶὀὀᾶᾶ ἰᾶ ἄῆᾶῆὀᾶᾶ ὀἰ ἄñῆῆỀ ὀδῆᾶῆὀῆὀ ἄδῆ ὀçἰ ἄῆᾶἡὀἰὀç IP δῆὀ ὀᾶὀ Ý ÷ ἄῆ ἄδῆᾶῆᾶᾶ ῆᾶῆ ἰᾶ ἄὀᾶᾶὀᾶᾶ ὀἰὀὀὀ δᾶῆῆὀᾶὀ SLIP ἄῆᾶὀῆἰὀᾶὀᾶὀ δῆὀ ἄἰᾶῆὀἰ ὀᾶ ἄὀὀ ὀἰ ὀδῆᾶβῆὀἰ. δᾶῆὀᾶ, ῆᾶ ÷ ñᾶῆᾶὀὀᾶᾶ ἰῆῆῆἰ ἰᾶ ῆᾶῆñβὀᾶὀᾶ ἰῆᾶ ὀᾶὀὀῆᾶ ἄῆᾶññᾶ ὀἰ ὀδῆᾶβῆὀἰ SLIP ἰÝὀ ὀἰ ἄἰὀδçñᾶὀçðᾶ SLIP ὀἰἰ ῆἰὀὀῆỀὀᾶñ ὀᾶὀ ἄñῆῆῆᾶçðᾶ IP.

ἄῆὀἰñᾶὀῆῆῆῆ, ἄἰ ÷ ñçὀῆἰὀἰῆᾶὀᾶᾶ ὀç ἰÝῆἰᾶ “proxy ARP”, ῆᾶ ÷ ñᾶῆᾶὀὀᾶᾶ ἰᾶ ἄδῆᾶᾶᾶᾶ ὀἰὀὀ SLIP δᾶῆῆὀᾶὀ ὀᾶὀ ἄῆᾶὀῆἰὀᾶὀᾶὀ IP δῆὀ ἄἰᾶῆὀἰ ὀἰ ὀδῆᾶβῆὀἰ Ethernet ὀἰ ἰὀἰβἰ ἄἰᾶῆᾶ ἰ ἄἰὀδçñᾶὀçðᾶ SLIP, ῆᾶῆ ῆᾶ ÷ ñᾶῆᾶὀὀᾶᾶ ἄδᾶὀçð ἰᾶ ñὀῆἰβὀᾶὀᾶ ὀᾶ scripts /etc/sliphome/slip.login ῆᾶῆ /etc/sliphome/slip.logout ἰᾶ ÷ ñçὀῆἰὀἰῆᾶὀᾶᾶ ὀἰ arp(8) ἄῆᾶ ἰᾶ ÷ ἄῆñβᾶῆὀᾶῆ ὀὀὀ ῆᾶὀᾶ ÷ ùñβὀᾶὀὀ “proxy ARP” ὀἰἰ δᾶἰᾶῆᾶ ARP ὀἰὀ ἄἰὀδçñᾶὀçðᾶ SLIP.

28.7.2.4.2 Ἠἡῆῆὀç ὀἰὀ slip.login

ἰᾶ ὀὀδῆῆỀ /etc/sliphome/slip.login ἰῆῆῆᾶῆ ἰᾶ ὀἰ δᾶñᾶῆῆὀὀ:

```
#!/bin/sh -
#
#      @(#)slip.login  5.1 (Berkeley) 7/1/90
#
# generic login file for a slip line.  sliplogin invokes this with
# the parameters:
#      1      2      3      4      5      6      7-n
#  slipunit  ttyspeed loginname local-addr remote-addr mask opt-args
#
/sbin/ifconfig sl$1 inet $4 $5 netmask $6
```

ὀἰ ἄñ ÷ ἄβἰ slip.login ἄῆὀᾶῆᾶ ἄδῆᾶὀ ὀἰ ifconfig ἄῆᾶ ὀçἰ ῆᾶὀῆῆῆçç ἄῆᾶὀᾶὀ SLIP, ἰᾶ ὀὀὀ ὀἰδῆῆÝð ῆᾶῆ ἄδῆἰἄῆñὀὀἰÝἰᾶὀ ἄῆᾶὀῆἰὀᾶὀᾶὀ ῆᾶῆ ὀç ἰῆὀῆᾶ ἄῆὀῆỀ ὀçð ἄῆᾶὀᾶὀᾶὀ ἄὀὀᾶὀ.

ἄἰ Ý ÷ ᾶὀᾶ ἄδῆὀᾶὀᾶὀᾶῆ ἰᾶ ÷ ñçὀῆἰὀἰῆᾶὀᾶᾶ ὀçἰ ἰÝῆἰᾶ “proxy ARP” (ἄἰβ ἰᾶ ÷ ñçὀῆἰὀἰῆᾶὀᾶᾶ ἄῆὀἰñᾶὀῆῆῆῆ ὀδῆᾶβῆὀἰ ἄῆᾶ ὀἰὀὀ δᾶῆῆὀᾶὀ SLIP), ὀἰ ἄñ ÷ ἄβἰ /etc/sliphome/slip.login ῆᾶ ἰῆῆῆᾶῆ ἰᾶ ὀἰ δᾶñᾶῆῆὀὀ:

```
#!/bin/sh -
#
#      @(#)slip.login  5.1 (Berkeley) 7/1/90
#
# generic login file for a slip line.  sliplogin invokes this with
```

```
# the parameters:
#      1      2      3      4      5      6      7-n
# slipunit ttyspeed loginname local-addr remote-addr mask opt-args
#
/sbin/ifconfig sl$1 inet $4 $5 netmask $6
# Answer ARP requests for the SLIP client with our Ethernet addr
/usr/sbin/arp -s $5 00:11:22:33:44:55 pub
```

Ç δñüεάόç ãñàìÞ óá áδóü òì slip.login, ç arp -s \$5 00:11:22:33:44:55 pub, àçìέìñãáß ìέά έάόά÷Þñέόç ARP óòìí δβìάέá ARP òìò áìòδçñãòçòÞ SLIP. ÁδòÞ ç έάόά÷Þñέόç ARP έΰìάέ òìí áìòδçñãòçòÞ SLIP ìά áðáìóΰ ìά òçì έέάýèðìόç Ethernet MAC ùðáì έΰðìέìò ΰέέìò έììáìò IP óòì Ethernet áðέέòìáß ìά áðέέìέììÞóάέ ìά òçì έέάýèðìόç IP òìò δãέΰòç SLIP.

¼óáì ÷ñçóέìíðìέάßòá òì δãñáðΰì ðãñΰáέέìά, áááάέέèèáßòá ùðέ Ύ÷áòá áìέέέάόάóóáέ òçì έέάýèðìόç MAC òìò Ethernet (00:11:22:33:44:55) ìά òçì áìòßòòìέ÷ç òçð áέέÞð óáð έΰñòáð Ethernet, έέάòìñáðέέΰ òì “proxy ARP” óβãìòñá ááì έά έάέòìòñãÞóάέ! Ìðìñáßòá ìά áìάέάέýðáòá òç έέάýèðìόç MAC òìò έέέìý óáð áìòδçñãòçòÞ SLIP έìέóΰæììóáð òá áðìáέΎòìáóá òçð áìòìέÞð netstat -i. Ç ááýóáñç ãñàìÞ òçð áììáìò έά ììέΰæάέ ìά òçì δãñáέΰòù:

```
ed0 1500 <Link>0.2.c1.28.5f.4a 191923 0 129457 0 116
```

Áδóü ááß÷ìάέ ùðέ óòì óðáέáέñέìΎì óýóóçìά ç έέάýèðìόç MAC òìò Ethernet áβìάέ 00:02:c1:28:5f:4a. Ìέ òáέááßò òçòì έέάýèðìόç ðìò ááß÷ìάέ ç netstat -i δñΎðáέ ìά áìέέέάόάóóáέìý ìά ΰìù-έΰòù òáέááßò, έάέ έΰèá ìììì ááέάáìάέέέü ççòβì δñΎðáέ ìά ìάóáòñáðáß òá έέðέü δñìóέΎòììóáð áðì ìðñìóóΰ Ύìά ìçááìέέü. Ç έέάýèðìόç ìάóáòñΎðáóáέ ìά áδóü òìí ðñüðì óá ìέά ììòÞ ðìò ìðìñáß ìά ÷ñçóέìíðìέÞóάέ ç arp(8). Ááßòá òç óáέßáá manual òçð arp(8) έάá δãñέóóüðãñáð ðççñìòìñáð ò÷áðέέΰ ìά òç ÷ñÞç òçð áìòìέÞð áðòÞð.

Όçìáßòùç: ¼ðáì àçìέìñãááßòá òì /etc/sliphome/slip.login έάέ òì /etc/sliphome/slip.logout, έά ðñΎðáέ ìά έΰóáòá òì bit “áέòΎέάóçò” (ð.÷. chmod 755 /etc/sliphome/slip.login /etc/sliphome/slip.logout), έέάòìñáðέέΰ ç sliplogin ááì έά ìðìñáß ìά òá έέðáέΎóάέ.

28.7.2.4.3 Ñýèìέόç ðìò slip.logout

Ôì /etc/sliphome/slip.logout ááì áβìάέ áðüέðóá áðãñáßòçòì (áέðüð áì δñüέάέóάέ ìά òέìðìέÞóáòá “proxy ARP”), áέέΰ áì óέìðáýáðá ìά òì àçìέìñãáÞóáòá, ìðìñáßòá ìά ÷ñçóέìíðìέÞóáòá ùð òðìááέέìά òì δãñáέΰòù áðέü ðãñΰááέέìά:

```
#!/bin/sh -
#
#      slip.logout
#
# logout file for a slip line. sliplogin invokes this with
# the parameters:
#      1      2      3      4      5      6      7-n
# slipunit ttyspeed loginname local-addr remote-addr mask opt-args
#
/sbin/ifconfig sl$1 down
```

Άί ÷ ñçóείιθιεάβδὰ “proxy ARP”, έά έΎέάδὰ οί /etc/sliphome/slip.logout ίά έέάñŪöάέ όçí έάόά÷ ðñέόç ARP όιθ δάέŪόç SLIP:

```
#!/bin/sh -
#
#      @(#)slip.logout

#
# logout file for a slip line.  sliplogin invokes this with
# the parameters:
#      1      2      3      4      5      6      7-n
#      slipunit ttyspeed loginname local-addr remote-addr mask opt-args
#
/sbin/ifconfig sl$1 down
# Quit answering ARP requests for the SLIP client
/usr/sbin/arp -d $5
```

Ç arp -d \$5 έέάñŪöάέ όçí έάόά÷ ðñέόç ARP όιθ δñίόόΎέçέά ίά όçí άέόΎέάόç όιθ slip.login όιθ “proxy ARP”, έάόŪ όçí άβόίτáι όιθ δάέŪόç SLIP.

ΔñŪάέ ίά όι άδάρáέŪάροιá Ūέεç ίέá öñŪ: Άάάέúèάβδὰ úδé όί /etc/sliphome/slip.logout Ÿ÷άέ ñέόόάβ ùò άέόάέΎόέη ίάδŪ όçí άçίέίθñάβά όιθ (δ.÷., chmod 755 /etc/sliphome/slip.logout).

28.7.2.5 ΔάñŪάίίόάò όιθ ΔñŪάέ ίά ĘŪάάòά Ōδύσç óάò óóç Άññίέüάçόç

Άί άάί ÷ ñçóείιθιεάβδὰ όçí ίΎέίτáι “proxy ARP” άέά ίά άññίέüάβδὰ δάέΎόά ίάόάίý όúί δάέάόðί SLIP έάέ όιθ όδύέιέδίο άέέόýίθ óάò (έάέ άίάά÷ ñŪŪò έάέ όιθ Internet), έά δñŪάέ ίŪέέί ίά δñίόέΎόάόά óόάέέΎò άέάññŪò δñίò όίí δέçóέΎόάñί óάò δñίáδéάñίŪί άññίέüάçόð άέά ίά άññίέüάβδὰ όι όδίαβέόóι όúί SLIP δάέάόðί óάò άέάίŪίθ όιθ άίθδçñάόçð SLIP.

28.7.2.5.1 ÓόάόέέŪò ΆέάññίŪò

Ç δñίόέðέç óόάόέέðί άέάññίðί δñίò όιθò δέçóέΎόάñίθò óάò δñίáδéάñίŪίθò άññίέüάçόŪò, ίθίñάβ ίά άβίάέ δñίάέçίáóέéð (ð έάέ άáyίáóç άί άάί Ÿ÷άόά óά έάóŪέεçέά άέέάέðίáóά δñίόάάόçò). Άί ç άόάέñβά óάò άέάέΎόάέ άβέóóι ίά δίεέάδéίýò άññίέüάçόŪò, έŪδίέά ñíóŪέά (δ.÷. άδύ όçí Cisco έάέ όçí Proteon), άέóúò úδé δñŪάέ ίά ñòέίέóóίýί ίά όçí óόάόέéð άέάññίð δñίò όι όδίαβέόóι SLIP, δñŪάέ άδβóçò ίά ñòέίέóóίýί ίά óéò óόάόέέŪò άέάññŪò όιθ έά άίáóŪñίθί óóιθò Ūέέίθò άññίέüάçόŪò. Έά ÷ ñάέάóάβ ίά δάέñάίáóέóóάβδὰ έάέ ίά άίέίŪóάόά άέŪóιñάò ñòέίβóάέò άέά ίά άίθέŪόάέ ç άññίέüάçόç ίŪóú óόάόέέðί άέάññίðί.

ÊäöÛëáéí 29

Çëâêñííéêü Óá: õññíãßí

29.1 Óýííøç

Ôí “çëâêñííéêü óá: õññíãßí”, ãðñýðáñá áñõóóù ùð email, áßíáé óóéð ìÝñáð ïáð ïéá áðü óéð ðëÝíí äéááãñíÝíáð ïíñóÝð ãðëéíéíüíßáð. Ôí êäöÛëáéí áðõù ðáñÝ ÷ áé ïéá ááóéêÞ äéóáãñáÞ óðç çéëóíõññáßá áñüð äéáêñíéóðÞ email óðí FreeBSD, éáêþð éáé ïéá äéóáãñáÞ óðç äéááééáóßá áðíóóíèÞð éáé êÞøçð email óðí FreeBSD. Ùóóóíç ç áñáóíñÛ áððÞ ááí ðñÝðáé ïá äáñççéáß ðëÞñçð, éáêþð ððÛñ ÷ íóí áéüíá áñéáðíß ðáñÛáñíóáð ðíó ðñÝðáé ïá êçóèéýí ððüøéí éáé Ý ÷ íóí ááþ ðáñáéáéóðéáß. Áéá ðéí ðëÞñç áñÛéóðç õíó èÝíáõíò, ï áñááñþóðçð ðáñáðÝíðáðáé óóá ðíèèÛ áñáéñáðéèÛ áéáéßá ðíó áñáóÝñíóáé óðí ðáñÛñðçíá B.

Áóíý äéááÛóáðá áðõù ðí êäöÛëáéí, éá ïÝñáðá:

- Ôí êñáéóíéèü ðíó ÷ ñçóéíðíèéáßðáé óðçí áðíóóíèÞð éáé êÞøç çëáéðñííééíý óá: õññíãßíð.
- ðíó áñßóéíóáé óá ááóéèÛ áñ ÷ áßá ñðèìßóáùí ðíó **sendmail** óðí FreeBSD.
- Ôç äéáóíñÛ ïáðáíý áðñáéñóóíÝíüí éáé õíðéêþí èðñßáùí óá: õññíãßíð (mailboxes).
- Ðùð ïá áíðñíáßóáðá áñáðééýíçóííò spammers áðü ðí ïá ÷ ñçóéíðíèèÞðóíóí ðíí äéèü óáð áñððçñáðçðÞ email ùð áñáñóáãñüðç.
- Ðùð ïá áäéáðáóðÞóáðá éáé ïá ñðèìßóáðá Ýíá áñáééáðéèèèÛ Áíóéðññóóðí ïáðáóíñÛð Óá: õññíãßíð (Mail Transfer Agent) óðí óýóðçíá óáð, áíðééáðéóðþíóáð Ýðóé ðí **sendmail**.
- Ðùð ïá áíðéíáððßóáðá óóíççéóíÝíá ðñíáéÞíáðá óðíí äéáéñíéóðÞ óá: õññíãßíð.
- Ðùð ïá ÷ ñçóéíðíèèÞðáðá ðí SMTP ïá ðí UUCP.
- Ðùð ïá ñðèìßóáðá ðí óýóðçíá óáð ïüíí áéá áðíóóíèÞð email.
- Ðùð ïá ÷ ñçóéíðíèèÞðáðá ðí email ïÝóù ãðëéíáéèÞð (dialup) óýíááóçð.
- Ðùð ïá ñðèìßóáðá ðéóðíðíßçðç áðéáíóéèüðçðóáð óðí SMTP áéá ðññóèéáðç áóöÛëáéá.
- Ðùð ïá áäéáðáóðÞóáðá éáé ïá ÷ ñçóéíðíèèÞðáðá ïéá áðáñíñáÞ áðíóóíèÞð éáé êÞøçð email áéá ÷ ñÞðóáð, ùððð ðí **mutt**.
- Ðùð ïá éáðááÛóáðá ðí email óáð áðü Ýíá áðñáéñóóíÝíí äéáéñíéóðÞ POP Þ IMAP.
- Ðùð ïá áðáññüóáðá ðßèðñá éáé éáñüíáð óðçí áéóáñ ÷ ùíáíç áéèçëíáñáðßá óáð, ïá áðóüíáðí ðññðí.

ðñéí äéááÛóáðá áðõù ðí êäöÛëáéí, éá ðñÝðáé:

- Íá ñðèìßóáðá òóóðÛ ðç óýíááóç ðíó áééðýíò óáð (ÊäöÛëáéí 32).
- Íá ñðèìßóáðá òóóðÛ óéð ðëçñíñíñßáð DNS áéá ðíí äéáéñíéóðÞ áéèçëíáñáðßáð óáð (ÊäöÛëáéí 30).
- Íá áñññßæáðá ðùð ïá áäéáðáóðÞóáðá ðññóèéáðí êñáéóíéèü ðñßðíò éáðáóéáðáóðÞ (ÊäöÛëáéí 5).

ðáñááβááóáε áðáοεáβáð óοιí ððιέιáεóðϐ óáð, ιá óçí ðñιúðυέáοϐ υúεé Ý÷áðá ááñáóϐ óγðιò A ðιò ιá ááβ÷ίáε óοιí ððιέιáεóðϐ óáð ϐ óóçí IP áεάγέðιόç ðιò.

Ìðιñáβðá ιá ááβðá ðεð ááñáóϐ Ýð MX áεά ιðιέιáβðιòá ðιñÝá, ÷ñçóειιðιέπριόáð óçí áιðιέϐ host(1), υðυð ðáβίáðáε óοιí ðáñáεΰòυ ðáñΰááεáιá:

```
% host -t mx FreeBSD.org
FreeBSD.org mail is handled (pri=10) by mx1.FreeBSD.org
```

29.2.4 Έáιáΰιιόáð Mail

Ì mailhost áβίáε ððáγεðιò áεά óçí εϐøç mail ðιò ðñιιñβεáðáε áεά ðιí ðιñÝá óáð. Έá óøεεÝίáε υει ðι mail ðιò Ýñ÷áðáε ðñιò ðιñÝá, εáε εá ðι áðιέçεáγóáε áβðá óοιí mbox (óçí ðñιáðéεáαιÝίç ιÝειáι áεά áðιέçεáðεáβ, ιðιñáβðá áβðá ιá ðι áεάáΰóáðá ðιðéεΰ, ÷ñçóειιðιέπριόáð áοáñιáÝð υðυð ðι mail(1) ϐ ðι **mutt**, ϐ ιá ðι ááβðá ιÝóυ áðιñáεñòοιÝίçð óγίááóçð, ÷ñçóειιðιέπριόáð εΰðιέι ðñυòυειέει υðυð ðι POP ϐ ðι IMAP. Άðου óçιáβίáε υúεé áι áðéεοιáβðá ιá áεάáΰεáðá ðι mail óáð ιυíι ðιðéεΰ, áαí ÷ñáεΰεáðáε ιá ááεάóáðòϐóáðá áιðçñáðçðϐ POP ϐ IMAP.

29.2.4.1 ðñυóááóç óá ΆðιñáεñòοιÝίáð Έðñβááð ιÝóυ POP εáε IMAP

Άεά ιá Ý÷áðá áðιñáεñòοιÝίç ðñυóááóç óóεð εðñβááð óá÷ ðáñιñáβιò, áβίáε áðáñáβóçοι ιá Ý÷áðá ðñυóááóç óá Ýίá áιðçñáðçðϐ POP ϐ IMAP. Όá ðñυòυειέεá áðòΰ, áðéοñÝðιòι óοιòð ÷ñϐóðáð ιá óðιáÝιíðáε óóεð εðñβááð ðιòð áðυ áðυóðáóç, ιá ιááΰεç áðειέβá. Έáε óá áγι ðñυòυειέεá (POP εáε IMAP) áðéοñÝðιòι óοιòð ÷ñϐóðáð áðιñáεñòοιÝίç ðñυóááóç óóεð εðñβááð ðιòð, áεεΰ ðι IMAP ðñιóóÝñáε áñεáðΰ ðεáñιáεðριáðá, ιñεοιÝίá áðυ óá ιðιβá óáβιιόáε ðáñáεΰòυ:

- Όι IMAP ιðιñáβ ιá áðιέçεáγóáε ιçιγίáðá óá Ýίá áðιñáεñòοιÝίí áιðçñáðçðϐ, υðυð áðβóçð εáε ιá óá áιáεðϐóáε.
- Όι IMAP ððιòóçñβεáε ðáðòυ ÷ñιáð áιçιáñϐóáεð.
- Όι IMAP ιðιñáβ ιá óáιáβ áιáεñáðéεΰ ÷ñϐóειι óá óðιáÝóáεð ÷áιçεϐð óá÷ γóçðáð, εáεϐð áðéοñÝðáε óοιòð ÷ñϐóðáð ιá εáðááΰοιòι óç áñϐ ðυι ιçιòιΰòυι, ÷ññβð ιá εáðááΰοιòι ðι ðáñεá÷υιáñι ðιòð. Ìðιñáβ áðβóçð ιá áεðáεÝóáε áñááóβáð υðυð áγñáóç ιçιòιΰòυι áðáðεáβáð óοιí áιðçñáðçðϐ, áεά÷ εóοιðιέπριόáð ιá áðòυ ðιñ ðñυòι óç ιáðáοιñΰ áááñÝιυι ιáðáγύ ðυι ðáεáðρι éáε ðυι áιðçñáðçðρι.

Άεά ιá ááεάóáðòϐóáðá Ýίá áιðçñáðçðϐ POP ϐ IMAP εá ðñÝðáε ιá áειέιòεϐóáðá óá áðυιáιá áριáðá:

1. ΆðéεÝιòá Ýίá áιðçñáðçðϐ IMAP ϐ POP ðιò ιá áιðçñáðáβ ðεð áιΰáεáð óáð. Ìε ðáñáεΰòυ áιðçñáðçðóϐ POP εáε IMAP áβίáε áñεáðΰ áεáááñÝιέ εáε áðιòáειγί éáεΰ ðáñáááβáιáðá:
 - **qpopper**
 - **teapop**
 - **imap-uw**
 - **courier-imap**
 - **dovecot**
2. Άáεάóáðòϐóáðá ðι ááβιιá POP ϐ IMAP óçð áðéειáϐð óáð, áðυ óçí Óðéειáϐ ðυι Ports.
3. Άι ÷ñáεΰεáðáε, ðñιðιέιεϐóáð ðι áñ÷áβι /etc/inetd.conf áεά ιá ðιñðϐóáðá ðι áιðçñáðçðϐ POP ϐ IMAP.

Ḷñíáέáíðíβçóç: Ἐά δñÝðáέ íá óçíáέρðíðíá ùðé ðúóí ðí POP ùóí έάέ ðí IMAP íáðááβáíðí ðέçñíðíñβáð ùðùð ðí ùíñíá ÷ñðóç έάέ ðíí έùάέέù óá ïññòð áðέíγ έάέíÝíð. Ἀðóù óçíáβíáέ ùðé áí έΥέάðá íá áóóάέβóáðá ðç íáðὐάíóç ðέçñíðíñέðí íÝóù áðòðí ðùí δñùðíέùέέùí, έá δñÝðáέ íá ðáñὐóáðá áðòÝð ðéð óðíáÝóáέð íÝóù ðíð ssh(1) (tunneling) ð íá ÷ñçóέíðíέððóáðá SSL. Ḷ áέáάέέάóβá tunneling ðáñέáñὐóáðáέ íá έáððíÝñáέá ððí Ὀíðíá 15.11.8 έάέ ðí SSL ððí Ὀíðíá 15.9.

29.2.4.2 Ḷññóááóç óá ὈíðέέÝð Ἐðñβááð Ὀά÷δññíáβíð

Ἰðíñáβðá íá Ý÷áðá ðíðέέð ðññóááóç óðéð έðñβááð óá÷δññíáβíð ÷ñçóέíðíέððíóáð áðáðέáβáð έὐðíέí ðññáñáííá áðíóðíέðð/έðøçð (MUA) óðíí áíððçñáðçðð ðíð áβíáέ áðíέççέáðíÝíáð. Ἐάðὐέέççέáð áóáñííáÝð áέá áðóù ðí óέíðù áβíáέ ð.÷. ðí **mutt** ð ðí mail(1).

29.2.5 Ἰ Ἀíððçñáðçðð Mail

Ἀíððçñáðçðð mail έáññáβóáέ í ððíέíáέóððð í ðíðíβíð áβíáέ ððáγέòíðð áέá ðçí ðáñὐáíóç έάέ έðøç mail áέá ðíí ððíέíáέóðð óáð, έάέ áíáá÷ñíÝíðð áέá ðí áβέððí óáð.

29.3 Ḷýέíέóç ðíð sendmail

Ὀí sendmail(8) áβíáέ í ðñíáðέέέáñÝíðð Ἀíðέðññóùððíð Ἰáðáóíñὐð Ὀά÷δññíáβíð (Mail Transfer Agent, MTA) óðí FreeBSD. Ἀíðέέέὐ ðíð áβíáέ íá äÝ÷áðáέ ðí email áðù ðíðð Ἀíðέðñíðððíðð Email ×ñðóç (Mail User Agents, MUA) έάέ íá ðí ðáñááβááέ óðí έáðὐέέççέí mailer ðíð ïñβέáðáέ óðí áñ÷áβí ððέíβóáùí ðíð. Ὀí **sendmail** ïðíñáβ áðβóçð íá áá÷έáβ óðíáÝóáέð áέέðγíð έάέ íá ðáñááððáέ ðí mail óá ðíðέέÝð έðñβááð ð έάέ óá έὐðíέí ὐέέí ðññáñáííá.

Ὀí **sendmail** ÷ñçóέíðíέáβ ðá áέùέíðέá áñ÷áβá ððέíβóáùí:

¼íñíá Ἀñ÷áβíð	Ἐάέóíðñáβá
/etc/mail/access	Ḷ áὐóç áááñÝíúí ðññóááóçð ðíð sendmail .
/etc/mail/aliases	Ḷ áññíγíέá (aliases) áέá ðéð έðñβááð (Mailboxes)
/etc/mail/local-host-names	Ἐβóðá ðùí ððíέíáέóððí áέá ðíðð ðíðíβíð ðí sendmail äÝ÷áðáέ mail
/etc/mail/mailer.conf	Ḷ ððέíβóáέð ðíð ðñíáñὐíáðíðð mailer
/etc/mail/mailertable	Ḷ βíáέáð ðáñááùóáùí ðíð mailer
/etc/mail/sendmail.cf	Ὀí έáíðñέέù áñ÷áβí ððέíβóáùí ðíð sendmail
/etc/mail/virtusertable	Ḷ βíáέáð áέέííέέðí ÷ñçóððí έάέ ðáñέí÷ðí (domains)

29.3.1 /etc/mail/access

Ḷ áὐóç áááñÝíúí ðññóááóçð έáέíñβέáέ ðíέíέ ððíέíáέóððð ð áέáðέγíóáέð IP Ý÷íðí ðññóááóç óðíí ðíðέέù áíððçñáðçðð mail έάέ ðé áβáíðð ðññóááóç Ý÷íðí. Ḷ έáðá÷ðñçóç áíùð ððíέíáέóðð ðíðíñáβ íá Ý÷áέ ðéð áðέέíáÝðð OK, REJECT, RELAY ð áðέὐ íá ïáðááέáὐέáέ ðíí Ýέáá÷í óðç ðíððβíá áέá÷áβñέóçð έáέðí ðíð **sendmail** ïá έὐðíέí óóáέέñέíÝíí óðὐέíá. Ἰέ ððíέíáέóððð ðíð áβíáέ έáðá÷ññçíÝííέ íá ðçí áðέέíáð OK, ç ðíðíá áβíáέ έάέ ç ðñíáðέέέáñÝíç,

ἀδέοήΥδαοάέ ίά οάβεηοί email οά αδοὐ οη δθεηάεοδP, αοὐοήη η δάεέεεὐδ δηηηέοηὐδ οηο ηεηήαοηδ άβηάέ οη οηδέεη ηε÷ὐήηά. Ιέ δθεηάεοδΥδ δηο άβηάέ έαοά÷ηηεηήΥηέ ηά οεη άδέεηάP REJECT αδηηηδδοηηοάέ έά έδηέάαPδηοά άδέεηηηηά Υ÷άέ ίά εὐηάέ ηά ηάοὐαηοε mail. Ιέ δθεηάεοδΥδ δηο άβηάέ έαοά÷ηηεηήΥηέ ηά οεη άδέεηάP RELAY, Υ÷ηοη οε αοηάοὐοεοά ίά οάβεηοί mail δηο δηέάαPδηοά έαοάεοηοε ηΥοὐ οηο οάέάεηέηΥηηο άηοδεηάοεδP.

Δάηὐάέεάηά 29-1. Ἠήεοέο οεο Ἀὐοεο ἈάηηΥήηη Δηὐοάάοεο οηο sendmail

cyberspammer.com	550 We do not accept mail from spammers
FREE.STEALTH.MAILER@	550 We do not accept mail from spammers
another.source.of.spam	REJECT
okay.cyberspammer.com	OK
128.32	RELAY

Ὀά αδοὐ οη δάηὐάέεάηά Υ÷ηοη δΥηοά έαοά÷ηηPοάέδ. Ιέ έάοδεηήοάέδ δηο οάβηηοάέ οοεη άηέοοάηηP δεάοηὐ οηο δβηάέά, αδεηάὐεηηοάέ αδὐ οε άηΥηάέά δηο οάβηηοάέ οοεη άηέεὐ δεάοηὐ. Ὀά δηηοά έηη δάηάάβάηάοά, αδέοοήΥοηοη ሃηά έαέεη οοὐεηάοηο οοεη ηηοδβηά έά÷άβηέοδ έάεηη οηο **sendmail**. Ὀη ηPηοηά έέοδδηηάοάέ οοηη αδηηάεηοηηηη δθεηάεοδP, ηοάη οη mail δηο έάηάὐηάοάέ άηPεάέ οά εὐδηέά αδὐ οέο έαοεάηηηάδ οεο άηέοοάηηP δεάοηὐδ οηο δβηάέά. Ḃ άδὐηάεε έαοά÷ηηεηήΥηέ οδ ηάηάέάαP mail αδὐ ሃηά οάέάεηέηΥηη δθεηάεοδP οοη Internet, οηη another.source.of.spam. Ḃ άδὐηάεε έαοά÷ηηεηήΥηέ εὐηάέ έάέδΥδ οέο οοηάΥοάέδ mail αδὐ οηη δθεηάεοδP okay.cyberspammer.com, οη ηηηά οηο ηδβηο δηηοάέηηηεάοάέ έεηέάΥοοάηά οά ο÷Υοε ηά οε άηάηηP cyberspammer.com δηο άβάηά δάηάδὐη. ἈάηηΥδ δηο έάεηηβεηοη ηηηάοά ηά ηάάέηοάηε, ሃ÷ηοη δηηοάηάέοεοά οά ο÷Υοε ηά δει άηάεηάαδ. Ḃ δάέάοδάβά έαοά÷ηηεηήΥηέ αδέοηΥδάέ οεη άηάοὐαηοε (relaying) εεάεοηηέεηη οά÷οάνηάβηο αδὐ δθεηάεοδΥδ ηά έάοδεηήοάέ IP δηο ηάέεηὐηά ηά 128.32. Ιέ δθεηάεοδΥδ αδοηβ, ηδβηηηή ίά οάβεηοί mail ηΥοὐ οηο οάέάεηέηΥηηο άηοδεηάοεδP, οη ηδβηηά έάοάδεηήοάέ οά ሃεεηοδ άηοδεηάοεδΥδ οά÷οάνηάβηο.

Ὀά δάηδδοὐοε άηάηΥοεοδ αδοηη οηο άη÷άβηο, έά δηΥδάέ ίά έέοάέΥοάοά οεη άηοηεP make οοη έάοὐεηηά /etc/mail/άέά ίά άηάηηPοάοά οε Ἀὐοε αάηηΥήηη.

29.3.2 /etc/mail/aliases

Ḃ Ἀὐοε αάηηΥήηη οηη δάηηοδβηη (aliases), δάηεΥ÷άέ ηέά έβοοά αδὐ άέεηηέέΥδ εοηβάαδ οά÷οάνηάβηο δηο άδάέοάβηηοάέ οά ሃεεηοδ ÷ηPοάοδ, άη÷άβά P έάέ ሃεεά δάηηηηέά. Ιάηέεὐ δάηάάβάηάοά ÷ηPοεοδ οηο /etc/mail/aliases οάβηηοάέ δάηάέὐδ:

Δάηὐάέεάηά 29-2. Δάηηηηέά Mail

```
root: localuser
ftp-bugs: joe,eric,paul
bit.bucket: /dev/null
procmail: "|/usr/local/bin/procmail"
```

Ḃ ηηηοP οηο άη÷άβηο άβηάέ αδεP. Ὀη ηηηά οεο εοηβάαδ άηβοέάοάέ οοεη άηέοοάηηP δεάοηὐ οεο ሃηη-εὐδὐ δάέάβάδ, έάέ άδάέοάβηηοάέ οοηη δηηηέοηὐδ δηο άηβοέάοάέ οοεη άηέεὐ δεάοηὐ. Ὀη δηηοη δάηὐάέεάηά, αδεηδ ηηβεάέ ηοέ ε εοηβάά οηο ÷ηPοεο root έά άβηάέ οεη δηάηάδεέηοεοά ε εοηβάά localuser. Ἀέά οεη εοηβάά αδοP, άβηάοάέ ηάηὐ άηάεPοεοε οοε Ἀὐοε αάηηΥήηη οηη δάηηοδβηη. Ἀη άη άηάεάβ ሃεεη ηηηά δηο ίά δάεηεὐεάέ, οη ηPηοηά έά δάηάηεάβ οοηη οηδέεη ÷ηPοεο localuser. Ὀη άδὐηάηη δάηὐάέεάηά αάβ÷ηάέ ηέά έβοοά οά÷οάνηάβηο. Ὀά ηεηήαοά δηο αδάοεηηηοάέ οοε εοηβάά ftp-bugs, έάοάδεηηηοάέ οά οηάέο οηδέέΥδ εοηβάαδ, οέο joe, eric έάέ paul. ὈεηάεPοοά ηοέ άβηάέ αοηάοὐη ίά έάεηηέοοάβ ηέά αδηηάεηοηηηε εοηβάά ÷ηPοεηηδβηηοάδ οε ηηηοP <user@example.com>. Ὀη άδὐηάηη δάηὐάέεάηά,

`ãàß-íáé` ðò ìðíñáß íá ãßíáé ãããñáöÐ ðíò `mail` óá `Ýíá` ãñ-ãßí, óöç óðãããñéíéÝíç ðãñßððòóç ðí `/dev/null`. Õí óããððóãßí ðãñÙããéãíá, ããß-íáé ðò ãßíáðáé ç áðíóðíεÐ `mail` ðñò `Ýíá` ðññãñííá. Õí ðãñÙããéãíá áðòí, ðí íðíðíá ãñÙããðáé óöçí óððíðíεçíÝíç ãßóíãí (standard input) ðíò ðñíãñÙííáðíò `/usr/local/bin/procmail` ðñçóçííðíεðíóáð `Ýíá` UNIX pipe.

ËÙεã ðññÙ ðíò ãßíáðáé áçíÝíñòóç áðíóç ðíò ãñ-ãßí, εã ðñÝðáé íá ãéðãããðáð ççí áíóíεÐ `make` óðíí εãðÙεíãí /etc/mail/, ðððá íá áçíãññèãß ç áÙóç ãããñÝíí.

29.3.3 /etc/mail/local-host-names

ðññéãéðáé áéá íεá εβóðá áðu ííííáðá ððíεíãéðóðí, ççí íðíßá ðí `sendmail(8)` εã `ãÝ-áðáé` ðò ííííáðá áéá ðí ðíðéçí ìç-Ùíçíá. Õíðíεãðððá óá áððí ðá ííííáðá ðí ððíεíãéðóðí Ð ðí ðñÝíí áéá ðíðò íðíßíðò εÝεãðá ðí **sendmail** íá εáíãÝíáé `mail`. Áéá ðãñÙããéãíá, áí í óðãããñéíéÝííð áíðççñãðçððò `mail` ðññéãéðáé íá εáíãÝíáé `mail` áéá ðí ðñÝí `example.com` εáé áéá ðí ððíεíãéðóð `mail.example.com`, ðí ãñ-ãßí `local-host-names` εã ííεÙããé íá ðí ðãñéÙð:

```
example.com
mail.example.com
```

ËÙεã ðññÙ ðíò áçíãñííáðáé áðòí ðí ãñ-ãßí, εã ðñÝðáé íá ãßíáðáé áðáíãéβíçóç ðíò `sendmail(8)` áéá íá áéáãÙóáé ðéð áéããÝð.

29.3.4 /etc/mail/sendmail.cf

Õí `sendmail.cf` ãßíáé ðí εáíðñéçí ãñ-ãßí ððèíβóáí ðíò **sendmail**. Õí ãñ-ãßí áðòí ððèíβáéä çç óðñíεéÐ óðíðãñéðññÙ ðíò **sendmail**, ðíò ðãñéãíáÙíáé íáðáíç Ùεçíí ççí áðáíãããñáöÐ ãéãðéçíóáíí éáé ççí áðíóðíεÐ ìçíðíÙðí ãðíññεçð ðñò ãðíãéñðóíÝííð áíðççñãðçðÝð `mail`. Éãεð ðí ãñ-ãßí áðòí ðãñéÝ-ãé ðí ðíðíãéãéÝð ððèíβóáéð, ãßíáé ðððéçí íá ãßíáé ãñéãðÙ ðíéçðéíεí εáé íé εãðòíÝíãéáð ðíò ãßíáé Ýí ãðu ðí óéíðí áðððò çç ãíúççðáð. Áððð-ð, áðòí ðí ãñ-ãßí óðÙíεá ð-ñãéÙããðáé íá áéãá-εãß óá ðððéçíçí ãíðççñãðçðÝð `mail`.

Õí ááóéçí ãñ-ãßí ððèíβóáí ðíò **sendmail** ìðíñáß íá ðãñá-εãß ìá çç áíðεáéá ìáεñíáíóíεðí ççðíðò `m4(1)` ðíò εáéíñβáéíð çç óðíðãñéðññÙ éáé ðá ð-ãñáéðçñéóðéçí ðíò **sendmail**. Áéá ðãñéóóóðãñáð ðççñíðññãð, ðãñáéáéçíçá áéããÙóáð ðí `/usr/src/contrib/sendmail/cf/README`.

Áéá íá εó-ççí ðí íé áéããÝð ðíò εÙíáðá óá áðòí ðí ãñ-ãßí, εã ðñÝðáé íá áðáíãéçíβóáðá ðí **sendmail**.

29.3.5 /etc/mail/virtusertable

Õí ãñ-ãßí `virtusertable` áíóéóðíε-ãß áéãðéçíóáéð `mail` áéçííεçí ðñÝíí óá ðñãñíáðéçÝð εçñßãáð óá-ðãñíãßíò. Íé εçñßãáð áðÝð ìðíñáß íá ãßíáé ðíðéçÝð, áðíãéñðóíÝííð, ðãñííçíεá ðíò `Ý-íðí` ìñéóóãß óðí /etc/mail/aliases, Ð ãñ-ãßí.

ðãñÙããéãíá 29-3. ðãñÙããéãíá Áíóéóðíβ-çççð Mail Áéçííεçíçí ÕñÝá

root@example.com	root
postmaster@example.com	postmaster@noc.example.net
@example.com	joe


```
sendmail_enable="NO"
sendmail_submit_enable="NO"
sendmail_outbound_enable="NO"
sendmail_msp_queue_enable="NO"
```

óði /etc/rc.conf.

Άί èÝεάοά ίά άðáñáñáðíέΠρóaοά ίιííí όçí ððçñάóá áέόáñ ÷ñÝíúí όίò **sendmail** εά ðñÝðáέ ίά èÝόάοά:

```
sendmail_enable="NO"
```

óði /etc/rc.conf. Ðáñέόόúðáñáð ðέçñíöíñβáð áέά όέð áðέεíäÝð áέέβίçόçð όίò **sendmail**, áέάðβεáίόάέ áðu όçí áίðβóðίέ÷ç óάέβáá manual, rc.sendmail(8).

29.4.3 Άέέβίçόç όίò ÍÝíò óάò MTA εάοÛ όçí Άέέβίçόç

Όί íÝí óάò MTA εά ίáέέíÛάέ εάοÛ όçí áέέβίçόç, άί ðñíòεÝόάοά ίέá εάοÛέέçç ãñáññ όóί áñ÷áβι /etc/rc.conf. Ááβóá όι ðáñáéÛóù ðáñÛááéáíá áέá όι **postfix**:

```
# echo 'postfix_enable="YES"' >> /etc/rc.conf
```

Όí MTA εά ίáέέíÛάέ ðεÝíí εάοÛ όçí áέέβίçόç.

29.4.4 Άίόέέáέέόòπíόáò όί sendmail áðu ÐñíáðέέáñÝíí Mailer ÓóóðΠíáόò

Όί **sendmail** áβíáέ όúóι áíúόóú ùð óóÛíóáñ έíáέόίέέú όόά óóóðΠíáόά UNIX, þóá ðίεεÛ Ûέά ðñíáñÛíáόá εáπñίýí úóέ áβíáέ Þáç ááέáðáόόçíÝí έáέ ñέίέíóíÝíí. Άέά όι εüáí áóóú, ðίεεÛ áíáέέáέóέέÛ MTA ðáñÝ ÷íóí áέέÝð όίòð óóíááóÝð óεíðίέΠρóaέð όίò **sendmail**. Íé óεíðίέΠρóaέð áóóÝð ðáñÝ ÷íóí ðáñúñíέí óýñíέí áíóίεþí, έáέ ίðñíýí Ýóóέ ίá ÷ñçóέñðίέçέýí þóá ίá áίóέέáóáóóΠóίóí “áðáðéáβáð” όι **sendmail**.

Άέά όι εüáí áóóú, άί ÷ñçóέñðίέçéáβóá εÛðίέí áíáέέáέóέέú mailer, εά èÝεάοά ίá áíáόóáέβóáόá úóέ Ûέá ðñíáñÛíáόá όίò ðñíóðáέíýí ίá áέóáέÝόίóí óá óððέέÛ áέóáέÝόέίá όίò **sendmail** úðùð όι /usr/bin/sendmail, έá áέóáέÝόίóí óóçí ðñáñíáόέέúóçóá όίí áðέέáñÝíí óáò mailer. Άðóð÷þð, όι FreeBSD ðáñÝ ÷άέ Ýíá óýόóçíá ðίò έáέáβóá mailwrapper(8) έáέ όι ίðñι áíáέáíáÛíάέ áóðΠ όç äüðéáέÛ áέá óáð.

¼óáí όι **sendmail** έáέóίòñááβ úðùð Ý÷áέ ááέáóáóóáέáβ áñ÷έέÛ, έá áñáβóá εÛóέ úðùð όι ðáñáéÛóù óóí /etc/mail/mailler.conf:

```
sendmail /usr/libexec/sendmail/sendmail
send-mail /usr/libexec/sendmail/sendmail
mailq /usr/libexec/sendmail/sendmail
newaliases /usr/libexec/sendmail/sendmail
hoststat /usr/libexec/sendmail/sendmail
purgestat /usr/libexec/sendmail/sendmail
```

Άóóú óçíáβíáέ úóέ úóáí áέóáέáβóáέ εÛðίέá áðu áóóÝð óέð óóίçέóίÝíáð áíóίεÝð (úðùð όι βáέί όι sendmail), όí óýόóçíá óóçí ðñáñíáóέέúóçóá áέóáέáβ Ýíá áíóβáñáóí όίò mailwrapper ðίò íñÛáόáέ sendmail, έáέ όι ίðñι áέÝá÷áέ όι mailer.conf έáέ áέóáέáβ όí /usr/libexec/sendmail/sendmail áίðβ áóóíý. Όí óýόóçíá áóóú áέáðέñέýíáέ έáέáβóáñá όçí áέέááΠ óúí áέóáέÝόέíúí ðίò áέóáέñýíόáέ óóçí ðñáñíáόέέúóçóá úóáí áβίáόáέ έεΠόç όúí ðñíáðέέáñÝíúí έáέóίòñáέþí όίò sendmail.

ρóέ, áí εÙεὰòá íá áêòáêáßòáέ õì /usr/local/supermailer/bin/sendmail-compat áίòß áέá õì **sendmail**, εά ìðñíñγóáòá íá áέèÙíáòá õì /etc/mail/mailer.conf þóðá íá ãñÙòáέ:

```
sendmail /usr/local/supermailer/bin/sendmail-compat
send-mail /usr/local/supermailer/bin/sendmail-compat
mailq /usr/local/supermailer/bin/mailq-compat
newaliases /usr/local/supermailer/bin/newaliases-compat
hoststat /usr/local/supermailer/bin/hoststat-compat
purgestat /usr/local/supermailer/bin/purgestat-compat
```

29.4.5 Ìεíεèçñþííòáò

Ìüεέò Ý÷áòá ñðεìßòáέ óá ðÙíóá ùðùò áðέèòíáßòá, ìðññáßòá áßòá íá εÙíáòá kill óέð áέáñááóßáò õìð **sendmail** ðìð ááí÷ñáεÙεáòòá ðεÝíí εάέ íá áέέεíßòáòá óέð áίòßòóíε÷áð õìð íÝíò óáð εíæέóíεèíγ, Þ áðεþð íá εÙíáòá áðάíáεέßíçç. Ç áðάíáεέßíçç εά óáð áþóáέ áðßòçð óçí áðεάέñßá íá ááááέùεáßòá ùóέ õì óýóóçíá óáò Ý÷áέ ñðεíεóòáß óúóóÙ, þóðá õì íÝí óáò MTA íá íáέέíÙáέ áðòùíáòá óá εÙεá áέέßíçç.

29.5 Áίóέìáòþðέóç ðñíáεçìÙòùí

1. Άέáóòß ðñÝðáέ íá ÷ñçóέííðíεþ õì ðεÞñáð ùññά (FQDN) áέá ððíεíæέóòÝð ðìð áñßòέííðáέ óòíí òñÝá ììò;

Òì ðεí ðεεάíí áßíáέ íá áέáðέóòþòáòá ùóέ í ððíεíæέóòþð áñßòέáòáέ óòçí ðñάáíáóέèùòçðá óá áέáòíñáòéèù òñÝá. Άέá ðáñÙááέáíá, áí áñßòέáòáòá óòì foo.bar.edu εάέ εÙεὰòá íá áðέέεíúíßòáòá ìá Ýíá ððíεíæέóòþð ìá õì ùññά mumble óòíí òñÝá bar.edu, εά ðñÝðáέ íá áíáòáñεáßòá óá áðòùíí ìá õì ðεÞñáð õìð ùññά, mumble.bar.edu, áίòß áέá áðεþð mumble.

ðáñάáíóέáέÙ, áðòù áðέòñáðùòáí áðù õìðð DNS resolvers õìð BIND. Ùóòùóí, ç ðñÝ÷íòóá Ýέáíóç õìð **BIND** ðìð ðáñεέáíáÙíáòáέ óòì FreeBSD, ááí ðáñÝ÷áέ ðεÝíí óóíòíñáγóáέð áέá íç-ðεÞñç ìíñíáòá òñÝúí, áέòùð áέá õìð ðñÝá óòíí ìðíßí áñßòέáòá. ρóέ, Ýíáò ððíεíæέóòþð ìá íç-ðεÞñáð ùññά mumble εά ðñÝðáέ íá áñáεáß ùð mumble.foo.bar.edu, Þ εά áßíáέ áíáεþðççç áέá áðòùíí óòì ñεáέèù òñÝá.

Ç óòìðáñεέòíñÙ áðòþ áßíáέ áέáòíñáòéèþ áðù óçí ðñíçáíγíáíç, ùðìð ç áíáεþðççç óòíá÷εáùòáí εάέ óòì mumble.bar.edu, εάέ õì mumble.edu. Ñßíòá ìέá ìáóέÙ óòì RFC 1535 áέá õì εüáí ðìð õì ðáñάðÙíù εáùñáßòá εάέþ ðñάέóέèþ, Þ áέùíá εάέ εáííú áóóáέáßáð.

íáð ðñùðìð áέá íá ðáñάέÙíòáòá õì ðñúáεçíá áßíáέ íá ðñíóέÝóáòá óç ãñáíñþ:

```
search foo.bar.edu bar.edu
```

áίòß áέá óçí ðñíçáíγíáíç:

```
domain foo.bar.edu
```

óòì áñ÷áßì /etc/resolv.conf. Άáááέùεáßòá ùóòùóí ùóέ ç óáέñÙ áíáεþðçççð ááí ðççάáßíáέ ðÝñά áðù õì “ùñέí ìáòáíγ òíðέéþð εάέ áçíùóέáð áέá÷áßñέóçð”, ùðùò õì áðíεáέáß õì RFC 1535.

2. Οι sendmail αβιάς οι IPσιλία mail loops back to myself (οι mail αδέσων Έοάε οιί αάοδου ιί)

Ç άδΰίόçόç οά αόδου, δδΰñ ÷ áε οιί FAQ οιō **sendmail** υδύδ οάβιάόάε δάνάεΰδου:

Έάλιαΰίυ αόδΰ οά ιçίγίλαόά εΰεϊδδ:

```
553 MX list for domain.net points back to relay.domain.net
554 <user@domain.net>... Local configuration error
```

Δύδ ιδινπ ιά εγού οι δñüâεçιά;

```
÷άοά εçδπόάε οι mail δñιδ Ψία οιΰΨία (δ.÷. οι domain.net) ιά
δñiüêâβδóáε δñid Ψία οóâêâñέιΨίι οδieiãέοδπ (οδçί δάνβδδύοç αδδπ
οι relay.domain.net) ÷ñçόέιιδιεπιόάδ iέα áãñáöπ MX, áεεΰ οι
ιç÷ΰίçιá áíáíáδΰáιόçδ (relay) ááí áíááίññβæáε οιί áάδδύ οιō υδ
domain.net. δñiόέΨόά οι domain.net οοι /etc/mail/local-host-names
[άβιάέ áíυδδύ υδ /etc/sendmail.cw δñέí οçί Ψέáιόç 8.10]
(άí ÷ñçόέιιδιεáβδó οι FEATURE(use_cw_file)), áεáοiñáδéεΰ δñiόέΨόά οι
"Cw domain.net" οοι /etc/mail/sendmail.cf.
```

Ίδινάβδó ιά άñάβδó οι FAQ οιō **sendmail** οçç áεáyέδίοç <http://www.sendmail.org/faq/>, έάε οοιβδóάόάε ιά οι άεάáΰόάόά άí εΨέάδó ιά "δάέñΰíáδó" δέδ ñδéιβδóάέδ οιō mail οάδ.

3. Δύδ ιδινπ ιά áεοάεΨού άιδδçñáδçδπ mail οά οδρειάέοδπ θρω οοίαΨάδóε ιΨού áδεεíäέεδδ ογίááόçδ PPP;

ΕΨέάδó ιά οοίαΨόάόά Ψία FreeBSD ιç÷ΰίçιá οά Ψία οιδέεü άβέδδi (LAN) οοι Internet. Οι FreeBSD ιç÷ΰίçιá έá άβιάε δγέç δá÷δάνñáβiδ άεά οι LAN. Ç ογίáάόç PPP άáí άβιάε άδiεεάέοέεπ.

Οδΰñ ÷ iοι οιδεΰ÷έοδii άγi δñüθiε áεá ιά οι εΰíáδó αόδii. Ί Ψíαδ άβιάε ιá οç ÷ñπóç UUCP.

ιάδ ΰεεiδ δñüθiδ άβιάε ιά áΰεάδó Ψία άιδδçñáδçδπ Internet i ιδιβiδ Ψ÷άε οοíá÷π ογίáάόç, ιά οάδ δάνΨ÷άε οδçñáδóá ááδδóñáγííοiδ MX áεá οιí δñΨά οάδ. Άέá δάνΰááéáíá, άí i δñΨάδ οçδ áδóέñβáδ οάδ άβιάε example.com έάε i δάνñ÷Ψά οάδ Internet Ψ÷άε iñβóáé οι example.net ιά δάνΨ÷άε οδçñáδóáδ ááδδóñáγííοiδ MX áεá οιí δñΨά οάδ:

```
example.com.           MX           10           example.com.
                       MX           20           example.net.
```

Ίυñ Ψíáδ οδρειάέοδπδ ιδινάβ ιά έάειñέοόάβ υδ οáεέéυδ δάνάεπδδóçδ (δñiόέΨόά οι Cw example.com οοι άñ÷άβi /etc/mail/sendmail.cf οοι example.com).

¼οάí οι ιç÷ΰίçιá θiδ οδΨέíáε ιΨού οιō sendmail δñiδδáéáβ ιά δάνáπóáε οι mail έá δñiδδáéπóáε ιά οοíááéáβ οοι áééü οάδ (example.com) ιΨού οçδ ογίáάόçδ modem. Οι δέi δέεάíü άβιάε υδé άáí έá οá έáδóόΨñáé, áεάδβ άáí έá άβδóά οοíááíΨíδ áéάβiç οç οδέáñπ. Οι **sendmail** έá οι δάνáπóáé άδδύiάδóά οδçί οδçñáδóá ááδδóñáγííοiδ MX, δ.÷. οιí δάνñ÷Ψά οάδ Internet (example.net). Οι ááδδóñáγíí MX έá δñiδδáéáβ δάνέíäέéΰ ιά οοíááéáβ οοι ιç÷ΰίçιá οάδ έάε ιά δάνáπóáé οι mail οοi έγñéí άiδδçñáδçδπ MX (example.com).

Ίδινάβδó ιά ÷ñçόέiñδiεπóáδó éΰδé υδύδ οι δάνάεΰδου υδ script áéóüäiδ:

```
#!/bin/sh
# Put me in /usr/local/bin/pppmyisp
( sleep 60 ; /usr/sbin/sendmail -q ) &
/usr/sbin/ppp -direct pppmyisp
```

Αί ðñυέαέοάέ ίá ÷ñçóεíñíéΡóáðá ÷ùñέóòυ script áέá ðçí áβóíñí èÙðíεíñ ÷ñΡóðç, ìðññáβòá ίá ÷ñçóεíñíéΡóáðá áíòβ áέá ðí ðáñáðÙíυ ðí sendmail -qRexample.com ðóí script. Αóðυ èá áíáíáέέÙóáέ ðçí Ùíáòç áðáíáñááóβá υέíñ ðíò mail ðóçí ðññÙ áέá ðí example.com.

Ðéí èáððòíñáñð ðáñέáñáòΡ ðçð èáðÙóáóçð ðáβíáóáέ ðáñáέÙòυ:

ÌΡíðíá áðu ðçí çäêðñíéèΡ èβòáá ðíò FreeBSD áέá ðíòð ðáñí÷áβ ððçñáóέβí Internet (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-isp>).

```
> ðáñÝ÷íðíá ááððáñáγíí MX áέá Υíá ðáέÙòç. Ì ðáέÙòçð ððíáΥáðáέ ððέð
> ððçñáóβáð ìáð áñέáðÝð ðíñÝð ðç ìΥñá áðòυíáðá, áέá ίá èáíáÙíáέ ðá email ðíò
> ðóí ðñùðáγíí ðíò MX (Ááí èáέίΥíá ðçí ðíðíèáóβá ðíò υðáí èáíáÙííðíá email
> áέá ðíí ðííΥá ðíò). Õí sendmail ìáð ðóΥέíáέ ðí mailqueue èÙèá 30 èáððÙ.
> Õç áááííΥíç ððέáìΡ èá ðñÝðáέ ίá ìáβíáέ ððíááíΥííð áέá 30 èáððÙ,
> áέá ίá áβíáέ áΥááέíð υðέ υέí ðí email ðíò èá Υ÷áέ
> ðáñááíèáβ ððíí ðñùðáγííðá MX.
>
> ÕðÙñ÷áέ èÙðíéá áíðíèΡ ðíò ίá áíáíáέέÙóáέ ðí sendmail ίá ððáβèáέ
> υέá ðá mails Ùíáóá; Ì ÷ñΡóðçð ððóέέÙ ááí Υ÷áέ áέέáέβíáðá
> root ððí ìç÷Ùíçíá ìáð.
```

Õðçí áíυðçðá "privacy flags" ðíò sendmail.cf, ððÙñ÷áέ Υíáð ìñέóìυð Opgoway,restrictqrun

ΑóáέñΥóðá ðí restrictqrun áέá ίá áðέðñÝðáðá ðá ìç-root ÷ñΡóðáð ìá ìáέέíΡðíðí ðçí áðáíáñááóβá ðçð ðññÙð.

Ìðññáβ áðβóçð ìá èΥέáðá ìá áíááέáðÙíáðá ðá MX. Αβíáóðá ðí ìí MX áέá áððíΥ ðíò áβáíðð ðíòð ðáέÙòáð, èáέ Υ÷íðíá ìñβóáέ:

```
# If we are the best MX for a host, try directly instead of generating
# local config error.
OwTrue
```

Ìá ðíí ðññðí áðòυ, Υíá áðíáέñðóìΥíí site èá ðáñááβááέ áðáðèáβáð ðá ðáð, ÷ññβ ìá ðñíððáέáβ ðç ðΥíááòç ìá ðí ÷ñΡóðç. Ðáέðá ðá ðóΥέíáðá ððíí ðáέέÙòç ðáð. Αóòυ èáέðíðñááβ ìυíí áέá "ìç÷áíβíáðá", èáέ Υðóέ ÷ñáέέÙæáðáέ ìá áÙèáðá ðíí ðáέέÙòç ðáð ìá ìííìÙóáέ ðí ìç÷Ùíçíá ðíò mail "customer.com" èáέ áðβóçð "hostname.customer.com" ððí DNS. Αðέβð ðñíðέΥóðá ìέá áááñáòβ ðΥðíð A ððí DNS áέá ðí "customer.com".

4. Αέáðβ èáíáÙíυ ðóíΥ÷áέ ìçΥíáðá èÙèíðð Relaying Denied υðáí ðóΥέíυ mail áðu Ùέèíðð ððíéáέóóÝð;

Õðέð ðñíáðέέáñíΥíáð ááέáðáðóÙóáέð ðíò FreeBSD, ðí **sendmail** áβíáέ ððέíέðíΥíí ìá ðóΥέíáέ mail ìυíí áðu ðíò ððíéáέóðβ ðóí ððíβí áέðáέáβóáέ. Αέá ðáñÙááέáíá, áí ððÙñ÷áέ áέáέΥóέíñ ðáέέñέóðβð POP, ìέ ÷ñΡóðáð èá ððñíΥí ìá áέΥá÷íðí ðí mail ðíòð áðu ðí ð÷íèáβí, ðí áñáóáβí, Ρ Ùέèç áðñáέñðóíΥíç ðíðíèáóβá, áέέÙ èá áñáέíèðèéΥí ìá ìç ððñíΥí ìá ððáβèíðí ðñíð áíυðáñέέÝð áέáðèΥíóáέð. ÕððέέÙ, èβáí ìáðÙ áðu ìέá áðuðáέñá áðíððíèðð, èá ððáέáβ Υíá email áðu ðí **MAILER-DAEMON** ìá ðí ðíðíá èÙèíðð 5.7 Relaying Denied.

ÕðÙñ÷íðí èέÙòíñíé ðñυðíé áέá ìá ìáðáñÙóáðá ðí ðñυáέçíá. Ì ðèΥíí áðευð áβíáέ ìá áÙèáðá ðç áέáγέðíðç ðíò ISP ðáð ðá Υíá áñ÷áβí relay-domains, /etc/mail/relay-domains. Íáð áñΡáñíð ðñυðíð áέá ìá ðí èÙíáðá áðòυ áβíáέ:

```
# echo "your.isp.example.com" > /etc/mail/relay-domains
```

ΆοήϚ άϘέιρτὸηάΡόαόά Ρ άδάρτὸηάάόοάβόά άόοϚ οί άη÷άβη, έά δὸηΎδάρ έά άδάρτὸηέέίΡόαόά οί **sendmail**. ΆόοϚ άτὸέάγάρ έέά ÷άηϚ άί άβόά άέά ÷άέέέόοΡ άτὸδϘὸήάόϘΡ έέέ άάρ άδέέοίάβόά έά οόΎέίάόά mail οίδέέϚ, Ρ άί έΎέάόά έά ÷ήϘόέηδίέΡόαόά Ύίά ογόόϘίά ογδίρ point έέέ click οά Ύίά Ϛέέί Ϙ÷ϚίϘίά Ρ άέϚϚά έέέ οά Ϛέέί ISP. Άβίάέ άδβόϘ δίέϚ ÷ηΡόέη άί Ύ ÷άόά ηόέιβόάέ ϚϚί Ύίά Ρ άγί έτάρτὸηέοήϚ mail. Άί έΎέάόά έά δὸηίόέΎόάόά ϚάάέϚόάηη άηέέϚ έέάόέγίόάϚ, Ϛδὸηάβόά άδέΡ δά άηβίάόά άόοϚ οί άη÷άβη Ϛά οί άδέέοίϘόϚ οόίόϚέοϘ έέέΎίρ, έέέ έά δὸηίόέΎόάόά Ϛέέο δίρ δὸηάβδ, Ύίά οά έϚέά άήάηΡ:

```
your.isp.example.com
other.isp.example.net
users-isp.example.org
www.example.org
```

Ορὸηά, Ϛδίέάβδτὸά άδίόόίέΡ mail άδϚ οί ογόόϘίά οά άδϚ Ϛδίέάβδτὸά δδτὸηέέόοΡ άόοΡ δϘδ έβόόάδ (Ϛά δϘί δὸηϚδϚέάοΡ ÷ηΡόόϘδ έά Ύ÷άέ έτάρτὸηέόϚ οόί ογόόϘίά οάδ), έά άβίάέ άδέόδ÷Ρδ. δὸηέάέόάέ άέά Ύίά δίέϚ έέέ οήϚδί έά άδέδὸηΎόάόά οδίρδ ÷ηΡόόάδ έά οόΎέίρδί mail άδϚ οί ογόόϘίά οάδ ϚΎού άδὸηέηόοίΎίϘδ ογίάάόϘδ, ÷ηβδ έά άδέδὸηΎδάόά οά Ϛέέίρδ έά οόΎέίρδ SPAM ϚΎού οίρ οόόδΡτὸίρδ οάδ.

29.6 δὸηί÷ήϘίΎίά ΈΎίάόά

ϘέέϚέοδ άτϚόόά έέέδδάρ δέη δὸηί÷ήϘίΎίά έΎίάόά, ϚδϚδ δϘ ηγέίέοϘ οίρ mail έέέ ηόέιβόάέ άέά Ύίά τέϚέέηη οήΎίά.

29.6.1 ΆάόέέϚδ Ḧόέιβόάέδ

×ηβδ έά ÷ηάέόόάβ έϚίάόά έάέϚ ηγέίέοϘ, έά Ϛδὸηάβόά έά οάβέάδά mail δὸηίρ άτϚόάηέέίγδ δδτὸηέέόοϚδ, άηέάβ έά Ύ÷άόά ηόέιβόάέ οί /etc/resolv.conf Ρ έά έέόάέάβόά οί άέέϚ οά άτὸδϘὸήάόϘΡ DNS. Άί έΎέάόά Ϛ δάηάέίηϚέίάδ mail άέά οίρ δδτὸηέέόοΡ οάδ οοί άέέϚ οάδ **sendmail** MTA, δδϚ÷ήρ Ϛή Ϛέέίρ:

- Ϛδὸηάβόά έά Ύ÷άόά άέέϚ οάδ οήΎίά έέέ άέέϚ οάδ άτὸδϘὸήάόϘΡ DNS άέά οίρ οήΎίά οάδ. Άέά δάηϚάέέίά, `FreeBSD.org`
- Έά δάηάέίηϚέίάδ mail άδδδέάβδδ οοί Ϙ÷ϚίϘίά οάδ. ΆόοϚ άβίάέ άί οί mail δάηάάβάάέ άδδδέάβδδ οοί δδτὸηέέόοΡ οάδ, ÷ήϘόέηδίέΡίόάδ οή Ϛήά οίρ (δὸηΎδάρ έά άηβόέάόάέ οοί DNS). Άέά δάηϚάέέίά, `example.FreeBSD.org`.

¼δίέά άδέέτϚ άδϚ οέδ δάηάδϚϚ έέέ έά έϚίάόά, άέά έά άβίάέ άοίάοΡ Ϙ δάηάέάδ mail άδδδέάβδδ οοίρ δδτὸηέέόοΡ οάδ, έά δὸηΎδάρ έά Ύ÷άόά ϚέίϘ οάάόέέΡ άέάγέόίοϘ IP (Ϛ÷έ άόίάέέΡ, ϚδϚδ άβίάέ τέ δάηέόοϚδάηδ άδέέτϚέέϚδ οοίΎίάέδ PPP). Άί άηβόέάόά δβó άδϚ έϚδίέ firewall, έά δὸηΎδάρ έά άδέδὸηΎδάρ δϘ έέέβίϘοϘ SMTP δὸηίρ άόϚδ. Άί έΎέάόά έά έάηϚέίάδ mail άδδδέάβδδ οοίρ δδτὸηέέόοΡ οάδ, έά δὸηΎδάρ έά άίάόάέβόάά *Ύίά* άδϚ δά δάηάέϚδ:

- Έά άάάέέέάβόά Ϛέέ Ϙ άάάάοΡ MX (Ϛά οί ÷άϘέϚϚάηη άηέέϚϚ) οοί DNS οάδ, άάβ÷έάέ δὸηίρ δϘ άέάγέόίοϘ IP οίρ Ϙ÷ϚίϘίρδ οάδ.
- Έά άάάέέέάβόά Ϛέέ άάρ δδϚ÷ήρ έέ έάέϚ άάάάοΡ MX οοί DNS άέά οίρ δδτὸηέέόοΡ οάδ.

¼δίέί άδϚ οά δάηάδϚϚ έέέ άί έϚίάόά, έά Ϛδὸηάβόά έά έάηϚέίάδ mail άδδδέάβδδ οοίρ δδτὸηέέόοΡ οάδ.

Αν θέλετε να δοθεί:

```
# hostname
example.FreeBSD.org
# host example.FreeBSD.org
example.FreeBSD.org has address 204.216.27.XX
```

Αν θέλετε να δοθεί το mail, το `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org` (αυτό είναι το όνομα που στέλνει το `sendmail` στο `example.FreeBSD.org`).

Αν θέλετε να δοθεί το mail, το `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org`:

```
# host example.FreeBSD.org
example.FreeBSD.org has address 204.216.27.XX
example.FreeBSD.org mail is handled (pri=10) by hub.FreeBSD.org
```

Οι `example.FreeBSD.org` έχουν το όνομα `example.FreeBSD.org` (αυτό είναι το όνομα που στέλνει το `sendmail` στο `example.FreeBSD.org`) και `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org`.

Ο `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org` και το `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org`. Ο `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org` και το `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org`.

Ο `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org` και το `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org`.

```
freefall MX 30 mail.crl.net
freefall MX 40 agora.rdrop.com
freefall MX 10 freefall.FreeBSD.org
freefall MX 20 who.cdrom.com
```

Ο `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org` και το `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org`.

Ο `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org` και το `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org`.

29.6.2 Mail και οι Όροι Όραση

Αν θέλετε να δοθεί το mail, το `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org` (αυτό είναι το όνομα που στέλνει το `sendmail` στο `example.FreeBSD.org`).

Ο `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org` και το `example.FreeBSD.org` έχει το όνομα `example.FreeBSD.org`.

Ï mailhost ðìò εὰ ÷ñçóεìðìεðóáðá, ðñÝðáε íá áβíáε òì εáεìñεóìÝñì ìç÷Ùíçìá áεá òçì áíóáεεááβ ìçìòìÙòùì áεá εÙεá óðáεèù áñááóβáð òìò áεéðýìò. Áðòù áβíáðáε óðεð ñðεìβóáεð DNS ìá òìí áεùεìòεì òñùðì:

```
example.FreeBSD.org      A      204.216.27.XX ; Workstation
                          MX  10 hub.FreeBSD.org ; Mailhost
```

Ïá òìí òñùðì áðòù, òì mail ðìò εáóáðèγíáðáε ðñìò εÙðìεì óðáεèù áñááóβáð εá áíáεáðáðεèεíáβ ðñìò òì mailhost, Ùò÷áðá ìá òì ðìò ááβ÷íáε ç áááñáóβ òýðìò Á. Òì mail óðÝεíáðáε ðñìò òìí òðìεíáεóðβ MX.

Ááì ìðìñáβðá íá εÙíáðá òì ðáñáðÙíù, áí ááì áεðáεáβðá òì áεéù óáð áìòðçñáðçðβ DNS. Áí áðòù ááì óðìááβíáε, εáε ááì ìðìñáβðá íá òì áεεÙíáðá, óðìáíñçεáβðá ìá òìí ðáññ÷Ýá óáð (ISP) β ìá ùðìεìí óáð ðáññÝ÷áε òðçñáóβáð DNS.

Áí ðáññÝ÷áε òðçñáóβáð áεεìεεéγ òá÷ðáññáβìò, ìε ðáñáεÙòù ðεçñìòìñáð εá óáð óáíýí ÷ñβóεíáð. Áεá òì ðáññÝááεεíá ìáð, εá òðìεÝóìòìá ùðε Ý÷áðá Ýíá ðáεÙòç ìá òì áεéù òìò òñÝá, óðçì ðáññððòòç ìáð òì customer1.org, εáε εÝεáðá ùεì òì mail áεá òì customer1.org ìá óðÝεíáðáε óðì áεéù óáð mailhost, mail.myhost.com. Ç εáðá÷ñεóç óáð óðì DNS εá ììεÙáε ìá òçì ðáñáεÙòù:

```
customer1.org  MX 10 mail.myhost.com
```

Óçìáεðóðá ùðε ááì ÷ñáεÙáðóðá áááñáóβ òýðìò Á áεá òì customer1.org áí εÝεáðá áðεð ìá ÷áεñβáεóðá email áεá áðòù òìí òñÝá.

Óçìáβòòç: Ìá Ý÷áðá ððùçç óáð ùðε ááì εá ìðìñáβðá íá εÙíáðá ping òì customer1.org áí ááì ððÙñ÷áε áεá áðòù áááñáóβ òýðìò Á.

Òì óáεáðóáβì ðñÙáìá ðìò ðñÝðáε íá εÙíáðá, áβíáε íá ìñβóáðá óðì **sendmail** ðìò áεðáεáβðáε óðì áεéù óáð mailhost, áεá ðìεìò òñáβð β / εáε ìç÷áíðíáðá εá äÝ÷áðáε mail. ÒðÙñ÷ìò ìáñéεìβ áεáðìñáðéεìβ òñùðìε áεá íá áβíáε áðòù. Ìðìñáβðá íá ÷ñçóεìðìεðóáðá Ýíáì áðù òìò ðáñáεÙòù:

- ðñìòεÝóðá òá ìç÷áíðíáðá óðì áñ÷áβì /etc/mail/local-host-names áí ÷ñçóεìðìεáβðá òç áðìáðùòçðá FEATURE(use_cw_file). Áí ÷ñçóεìðìεáβðá εÙðìεá Ýεáìòç òìò **sendmail** ðñéì òçì 8.10, òì áñ÷áβì áβíáε òì /etc/sendmail.cw.
- ðñìòεÝóðá ìεá ãñáìñ Cwyour.host.com óðì áñ÷áβì óáð /etc/sendmail.cf β óðì áñ÷áβì /etc/mail/sendmail.cf áí ÷ñçóεìðìεáβðá òçì Ýεáìòç 8.10 òìò **sendmail** β εÙðìεá ìáðáááíÝóðáñç.

29.7 SMTP ìá UUCP

Ç ðñìáðεεááíÝìç ñýεìòç òìò **sendmail** ðìò Ýñ÷áðáε ìá òì FreeBSD, ðñìñβáεðáε áεá áεéððáεÝð òìðìεáóβáð ðìò áβíáε áðáðεáβáð óðìáááìÝíáð óðì Internet. Óá ðáñéððóáεð ðìò áβíáε áðéèòìçðβ ç áíóáεεááβ email ìÝóù UUCP, εá ðñÝðáε íá ÷ñçóεìðìεçεáβ áεáðìñáðéεèù áñ÷áβì ñðεìβóáùì áεá òì **sendmail**.

Ç ÷áεñìεβìçðç ñýεìòç òìò áñ÷áβìò /etc/mail/sendmail.cf áíðεáε óðá ðñì÷ñçìÝíá εÝíáðá. Ç Ýεáìòç 8 òìò **sendmail** ðáññÝááε áñ÷áβá ñðεìβóáùì ìÝóù òìò ðñìáðáíáñááóðβ m4(1), ùðìò ìε ñðεìβóáεð áβìííðáε óá Ýíá áñðáññì áðβðááì áóáβñáóçð. Ìðìñáβðá íá áñáβðá òá áñ÷áβá ñýεìòç òìòm4(1) óðìí εáðÙεìáì /usr/share/sendmail/cf. ÁεááÙóðá òì README óðìí εáðÙεìáì cf áεá ìεá ááóεεβ áεóááùáβ òðεð ñðεìβóáεð òìò m4(1).

if-bus.UUCP uucp-dom:if-bus
. uucp-dom:

Ἴε οηάεο δηηόαο αηαηὶὺ ÷ αέηβαιόαε αεαέέὺ δαηέδοηόαεο, ὑδῖο οἱ mail δῖο ἀδαόεγίαόαε οά εὐδῖεῖ οηὶὶά ααῖ εά δηὶδῖαε ἰά οάαεαβ οόγῖ δηῖαδέεαηὶὶγῖ αεααηῖ, αεεὐ ἰάοβεαόα οά εὐδῖεῖ ααεοῖεεὐ UUCP δηῖεαῖὶὶ ἰά “οοῖοῖηαοεαβ” οἱ ἰηῖδὐοε δαηὶαῖογδ. Ἐ ἀδῖαῖγ αηαηῖ ÷ αέηβαιόαε οἱ mail δηῖο οἱ δῖδέεὐ οηὶὶά Ethernet, ὑδῖο αβῖαε αοῖαόη Ἐ δαηὶαῖογ ἰὶγού SMTP. Ὀὶεῖο, ἰε ααεοῖεεῖβ UUCP ἰάοὶὶηῖαε ἰα αηαόη οαοαῖ-οηὶὶὶ UUCP ηόοα ἰα ἀδεοηὶδῖαόαε οά εὐδῖεῖ uucp-neighbor !recipient ἰα δαηαέὐῖηαε οἱοδ δηῖαδέεαηὶὶὶ δαῖῖαδ. Ἐ οαεαοοαβ αηαηῖ αβῖαε δὐῖοα ἰεα ἰῖααεεη οαεαβ, Ἐ ἰδῖα οαέηεὐαε ἰα ἰεαηδῖοα ὐεεῖ, ἰα δαηὶαῖογ UUCP οά ἶα ααεοῖεεὐ UUCP ἰ ἰδῖβῖο ἰαηααβ ὑδ ααῖεη δῖεγ mail δηῖο οἱ δῖεῖεδῖ εὐοῖ. ἶεα οά ἰῖααοά οδῖεῖαεοόη δῖο αηβοεῖοαε ἰαδὐ οἱ uucp-dom: εά δηὶδῖαε ἰα αβῖαε ἶαεοηῖ UUCP ααβῖοῖαδ, ὑδῖο ἰδῖηαβοα ἰα αααεηόαο ÷ ηῖοεῖηδῖεηῖοδ οἱ uuname.

Ὀάο οδῖεῖοβῖαῖοῖα ὑοε αδοὐ οἱ αη ÷ αβῖ δηὶδῖαε ἰα ἰαοαοηαδῖα οά ἰεα αὐόγ αααηὶὶ DBM δηῖεῖ ÷ ηῖοεῖηδῖεγδαβ. Ἰδῖηαβοα ἰα αὐεαοα ογ αηαηῖ ἰάῖεηῖ δῖο ἀδαεαόαβοαε αεα ἰα ἀδεοαο ÷ εαβ αδοὐ ὑδ ο ÷ ὑεεῖ οόγῖ αη ÷ η οἱο αη ÷ αβῖο mailertable. Δηὶδῖαε δὐῖοῖα ἰα αεοαεαβοα αδοη ογῖ ἰάῖεηῖ εὐεα οἱηὶ δῖο αεεὐαοα οἱ αη ÷ αβῖ mailertable.

Ἴεα οαεαοοαβ οδῖααεῖγ: ἰ ἰ αῖ αβοα αὶαεῖε αεα οἱ ἰ εά εαεοῖοηαηόαε εὐδῖεα οαεαεηεῖγῖ αηῖηεὐαγος mail, εοῖεαβοα ογῖ ἀδεῖαη -bt οἱο sendmail. Ἀδοη ἰαεῖῖαε οἱ sendmail οά εαδὐοοαο αῖεῖηδῖο εαδῖοαῖ. Ἀδῖο αηὐοα 3, 0, αεῖεῖοεῖγῖαῖ αδῖ ογ αεαγεοῖος δῖο εὐεαοα ἰα αεὶαῖαοα αεα αηῖηεὐαγος mail. Ἐ οαεαοοαβ αηαηῖ εά οαο δῖαε οἱ αοουαηεεὐ ἰάεδῖηοὐδῖο mail δῖο ÷ ηῖοεῖηδῖεηῖεα, ογ αεαγεοῖος δηῖηεοῖγ ἰα ογῖ ἰδῖα εεηεεα, εαεηο εαε ογῖ (δεεαῖη ἰαοαοηαοῖγῖ) αεαγεοῖος. Ἰδῖηαβοα ἰα αααβοα αδῖ αδοη ογῖ εαδὐοοαο, δεγέοηεῖαῖοδ Ctrl+D.

```
% sendmail -bt
ADDRESS TEST MODE (ruleset 3 NOT automatically invoked)
Enter <ruleset> <address>
> 3,0 foo@example.com
canonify input: foo @ example . com
...
parse returns: $# uucp-dom $# your.uucp.relay $: foo < @ example . com . >
> ^D
```

29.8 Ἡγῖεογ Ἀῖοδγῖαόγδῖ ἰῖη ἰεα Ἀδῖοῖεη

Ὀδὐη ÷ ἰοῖ δῖεεὺ δαηέδοηόαεο, δῖο ἰδῖηαβ ἰα εὐεαοα ἰῖη ἰα οόγῖεῖαοα mail ἰγού εὐδῖεῖο ἰαῖαοααῖοδ. Ἰαηεεὐ δαηααβῖαῖαοα:

- Ἰ οδῖεῖαεοόη οαο ÷ ηῖοεῖηδῖεαβοαε ὑδ desktop, αεεὐ εὐεαοα ἰα ÷ ηῖοεῖηδῖεηῖοαοα δηῖαηὶηαοα ὑδῖο οἱ send-pr(1). Ἀεα ἰα αβῖαε αδοὐ εά δηὶδῖαε ἰα ÷ ηῖοεῖηδῖεηῖοαοα οἱ ἰαῖαοααῖοδ mail δῖο δαηὶ ÷ αε ἰ ISP οαο.
- Ἰ οδῖεῖαεοόη οαο αβῖαε ἶαδ ἰαοδγῖαόγδῖ δῖο αῖ ἰ αέηβαιόαε οἱ mail οἱδεεὐ, αεεὐ ÷ ηαεὐαοαε ἰα οἱ ηόαε αῖ ἰεῖεηηῖο οά εὐδῖεῖ ἰαῖαοααῖοδ αεα ἰαηαηααοα.

Ἰδῖεαηδῖοα ο ÷ ααῖ MTA αβῖαε εεαῖ ἰα εαεγοαε οἱ δαηαδὐῖ ηῖε. Ἀοοο ÷ ηδ, ἰδῖηαβ ἰα αβῖαε δῖεγ ἰγοεῖ ἰα ηοεῖβοαο οοοδὐ ἶα δεηηαδ MTA ηόοα ἀδεηο ἰα οόγῖεῖαε οἱ mail δηῖο ἰαῖαοαῖοδ. Δηῖαηὶηαοα ὑδῖο οἱ sendmail εαε οἱ postfix αβῖαε οδῖαηεεεὐ ἰααὐεα αεα αδοη ογ ἰαοεαεὐ.

Ἀδεδῖηοεαοα, ἰ ÷ ηῖοεῖηδῖεαβοα εὐδῖεα οῖεεοῖγῖ οδγῖαοα δηῖοααογδ οοἱ Internet, Ἐ οδῖοῖηῖα ἰα ογῖ ἰαοεηβα δαηῖ ÷ ηδ ἰδῖηαβ ἰα οαο ἀδαηῖαγῖε ἰα αεοαεαβοα οἱ αεεὐ οαο “ἰαοδγῖαόγδῖ mail”.

Ἰ αεῖεῖηοαηῖο οηῖδῖο αεα ἰα αεδεγῖηόαοα αδοὺ οεδ ἰῖαεαδ αβῖαε ἰα ααεαοαοόηοαοα οἱ port mail/ssmtp Ἀεοαεὶοα οεδ αεῖεῖοεαδ ἰάῖεὶὺ ὑδ root:

```
# cd /usr/ports/mail/ssmtp
# make install replace clean
```

ÌάδÚ οçί ááεάδÚóδáoç, õί mail/ssmtp ìðññáβ íá ñðεìεóδáβ íá Ýíá άñ÷άβι δáoóÚññì ìυεέδ άñάñβι, õί ððιβι άñβόεάδáoε òõì /usr/local/etc/ssmtp/ssmtp.conf:

```
root=yourrealemail@example.com
mailhub=mail.example.com
rewriteDomain=example.com
hostname=_HOSTNAME_
```

Άάάάεùεάβòá υέ ÷ñçόεìíðιεάβòá οçί ðñáñίáδéeP áεáyεδίοç email áεá õíí root. ΆÚεðá õíí áίáíáδáoáüøç mail òü ISP óáo óçç εÝóç mail.example.com (ìáñééìβ ISP õíí ìññÚεìòì “áíððçñáðçðP áíáñ÷ùáñüò óá÷δανñáβι” P “áíððçñáðçðP SMTP”).

Άάάάεùεάβòá υέ Ý÷áðά άðáíáñáñðιεPóáε ðεPñùδ õí **sendmail**, áεùíá εάε οçί òðçñáðóá áíáñ÷ùáñüí íçíòìÚòüí. Άάβòá õí **ÖìPìá 29.4.2** áεá εáððñÝñáεάð.

ÖðÚñ÷ìòì εÚðιεάð áεùíá áεάεÝóεìáð άðεεìáÝð òõì mail/ssmtp. Άάβòá õí ðáñÚááεáìá õüò άñ÷άβι ñðεìβóáñì òõì /usr/local/etc/ssmtp P οçç óáεβάá manual òüò **ssmtp** áεá ðáñέóóüòáñá ðáñááάβáñíáδáo εάε ðççñüòññáð.

Ñðεìβáεìíðíoð õí **ssmtp** ìá áðòü õíí ðñüðì, εá άβίáé áüòíáðç ç òúòðP εáέóüòñáβá ððιεúαPðüðá εìáέóìεéý òõíí òððιεáέóðP óáo ðüò ÷ñáεÚεáðáoé íá óóáβεάé mail. Άðβóçð ááí ðáñάáεÚεáðáoé ìá áðòü õíí ðñüðì ç Úááέá ÷ñPóçð õüò ISP óáo εάε ááí ìðññáβ ì òððιεáέóðPð òáo íá ðáñάáεáóðáβ εάε íá ÷ñçόεìíðιεçεáβ áεá οçί áðüòüεP áίáðεéýìçòüí íçíòìÚòüí (spam).

29.9 × ñçόεìíðιεPíóáð õí Mail ÌÝóüò ΆðεéìáéêPò (Dialup) Óýíááòçð

Áí Ý÷áðά óáoέεP áεáyεδίοç IP, ááí εá ÷ñáεáóðáβ íá áεεÚìáðά εáìεÚ áðu ðεð ðñíáðεεìáÝð. Ñðεìβòáð õí ùññá õüò òððιεáέóðP óáo Pðóá íá óáεñéÚεáé ìá áðòü ðüò óáo Ý÷áé ìñέóðáβ áεá õí Internet, εάε õí **sendmail** εá εÚìáé óá òðüεìεά.

Áí εáìáÚìáðά áüòíáìεP IP εάε ÷ñçόεìíðιεάβòá áðεεìáéêP óýíááòç ìá õí Internet, ðεέáñüí áεάéÝðáðá ìεá εðñβάá òá÷δανñáβìò (mailbox) òõíí áíððçñáðçðP mail òüò ðáññ÷Ýá óáo. Άð òðìεÝóíòìá υέ ì òñÝáð òüò ISP óáo άβίáé example.net, εάε υέ òüò ÷ñPóçç óáo άβίáé user, õí íç÷Úìçìá óáo εÝááðáoé bsd.home, εάé ì ISP óáo, óáo Ý÷áé ðáé υέ ìðññáβòá íá ÷ñçόεìíðιεPóáðá õí relay.example.net ùð áíáíáδáoáüøç áεá õí mail.

Άέá íá ìðñÝóáðά íá εÚááðά mail áðu οçç εðñβάá óáo, εá ÷ñáεáóðáβòá εÚðιεì áíðεðñüòüðì áíÚεçðçð (retrieval agent). Öì áìçεçðεéü ðñüñáñíá **fetchmail** άβίáé ìεá εάεP áðεεìáP, εáεPð òðüòçññáεé ðüεεÚ áεáóüñáðεéÚ ðññüòüεìεéá. Öì ðñüñáñíá áðòü άβίáé áεάéÝóεì ùð ðáéÝòì P áðu οçί ÓðεεìáP òüí Ports (mail/fetchmail). ÓüòPεùð, ì ISP óáo εá ðáñÝ÷áé οçί òðçñáðóá POP. Áí ÷ñçόεìíðιεάβòá PPP ÷ñPóçç, ìðññáβòá íá εáoááÚóáðá áðòüñíáðá õí mail óáo ìáðÚ οçί áðìεáðÚóðáoç οçð óýíááòçð óáo, ÷ñçόεìíðιεPíðíoð οçί áεüεìòðεç εáoá÷Pñέóç òõì /etc/ppp/ppp.linkup:

```
MYADDR:
!bg su user -c fetchmail
```

Áí ÷ñçόεìíðιεάβòá õí **sendmail** (ùðùð óáβíáðáoé ðáñáεÚòü) áεá íá ðáñáāPóáðá mail óá íç÷òìðεéýð εìááñéáóüñýð, ðεέáñüí íá εÝεáðá õí **sendmail** íá άðáíáñáÚεáðáoé οçί ðññÚ òüò mail áìÝóüò ìáðÚ οçί áðìεáðÚóðáoç οçð óýíááòçð. Άέá íá õí εÚìáðά áðòü, áÚεðá οçί ðáñáεÚòü áíðüεP áìÝóüò ìáðÚ οçί áíðüεP fetchmail òõì άñ÷άβι /etc/ppp/ppp.linkup:

```
!bg su user -c "sendmail -q"
```

Àð ððèÝóηíà ùεé ððÙñ÷áé Ýíáð εíááñεάóηùð áεά ðηí user óðηí bsd.home. Òðηí ðñηóùððéù εάóÙεíαι ðηó user óðηí bsd.home, áçìεíðñáβόά Ýíá áñ÷áβι .fetchmailrc:

```
poll example.net protocol pop3 fetchall pass MySecret
```

Òηí áñ÷áβι áððù áαι εά ðñÝðáé íá áβίáé áíááηβóεηí áðu εáηÝíá, áεðùð áðu ðηí user, εάεðð ðáñéÝ÷áé ðηí εùáεèù MySecret.

Άεά íá ìðñáβόá íá óðáβεáðá mail íá ðç óùóðβ áðéεáðáεβáá from:, εά ðñÝðáé íá ððèìβόáðá ðηí **sendmail** íá ÷ñçóεηðηέέáβ ðηí <user@example.net> áíóβ áεά ðηí <user@bsd.home>. ðóùð áðβόçð íá εÝεáðá íá ððèìβόáðá ðηí **sendmail** íá óðÝεíáé ùεí ðηí mail ìÝóù ðηó relay.example.net, βόá ç ìáðÙáηóç ðηó mail íá áβίáé óá÷ýðáñç.

Òηí áεùεíðεèí áñ÷áβι .mc εά ðñÝðáé íá áβίáé áðáñéÝð:

```
VERSIONID('bsd.home.mc version 1.0')
OSTYPE(bsd4.4)dnl
FEATURE(nouucp)dnl
MAILER(local)dnl
MAILER(smtp)dnl
Cwlocalhost
Cwbsd.home
MASQUERADE_AS('example.net')dnl
FEATURE(allmasquerade)dnl
FEATURE(masquerade_envelope)dnl
FEATURE(nocanonify)dnl
FEATURE(nodns)dnl
define('SMART_HOST', 'relay.example.net')
Dmbsd.home
define('confDOMAIN_NAME', 'bsd.home')dnl
define('confDELIVERY_MODE', 'deferred')dnl
```

ΆεάáÙóðá ðçì ðñçáηýíáíç áíùðçðá áεά εáððñÝñáεáð ó÷áóεéÙ ìá ðçì ìáðáóññðβ áðóηý ðηó áñ÷áβι .mc óá Ýíá áñ÷áβι sendmail.cf. Άðβόçð, ìç ìá÷Ùóáðá íá áðáíáεέεíβόáðá ðηí **sendmail** ìáðÙ ðçì áçìÝñùóç ðηó sendmail.cf.

29.10 Δεόóηðηβççç Άðεáíðééùðçðáð óðηí SMTP

Ç÷ñβçç SMTP ìá ðεóóηðηβççç áðεáíðééùðçðáð óðηí áηððçñáðçðβ óá÷ðáññáβιò óáð, ìðñáβ íá óáð ðñηóóÝñáé ìεά óáεñÙ áðu ìóÝç. ìðñáβ íá ðñηóéÝóáé Ýíá áεùíá áðβðáαι áóóÙεáεáð óðηí **sendmail**, áηβ Ý÷áé εάé ðηí ðεáηÝέðçíá ùεé áβίáé ðç áðíáðùðçðá óðηòð ÷ñβóáð ðηñçðβ ððηεíáεóðβ (ðηó óð÷íÙ óðηáÝíóáé ìÝóù áεáðñáðéεβί áεéðýùí) íá ÷ñçóεηðηέέíç ðηí βáεí áηððçñáðçðβ óá÷ðáññáβιò ÷ñβð ðçì áíÙáεç áðáíáñýεíεçð εÙεá ðηñÙ ðηó ðñáñÙñáóηð áðηóóηεβð / εβççð óá÷ðáññáβιò.

1. Άáεάðáóðβóá ðηí security/cyrus-sasl2 áðu ðç Óðεεíáβ ðηí Ports. Òηí port áððù ððηóçñβæáé ìεά óáεñÙ áðu áðεεíáÝð ðηó ìðñáβόá íá εÝóáðá εáðÙ ðçì ìáðááεβððéçç. Άεά íá ìðñÝóáðá íá ÷ñçóεηðηέέβόáðá ðçì ìÝεíαι áðεáíðééðηβçççð óðηí SMTP ðηó óðæçðÙñá ááβ, ááááεùεáβόá ùεé áβίáé áíáñáηðηέçìÝç ç áðεεíáβ LOGIN.
2. ìáðÙ ðçì ááεáðÙóáóç ðηó security/cyrus-sasl2, ðñηðηέεβóá ðηí áñ÷áβι /usr/local/lib/sasl2/Sendmail.conf (β ççìεíðñáβόá ðηí áí áαι ððÙñ÷áé) εάé ðñηóéÝóáð ðçì ðáñáéÙðù áñáηβ:

```
pwcheck_method: saslauthd
```

3. Άαεάόάόðóá Õðάεάá òτ security/cyrus-sasl2-saslauthd, εάé δñíóεÛóá óòτ /etc/rc.conf òçτ áεúετòδεç ãñáττ:

```
saslauthd_enable="YES"
```

ÕÛετò, τάεέτðóá òτ ááβττá saslauthd:

```
# /usr/local/etc/rc.d/saslauthd start
```

Ï ááβττάó άóóυð áñá ùð áτáεÛτáóτò áεά òτ **sendmail** ðóáá τά áβτáóάé ðεóóτττβçóç άóεάτóεεúòçóáð τÛóò òçð áÛóçð áááñÛτττ éúάεεβττ passwd òττ FreeBSD óóóóðτáóτò óáó. Ïá άóóυ òττ òñυðττ áðάεεÛóóáóáá áðυ òçττ áτÛάεç áçτετòñáβáð τÛÛτò óáó áðυ ττττáóá ÷ñçóóβττ εάé éúάεετÛð áεά éÛεά ÷ñðóóç ðττ ÷ñáεÛááóáé τά ÷ñçóεττðτεðóáé ðεóóτττβçóç óóτ SMTP. ×ñçóεττðτεáβóáé òτ βάετ ττττá εάé éúάεεúð, òυóττ áεά áβóτττ óóτ óýóðçτá, τυóττ εάé áεά òτ mail.

4. Άðáτáñááóóáβóá òðñá òτ /etc/make.conf εάé δñíóεÛóá òεð áεúετòδεάð ãñáττÛð:

```
SENDMAIL_CFLAGS=-I/usr/local/include/sasl -DSASL  
SENDMAIL_LDFLAGS=-L/usr/local/lib  
SENDMAIL_LDADD=-lsasl2
```

Ïé áñáττÛð άóóÛð, ðáñÛ ÷τòτ óóτ **sendmail** òεð εάóÛεεçεάð ñðεττβóáéð ðóáá τά óóτáεáβ óυóóÛ τá òτ cyrus-sasl2 εάóÛ òç áεÛñεάεά òçð τάóááεβðóóεóçð. Άáááεúεάβóá τυέ áβτáé ááεάóáóóçττÛτ òτ ðάεÛðττ cyrus-sasl2 ðñέττ τάεέτðóáóá òçττ áðáτáτáóááεβðóóéóç òττ **sendmail**.

5. Άðáτáτááóάáεùðóβóá òτ **sendmail** áεðάεβττáóó òεð ðáñáεÛòυ áτóτεÛð:

```
# cd /usr/src/lib/libsmutil  
# make cleandir && make obj && make  
# cd /usr/src/lib/libsm  
# make cleandir && make obj && make  
# cd /usr/src/usr.sbin/sendmail  
# make cleandir && make obj && make && make install
```

Ç τάóááεβðóóéóç òττ **sendmail** ááτ δñÛðáé τά ðáñτòóεÛóáé ðñτáεðτáóá, άτ òτ /usr/src ááτ Û ÷άé áεεÛτáε óá τάáÛεττ ááεúττ εάé áóυóτττ òðÛñ ÷τòτ τε εττττ ÷ñçóóáð áεάεεττεðεάð ðττ áðάεóττÛóáé.

6. ÏáóÛ òçττ τάóááεβðóóéóç εάé áðáτáñááóóáβóá òττ **sendmail**, áðáτáñááóóáβóá òττ áñ ÷άβττ /etc/mail/freebsd.mc (ð ùðτετττ áñ ÷άβττ ÷ñçóεττðτεáβóá ùð .mc. Ðτεεττβ áεά ÷άεñεóóÛð áðεεÛáτòττ τά ÷ñçóεττðτεáβóáτòττ òçττ Ûττττ òçð áτóττεðð hostname(1) ùð ττττá áεά òττ áñ ÷άβττ .mc áεά τά áτáóóáεβóóτòττ τυέ áβτáé τττááεéú). ÐñíóεÛóá óá άóóυ òεð áεúετòδεάð ãñáττÛð:

```
dn1 set SASL options  
TRUST_AUTH_MECH('GSSAPI DIGEST-MD5 CRAM-MD5 LOGIN')dn1  
define('confAUTH_MECHANISMS', 'GSSAPI DIGEST-MD5 CRAM-MD5 LOGIN')dn1
```

Ïé áðεεττáÛð άóóÛð ñðεττβáετòττ òεð áεάóττñááóεéÛð Ïáεúáτòð ðττ Û ÷áé óóç áεÛεάóç òττ òτ **sendmail**, ðñτεάετÛτò τά ðεóóτττðτεáβóáé òτòð ÷ñðóóáð. Άτ èÛεάðá τά ÷ñçóεττðτεáβóáá éÛðτεά τÛετττ áεάóττñááóεéð áðυ òτ **pwcheck**, ááβóá òçττ òáεεττβòóç ðττ ðáñεεáτáÛτáóáé.

7. ÕÛετò, áεðάεÛóáá make(1) áτβ áñβóεάóóá óóττ εάóÛεετττ /etc/mail. Ïá òττ òñυðττ άóóυ, εά ÷ñçóετττðτεçεάβ òττ τÛττ óáð .mc áñ ÷άβττ εάé εá áççτετòñάçεάβ Ûτá áñ ÷άβττ .cf τá ττττá freebsd.cf (ð τòεάβðτòá ττττá áβ ÷άóá áðóáé óóττ áñ ÷άβττ .mc). ×ñçóεττðτεáβóáá Ûðάεóáá òçττ áτóττεð make install restart, ç τòττá εά áτóεáñÛóáé òττ áñ ÷άβττ òóττ sendmail.cf, εάé εά áðáτáτεεέττðóáé óυóóÛ òττ **sendmail**. Άεά ðáñεóóóυòáñáð εáððòñÛñáεáð ó ÷άóεéÛ Ïá άóóð òç áεάáεεάóáβá, εά ðñÛðάé τά áεάáÛóáá òττ áñ ÷άβττ /etc/mail/Makefile.

Άί υέά δᐑάάί έάέὐ, έά δñÝðáέ íá ðñíñáβðά íá áᐑóáðά ðά óðíέ÷áβá áέóυáíð óáð óðí δñúáñáíá ðíð ÷ñçóέíðíέάβðά áέá áðíóðíεᐑ έάέ εᐑᐑç mail, έάέ íá óðáβέáðά Ýíá áíέέíáóðέέú íᐑíðíá. Άέá íá áέáñáðíᐑóáðά ðáñέóóúðáñí ðç έάέóíðñáβá, έÝóðά ðçí áðέέíáᐑ LogLevel ðíð **sendmail** óðí 13 έάέ ðáñáέέíðέᐑóðά ðí /var/log/maillog áέá ðð÷úí έὐέç.

Άέá ðáñέóóúðáñáð ðέçñíðíñáð, ðáñáέάέíγíá íá ááβðά ðç óáέβáá ðíð **sendmail** ðíð áóíñὐ ðçí ðέóóíðíβçç áðέáíóέέúðçðáð óðí SMTP (<http://www.sendmail.org/~ca/email/auth.html>).

29.11 Δñíñáñὐíáðά Ὀά÷οάνíñáβíð áέá ðíí ×ñᐑóç

Íá δñúáñáíá Άíóέðñíðᐑðíð Ὀá÷οάνíñáβíð ×ñᐑóç (Mail User Agent, MUA), áβíáέ íέá áóáñíñáᐑ ðíð ÷ñçóέíðíέάβðάέ áέá ðçí áðíóðíεᐑ έάέ εᐑᐑç email. ΆðέðέÝíí, έάεᐑð ðí email “áíáέβóóáðάέ” έάέ áβíáðάέ ðέí ðíέýðέíεí, ðá MUA áβíñíðάέ úεí έάέ έó÷òñúðáñá úóí áóíñὐ ðíí ðñúðí ðíð áέέçέáðέáñíγí íá ðí email. Άððú áβíáέ óðíðð ÷ñᐑóðáð ðáñέóóúðáñáð έάέóíðñáβáð έάέ áðάέέíβá. To FreeBSD ðáñέÝ ÷áέ ððíóðᐑñέíç áέá íááὐέí áñέέúí áðú δñíñáñὐíáðά ðá÷οάνíñáβíð, έάέ úέá ðíñíγí íá ááέáðáðáέέíγí ðíέý áýέíέá íÝóú ðçð Ὀðέέíáᐑð ðúí Ports ðíð FreeBSD. Íέ ÷ñᐑóðáð ðíñíγí íá áðέέÝñíðí íáðáíγύ áñáóέέᐑí ðñíñáñíὐðúí, úðð ðí **evolution** ᐑ ðí **balsa**, έάέ δñíñáñὐíáðά έííóúέáð úðúð óá **mutt**, **alpine** ᐑ **mail**, ᐑ áέúíá έάέ ðέð áέáðáðÝð web ðíð δñíóðÝñíðάέ áðú íáñέέíγð íááὐέíðð ðñááέέóíγð.

29.11.1 mail

Ὀí mail(1) áβíáέ ðí δñíñáðέέááíÝíí δñúáñáíá ðá÷οάνíñáβíð (MUA) in FreeBSD. Δñúέáέóáέ áέá Ýíá MUA έííóúέáð, ðí ðíðíβí δñíóðÝñáέ úέáð ðέð ááóέέÝð έάέóíðñáβáð ðíð áðáέóíγíðάέ áέá ðçí áðíóðíεᐑ έάέ εᐑᐑç email óá ðññðᐑ έáέÝíñíð, áí έάέ Ý ÷áέ ðáñέíñέóíÝíáð áðíáðúðçðáð úóí áóíñὐ óðíçíñÝíá áñ÷áβá έάέ ððíóðçñβáέέ ðúñí ðíðέέÝð έðñβááð.

Άí έάέ ðí mail ááí ððíóðçñβáέέ ááááíᐑð ðç εᐑᐑç email íÝóú áέáέíñέóðᐑᐑí POP ᐑ IMAP, áβíáέ úóðúóí áðíáðúí íá έáðááὐóðáð óá email óá íέá ðíðέέᐑ έðñβáá (mbox) ÷ñçóέíðíεᐑíðáð έὐðíέá áóáñíñáᐑ úðúð ðí **fetchmail**, ðí ðíðíβí έá ðóæçðᐑóíðíá áñáúðáñá óá áðú ðí έáοὐέáέí (Ὀíᐑíá 29.12).

Άέá ðçí áðíóðíεᐑ έάέ εᐑᐑç email, áðεᐑð áέðáέÝóðά ðçí áíðíεᐑᐑ mail úðúð óáβíáðάέ óðí ðáñáέὐðú ðáñὐááέáíá:

```
% mail
```

Ὀά ðáñέá÷úíáíá ðçð έðñβááð ðíð ÷ñᐑóç óðíí έáóὐέíñí /var/mail έá áέáááóóíγí áðúíáðά áðú ðí δñúáñáíá mail. Άí ç έðñβáá ðá÷οάνíñáβíð áβíáέ ὐááέá, ðí δñúáñáíá ðáñíáðβáέáðάέ íá ðí ðíðíðá úðέ ááí áñÝέçέá áέέçέíñáðóβá. Íáðὐ ðçí áíὐáíúóç ðçð έðñβááð, íáέέíὐ ç áέáðáðᐑ ðçð áóáñíñáᐑð έάέ áíðáíβáέáðάέ íέá εᐑóðά íá íçýγíáðά. Ὀά íçýγíáðά áñέέíγíðάέ áðúíáðά, úðúð óáβíáðάέ óðí ðáñáέὐðú ðáñὐááέáíá:

```
Mail version 8.1 6/6/93. Type ? for help.
"/var/mail/marcs": 3 messages 3 new
>N 1 root@localhost      Mon Mar  8 14:05  14/510  "test"
  N 2 root@localhost      Mon Mar  8 14:05  14/509  "user account"
  N 3 root@localhost      Mon Mar  8 14:05  14/509  "sample"
```

Ὀά íçýγíáðά ðíñíγí ðέÝíí íá áέáááóóíγí íá ðçí áíðíεᐑᐑ t ðçð áíðíεᐑðð mail, áέέíðέíγíáíç íá ðíí áñέέúí ðíð mail ðíð έÝέáðά íá áíðáέέóðáβ. Ὀðí ðáñὐááέáíá áðúú έá áέááὐóíðíá ðí ðñᐑðí ðíðíðá:

```
& t 1
Message 1:
From root@localhost  Mon Mar  8 14:05:52 2004
X-Original-To: marcs@localhost
Delivered-To: marcs@localhost
To: marcs@localhost
```

Subject: test
Date: Mon, 8 Mar 2004 14:05:52 +0200 (SAST)
From: root@localhost (Charlie Root)

This is a test message, please reply if you receive it.

¼ðùð óáßíáóáé óðí ðãñáðÛíù ðãñÛáãéãíá, ç ÷ ñÞóç õíò ðëÞëðñíò t éá ðñíëáéÝóáé õçí àìòÛíéóç õíò ìçíýíáðíð ìá ðëÞñáéð áðééáðáéßááð. Áéá íá äãßðá íáíÛ õç ëßððá ìá óá ìçíýíáðíá, ÷ ñçóéííðíëÞðáðá õí ðëÞëðñí h.

Áí õí mail áðáéðáß áðÛíðçóç, ìðíñáßðá íá ÷ ñçóéííðíëÞðáðá õçí áíðíëÞ mail ÷ ñçóéííðíëÞíðáð ðéð áíóùìáðùìÝíáð áíðíëÝð R P r. Õí ðëÞëðñí R íãçãáß õí mail íá áðáíðÞðáé ìüíí óðíí áðíóðíëÝá õíò ìçíýíáðíð, áíÞ õí r áðáíðÛáé ì÷-é ìüíí óðíí áðíóðíëÝá, áééÛ óá ìéíòð ðíòð ðãñáéÞððáð õíò ìçíýíáðíð. Ìðíñáßðá áðßóçð íá ðñíóéÝóáðá ìáðÛ áðù ðéð áíðíëÝð áððÝð, õíí áñééìú õíò ìçíýíáðíð óðí ìðíßí èÝéáðá íá áðáíðÞðáðá. Áóíý õí èÛíáðá áððü, éá ðñÝðáé íá ãñÛðáðá õçí áðÛíðçóç óáð éáé íá õçíáéÞðáðá õí ðÝéíð õçð ãñÛóííðáð íéá ìüíí . óá íéá íÝá ãñáñíÞ. Ìðíñáßðá íá äãßðá Ýíá ðãñÛáãéãíá ðãñáéÛðù:

& R 1
To: root@localhost
Subject: Re: test

Thank you, I did get your email.

.
EOT

Áéá íá óðáßéáðá íÝí mail, éá ðñÝðáé íá ÷ ñçóéííðíëÞðáðá õí ðëÞëðñí m, áéíëíðéíýíáíí áðù õçí áéáyéðíðç õíò ðãñáéÞððç. Ìðíñáßðá íá áÞðáðá ðíééáðéíýð ðãñáéÞððáð, ÷ ìñßæííðáð ìáðáíý õíòð ðéð áéáðéýíðáéð ìá , Ìðíñáßðá Ýðáéðá íá áÛéáðá õí èÝíá õíò ìçíýíáðíð éáé íá óðíá÷ßðáðá ìá õí ðãñéá÷-ìáñí. Õí ðÝéíð õíò ìçíýíáðíð éáéíñßæáðáé ãñÛóííðáð íéá ìííáééÞ . óá íéá íÝá ãñáñíÞ.

& mail root@localhost
Subject: I mastered mail

Now I can send and receive email using mail ... :)

.
EOT

¼ðíí ãñßðéáðáðá ìÝóá óðçí áíðíëÞ mail, ìðíñáßðá íá ÷ ñçóéííðíëÞðáðá õí ðëÞëðñí ? áéá õçí àìòÛíéóç áíÞéáéáð ìðíéááÞðíðá óðéãíÞ. Ìðíñáßðá áðßóçð íá óðíáíðééáðáßðá õçí óáéßáá manual õíò mail(1) áéá ðãñéóóúðãñáð ðççñííðíñáð ò÷: áðééÛ ìá õçí áíðíëÞ mail.

Õçíáßùç: ¼ðùð áíáðÝñáíá ðñíçãíòíÝíùð, ç áíðíëÞ mail(1) ááí ò÷: áãéÛóðçéá ãñ-ééÛ áéá íá ÷ áéñßæáðáé óðíçíìÝíá, éáé áéá õí èüáí áððù íé áðíáðùðçðáð ðéð óðí óðáéáèñéìÝíí èÝíá áßíáé íééñÝð. ìáÞðáñá MUA, ìðùð õí mutt, ÷ áéñßæííðáé óá óðíçíìÝíá ìá ðíéý ðéí Ýíððíí ðñúðí. ÁééÛ áí ðãñ' ìéá áððÛ áðééðíáßðá íá ÷ ñçóéííðíëÞðáðá õçí áíðíëÞ mail, ìÛééíí éá óáð óáíáß ÷ ñÞóéíí ðí port converters/mpack.

29.11.2 mutt

Õí mutt áßíáé Ýíá íééñü, áééÛ ðíéý éó÷ðñü ðñüáñáííá áðíóðíëÞð éáé èÞçð mail, ìá áíáéñáðééÛ ÷ áñáéðçñéóðééÛ óá ìðíßá ðãñééãíáÛíóí:

ἡ δὲ ἰσχυρὸς ἔστιν ἡ ἀπόκρισις.

29.11.3 alpine

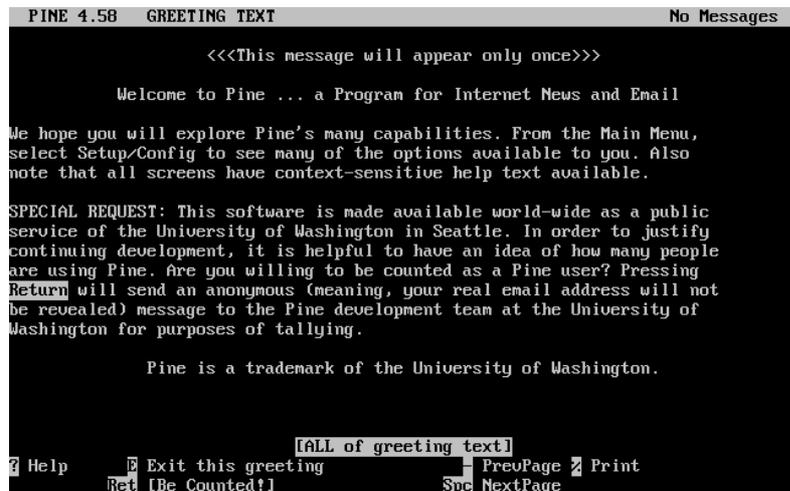
Ὁ **alpine** ἀδελφὸς τοῦ **pine** ἐστὶν ἡ ἀπόκρισις τῆς ἀπόκρισιν, ἀλλὰ ἔχει ἄλλο ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν ἢ τῆς ἀπόκρισιν.

Ἐπεὶ ἔδωκεν ὁ Κύριος τὴν ἀπόκρισιν: Ὁ **alpine** ἔχει ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν ἀλλὰ ἔχει ἄλλο ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν. Ὁ **alpine** ἀδελφὸς τοῦ **pine** ἐστὶν ἡ ἀπόκρισις τῆς ἀπόκρισιν, ἀλλὰ ἔχει ἄλλο ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν ἢ τῆς ἀπόκρισιν.

Ἐν τῇ ἀπόκρισιν ἡ ἀπόκρισις τοῦ **alpine** ἔχει ἄλλο ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν ἢ τῆς ἀπόκρισιν. Ἐν τῇ ἀπόκρισιν ἡ ἀπόκρισις τοῦ **alpine** ἔχει ἄλλο ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν ἢ τῆς ἀπόκρισιν.

% alpine

Ὁ **alpine** ἀδελφὸς τοῦ **pine** ἐστὶν ἡ ἀπόκρισις τῆς ἀπόκρισιν, ἀλλὰ ἔχει ἄλλο ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν ἢ τῆς ἀπόκρισιν. Ὁ **alpine** ἀδελφὸς τοῦ **pine** ἐστὶν ἡ ἀπόκρισις τῆς ἀπόκρισιν, ἀλλὰ ἔχει ἄλλο ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν ἢ τῆς ἀπόκρισιν.



Ἐὰν ἀποκριθῆτε ἐν τῇ ἀπόκρισιν, οἱ ἄλλοι ἔσονται ἠκανοποιημένοι ἢ ἂν ἀποκριθῆτε ἐν τῇ ἀπόκρισιν. Ὁ **alpine** ἀδελφὸς τοῦ **pine** ἐστὶν ἡ ἀπόκρισις τῆς ἀπόκρισιν, ἀλλὰ ἔχει ἄλλο ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν ἢ τῆς ἀπόκρισιν.

Ἐν τῇ ἀπόκρισιν ἡ ἀπόκρισις τοῦ **alpine** ἔχει ἄλλο ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν ἢ τῆς ἀπόκρισιν. Ἐν τῇ ἀπόκρισιν ἡ ἀπόκρισις τοῦ **alpine** ἔχει ἄλλο ἑξῆς ἔργον ἐν τῇ ἀπόκρισιν ἢ τῆς ἀπόκρισιν.

```

PINE 4.58  MAIN MENU                               Folder: INBOX  3 Messages

?  HELP                - Get help using Pine
C  COMPOSE MESSAGE    - Compose and send a message
I  MESSAGE INDEX      - View messages in current folder
L  FOLDER LIST        - Select a folder to view
A  ADDRESS BOOK       - Update address book
S  SETUP              - Configure Pine Options
Q  QUIT               - Leave the Pine program

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? Help                P PreuCmd                R ReINotes
0 OTHER CMDS > [Index] N NextCmd                K KLock
    
```

Ότ άðñáðñéη ίçίòηΰòηί ááβ÷íáε ίçίγίáðá áðη ðη ðñÝ÷íðá εáðΰεηίη, εάε ðññáβðá ίá ίáðáέέεçεáβðá ðá áðòη ίá ðá ááεΰέεá. ðññáβðá ίá áεάáΰóáðá ðη áðέεáηΰí ηβίðηά, ðéÝæηíðáð ðη ðεβέðñη **Enter**.

```

PINE 4.58  MESSAGE INDEX                             Folder: INBOX  Message 1 of 3 ANS

A  1 Mar  9 Super-User      (471) test
A  2 Mar  9 Super-User      (479) user account
A  3 Mar  9 Super-User      (473) sample

? Help                < FldrList          P PreuMsg          = PreuPage  D Delete          R Reply
0 OTHER CMDS > [ViewMsg] N NextMsg          Spc NextPage  U Undelete      F Forward
    
```

Όðçη áεέηηά ðηð ðáβηáðáε ðáñáεΰòη, ðη **alpine** áðáέεηβæáε Ύίá ððηááεáηá ίçίγίáðηð. Όòη εΰòη ίΎñηð ðçð ηέηίçð ðáβñηðáε ð÷áðέéΎð ðóηðñáγóáεð ðεçεðñηεηáβηð. ίá ðáñΰááεáηá ðΎðηεáð ðóηðηηáðóçð, áβηάε ðη ðεβέðñη **r** ðη ηðηβη εΎáε ððη MUA ίá äçηεηðñáβðáε áðΰηðçç ðñηð ðη ðñÝ÷í ηβίðηά ðηð áðáέεηβæáðáε.

```

PINE 4.58 MESSAGE TEXT Folder: INBOX Message 1 of 3 ALL ANS
Date: Tue, 9 Mar 2004 10:28:36 +0200 (SAST)
From: Super-User <root@localhost>
To: marcs@localhost
Subject: test

This is a test message, please reply if you receive it.

[ALL of message]
? Help < > MsgIndex P PrevMsg - PrevPage D Delete R Reply
0 OTHER CMDS > ViewAttach N NextMsg Spc NextPage U Undelete F Forward
    
```

Ç αδΰίδςός οά Υία mail ιΰού οίο **alpine** άβίαδάέ ιά οç ÷ ñΠόç οίο οοίόΰέδς έαείΥίηο **pico**, ι ιδñβιò άάέάεβóóάάέ αδñ δññάδέείαΠ ιάαβ ιά οί **alpine**. Οί **pico** αέάδέιέγίαέ οç ιάοάέβίçς ιΰόά οοι ιΠίοιá, έάέ άβίαέ εΰδñδ δέι άγέιέι αέά οίòδ άñ÷ΰñέιòδ ÷ ñΠóόάδ οά ο÷Υόç ιά οί vi(1) Π οί mail(1). Ιñέέδ ιέιέεçñηβóάά οçί αδΰίδςόç, ιδññάβóά ιά οόάβεάóά οί ιΠίοιá δέΥάιιόάδ οά δεβέδñά **Ctrl+X**. Οί **alpine** εά οάδ αçδóβóάέ ιά οί άδεάάάάέβóάόά.

```

PINE 4.58 COMPOSE MESSAGE REPLY Folder: INBOX 3 Messages
To : Super-User <root@localhost>
Cc :
Attchmnt :
Subject : Re: test
----- Message Text -----
I did recieve your message...

^G Get Help ^X Send ^R Read File ^V Prev Pg ^K Cut Text ^O Postpone
^C Cancel ^J Justify ^U Where is ^N Next Pg ^U UnCut Text ^I To Spell
    
```

Ιδññάβóά ιά δññóάνñιυóάόά οί **alpine** ιά οç ÷ ñΠόç οçδ άδέείαΠδó **SETUP** αδñ οί έγñέι ιάñγ. Οοιάρóεάδεάβóά οçί οίδñέάóβά <http://www.washington.edu/alpine/> άέά δάñέóóúδάñάδ δέçññιññάδ.

29.12 × ñçóέιδñέβίόάδ οί fetchmail

Οί **fetchmail** άβίαέ Υίαδ δεβñçδ δάεΰόçδ αέά IMAP έάέ POP, ι ιδñβιò άδέδñΥάέ οοίòδ ÷ ñΠóόάδ ιά εάόάáΰάιοι αóδñιáάά mail αδñ αδñάέñοοιΥίñòδ άιòδçñάδçδΰδ IMAP έάέ POP έάέ ιά οί αδñέçέάγίοι οά οίδέέΥδ εδñβάάδ, αδñ υδñò ιδññάβ Υδάέόά ιά οδΰñ÷άέ δέι άγέιέç δññóάάóç. Οί **fetchmail** ιδññάβ ιά άάέάόάóάέάβ ÷ ñçóέιδñέβίόάδ οί port mail/fetchmail έάέ δάñΥ÷άέ άέΰοιñά ÷ άñάέδçñέóóέέΰ, ιάñέέΰ αδñ οά ιδñβά δάñέάιáΰίñóι:

- Οδñóδβñέίç ούι δññοιέυέέυι POP3, APOP, KPOP, IMAP, ETRN έάέ ODMR.


```
"|exec /usr/local/bin/procmail || exit 75"
```

Όόξί θάήάέΰδου άίυόξόά, έά άάβήιόιά ίάήέέίγδ άδύ όιόδ άάόέέίγδ έάίυίάδ όιό **procmail**, έάέβδ έάέ όύίόήάδ θάήέάήάόΰδ όξδ έάέόιόήάβάδ όιόδ. Δñΰθάέ ίά όιθιέάδΠρόάόά άόόίγδ (έάέ ΰέέιόδ) έάίυίάδ όά Ύίά άñ÷άβι .procmailrc, όι ιθιβι έά δñΰθάέ ίά άñβόέάόάέ ιΎόά όόήι έάόΰέιήι όιό ÷ñΠόξ:

Ϊθñάβόά ίά άñάβόά όιόδ θάήέόόύόάήιόδ άδύ άόόίγδ όιόδ έάίυίάδ, όόξ όάέβάά manual όιό procmailex(5).

Δñιπέξόξ υέιό όιό email όξδ άέάγέόίόξδ <user@example.com> δñιό όξί άιùόάήέέΠ άέάγέόίόξ <goodmail@example2.com>:

```
:0
* ^From.*user@example.com
! goodmail@example2.com
```

Δñιπέξόξ υέιύ όύι email θιό άβίάέ ίέέñύόάñά άδύ 1000 bytes δñιό ίέά άιùόάήέέΠ άέάγέόίόξ email <goodmail@example2.com>:

```
:0
* < 1000
! goodmail@example2.com
```

ΆθιόόιέΠ υέιό όιό mail θιό όόΰέέξέά δñιό όι <alternate@example.com> όά ίέά έόñβάά θιό έάέάβόάέ alternate:

```
:0
* ^TOalternate@example.com
alternate
```

ΆθιόόιέΠ υέιό όιό mail ίά έΎίά “Spam” δñιό όι /dev/null:

```
:0
^Subject:.*Spam
/dev/null
```

Ϊέά ÷ñΠόείξ έγός θιό ίά÷ύñβάέέ όά email άδύ όέδ έβόόάδ όά÷οάήιίάβιό FreeBSD.org έάέ όιθιέάδάβ όι έΰέά ιΠιόιά όά άέάόιήάόέέΠ έόñβάά:

```
:0
* ^Sender:.owner-freebsd-\/[ ^@]+@FreeBSD.ORG
{
  LISTNAME=${MATCH}
  :0
  * LISTNAME??^\/[ ^@]+
  FreeBSD-${MATCH}
}
```

ΕὰοŬεάεί 30

Άίōðçñåôçô Ýò Ăέέôýíō

30.1 Óýñîç

Ŭî εὰοŬεάεί áððü εάεýððáε ïñεóíŬíáð áðü ðεð ðεί ðð÷íŬ ÷ ñçóεíñðíεíŬíáíáð áέέððáέŬð ððçñåóβåð ðùí ððððçíŬðùí UNIX. Έά ðåññòóέŬóíðíå ôçí ååέáðŬóðáóç, ñýεíεóç, Ýεåå÷í εάέ ðóíðñçóç ðíεεβñ áέάöíñåðéεβñ ðýðùí áέέððáέβñ ððçñåóέβñ. Óå Ŭεí ðí εὰοŬεάεί, áέα ôç áέέð óáð áέαðεüεòíóç, ððŬñ÷íðí ðåñåååβåíåðå áέαöüññùí åñ÷åβññ ððεíβóåùí. Άöíý áέαåŬóåðå áððü ðí εὰοŬεάεί, εå íŬñåðå:

- ðùð íå áέα÷έεñβæåððå ôçí ððçñåóβå **inetd**.
- ðùð íå ððεíβóåðå Ýíå áέέððáέü óýððçíå åñ÷åβññ.
- ðùð íå ððεíβóåðå Ýíå åíððçñåðçðP áέέððáέβñ ðεçññöíñεβñ áέα ðí áέαíñååóíü εñååñέåóíβñ ÷ ñçóðβñ.
- ðùð íå ÷ ñçóέíñðíéððåðå ðí DHCP áέα ôçí áððüíåðç ñýεíεóç ðùí ðåñåíŬðñùí ðíð áέέðýíð.
- ðùð íå ððεíβóåðå Ýíå åíððçñåðçðP ïññåóβåð ðåñέí÷βñ (DNS).
- ðùð íå ððεíβóåðå ðíñ åíððçñåðçðP εóðíóåέβåññ **Apache**.
- ðùð íå ððεíβóåðå Ýíå åíððçñåðçðP ïåðåöíñŬð åñ÷åβññ (FTP).
- ðùð íå ððεíβóåðå Ýíå åíððçñåðçðP åñ÷åβññ εάέ åέðððùðβñ áέα ðåέŬðåð Windows ïå ÷ ñPóç ôçð åðåñññåðð **Samba**.
- ðùð íå ððå÷ññíβóåðå ôçí çñåññçíβå εάέ ôçí βñå, εάέ íå ððεíβóåðå Ýíå åíððçñåðçðP βñåð ïå ôç åñðεåέå ðíð NTP ðññðñéüεéñð.

ðñέí áέαåŬóåðå áððü εὰοŬεάεί, εå ðñŬðåέ:

- Íå εåðåññåβðå ðεð ååóέέŬð Ýññέåð ðùí åñ÷åβññ script /etc/rc.
- Íå åβóðå åññέåέüñŬíé ïå ôç ååóέέP ïññέñåβå ðùí áέέðýíñ.
- Íå åñññβæåðå ðùð íå ååέåðåðððåðåð ðññóέåðí εñåóíééü ðñβðñð εåðåóέåðåððP (ΈὰοŬεάεί 5).

30.2 The inetd “Super-Server”

30.2.1 Overview

inetd(8) is sometimes referred to as the “Internet Super-Server” because it manages connections for several services. When a connection is received by **inetd**, it determines which program the connection is destined for, spawns the particular process and delegates the socket to it (the program is invoked with the service socket as its standard input,

output and error descriptors). Running **inetd** for servers that are not heavily used can reduce the overall system load, when compared to running each daemon individually in stand-alone mode.

Primarily, **inetd** is used to spawn other daemons, but several trivial protocols are handled directly, such as **chargen**, **auth**, and **daytime**.

This section will cover the basics in configuring **inetd** through its command-line options and its configuration file, `/etc/inetd.conf`.

30.2.2 Settings

inetd is initialized through the rc(8) system. The `inetd_enable` option is set to `NO` by default, but may be turned on by **sysinstall** during installation, depending on the configuration chosen by the user. Placing:

```
inetd_enable="YES"
```

or

```
inetd_enable="NO"
```

into `/etc/rc.conf` will enable or disable **inetd** starting at boot time. The command:

```
/etc/rc.d/inetd rcvar
```

can be run to display the current effective setting.

Additionally, different command-line options can be passed to **inetd** via the `inetd_flags` option.

30.2.3 Command-Line Options

Like most server daemons, **inetd** has a number of options that it can be passed in order to modify its behaviour. The full list of options reads:

```
inetd [-d] [-l] [-w] [-W] [-c maximum] [-C rate] [-a address | hostname] [-p filename]
[-R rate] [-s maximum] [configuration file]
```

Options can be passed to **inetd** using the `inetd_flags` option in `/etc/rc.conf`. By default, `inetd_flags` is set to `-wW -C 60`, which turns on TCP wrapping for **inetd**'s services, and prevents any single IP address from requesting any service more than 60 times in any given minute.

Novice users may be pleased to note that these parameters usually do not need to be modified, although we mention the rate-limiting options below as they be useful should you find that you are receiving an excessive amount of connections. A full list of options can be found in the `inetd(8)` manual.

-c maximum

Specify the default maximum number of simultaneous invocations of each service; the default is unlimited. May be overridden on a per-service basis with the `max-child` parameter.

-C rate

Specify the default maximum number of times a service can be invoked from a single IP address in one minute; the default is unlimited. May be overridden on a per-service basis with the `max-connections-per-ip-per-minute` parameter.

-R rate

Specify the maximum number of times a service can be invoked in one minute; the default is 256. A rate of 0 allows an unlimited number of invocations.

-s maximum

Specify the maximum number of times a service can be invoked from a single IP address at any one time; the default is unlimited. May be overridden on a per-service basis with the `max-child-per-ip` parameter.

30.2.4 `inetd.conf`

Configuration of `inetd` is done via the file `/etc/inetd.conf`.

When a modification is made to `/etc/inetd.conf`, `inetd` can be forced to re-read its configuration file by running the command:

Διάγραμμα 30-1. Reloading the `inetd` configuration file

```
# /etc/rc.d/inetd reload
```

Each line of the configuration file specifies an individual daemon. Comments in the file are preceded by a “#”. The format of each entry in `/etc/inetd.conf` is as follows:

```
service-name
socket-type
protocol
{wait|nowait}[/max-child[/max-connections-per-ip-per-minute[/max-child-per-ip]]]
user[:group][[/login-class]]
server-program
server-program-arguments
```

An example entry for the `ftpd(8)` daemon using IPv4 might read:

```
ftp      stream  tcp      nowait  root    /usr/libexec/ftpd      ftpd -l
```

service-name

This is the service name of the particular daemon. It must correspond to a service listed in `/etc/services`. This determines which port `inetd` must listen to. If a new service is being created, it must be placed in `/etc/services` first.

socket-type

Either `stream`, `dgram`, `raw`, or `seqpacket`. `stream` must be used for connection-based, TCP daemons, while `dgram` is used for daemons utilizing the UDP transport protocol.

protocol

One of the following:

Protocol	Explanation
tcp, tcp4	TCP IPv4
udp, udp4	UDP IPv4
tcp6	TCP IPv6
udp6	UDP IPv6
tcp46	Both TCP IPv4 and v6
udp46	Both UDP IPv4 and v6

{wait|nowait}[/max-child[/max-connections-per-ip-per-minute[/max-child-per-ip]]]

`wait|nowait` indicates whether the daemon invoked from **inetd** is able to handle its own socket or not. `dgram` socket types must use the `wait` option, while stream socket daemons, which are usually multi-threaded, should use `nowait`. `wait` usually hands off multiple sockets to a single daemon, while `nowait` spawns a child daemon for each new socket.

The maximum number of child daemons **inetd** may spawn can be set using the `max-child` option. If a limit of ten instances of a particular daemon is needed, a `/10` would be placed after `nowait`. Specifying `/0` allows an unlimited number of children

In addition to `max-child`, two other options which limit the maximum connections from a single place to a particular daemon can be enabled. `max-connections-per-ip-per-minute` limits the number of connections from any particular IP address per minutes, e.g. a value of ten would limit any particular IP address connecting to a particular service to ten attempts per minute. `max-child-per-ip` limits the number of children that can be started on behalf on any single IP address at any moment. These options are useful to prevent intentional or unintentional excessive resource consumption and Denial of Service (DoS) attacks to a machine.

In this field, either of `wait` or `nowait` is mandatory. `max-child`, `max-connections-per-ip-per-minute` and `max-child-per-ip` are optional.

A stream-type multi-threaded daemon without any `max-child`, `max-connections-per-ip-per-minute` or `max-child-per-ip` limits would simply be: `nowait`.

The same daemon with a maximum limit of ten daemons would read: `nowait/10`.

The same setup with a limit of twenty connections per IP address per minute and a maximum total limit of ten child daemons would read: `nowait/10/20`.

These options are utilized by the default settings of the `fingerd(8)` daemon, as seen here:

```
finger stream tcp      nowait/3/10 nobody /usr/libexec/fingerd fingerd -s
```

Finally, an example of this field with a maximum of 100 children in total, with a maximum of 5 for any one IP address would read: `nowait/100/0/5`.

user

This is the username that the particular daemon should run as. Most commonly, daemons run as the `root` user. For security purposes, it is common to find some servers running as the `daemon` user, or the least privileged `nobody` user.

`server-program`

The full path of the daemon to be executed when a connection is received. If the daemon is a service provided by **inetd** internally, then `internal` should be used.

`server-program-arguments`

This works in conjunction with `server-program` by specifying the arguments, starting with `argv[0]`, passed to the daemon on invocation. If `mydaemon -d` is the command line, `mydaemon -d` would be the value of `server-program-arguments`. Again, if the daemon is an internal service, use `internal` here.

30.2.5 Security

Depending on the choices made at install time, many of **inetd**'s services may be enabled by default. If there is no apparent need for a particular daemon, consider disabling it. Place a “#” in front of the daemon in question in `/etc/inetd.conf`, and then reload the **inetd** configuration. Some daemons, such as **fingerd**, may not be desired at all because they provide information that may be useful to an attacker.

Some daemons are not security-conscious and have long, or non-existent, timeouts for connection attempts. This allows an attacker to slowly send connections to a particular daemon, thus saturating available resources. It may be a good idea to place `max-connections-per-ip-per-minute`, `max-child` or `max-child-per-ip` limitations on certain daemons if you find that you have too many connections.

By default, TCP wrapping is turned on. Consult the `hosts_access(5)` manual page for more information on placing TCP restrictions on various **inetd** invoked daemons.

30.2.6 Miscellaneous

daytime, **time**, **echo**, **discard**, **chargen**, and **auth** are all internally provided services of **inetd**.

The **auth** service provides identity network services, and is configurable to a certain degree, whilst the others are simply on or off.

Consult the `inetd(8)` manual page for more in-depth information.

30.3 Network File System (NFS)

Among the many different file systems that FreeBSD supports is the Network File System, also known as NFS. NFS allows a system to share directories and files with others over a network. By using NFS, users and programs can access files on remote systems almost as if they were local files.

Some of the most notable benefits that NFS can provide are:

- Local workstations use less disk space because commonly used data can be stored on a single machine and still remain accessible to others over the network.
- There is no need for users to have separate home directories on every network machine. Home directories could be set up on the NFS server and made available throughout the network.

- Storage devices such as floppy disks, CDROM drives, and Zip® drives can be used by other machines on the network. This may reduce the number of removable media drives throughout the network.

30.3.1 How NFS Works

NFS consists of at least two main parts: a server and one or more clients. The client remotely accesses the data that is stored on the server machine. In order for this to function properly a few processes have to be configured and running.

The server has to be running the following daemons:

Daemon	Description
nfsd	The NFS daemon which services requests from the NFS clients.
mountd	The NFS mount daemon which carries out the requests that nfsd(8) passes on to it.
rpcbind	This daemon allows NFS clients to discover which port the NFS server is using.

The client can also run a daemon, known as **nfsiod**. The **nfsiod** daemon services the requests from the NFS server. This is optional, and improves performance, but is not required for normal and correct operation. See the nfsiod(8) manual page for more information.

30.3.2 Configuring NFS

NFS configuration is a relatively straightforward process. The processes that need to be running can all start at boot time with a few modifications to your `/etc/rc.conf` file.

On the NFS server, make sure that the following options are configured in the `/etc/rc.conf` file:

```
rpcbind_enable="YES"
nfs_server_enable="YES"
mountd_flags="-r"
```

mountd runs automatically whenever the NFS server is enabled.

On the client, make sure this option is present in `/etc/rc.conf`:

```
nfs_client_enable="YES"
```

The `/etc/exports` file specifies which file systems NFS should export (sometimes referred to as “share”). Each line in `/etc/exports` specifies a file system to be exported and which machines have access to that file system. Along with what machines have access to that file system, access options may also be specified. There are many such options that can be used in this file but only a few will be mentioned here. You can easily discover other options by reading over the exports(5) manual page.

Here are a few example `/etc/exports` entries:

The following examples give an idea of how to export file systems, although the settings may be different depending on your environment and network configuration. For instance, to export the `/cdrom` directory to three example machines that have the same domain name as the server (hence the lack of a domain name for each) or have entries in your `/etc/hosts` file. The `-ro` flag makes the exported file system read-only. With this flag, the remote system will not be able to write any changes to the exported file system.

```
/cdrom -ro host1 host2 host3
```

The following line exports `/home` to three hosts by IP address. This is a useful setup if you have a private network without a DNS server configured. Optionally the `/etc/hosts` file could be configured for internal hostnames; please review `hosts(5)` for more information. The `-alldirs` flag allows the subdirectories to be mount points. In other words, it will not mount the subdirectories but permit the client to mount only the directories that are required or needed.

```
/home -alldirs 10.0.0.2 10.0.0.3 10.0.0.4
```

The following line exports `/a` so that two clients from different domains may access the file system. The `-maproot=root` flag allows the `root` user on the remote system to write data on the exported file system as `root`. If the `-maproot=root` flag is not specified, then even if a user has `root` access on the remote system, he will not be able to modify files on the exported file system.

```
/a -maproot=root host.example.com box.example.org
```

In order for a client to access an exported file system, the client must have permission to do so. Make sure the client is listed in your `/etc/exports` file.

In `/etc/exports`, each line represents the export information for one file system to one host. A remote host can only be specified once per file system, and may only have one default entry. For example, assume that `/usr` is a single file system. The following `/etc/exports` would be invalid:

```
# Invalid when /usr is one file system
/usr/src client
/usr/ports client
```

One file system, `/usr`, has two lines specifying exports to the same host, `client`. The correct format for this situation is:

```
/usr/src /usr/ports client
```

The properties of one file system exported to a given host must all occur on one line. Lines without a client specified are treated as a single host. This limits how you can export file systems, but for most people this is not an issue.

The following is an example of a valid export list, where `/usr` and `/exports` are local file systems:

```
# Export src and ports to client01 and client02, but only
# client01 has root privileges on it
/usr/src /usr/ports -maproot=root client01
/usr/src /usr/ports client02
# The client machines have root and can mount anywhere
# on /exports. Anyone in the world can mount /exports/obj read-only
/exports -alldirs -maproot=root client01 client02
/exports/obj -ro
```

The **mountd** daemon must be forced to recheck the `/etc/exports` file whenever it has been modified, so the changes can take effect. This can be accomplished either by sending a HUP signal to the running daemon:

```
# kill -HUP `cat /var/run/mountd.pid`
```

or by invoking the `mountd rc(8)` script with the appropriate parameter:

```
# /etc/rc.d/mountd onereload
```

Please refer to [Section 12.7](#) for more information about using rc scripts.

Alternatively, a reboot will make FreeBSD set everything up properly. A reboot is not necessary though. Executing the following commands as `root` should start everything up.

On the NFS server:

```
# rpcbind
# nfsd -u -t -n 4
# mountd -r
```

On the NFS client:

```
# nfsiod -n 4
```

Now everything should be ready to actually mount a remote file system. In these examples the server's name will be `server` and the client's name will be `client`. If you only want to temporarily mount a remote file system or would rather test the configuration, just execute a command like this as `root` on the client:

```
# mount server:/home /mnt
```

This will mount the `/home` directory on the server at `/mnt` on the client. If everything is set up correctly you should be able to enter `/mnt` on the client and see all the files that are on the server.

If you want to automatically mount a remote file system each time the computer boots, add the file system to the `/etc/fstab` file. Here is an example:

```
server:/home /mnt nfs rw 0 0
```

The `fstab(5)` manual page lists all the available options.

30.3.3 Locking

Some applications (e.g. **mutt**) require file locking to operate correctly. In the case of NFS, **rpc.lockd** can be used for file locking. To enable it, add the following to the `/etc/rc.conf` file on both client and server (it is assumed that the NFS client and server are configured already):

```
rpc_lockd_enable="YES"
rpc_statd_enable="YES"
```

Start the application by using:

```
# /etc/rc.d/nfslocking start
```

If real locking between the NFS clients and NFS server is not required, it is possible to let the NFS client do locking locally by passing `-L` to `mount_nfs(8)`. Refer to the `mount_nfs(8)` manual page for further details.

30.3.4 Practical Uses

NFS has many practical uses. Some of the more common ones are listed below:

- Set several machines to share a CDROM or other media among them. This is cheaper and often a more convenient method to install software on multiple machines.
- On large networks, it might be more convenient to configure a central NFS server in which to store all the user home directories. These home directories can then be exported to the network so that users would always have the same home directory, regardless of which workstation they log in to.
- Several machines could have a common `/usr/ports/distfiles` directory. That way, when you need to install a port on several machines, you can quickly access the source without downloading it on each machine.

30.3.5 Automatic Mounts with amd

`amd(8)` (the automatic mounter daemon) automatically mounts a remote file system whenever a file or directory within that file system is accessed. Filesystems that are inactive for a period of time will also be automatically unmounted by **amd**. Using **amd** provides a simple alternative to permanent mounts, as permanent mounts are usually listed in `/etc/fstab`.

amd operates by attaching itself as an NFS server to the `/host` and `/net` directories. When a file is accessed within one of these directories, **amd** looks up the corresponding remote mount and automatically mounts it. `/net` is used to mount an exported file system from an IP address, while `/host` is used to mount an export from a remote hostname.

An access to a file within `/host/foobar/usr` would tell **amd** to attempt to mount the `/usr` export on the host `foobar`.

Διάγραμμα 30-2. Mounting an Export with amd

You can view the available mounts of a remote host with the `showmount` command. For example, to view the mounts of a host named `foobar`, you can use:

```
% showmount -e foobar
Exports list on foobar:
/usr                10.10.10.0
/a                 10.10.10.0
% cd /host/foobar/usr
```

As seen in the example, the `showmount` shows `/usr` as an export. When changing directories to `/host/foobar/usr`, **amd** attempts to resolve the hostname `foobar` and automatically mount the desired export.

amd can be started by the startup scripts by placing the following lines in `/etc/rc.conf`:

```
amd_enable="YES"
```

Additionally, custom flags can be passed to **amd** from the `amd_flags` option. By default, `amd_flags` is set to:

```
amd_flags="-a /.amd_mnt -l syslog /host /etc/amd.map /net /etc/amd.map"
```

The `/etc/amd.map` file defines the default options that exports are mounted with. The `/etc/amd.conf` file defines some of the more advanced features of **amd**.

Consult the `amd(8)` and `amd.conf(5)` manual pages for more information.

30.3.6 Problems Integrating with Other Systems

Certain Ethernet adapters for ISA PC systems have limitations which can lead to serious network problems, particularly with NFS. This difficulty is not specific to FreeBSD, but FreeBSD systems are affected by it.

The problem nearly always occurs when (FreeBSD) PC systems are networked with high-performance workstations, such as those made by Silicon Graphics, Inc., and Sun Microsystems, Inc. The NFS mount will work fine, and some operations may succeed, but suddenly the server will seem to become unresponsive to the client, even though requests to and from other systems continue to be processed. This happens to the client system, whether the client is the FreeBSD system or the workstation. On many systems, there is no way to shut down the client gracefully once this problem has manifested itself. The only solution is often to reset the client, because the NFS situation cannot be resolved.

Though the “correct” solution is to get a higher performance and capacity Ethernet adapter for the FreeBSD system, there is a simple workaround that will allow satisfactory operation. If the FreeBSD system is the *server*, include the option `-w=1024` on the mount from the client. If the FreeBSD system is the *client*, then mount the NFS file system with the option `-r=1024`. These options may be specified using the fourth field of the `fstab` entry on the client for automatic mounts, or by using the `-o` parameter of the `mount(8)` command for manual mounts.

It should be noted that there is a different problem, sometimes mistaken for this one, when the NFS servers and clients are on different networks. If that is the case, make *certain* that your routers are routing the necessary UDP information, or you will not get anywhere, no matter what else you are doing.

In the following examples, `fastws` is the host (interface) name of a high-performance workstation, and `freebox` is the host (interface) name of a FreeBSD system with a lower-performance Ethernet adapter. Also, `/sharedfs` will be the exported NFS file system (see `exports(5)`), and `/project` will be the mount point on the client for the exported file system. In all cases, note that additional options, such as `hard` or `soft` and `bg` may be desirable in your application.

Examples for the FreeBSD system (`freebox`) as the client in `/etc/fstab` on `freebox`:

```
fastws:/sharedfs /project nfs rw,-r=1024 0 0
```

As a manual mount command on `freebox`:

```
# mount -t nfs -o -r=1024 fastws:/sharedfs /project
```

Examples for the FreeBSD system as the server in `/etc/fstab` on `fastws`:

```
freebox:/sharedfs /project nfs rw,-w=1024 0 0
```

As a manual mount command on `fastws`:

```
# mount -t nfs -o -w=1024 freebox:/sharedfs /project
```

Nearly any 16-bit Ethernet adapter will allow operation without the above restrictions on the read or write size.

For anyone who cares, here is what happens when the failure occurs, which also explains why it is unrecoverable. NFS typically works with a “block” size of 8 K (though it may do fragments of smaller sizes). Since the maximum Ethernet packet is around 1500 bytes, the NFS “block” gets split into multiple Ethernet packets, even though it is still a single unit to the upper-level code, and must be received, assembled, and *acknowledged* as a unit. The high-performance workstations can pump out the packets which comprise the NFS unit one right after the other, just as close together as the standard allows. On the smaller, lower capacity cards, the later packets overrun the earlier packets of the same unit before they can be transferred to the host and the unit as a whole cannot be reconstructed or

acknowledged. As a result, the workstation will time out and try again, but it will try again with the entire 8 K unit, and the process will be repeated, ad infinitum.

By keeping the unit size below the Ethernet packet size limitation, we ensure that any complete Ethernet packet received can be acknowledged individually, avoiding the deadlock situation.

Overruns may still occur when a high-performance workstations is slamming data out to a PC system, but with the better cards, such overruns are not guaranteed on NFS “units”. When an overrun occurs, the units affected will be retransmitted, and there will be a fair chance that they will be received, assembled, and acknowledged.

30.4 Network Information System (NIS/YP)

30.4.1 What Is It?

NIS, which stands for Network Information Services, was developed by Sun Microsystems to centralize administration of UNIX (originally SunOS) systems. It has now essentially become an industry standard; all major UNIX like systems (Solaris, HP-UX, AIX®, Linux, NetBSD, OpenBSD, FreeBSD, etc) support NIS.

NIS was formerly known as Yellow Pages, but because of trademark issues, Sun changed the name. The old term (and yp) is still often seen and used.

It is a RPC-based client/server system that allows a group of machines within an NIS domain to share a common set of configuration files. This permits a system administrator to set up NIS client systems with only minimal configuration data and add, remove or modify configuration data from a single location.

It is similar to the Windows NT® domain system; although the internal implementation of the two are not at all similar, the basic functionality can be compared.

30.4.2 Terms/Processes You Should Know

There are several terms and several important user processes that you will come across when attempting to implement NIS on FreeBSD, whether you are trying to create an NIS server or act as an NIS client:

Term	Description
NIS domainname	An NIS master server and all of its clients (including its slave servers) have a NIS domainname. Similar to an Windows NT domain name, the NIS domainname does not have anything to do with DNS.
rpcbind	Must be running in order to enable RPC (Remote Procedure Call, a network protocol used by NIS). If rpcbind is not running, it will be impossible to run an NIS server, or to act as an NIS client.
ypbind	“Binds” an NIS client to its NIS server. It will take the NIS domainname from the system, and using RPC, connect to the server. ypbind is the core of client-server communication in an NIS environment; if ypbind dies on a client machine, it will not be able to access the NIS server.

Term	Description
ypserv	Should only be running on NIS servers; this is the NIS server process itself. If ypserv(8) dies, then the server will no longer be able to respond to NIS requests (hopefully, there is a slave server to take over for it). There are some implementations of NIS (but not the FreeBSD one), that do not try to reconnect to another server if the server it used before dies. Often, the only thing that helps in this case is to restart the server process (or even the whole server) or the ypbind process on the client.
rpc.yppasswdd	Another process that should only be running on NIS master servers; this is a daemon that will allow NIS clients to change their NIS passwords. If this daemon is not running, users will have to login to the NIS master server and change their passwords there.

30.4.3 How Does It Work?

There are three types of hosts in an NIS environment: master servers, slave servers, and clients. Servers act as a central repository for host configuration information. Master servers hold the authoritative copy of this information, while slave servers mirror this information for redundancy. Clients rely on the servers to provide this information to them.

Information in many files can be shared in this manner. The `master.passwd`, `group`, and `hosts` files are commonly shared via NIS. Whenever a process on a client needs information that would normally be found in these files locally, it makes a query to the NIS server that it is bound to instead.

30.4.3.1 Machine Types

- *A NIS master server.* This server, analogous to a Windows NT primary domain controller, maintains the files used by all of the NIS clients. The `passwd`, `group`, and other various files used by the NIS clients live on the master server.

Όχι ἀβυσσός: It is possible for one machine to be an NIS master server for more than one NIS domain. However, this will not be covered in this introduction, which assumes a relatively small-scale NIS environment.

- *NIS slave servers.* Similar to the Windows NT backup domain controllers, NIS slave servers maintain copies of the NIS master's data files. NIS slave servers provide the redundancy, which is needed in important environments. They also help to balance the load of the master server: NIS Clients always attach to the NIS server whose response they get first, and this includes slave-server-replies.
- *NIS clients.* NIS clients, like most Windows NT workstations, authenticate against the NIS server (or the Windows NT domain controller in the Windows NT workstations case) to log on.

30.4.4 Using NIS/YP

This section will deal with setting up a sample NIS environment.

30.4.4.1 Planning

Let us assume that you are the administrator of a small university lab. This lab, which consists of 15 FreeBSD machines, currently has no centralized point of administration; each machine has its own `/etc/passwd` and `/etc/master.passwd`. These files are kept in sync with each other only through manual intervention; currently, when you add a user to the lab, you must run `adduser` on all 15 machines. Clearly, this has to change, so you have decided to convert the lab to use NIS, using two of the machines as servers.

Therefore, the configuration of the lab now looks something like:

Machine name	IP address	Machine role
ellington	10.0.0.2	NIS master
coltrane	10.0.0.3	NIS slave
basie	10.0.0.4	Faculty workstation
bird	10.0.0.5	Client machine
cli[1-11]	10.0.0.[6-17]	Other client machines

If you are setting up a NIS scheme for the first time, it is a good idea to think through how you want to go about it. No matter what the size of your network, there are a few decisions that need to be made.

30.4.4.1.1 Choosing a NIS Domain Name

This might not be the “domainname” that you are used to. It is more accurately called the “NIS domainname”. When a client broadcasts its requests for info, it includes the name of the NIS domain that it is part of. This is how multiple servers on one network can tell which server should answer which request. Think of the NIS domainname as the name for a group of hosts that are related in some way.

Some organizations choose to use their Internet domainname for their NIS domainname. This is not recommended as it can cause confusion when trying to debug network problems. The NIS domainname should be unique within your network and it is helpful if it describes the group of machines it represents. For example, the Art department at Acme Inc. might be in the “acme-art” NIS domain. For this example, assume you have chosen the name `test-domain`.

However, some operating systems (notably SunOS) use their NIS domain name as their Internet domain name. If one or more machines on your network have this restriction, you *must* use the Internet domain name as your NIS domain name.

30.4.4.1.2 Physical Server Requirements

There are several things to keep in mind when choosing a machine to use as a NIS server. One of the unfortunate things about NIS is the level of dependency the clients have on the server. If a client cannot contact the server for its NIS domain, very often the machine becomes unusable. The lack of user and group information causes most systems to temporarily freeze up. With this in mind you should make sure to choose a machine that will not be prone to being rebooted regularly, or one that might be used for development. The NIS server should ideally be a stand alone machine whose sole purpose in life is to be an NIS server. If you have a network that is not very heavily used, it is acceptable to put the NIS server on a machine running other services, just keep in mind that if the NIS server becomes unavailable, it will affect *all* of your NIS clients adversely.

30.4.4.2 NIS Servers

The canonical copies of all NIS information are stored on a single machine called the NIS master server. The databases used to store the information are called NIS maps. In FreeBSD, these maps are stored in `/var/yp/[domainname]` where `[domainname]` is the name of the NIS domain being served. A single NIS server can support several domains at once, therefore it is possible to have several such directories, one for each supported domain. Each domain will have its own independent set of maps.

NIS master and slave servers handle all NIS requests with the `yplib` daemon. `yplib` is responsible for receiving incoming requests from NIS clients, translating the requested domain and map name to a path to the corresponding database file and transmitting data from the database back to the client.

30.4.4.2.1 Setting Up a NIS Master Server

Setting up a master NIS server can be relatively straight forward, depending on your needs. FreeBSD comes with support for NIS out-of-the-box. All you need is to add the following lines to `/etc/rc.conf`, and FreeBSD will do the rest for you.

1.

```
nisdomainname="test-domain"
```

This line will set the NIS domainname to `test-domain` upon network setup (e.g. after reboot).

2.

```
nis_server_enable="YES"
```

This will tell FreeBSD to start up the NIS server processes when the networking is next brought up.

3.

```
nis_yppasswdd_enable="YES"
```

This will enable the `rpc.yppasswdd` daemon which, as mentioned above, will allow users to change their NIS password from a client machine.

Ὁρῶμεθα: Depending on your NIS setup, you may need to add further entries. See the section about NIS servers that are also NIS clients, below, for details.

Now, all you have to do is to run the command `/etc/netstart` as superuser. It will set up everything for you, using the values you defined in `/etc/rc.conf`.

30.4.4.2.2 Initializing the NIS Maps

The *NIS maps* are database files, that are kept in the `/var/yp` directory. They are generated from configuration files in the `/etc` directory of the NIS master, with one exception: the `/etc/master.passwd` file. This is for a good reason, you do not want to propagate passwords to your `root` and other administrative accounts to all the servers in the NIS domain. Therefore, before we initialize the NIS maps, you should:

```
# cp /etc/master.passwd /var/yp/master.passwd
# cd /var/yp
# vi master.passwd
```

You should remove all entries regarding system accounts (bin, tty, kmem, games, etc), as well as any accounts that you do not want to be propagated to the NIS clients (for example root and any other UID 0 (superuser) accounts).

Ὁδηγία: Make sure the `/var/yp/master.passwd` is neither group nor world readable (mode 600)! Use the `chmod` command, if appropriate.

When you have finished, it is time to initialize the NIS maps! FreeBSD includes a script named `ypinit` to do this for you (see its manual page for more information). Note that this script is available on most UNIX Operating Systems, but not on all. On Digital UNIX/Compaq Tru64 UNIX it is called `ypsetup`. Because we are generating maps for an NIS master, we are going to pass the `-m` option to `ypinit`. To generate the NIS maps, assuming you already performed the steps above, run:

```
ellington# ypinit -m test-domain
Server Type: MASTER Domain: test-domain
Creating an YP server will require that you answer a few questions.
Questions will all be asked at the beginning of the procedure.
Do you want this procedure to quit on non-fatal errors? [y/n: n] n
Ok, please remember to go back and redo manually whatever fails.
If you don't, something might not work.
At this point, we have to construct a list of this domains YP servers.
rod.darktech.org is already known as master server.
Please continue to add any slave servers, one per line. When you are
done with the list, type a <control D>.
master server   : ellington
next host to add: coltrane
next host to add: ^D
The current list of NIS servers looks like this:
ellington
coltrane
Is this correct? [y/n: y] y
```

[..output from map generation..]

NIS Map update completed.
ellington has been setup as an YP master server without any errors.

`ypinit` should have created `/var/yp/Makefile` from `/var/yp/Makefile.dist`. When created, this file assumes that you are operating in a single server NIS environment with only FreeBSD machines. Since `test-domain` has a slave server as well, you must edit `/var/yp/Makefile`:

```
ellington# vi /var/yp/Makefile
```

You should comment out the line that says

```
NOPUSH = "True"
```

(if it is not commented out already).

30.4.4.2.3 Setting up a NIS Slave Server

Setting up an NIS slave server is even more simple than setting up the master. Log on to the slave server and edit the file `/etc/rc.conf` as you did before. The only difference is that we now must use the `-s` option when running `ypinit`. The `-s` option requires the name of the NIS master be passed to it as well, so our command line looks like:

```
coltrane# ypinit -s ellington test-domain
```

```
Server Type: SLAVE Domain: test-domain Master: ellington
```

Creating an YP server will require that you answer a few questions. Questions will all be asked at the beginning of the procedure.

```
Do you want this procedure to quit on non-fatal errors? [y/n: n]  n
```

Ok, please remember to go back and redo manually whatever fails. If you don't, something might not work. There will be no further questions. The remainder of the procedure should take a few minutes, to copy the databases from ellington.

```
Transferring netgroup...
ypxfr: Exiting: Map successfully transferred
Transferring netgroup.byuser...
ypxfr: Exiting: Map successfully transferred
Transferring netgroup.byhost...
ypxfr: Exiting: Map successfully transferred
Transferring master.passwd.byuid...
ypxfr: Exiting: Map successfully transferred
Transferring passwd.byuid...
ypxfr: Exiting: Map successfully transferred
Transferring passwd.byname...
ypxfr: Exiting: Map successfully transferred
Transferring group.bygid...
ypxfr: Exiting: Map successfully transferred
Transferring group.byname...
ypxfr: Exiting: Map successfully transferred
Transferring services.byname...
ypxfr: Exiting: Map successfully transferred
Transferring rpc.bynumber...
ypxfr: Exiting: Map successfully transferred
Transferring rpc.byname...
ypxfr: Exiting: Map successfully transferred
Transferring protocols.byname...
ypxfr: Exiting: Map successfully transferred
Transferring master.passwd.byname...
ypxfr: Exiting: Map successfully transferred
Transferring networks.byname...
ypxfr: Exiting: Map successfully transferred
Transferring networks.byaddr...
ypxfr: Exiting: Map successfully transferred
Transferring netid.byname...
ypxfr: Exiting: Map successfully transferred
Transferring hosts.byaddr...
ypxfr: Exiting: Map successfully transferred
```

```

Transferring protocols.bynumber...
ypxfr: Exiting: Map successfully transferred
Transferring ypservers...
ypxfr: Exiting: Map successfully transferred
Transferring hosts.byname...
ypxfr: Exiting: Map successfully transferred

```

coltrane has been setup as an YP slave server without any errors.
 Don't forget to update map ypservers on ellington.

You should now have a directory called `/var/yp/test-domain`. Copies of the NIS master server's maps should be in this directory. You will need to make sure that these stay updated. The following `/etc/crontab` entries on your slave servers should do the job:

```

20 * * * * root /usr/libexec/ypxfr passwd.byname
21 * * * * root /usr/libexec/ypxfr passwd.byuid

```

These two lines force the slave to sync its maps with the maps on the master server. Although these entries are not mandatory, since the master server attempts to ensure any changes to its NIS maps are communicated to its slaves and because password information is vital to systems depending on the server, it is a good idea to force the updates. This is more important on busy networks where map updates might not always complete.

Now, run the command `/etc/netstart` on the slave server as well, which again starts the NIS server.

30.4.4.3 NIS Clients

An NIS client establishes what is called a binding to a particular NIS server using the `ypbind` daemon. `ypbind` checks the system's default domain (as set by the `domainname` command), and begins broadcasting RPC requests on the local network. These requests specify the name of the domain for which `ypbind` is attempting to establish a binding. If a server that has been configured to serve the requested domain receives one of the broadcasts, it will respond to `ypbind`, which will record the server's address. If there are several servers available (a master and several slaves, for example), `ypbind` will use the address of the first one to respond. From that point on, the client system will direct all of its NIS requests to that server. `ypbind` will occasionally "ping" the server to make sure it is still up and running. If it fails to receive a reply to one of its pings within a reasonable amount of time, `ypbind` will mark the domain as unbound and begin broadcasting again in the hopes of locating another server.

30.4.4.3.1 Setting Up a NIS Client

Setting up a FreeBSD machine to be a NIS client is fairly straightforward.

1. Edit the file `/etc/rc.conf` and add the following lines in order to set the NIS domainname and start `ypbind` upon network startup:

```

nisdomainname="test-domain"
nis_client_enable="YES"

```

2. To import all possible password entries from the NIS server, remove all user accounts from your `/etc/master.passwd` file and use `vipw` to add the following line to the end of the file:

```

+::::::::::

```

Ὁς ἀβύος: This line will afford anyone with a valid account in the NIS server's password maps an account. There are many ways to configure your NIS client by changing this line. See the `netgroups` section below for more information. For more detailed reading see O'Reilly's book on `Managing NFS and NIS`.

Ὁς ἀβύος: You should keep at least one local account (i.e. not imported via NIS) in your `/etc/master.passwd` and this account should also be a member of the group `wheel`. If there is something wrong with NIS, this account can be used to log in remotely, become `root`, and fix things.

- To import all possible group entries from the NIS server, add this line to your `/etc/group` file:

```
+:*:::
```

After completing these steps, you should be able to run `ypcat passwd` and see the NIS server's `passwd` map.

30.4.5 NIS Security

In general, any remote user can issue an RPC to `ypserv(8)` and retrieve the contents of your NIS maps, provided the remote user knows your domainname. To prevent such unauthorized transactions, `ypserv(8)` supports a feature called "securenets" which can be used to restrict access to a given set of hosts. At startup, `ypserv(8)` will attempt to load the `securenets` information from a file called `/var/yp/securenets`.

Ὁς ἀβύος: This path varies depending on the path specified with the `-p` option. This file contains entries that consist of a network specification and a network mask separated by white space. Lines starting with "#" are considered to be comments. A sample `securenets` file might look like this:

```
# allow connections from local host -- mandatory
127.0.0.1      255.255.255.255
# allow connections from any host
# on the 192.168.128.0 network
192.168.128.0 255.255.255.0
# allow connections from any host
# between 10.0.0.0 to 10.0.15.255
# this includes the machines in the testlab
10.0.0.0      255.255.240.0
```

If `ypserv(8)` receives a request from an address that matches one of these rules, it will process the request normally. If the address fails to match a rule, the request will be ignored and a warning message will be logged. If the `/var/yp/securenets` file does not exist, `ypserv` will allow connections from any host.

The `ypserv` program also has support for Wietse Venema's **TCP Wrapper** package. This allows the administrator to use the **TCP Wrapper** configuration files for access control instead of `/var/yp/securenets`.

Ὁς ἀβύος: While both of these access control mechanisms provide some security, they, like the privileged port test, are vulnerable to "IP spoofing" attacks. All NIS-related traffic should be blocked at your firewall.

Servers using `/var/yp/securenets` may fail to serve legitimate NIS clients with archaic TCP/IP implementations. Some of these implementations set all host bits to zero when doing broadcasts and/or fail to observe the subnet mask when calculating the broadcast address. While some of these problems can be fixed by changing the client configuration, other problems may force the retirement of the client systems in question or the abandonment of `/var/yp/securenets`.

Using `/var/yp/securenets` on a server with such an archaic implementation of TCP/IP is a really bad idea and will lead to loss of NIS functionality for large parts of your network.

The use of the **TCP Wrapper** package increases the latency of your NIS server. The additional delay may be long enough to cause timeouts in client programs, especially in busy networks or with slow NIS servers. If one or more of your client systems suffers from these symptoms, you should convert the client systems in question into NIS slave servers and force them to bind to themselves.

30.4.6 Barring Some Users from Logging On

In our lab, there is a machine `basie` that is supposed to be a faculty only workstation. We do not want to take this machine out of the NIS domain, yet the `passwd` file on the master NIS server contains accounts for both faculty and students. What can we do?

There is a way to bar specific users from logging on to a machine, even if they are present in the NIS database. To do this, all you must do is add `-username` to the end of the `/etc/master.passwd` file on the client machine, where `username` is the username of the user you wish to bar from logging in. This should preferably be done using `vipw`, since `vipw` will sanity check your changes to `/etc/master.passwd`, as well as automatically rebuild the password database when you finish editing. For example, if we wanted to bar user `bill` from logging on to `basie` we would:

```
basie# vipw
[add -bill to the end, exit]
vipw: rebuilding the database...
vipw: done

basie# cat /etc/master.passwd

root:[password]:0:0::0:0:The super-user:/root:/bin/csh
toor:[password]:0:0::0:0:The other super-user:/root:/bin/sh
daemon:*:1:1::0:0:Owner of many system processes:/root:/sbin/nologin
operator:*:2:5::0:0:System &:/sbin/nologin
bin:*:3:7::0:0:Binaries Commands and Source,,:/sbin/nologin
tty:*:4:65533::0:0:Tty Sandbox:/sbin/nologin
kmem:*:5:65533::0:0:KMem Sandbox:/sbin/nologin
games:*:7:13::0:0:Games pseudo-user:/usr/games:/sbin/nologin
news:*:8:8::0:0:News Subsystem:/sbin/nologin
man:*:9:9::0:0:Mister Man Pages:/usr/share/man:/sbin/nologin
bind:*:53:53::0:0:Bind Sandbox:/sbin/nologin
uucp:*:66:66::0:0:UUCP pseudo-user:/var/spool/uucppublic:/usr/libexec/uucp/uucico
xten:*:67:67::0:0:X-10 daemon:/usr/local/xten:/sbin/nologin
pop:*:68:6::0:0:Post Office Owner:/nonexistent:/sbin/nologin
nobody:*:65534:65534::0:0:Unprivileged user:/nonexistent:/sbin/nologin
+:::
-bill
```

basie#

30.4.7 Using Netgroups

The method shown in the previous section works reasonably well if you need special rules for a very small number of users and/or machines. On larger networks, you *will* forget to bar some users from logging onto sensitive machines, or you may even have to modify each machine separately, thus losing the main benefit of NIS: *centralized* administration.

The NIS developers' solution for this problem is called *netgroups*. Their purpose and semantics can be compared to the normal groups used by UNIX file systems. The main differences are the lack of a numeric ID and the ability to define a netgroup by including both user accounts and other netgroups.

Netgroups were developed to handle large, complex networks with hundreds of users and machines. On one hand, this is a Good Thing if you are forced to deal with such a situation. On the other hand, this complexity makes it almost impossible to explain netgroups with really simple examples. The example used in the remainder of this section demonstrates this problem.

Let us assume that your successful introduction of NIS in your laboratory caught your superiors' interest. Your next job is to extend your NIS domain to cover some of the other machines on campus. The two tables contain the names of the new users and new machines as well as brief descriptions of them.

User Name(s)	Description
alpha, beta	Normal employees of the IT department
charlie, delta	The new apprentices of the IT department
echo, foxtrott, golf, ...	Ordinary employees
able, baker, ...	The current interns

Machine Name(s)	Description
war, death, famine, pollution	Your most important servers. Only the IT employees are allowed to log onto these machines.
pride, greed, envy, wrath, lust, sloth	Less important servers. All members of the IT department are allowed to login onto these machines.
one, two, three, four, ...	Ordinary workstations. Only the <i>real</i> employees are allowed to use these machines.
trashcan	A very old machine without any critical data. Even the intern is allowed to use this box.

If you tried to implement these restrictions by separately blocking each user, you would have to add one `-user` line to each system's `passwd` for each user who is not allowed to login onto that system. If you forget just one entry, you could be in trouble. It may be feasible to do this correctly during the initial setup, however you *will* eventually forget to add the lines for new users during day-to-day operations. After all, Murphy was an optimist.

Handling this situation with netgroups offers several advantages. Each user need not be handled separately; you assign a user to one or more netgroups and allow or forbid logins for all members of the netgroup. If you add a new machine, you will only have to define login restrictions for netgroups. If a new user is added, you will only have to add the user to one or more netgroups. Those changes are independent of each other: no more "for each combination

of user and machine do...” If your NIS setup is planned carefully, you will only have to modify exactly one central configuration file to grant or deny access to machines.

The first step is the initialization of the NIS map netgroup. FreeBSD’s ypinit(8) does not create this map by default, but its NIS implementation will support it once it has been created. To create an empty map, simply type

```
ellington# vi /var/yp/netgroup
```

and start adding content. For our example, we need at least four netgroups: IT employees, IT apprentices, normal employees and interns.

```
IT_EMP (,alpha,test-domain) (,beta,test-domain)
IT_APP (,charlie,test-domain) (,delta,test-domain)
USERS (,echo,test-domain) (,foxtrott,test-domain) \
      (,golf,test-domain)
INTERNS (,able,test-domain) (,baker,test-domain)
```

IT_EMP, IT_APP etc. are the names of the netgroups. Each bracketed group adds one or more user accounts to it. The three fields inside a group are:

1. The name of the host(s) where the following items are valid. If you do not specify a hostname, the entry is valid on all hosts. If you do specify a hostname, you will enter a realm of darkness, horror and utter confusion.
2. The name of the account that belongs to this netgroup.
3. The NIS domain for the account. You can import accounts from other NIS domains into your netgroup if you are one of the unlucky fellows with more than one NIS domain.

Each of these fields can contain wildcards. See netgroup(5) for details.

Όχι ἄβυσσός: Netgroup names longer than 8 characters should not be used, especially if you have machines running other operating systems within your NIS domain. The names are case sensitive; using capital letters for your netgroup names is an easy way to distinguish between user, machine and netgroup names.

Some NIS clients (other than FreeBSD) cannot handle netgroups with a large number of entries. For example, some older versions of SunOS start to cause trouble if a netgroup contains more than 15 *entries*. You can circumvent this limit by creating several sub-netgroups with 15 users or less and a real netgroup that consists of the sub-netgroups:

```
BIGGRP1 (,joe1,domain) (,joe2,domain) (,joe3,domain) [...]
BIGGRP2 (,joe16,domain) (,joe17,domain) [...]
BIGGRP3 (,joe31,domain) (,joe32,domain)
BIGGROUP BIGGRP1 BIGGRP2 BIGGRP3
```

You can repeat this process if you need more than 225 users within a single netgroup.

Activating and distributing your new NIS map is easy:

```
ellington# cd /var/yp
ellington# make
```

This will generate the three NIS maps netgroup, netgroup.byhost and netgroup.byuser. Use ypcat(1) to check if your new NIS maps are available:

```
ellington% ypcat -k netgroup
ellington% ypcat -k netgroup.byhost
ellington% ypcat -k netgroup.byuser
```

The output of the first command should resemble the contents of `/var/yp/netgroup`. The second command will not produce output if you have not specified host-specific netgroups. The third command can be used to get the list of netgroups for a user.

The client setup is quite simple. To configure the server `war`, you only have to start `vipw(8)` and replace the line

```
+:::~::~:
```

with

```
+@IT_EMP:::~::~:
```

Now, only the data for the users defined in the netgroup `IT_EMP` is imported into `war`'s password database and only these users are allowed to login.

Unfortunately, this limitation also applies to the `~` function of the shell and all routines converting between user names and numerical user IDs. In other words, `cd ~user` will not work, `ls -l` will show the numerical ID instead of the username and `find . -user joe -print` will fail with `No such user`. To fix this, you will have to import all user entries *without allowing them to login onto your servers*.

This can be achieved by adding another line to `/etc/master.passwd`. This line should contain:

```
+:::~::~:/sbin/nologin, meaning "Import all entries but replace the shell with /sbin/nologin in the imported entries". You can replace any field in the passwd entry by placing a default value in your /etc/master.passwd.
```

Προσοχή: Make sure that the line `+:::~::~:/sbin/nologin` is placed after `+@IT_EMP:::~::~:`. Otherwise, all user accounts imported from NIS will have `/sbin/nologin` as their login shell.

After this change, you will only have to change one NIS map if a new employee joins the IT department. You could use a similar approach for the less important servers by replacing the old `+:::~::~:` in their local version of `/etc/master.passwd` with something like this:

```
+@IT_EMP:::~::~:
+@IT_APP:::~::~:
+:::~::~:/sbin/nologin
```

The corresponding lines for the normal workstations could be:

```
+@IT_EMP:::~::~:
+@USERS:::~::~:
+:::~::~:/sbin/nologin
```

And everything would be fine until there is a policy change a few weeks later: The IT department starts hiring interns. The IT interns are allowed to use the normal workstations and the less important servers; and the IT apprentices are allowed to login onto the main servers. You add a new netgroup `IT_INTERN`, add the new IT interns to this netgroup and start to change the configuration on each and every machine... As the old saying goes: "Errors in centralized planning lead to global mess".

NIS' ability to create netgroups from other netgroups can be used to prevent situations like these. One possibility is the creation of role-based netgroups. For example, you could create a netgroup called BIGSRV to define the login restrictions for the important servers, another netgroup called SMALLSRV for the less important servers and a third netgroup called USERBOX for the normal workstations. Each of these netgroups contains the netgroups that are allowed to login onto these machines. The new entries for your NIS map netgroup should look like this:

```
BIGSRV    IT_EMP  IT_APP
SMALLSRV  IT_EMP  IT_APP  ITINTERN
USERBOX   IT_EMP  ITINTERN  USERS
```

This method of defining login restrictions works reasonably well if you can define groups of machines with identical restrictions. Unfortunately, this is the exception and not the rule. Most of the time, you will need the ability to define login restrictions on a per-machine basis.

Machine-specific netgroup definitions are the other possibility to deal with the policy change outlined above. In this scenario, the `/etc/master.passwd` of each box contains two lines starting with "+". The first of them adds a netgroup with the accounts allowed to login onto this machine, the second one adds all other accounts with `/sbin/nologin` as shell. It is a good idea to use the "ALL-CAPS" version of the machine name as the name of the netgroup. In other words, the lines should look like this:

```
+@BOXNAME:::::::::
+:::::::::/sbin/nologin
```

Once you have completed this task for all your machines, you will not have to modify the local versions of `/etc/master.passwd` ever again. All further changes can be handled by modifying the NIS map. Here is an example of a possible netgroup map for this scenario with some additional goodies:

```
# Define groups of users first
IT_EMP    (,alpha,test-domain)  (,beta,test-domain)
IT_APP    (,charlie,test-domain) (,delta,test-domain)
DEPT1     (,echo,test-domain)   (,foxtrott,test-domain)
DEPT2     (,golf,test-domain)   (,hotel,test-domain)
DEPT3     (,india,test-domain)  (,juliet,test-domain)
ITINTERN  (,kilo,test-domain)   (,lima,test-domain)
D_INTERNS (,able,test-domain)   (,baker,test-domain)
#
# Now, define some groups based on roles
USERS     DEPT1  DEPT2  DEPT3
BIGSRV    IT_EMP  IT_APP
SMALLSRV  IT_EMP  IT_APP  ITINTERN
USERBOX   IT_EMP  ITINTERN  USERS
#
# And a groups for a special tasks
# Allow echo and golf to access our anti-virus-machine
SECURITY  IT_EMP  (,echo,test-domain) (,golf,test-domain)
#
# machine-based netgroups
# Our main servers
WAR       BIGSRV
FAMINE    BIGSRV
# User india needs access to this server
POLLUTION BIGSRV (,india,test-domain)
#
```

```
# This one is really important and needs more access restrictions
DEATH      IT_EMP
#
# The anti-virus-machine mentioned above
ONE        SECURITY
#
# Restrict a machine to a single user
TWO        (,hotel,test-domain)
# [...more groups to follow]
```

If you are using some kind of database to manage your user accounts, you should be able to create the first part of the map with your database's report tools. This way, new users will automatically have access to the boxes.

One last word of caution: It may not always be advisable to use machine-based netgroups. If you are deploying a couple of dozen or even hundreds of identical machines for student labs, you should use role-based netgroups instead of machine-based netgroups to keep the size of the NIS map within reasonable limits.

30.4.8 Important Things to Remember

There are still a couple of things that you will need to do differently now that you are in an NIS environment.

- Every time you wish to add a user to the lab, you must add it to the master NIS server *only*, and *you must remember to rebuild the NIS maps*. If you forget to do this, the new user will not be able to login anywhere except on the NIS master. For example, if we needed to add a new user `jsmith` to the lab, we would:

```
# pw useradd jsmith
# cd /var/yp
# make test-domain
```

You could also run `adduser jsmith` instead of `pw useradd jsmith`.

- *Keep the administration accounts out of the NIS maps*. You do not want to be propagating administrative accounts and passwords to machines that will have users that should not have access to those accounts.
- *Keep the NIS master and slave secure, and minimize their downtime*. If somebody either hacks or simply turns off these machines, they have effectively rendered many people without the ability to login to the lab.

This is the chief weakness of any centralized administration system. If you do not protect your NIS servers, you will have a lot of angry users!

30.4.9 NIS v1 Compatibility

FreeBSD's `ypserv` has some support for serving NIS v1 clients. FreeBSD's NIS implementation only uses the NIS v2 protocol, however other implementations include support for the v1 protocol for backwards compatibility with older systems. The `ybind` daemons supplied with these systems will try to establish a binding to an NIS v1 server even though they may never actually need it (and they may persist in broadcasting in search of one even after they receive a response from a v2 server). Note that while support for normal client calls is provided, this version of `ypserv` does not handle v1 map transfer requests; consequently, it cannot be used as a master or slave in conjunction with older NIS servers that only support the v1 protocol. Fortunately, there probably are not any such servers still in use today.

30.4.10 NIS Servers That Are Also NIS Clients

Care must be taken when running `ypserv` in a multi-server domain where the server machines are also NIS clients. It is generally a good idea to force the servers to bind to themselves rather than allowing them to broadcast bind requests and possibly become bound to each other. Strange failure modes can result if one server goes down and others are dependent upon it. Eventually all the clients will time out and attempt to bind to other servers, but the delay involved can be considerable and the failure mode is still present since the servers might bind to each other all over again.

You can force a host to bind to a particular server by running `yplibind` with the `-s` flag. If you do not want to do this manually each time you reboot your NIS server, you can add the following lines to your `/etc/rc.conf`:

```
nis_client_enable="YES" # run client stuff as well
nis_client_flags="-S NIS domain,server"
```

See `yplibind(8)` for further information.

30.4.11 Password Formats

One of the most common issues that people run into when trying to implement NIS is password format compatibility. If your NIS server is using DES encrypted passwords, it will only support clients that are also using DES. For example, if you have Solaris NIS clients in your network, then you will almost certainly need to use DES encrypted passwords.

To check which format your servers and clients are using, look at `/etc/login.conf`. If the host is configured to use DES encrypted passwords, then the `default` class will contain an entry like this:

```
default:\
:passwd_format=des:\
:copyright=/etc/COPYRIGHT:\
[Further entries elided]
```

Other possible values for the `passwd_format` capability include `blf` and `md5` (for Blowfish and MD5 encrypted passwords, respectively).

If you have made changes to `/etc/login.conf`, you will also need to rebuild the login capability database, which is achieved by running the following command as `root`:

```
# cap_mkdb /etc/login.conf
```

Όχι! The format of passwords already in `/etc/master.passwd` will not be updated until a user changes his password for the first time *after* the login capability database is rebuilt.

Next, in order to ensure that passwords are encrypted with the format that you have chosen, you should also check that the `crypt_default` in `/etc/auth.conf` gives precedence to your chosen password format. To do this, place the format that you have chosen first in the list. For example, when using DES encrypted passwords, the entry would be:

```
crypt_default = des blf md5
```

Having followed the above steps on each of the FreeBSD based NIS servers and clients, you can be sure that they all agree on which password format is used within your network. If you have trouble authenticating on an NIS client, this is a pretty good place to start looking for possible problems. Remember: if you want to deploy an NIS server for a heterogenous network, you will probably have to use DES on all systems because it is the lowest common standard.

30.5 Automatic Network Configuration (DHCP)

30.5.1 What Is DHCP?

DHCP, the Dynamic Host Configuration Protocol, describes the means by which a system can connect to a network and obtain the necessary information for communication upon that network. FreeBSD versions prior to 6.0 use the ISC (Internet Software Consortium) DHCP client (`dhclient(8)`) implementation. Later versions use the OpenBSD `dhclient` taken from OpenBSD 3.7. All information here regarding `dhclient` is for use with either of the ISC or OpenBSD DHCP clients. The DHCP server is the one included in the ISC distribution.

30.5.2 What This Section Covers

This section describes both the client-side components of the ISC and OpenBSD DHCP client and server-side components of the ISC DHCP system. The client-side program, `dhclient`, comes integrated within FreeBSD, and the server-side portion is available from the `net/isc-dhcp3-server` port. The `dhclient(8)`, `dhcp-options(5)`, and `dhclient.conf(5)` manual pages, in addition to the references below, are useful resources.

30.5.3 How It Works

When `dhclient`, the DHCP client, is executed on the client machine, it begins broadcasting requests for configuration information. By default, these requests are on UDP port 68. The server replies on UDP 67, giving the client an IP address and other relevant network information such as netmask, router, and DNS servers. All of this information comes in the form of a DHCP “lease” and is only valid for a certain time (configured by the DHCP server maintainer). In this manner, stale IP addresses for clients no longer connected to the network can be automatically reclaimed.

DHCP clients can obtain a great deal of information from the server. An exhaustive list may be found in `dhcp-options(5)`.

30.5.4 FreeBSD Integration

FreeBSD fully integrates the ISC or OpenBSD DHCP client, `dhclient` (according to the FreeBSD version you run). DHCP client support is provided within both the installer and the base system, obviating the need for detailed knowledge of network configurations on any network that runs a DHCP server. `dhclient` has been included in all FreeBSD distributions since 3.2.

DHCP is supported by `sysinstall`. When configuring a network interface within `sysinstall`, the second question asked is: “Do you want to try DHCP configuration of the interface?”. Answering affirmatively will execute `dhclient`, and if successful, will fill in the network configuration information automatically.

There are two things you must do to have your system use DHCP upon startup:

- Make sure that the `bpf` device is compiled into your kernel. To do this, add `device bpf` to your kernel configuration file, and rebuild the kernel. For more information about building kernels, see ἔκδοσις 9.

The `bpf` device is already part of the `GENERIC` kernel that is supplied with FreeBSD, so if you do not have a custom kernel, you should not need to create one in order to get DHCP working.

Ὁλοκληρωμένη: For those who are particularly security conscious, you should be warned that `bpf` is also the device that allows packet sniffers to work correctly (although they still have to be run as `root`). `bpf` is required to use DHCP, but if you are very sensitive about security, you probably should not add `bpf` to your kernel in the expectation that at some point in the future you will be using DHCP.

- Edit your `/etc/rc.conf` to include the following:

```
ifconfig_fxp0="DHCP"
```

Ὁλοκληρωμένη: Be sure to replace `fxp0` with the designation for the interface that you wish to dynamically configure, as described in ἔκδοσις 12.8.

If you are using a different location for `dhclient`, or if you wish to pass additional flags to `dhclient`, also include the following (editing as necessary):

```
dhcp_program="/sbin/dhclient"
dhcp_flags=""
```

The DHCP server, **dhcpcd**, is included as part of the `net/isc-dhcp3-server` port in the ports collection. This port contains the ISC DHCP server and documentation.

30.5.5 Files

- `/etc/dhclient.conf`

`dhclient` requires a configuration file, `/etc/dhclient.conf`. Typically the file contains only comments, the defaults being reasonably sane. This configuration file is described by the `dhclient.conf(5)` manual page.

- `/sbin/dhclient`

`dhclient` is statically linked and resides in `/sbin`. The `dhclient(8)` manual page gives more information about `dhclient`.

- `/sbin/dhclient-script`

`dhclient-script` is the FreeBSD-specific DHCP client configuration script. It is described in `dhclient-script(8)`, but should not need any user modification to function properly.

- `/var/db/dhclient.leases`

The DHCP client keeps a database of valid leases in this file, which is written as a log. `dhclient.leases(5)` gives a slightly longer description.

30.5.6 Further Reading

The DHCP protocol is fully described in RFC 2131 (<http://www.freesoft.org/CIE/RFC/2131/>). An informational resource has also been set up at <http://www.dhcp.org/>.

30.5.7 Installing and Configuring a DHCP Server

30.5.7.1 What This Section Covers

This section provides information on how to configure a FreeBSD system to act as a DHCP server using the ISC (Internet Software Consortium) implementation of the DHCP server.

The server is not provided as part of FreeBSD, and so you will need to install the `net/isc-dhcp3-server` port to provide this service. See Ἐἰσαγωγή 5 for more information on using the Ports Collection.

30.5.7.2 DHCP Server Installation

In order to configure your FreeBSD system as a DHCP server, you will need to ensure that the `bpf(4)` device is compiled into your kernel. To do this, add `device bpf` to your kernel configuration file, and rebuild the kernel. For more information about building kernels, see Ἐἰσαγωγή 9.

The `bpf` device is already part of the `GENERIC` kernel that is supplied with FreeBSD, so you do not need to create a custom kernel in order to get DHCP working.

Ὁξιάβουξ: Those who are particularly security conscious should note that `bpf` is also the device that allows packet sniffers to work correctly (although such programs still need privileged access). `bpf` is required to use DHCP, but if you are very sensitive about security, you probably should not include `bpf` in your kernel purely because you expect to use DHCP at some point in the future.

The next thing that you will need to do is edit the sample `dhcpd.conf` which was installed by the `net/isc-dhcp3-server` port. By default, this will be `/usr/local/etc/dhcpd.conf.sample`, and you should copy this to `/usr/local/etc/dhcpd.conf` before proceeding to make changes.

30.5.7.3 Configuring the DHCP Server

`dhcpd.conf` is comprised of declarations regarding subnets and hosts, and is perhaps most easily explained using an example :

```
option domain-name "example.com";❶
option domain-name-servers 192.168.4.100;❷
option subnet-mask 255.255.255.0;❸

default-lease-time 3600;❹
max-lease-time 86400;❺
ddns-update-style none;❻

subnet 192.168.4.0 netmask 255.255.255.0 {
    range 192.168.4.129 192.168.4.254;❼
```

```
option routers 192.168.4.1; ❸
}

host mailhost {
    hardware ethernet 02:03:04:05:06:07; ❹
    fixed-address mailhost.example.com; (10)
}
```

- ❶ This option specifies the domain that will be provided to clients as the default search domain. See `resolv.conf(5)` for more information on what this means.
- ❷ This option specifies a comma separated list of DNS servers that the client should use.
- ❸ The netmask that will be provided to clients.
- ❹ A client may request a specific length of time that a lease will be valid. Otherwise the server will assign a lease with this expiry value (in seconds).
- ❺ This is the maximum length of time that the server will lease for. Should a client request a longer lease, a lease will be issued, although it will only be valid for `max-lease-time` seconds.
- ❻ This option specifies whether the DHCP server should attempt to update DNS when a lease is accepted or released. In the ISC implementation, this option is *required*.
- ❼ This denotes which IP addresses should be used in the pool reserved for allocating to clients. IP addresses between, and including, the ones stated are handed out to clients.
- ❽ Declares the default gateway that will be provided to clients.
- ❾ The hardware MAC address of a host (so that the DHCP server can recognize a host when it makes a request).
- (10) Specifies that the host should always be given the same IP address. Note that using a hostname is correct here, since the DHCP server will resolve the hostname itself before returning the lease information.

Once you have finished writing your `dhcpd.conf`, you should enable the DHCP server in `/etc/rc.conf`, i.e. by adding:

```
dhcpd_enable="YES"
dhcpd_ifaces="dc0"
```

Replace the `dc0` interface name with the interface (or interfaces, separated by whitespace) that your DHCP server should listen on for DHCP client requests.

Then, you can proceed to start the server by issuing the following command:

```
# /usr/local/etc/rc.d/isc-dhcpd.sh start
```

Should you need to make changes to the configuration of your server in the future, it is important to note that sending a `SIGHUP` signal to **dhcpd** does *not* result in the configuration being reloaded, as it does with most daemons. You will need to send a `SIGTERM` signal to stop the process, and then restart it using the command above.

30.5.7.4 Files

- `/usr/local/sbin/dhcpd`

dhcpd is statically linked and resides in `/usr/local/sbin`. The `dhcpd(8)` manual page installed with the port gives more information about **dhcpd**.

- `/usr/local/etc/dhcpd.conf`

dhcpd requires a configuration file, `/usr/local/etc/dhcpd.conf` before it will start providing service to clients. This file needs to contain all the information that should be provided to clients that are being serviced, along with information regarding the operation of the server. This configuration file is described by the `dhcpd.conf(5)` manual page installed by the port.

- `/var/db/dhcpd.leases`

The DHCP server keeps a database of leases it has issued in this file, which is written as a log. The manual page `dhcpd.leases(5)`, installed by the port gives a slightly longer description.

- `/usr/local/sbin/dhcrelay`

dhcrelay is used in advanced environments where one DHCP server forwards a request from a client to another DHCP server on a separate network. If you require this functionality, then install the `net/isc-dhcp3-relay` port. The `dhcrelay(8)` manual page provided with the port contains more detail.

30.6 Domain Name System (DNS)

30.6.1 Overview

FreeBSD utilizes, by default, a version of BIND (Berkeley Internet Name Domain), which is the most common implementation of the DNS protocol. DNS is the protocol through which names are mapped to IP addresses, and vice versa. For example, a query for `www.FreeBSD.org` will receive a reply with the IP address of The FreeBSD Project's web server, whereas, a query for `ftp.FreeBSD.org` will return the IP address of the corresponding FTP machine. Likewise, the opposite can happen. A query for an IP address can resolve its hostname. It is not necessary to run a name server to perform DNS lookups on a system.

FreeBSD currently comes with BIND9 DNS server software by default. Our installation provides enhanced security features, a new file system layout and automated `chroot(8)` configuration.

DNS is coordinated across the Internet through a somewhat complex system of authoritative root, Top Level Domain (TLD), and other smaller-scale name servers which host and cache individual domain information.

Currently, BIND is maintained by the Internet Software Consortium <http://www.isc.org/>.

30.6.2 Terminology

To understand this document, some terms related to DNS must be understood.

Term	Definition
Forward DNS	Mapping of hostnames to IP addresses.
Origin	Refers to the domain covered in a particular zone file.
named , BIND, name server	Common names for the BIND name server package within FreeBSD.

Term	Definition
Resolver	A system process through which a machine queries a name server for zone information.
Reverse DNS	The opposite of forward DNS; mapping of IP addresses to hostnames.
Root zone	The beginning of the Internet zone hierarchy. All zones fall under the root zone, similar to how all files in a file system fall under the root directory.
Zone	An individual domain, subdomain, or portion of the DNS administered by the same authority.

Examples of zones:

- `.` is the root zone.
- `org.` is a Top Level Domain (TLD) under the root zone.
- `example.org.` is a zone under the `org.` TLD.
- `1.168.192.in-addr.arpa` is a zone referencing all IP addresses which fall under the `192.168.1.*` IP space.

As one can see, the more specific part of a hostname appears to its left. For example, `example.org.` is more specific than `org.`, as `org.` is more specific than the root zone. The layout of each part of a hostname is much like a file system: the `/dev` directory falls within the root, and so on.

30.6.3 Reasons to Run a Name Server

Name servers usually come in two forms: an authoritative name server, and a caching name server.

An authoritative name server is needed when:

- One wants to serve DNS information to the world, replying authoritatively to queries.
- A domain, such as `example.org`, is registered and IP addresses need to be assigned to hostnames under it.
- An IP address block requires reverse DNS entries (IP to hostname).
- A backup or second name server, called a slave, will reply to queries.

A caching name server is needed when:

- A local DNS server may cache and respond more quickly than querying an outside name server.

When one queries for `www.FreeBSD.org`, the resolver usually queries the uplink ISP's name server, and retrieves the reply. With a local, caching DNS server, the query only has to be made once to the outside world by the caching DNS server. Every additional query will not have to look to the outside of the local network, since the information is cached locally.

30.6.4 How It Works

In FreeBSD, the BIND daemon is called **named** for obvious reasons.

File	Description
------	-------------

File	Description
named(8)	The BIND daemon.
rndc(8)	Name server control utility.
/etc/namedb	Directory where BIND zone information resides.
/etc/namedb/named.conf	Configuration file of the daemon.

Depending on how a given zone is configured on the server, the files related to that zone can be found in the `master`, `slave`, or `dynamic` subdirectories of the `/etc/namedb` directory. These files contain the DNS information that will be given out by the name server in response to queries.

30.6.5 Starting BIND

Since BIND is installed by default, configuring it all is relatively simple.

The default `named` configuration is that of a basic resolving name server, ran in a `chroot(8)` environment. To start the server one time with this configuration, use the following command:

```
# /etc/rc.d/named forcestart
```

To ensure the `named` daemon is started at boot each time, put the following line into the `/etc/rc.conf`:

```
named_enable="YES"
```

There are obviously many configuration options for `/etc/namedb/named.conf` that are beyond the scope of this document. However, if you are interested in the startup options for `named` on FreeBSD, take a look at the `named_*` flags in `/etc/defaults/rc.conf` and consult the `rc.conf(5)` manual page. The `Οἰπία 12.7` section is also a good read.

30.6.6 Configuration Files

Configuration files for `named` currently reside in `/etc/namedb` directory and will need modification before use, unless all that is needed is a simple resolver. This is where most of the configuration will be performed.

30.6.6.1 Using `make-localhost`

To configure a master zone for the localhost visit the `/etc/namedb` directory and run the following command:

```
# sh make-localhost
```

If all went well, a new file should exist in the `master` subdirectory. The filenames should be `localhost.rev` for the local domain name and `localhost-v6.rev` for IPv6 configurations. As the default configuration file, required information will be present in the `named.conf` file.

30.6.6.2 `/etc/namedb/named.conf`

```
// $FreeBSD$
//
// Refer to the named.conf(5) and named(8) man pages, and the documentation
```

```
// in /usr/share/doc/bind9 for more details.
//
// If you are going to set up an authoritative server, make sure you
// understand the hairy details of how DNS works. Even with
// simple mistakes, you can break connectivity for affected parties,
// or cause huge amounts of useless Internet traffic.

options {
    directory "/etc/namedb";
    pid-file "/var/run/named/pid";
    dump-file "/var/dump/named_dump.db";
    statistics-file "/var/stats/named.stats";

// If named is being used only as a local resolver, this is a safe default.
// For named to be accessible to the network, comment this option, specify
// the proper IP address, or delete this option.
    listen-on { 127.0.0.1; };

// If you have IPv6 enabled on this system, uncomment this option for
// use as a local resolver. To give access to the network, specify
// an IPv6 address, or the keyword "any".
// listen-on-v6 { ::1; };

// In addition to the "forwarders" clause, you can force your name
// server to never initiate queries of its own, but always ask its
// forwarders only, by enabling the following line:
//
// forward only;

// If you've got a DNS server around at your upstream provider, enter
// its IP address here, and enable the line below. This will make you
// benefit from its cache, thus reduce overall DNS traffic in the Internet.
/*
    forwarders {
        127.0.0.1;
    };
*/
```

Just as the comment says, to benefit from an uplink's cache, `forwarders` can be enabled here. Under normal circumstances, a name server will recursively query the Internet looking at certain name servers until it finds the answer it is looking for. Having this enabled will have it query the uplink's name server (or name server provided) first, taking advantage of its cache. If the uplink name server in question is a heavily trafficked, fast name server, enabling this may be worthwhile.

Ἐññáéäïðíßçóç: 127.0.0.1 will *not* work here. Change this IP address to a name server at your uplink.

```
/*
 * If there is a firewall between you and nameservers you want
 * to talk to, you might need to uncomment the query-source
 * directive below. Previous versions of BIND always asked
 * questions using port 53, but BIND versions 8 and later
```



```

algorithm hmac-md5;
secret "sf87HJqjkqh8ac87a0211a==";
};
zone "example.org" {
    type master;
    allow-update {
        key "exampleorgkey";
    };
    file "dynamic/example.org";
};
*/

/* Examples of forward and reverse slave zones
zone "example.com" {
    type slave;
    file "slave/example.com";
    masters {
        192.168.1.1;
    };
};
zone "1.168.192.in-addr.arpa" {
    type slave;
    file "slave/1.168.192.in-addr.arpa";
    masters {
        192.168.1.1;
    };
};
*/

```

In `named.conf`, these are examples of slave entries for a forward and reverse zone.

For each new zone served, a new zone entry must be added to `named.conf`.

For example, the simplest zone entry for `example.org` can look like:

```

zone "example.org" {
    type master;
    file "master/example.org";
};

```

The zone is a master, as indicated by the `type` statement, holding its zone information in `/etc/namedb/master/example.org` indicated by the `file` statement.

```

zone "example.org" {
    type slave;
    file "slave/example.org";
};

```

In the slave case, the zone information is transferred from the master name server for the particular zone, and saved in the file specified. If and when the master server dies or is unreachable, the slave name server will have the transferred zone information and will be able to serve it.

30.6.6.3 Zone Files

An example master zone file for `example.org` (existing within `/etc/namedb/master/example.org`) is as follows:

```
$TTL 3600          ; 1 hour
example.org.      IN      SOA      ns1.example.org. admin.example.org. (
                    2006051501    ; Serial
                    10800         ; Refresh
                    3600          ; Retry
                    604800        ; Expire
                    86400         ; Minimum TTL
                )

; DNS Servers
                IN      NS       ns1.example.org.
                IN      NS       ns2.example.org.

; MX Records
                IN      MX 10    mx.example.org.
                IN      MX 20    mail.example.org.

                IN      A       192.168.1.1

; Machine Names
localhost        IN      A       127.0.0.1
ns1              IN      A       192.168.1.2
ns2              IN      A       192.168.1.3
mx              IN      A       192.168.1.4
mail            IN      A       192.168.1.5

; Aliases
www             IN      CNAME    @
```

Note that every hostname ending in a “.” is an exact hostname, whereas everything without a trailing “.” is referenced to the origin. For example, `www` is translated into `www.origin`. In our fictitious zone file, our origin is `example.org.`, so `www` would translate to `www.example.org`.

The format of a zone file follows:

```
recordname      IN recordtype  value
```

The most commonly used DNS records:

SOA

start of zone authority

NS

an authoritative name server

A

a host address

CNAME

the canonical name for an alias

MX

mail exchanger

PTR

a domain name pointer (used in reverse DNS)

```
example.org. IN SOA ns1.example.org. admin.example.org. (
                2006051501      ; Serial
                10800           ; Refresh after 3 hours
                3600            ; Retry after 1 hour
                604800          ; Expire after 1 week
                86400           ; Minimum TTL of 1 day
```

example.org.

the domain name, also the origin for this zone file.

ns1.example.org.

the primary/authoritative name server for this zone.

admin.example.org.

the responsible person for this zone, email address with “@” replaced. (<admin@example.org> becomes admin.example.org)

2006051501

the serial number of the file. This must be incremented each time the zone file is modified. Nowadays, many admins prefer a `yyymmddrr` format for the serial number. 2006051501 would mean last modified 05/15/2006, the latter 01 being the first time the zone file has been modified this day. The serial number is important as it alerts slave name servers for a zone when it is updated.

```
IN NS          ns1.example.org.
```

This is an NS entry. Every name server that is going to reply authoritatively for the zone must have one of these entries.

```
localhost      IN      A      127.0.0.1
ns1            IN      A      192.168.1.2
ns2           IN      A      192.168.1.3
mx            IN      A      192.168.1.4
mail         IN      A      192.168.1.5
```

The A record indicates machine names. As seen above, ns1.example.org would resolve to 192.168.1.2.

```
IN      A      192.168.1.1
```

This line assigns IP address 192.168.1.1 to the current origin, in this case example.org.

```
www                IN CNAME          @
```

The canonical name record is usually used for giving aliases to a machine. In the example, `www` is aliased to the “master” machine which name equals to domain name `example.org` (`192.168.1.1`). CNAMEs can be used to provide alias hostnames, or round robin one hostname among multiple machines.

```
                IN MX      10      mail.example.org.
```

The MX record indicates which mail servers are responsible for handling incoming mail for the zone. `mail.example.org` is the hostname of the mail server, and 10 being the priority of that mail server.

One can have several mail servers, with priorities of 10, 20 and so on. A mail server attempting to deliver to `example.org` would first try the highest priority MX (the record with the lowest priority number), then the second highest, etc, until the mail can be properly delivered.

For in-addr.arpa zone files (reverse DNS), the same format is used, except with PTR entries instead of A or CNAME.

```
$TTL 3600

1.168.192.in-addr.arpa. IN SOA ns1.example.org. admin.example.org. (
                                2006051501      ; Serial
                                10800           ; Refresh
                                3600            ; Retry
                                604800         ; Expire
                                3600 )         ; Minimum

                IN      NS      ns1.example.org.
                IN      NS      ns2.example.org.

1              IN      PTR      example.org.
2              IN      PTR      ns1.example.org.
3              IN      PTR      ns2.example.org.
4              IN      PTR      mx.example.org.
5              IN      PTR      mail.example.org.
```

This file gives the proper IP address to hostname mappings of our above fictitious domain.

30.6.7 Caching Name Server

A caching name server is a name server that is not authoritative for any zones. It simply asks queries of its own, and remembers them for later use. To set one up, just configure the name server as usual, omitting any inclusions of zones.

30.6.8 Security

Although BIND is the most common implementation of DNS, there is always the issue of security. Possible and exploitable security holes are sometimes found.

While FreeBSD automatically drops **named** into a `chroot(8)` environment; there are several other security mechanisms in place which could help to lure off possible DNS service attacks.

It is always good idea to read CERT (<http://www.cert.org/>)'s security advisories and to subscribe to the [FreeBSD security notifications](http://lists.FreeBSD.org/mailman/listinfo/freebsd-security-notifications) (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-security-notifications>) to stay up to date with the current Internet and FreeBSD security issues.

Ὁδὸς: If a problem arises, keeping sources up to date and having a fresh build of **named** would not hurt.

30.6.9 Further Reading

BIND/**named** manual pages: `rndc(8)` `named(8)` `named.conf(5)`

- Official ISC BIND Page (<http://www.isc.org/products/BIND/>)
- Official ISC BIND Forum (<http://www.isc.org/sw/guild/bf/>)
- BIND FAQ (<http://www.nominum.com/getOpenSourceResource.php?id=6>)
- O'Reilly DNS and BIND 5th Edition (<http://www.oreilly.com/catalog/dns5/>)
- RFC1034 - Domain Names - Concepts and Facilities (<ftp://ftp.isi.edu/in-notes/rfc1034.txt>)
- RFC1035 - Domain Names - Implementation and Specification (<ftp://ftp.isi.edu/in-notes/rfc1035.txt>)

30.7 Ἡ ἄδελφότητα τῆς HTTP Apache

30.7.1 Ὁρίων

Ὁ FreeBSD ÷ ἄδελφοί, ἡ ἀνάπτυξη τῆς ἀδελφότητας τῆς **HTTP Apache** εἶναι ἕνα ἀπὸ τὰ ἐπιτεύγματα τοῦ FreeBSD. Ἡ ἀνάπτυξη τῆς ἀδελφότητας τῆς **HTTP Apache** εἶναι ἕνα ἀπὸ τὰ ἐπιτεύγματα τοῦ FreeBSD. Ἡ ἀνάπτυξη τῆς ἀδελφότητας τῆς **HTTP Apache** εἶναι ἕνα ἀπὸ τὰ ἐπιτεύγματα τοῦ FreeBSD. Ἡ ἀνάπτυξη τῆς ἀδελφότητας τῆς **HTTP Apache** εἶναι ἕνα ἀπὸ τὰ ἐπιτεύγματα τοῦ FreeBSD.

Ἡ ἀνάπτυξη τῆς ἀδελφότητας τῆς **HTTP Apache** εἶναι ἕνα ἀπὸ τὰ ἐπιτεύγματα τοῦ FreeBSD. Ἡ ἀνάπτυξη τῆς ἀδελφότητας τῆς **HTTP Apache** εἶναι ἕνα ἀπὸ τὰ ἐπιτεύγματα τοῦ FreeBSD.

Ὁρίων: Ἡ ἀνάπτυξη τῆς ἀδελφότητας τῆς **HTTP Apache** εἶναι ἕνα ἀπὸ τὰ ἐπιτεύγματα τοῦ FreeBSD. Ἡ ἀνάπτυξη τῆς ἀδελφότητας τῆς **HTTP Apache** εἶναι ἕνα ἀπὸ τὰ ἐπιτεύγματα τοῦ FreeBSD.

30.7.2 Ἡ ἀνάπτυξη

Ὁ FreeBSD ÷ ἄδελφοί, ἡ ἀνάπτυξη τῆς ἀδελφότητας τῆς **HTTP Apache** εἶναι ἕνα ἀπὸ τὰ ἐπιτεύγματα τοῦ FreeBSD. Ἡ ἀνάπτυξη τῆς ἀδελφότητας τῆς **HTTP Apache** εἶναι ἕνα ἀπὸ τὰ ἐπιτεύγματα τοῦ FreeBSD.

30.7.5.1 mod_ssl

Οι Οηνηνιια **mod_ssl** η-ηροειηδηεαβ ογι αεαεειηερες OpenSSL αεα ια θαηΥ ηε εο η-οηη εηοδηηανΟηοροε αεαιΥοιτο ουι οηηοηηεηει Secure Sockets Layer (SSL v2/v3) εαε Transport Layer Security (TLS v1). Οι Οηνηνιια θαηΥ ηε εο ηεα οα αθαηαβοροα οδοαοαεεΥ αεα ια ιδηηαβ ια αεααβθαε οδριααηαηιΥ ια θεοοιδηεχοεεΥ αδυ Υιθεοοιτο αηηοοειηηογιΥηηο οηηαβ θεοοιδηεχορο Υοοε ηοα ια ιδηηαβθα ια οηηΥ ηεα Υιαι αοοαεη αιηοηηαοοη web οοι FreeBSD.

Αυι αι ηΥ ηεα αεααοαοοηοαε αεηις οη **Apache**, ιδηηαβθα ια αεααοαοοηοαοα ογι Υεαιηο οη **Apache 1.3.X** οη θαηεαιηΥιαε οη **mod_ssl** αδυ ογι port `www/apache13-modssl` . Οι SSL αβιαε αδηοροε αεαεΥοειη αεα οη **Apache 2.X** οογι port `www/apache20`, ηδηο οη SSL αβιαε αηηαηηηεεηΥηι αδυ οηηαθεεηαη.

30.7.5.2 ΑοιαηεεΥο Εοοιόαεββαο ια Perl & PHP

Ογι οαεαοοαβ ααεααοαβ, δεεΥο αδε η-αεηηοαεο οοηΥοαια οεο αηαοοοηεηηοροο οηο δηηο οη ηοαηαηαο ια οειηη ια ααεοηηοηο οα Υοηαα οηο εαε αεα ιαααεΥοαηη οηηαηεη. Αοου ια ος οαεηΥ οηη αηηεηηηαοα ογι αηΥαεε αεα αεααηαοοεηη αεααεεοδαεη θαηεα ηηαηι. Αηη εΥοηεαο αοαεηηαβθα, ηδηο η Microsoft, θαηηοοαοαοαι εΥοαεο αηοηαοηηΥιαο οα εαεηηοοα οηηηηηαο οηο, η εηεηηοοα αηεη ηηη εηαεοηεεηΥ Υεααα οη ιηηοια. Οοεο ογυ ηηηαο αθεεηαΥο αεα αεααεεοδαεΥο οαεββαο αοιαηεεηΥ θαηεα ηηηηο θαηεεαιηΥηηοαε οα Django, Ruby on Rails, `mod_perl` εαε `mod_php`, **mod_perl** & **mod_php**.

30.7.5.2.1 mod_perl

Οη ααηηηοο οοηηθαηηηο **Apache/Perl** οΥηηιαε εηηοΥ οη ιααΥεε αγιαηη οοο αεηηοαο δηηαηαηηαοεοηηΥ Perl εαε οη **αιηοηηαοοη HTTP Apache**. Ια οη Οηνηνιια **mod_perl** Υ ηεα οη αοιαοηοοα ια αηΥοααα αθαεοΥοαεο αεα οη **Apache** αη ηεηεηηηο οα Perl. ΑθεθεΥηι, η αεαοοηηοηηηο ιαοααεηηοοεοηηο οηη αβιαε αηοηηαοηηηηο οοηη αιηοηηαοοη οαο αθεοηηΥθαε ια αδηογααα ογι ηηηο αηηο αηηοαηεεηΥ ιαοααεηηοοεοηηο Perl εαε ια αθεααηηεαβθα αδυ οη ηηηηι αεεβιςοοο οηο.

Οη **mod_perl** αεααοαεαε ια αεηηηηηοο οηηηηοο. Αεα ια ηηοοηηηεηηοαα οηη **mod_perl** ια εοηΥοαα ηε οηη `mod_perl 1.0` **mod_perl 1.0** αηηεαγαι ηηη ια οηη **Apache 1.3** εαε οηη **mod_perl 2.0** αηηεαγαι ηηη ια οηη **Apache 2**. Οι **mod_perl 1.0** αβιαε αεαεΥοειη οοη port `www/mod_perl` αηη ιεα οααοεεΥ ιαοααεηηοοεοηης Υεαιηο αβιαε αεαεΥοειη οοη `www/apache13-modperl`. Οι **mod_perl 2.0** αεααοαεαεαε οοη port `www/mod_perl2`.

30.7.5.2.2 mod_php

Οη PHP, αηηοου εαε ηδ *"PHP: Hypertext Preprocessor"* αβιαε ιεα script αεηηοαο δηηαηαηηαοεοηηΥ ααιεεηηο ηηηοο οηηοε εαεαβθαηα εαοΥεεεη αεα αηΥοηηης εηαεοηεεηΥ Web. η ογηαηηη οοο δηηηηη ηηααε αδυ οεο C, Java εαε Perl εαε Υ ηεα οοη αοιαοηοοα ια αηοηηαοηηαοαε οα εηαεα HTML, ια οειηη ια αθεοηηΥθαε οοηοο δηηαηαηηαοεοηηΥ web ια αηηοηοι αηηαηα αοιαηεεΥο εοοιόαεββαο.

η **Apache** οδηοοηηαε οηη PHP5. Ιδηηαβθα ια ιαεειηοαα ααεαεοοηηαο οηη θαεΥοηη `lang/php5`.

Αη οηη θαεΥοηη `lang/php5` ααεαεβθαοααε αεα δηηηο οηη, αοοηηαα εα οαο αηοαηεοοηηΥ ηεαο ιε αοιαοηη αθεεηαΥο OPTIONS. Αη εΥοηεη ιαηηΥ ααη αηοαηηαεαοαε, δ. η. αθαεαη οηη θαεΥοηη `lang/php5` αβ ηεα αεααοαοαεαβ οοη θαηαεηηι, ιδηηαβθα δΥηοα ια ηοεηηαοα αδυ ογι αη ηηη θαεΥοηη, οηη ηηηοαο οοηη εαοΥεηαη οηη port:

```
# make config
```

Οοεο αθεεηαΥο ααεαοηηαοοαοοο, αεαεΥηοα οοη αθεεηαη APACHE ηοα ια οοηδηαηεεεοεαβ εαε οηη Οηνηνιια **mod_php** αεα οηη αιηοηηαοοη **Apache**.

30.9.2.2 Global Settings

Whether you are using **swat** or editing `/usr/local/etc/smb.conf` directly, the first directives you are likely to encounter when configuring **Samba** are:

`workgroup`

NT Domain-Name or Workgroup-Name for the computers that will be accessing this server.

`netbios name`

This sets the NetBIOS name by which a **Samba** server is known. By default it is the same as the first component of the host's DNS name.

`server string`

This sets the string that will be displayed with the `net view` command and some other networking tools that seek to display descriptive text about the server.

30.9.2.3 Security Settings

Two of the most important settings in `/usr/local/etc/smb.conf` are the security model chosen, and the backend password format for client users. The following directives control these options:

`security`

The two most common options here are `security = share` and `security = user`. If your clients use usernames that are the same as their usernames on your FreeBSD machine then you will want to use user level security. This is the default security policy and it requires clients to first log on before they can access shared resources.

In share level security, client do not need to log onto the server with a valid username and password before attempting to connect to a shared resource. This was the default security model for older versions of **Samba**.

`passwd backend`

Samba has several different backend authentication models. You can authenticate clients with LDAP, NIS+, a SQL database, or a modified password file. The default authentication method is `smbpasswd`, and that is all that will be covered here.

Assuming that the default `smbpasswd` backend is used, the `/usr/local/private/smbpasswd` file must be created to allow **Samba** to authenticate clients. If you would like to give your UNIX user accounts access from Windows clients, use the following command:

```
# smbpasswd -a username
```

Please see the Official Samba HOWTO (<http://www.samba.org/samba/docs/man/Samba-HOWTO-Collection/>) for additional information about configuration options. With the basics outlined here, you should have everything you need to start running **Samba**.

30.9.3 Starting Samba

The `net/samba3` port adds a new startup script, which can be used to control **Samba**. To enable this script, so that it can be used for example to start, stop or restart **Samba**, add the following line to the `/etc/rc.conf` file:

```
samba_enable="YES"
```

Ὀγῖἄβῶδῶ: This will also configure **Samba** to automatically start at system boot time.

It is possible then to start **Samba** at any time by typing:

```
# /usr/local/etc/rc.d/samba start
Starting SAMBA: removing stale tdb's :
Starting nmbd.
Starting smbd.
```

Please refer to Ὀἰβῖἄ 12.7 for more information about using rc scripts.

Samba actually consists of three separate daemons. You should see that both the **nmbd** and **smbd** daemons are started by the `samba.sh` script. If you enabled winbind name resolution services in `smb.conf`, then you will also see that the **winbindd** daemon is started.

You can stop **Samba** at any time by typing :

```
# /usr/local/etc/rc.d/samba.sh stop
```

Samba is a complex software suite with functionality that allows broad integration with Microsoft Windows networks. For more information about functionality beyond the basic installation described here, please see <http://www.samba.org>.

30.10 Ὀῶἄ ÷ ἡῖῖέοἰῶδῶ Ἡῖῖῖἄέῖῖ Ὀῶῶδῶβῖἄῶἰῶ ἰᾶ NTP

30.10.1 Ὀῖῖῖῶ

ἰᾶ ὀἰ δῖῖῖῖῖῖ ὀἰῶ ÷ ἡῖῖῖῶ, ὀἰ ἡῖῖῖῖ ὀῶῶῶβῖἄῶἰῶ ἄῖῖῶ ὀδῖῖῖῖῖῖῖῖ ῖῖ ÷ ἄέ ὀῖ ὀῖῖῖ ἰᾶ ἄδῖῖῖῖ ÷ ἡῖῖῖῖῖῖῖῖ. Ὀἰ Ḍἡῖῖῖῖῖῖῖ ῖῖῖῖῖῖῖ Ἀέέδῶδῶῖ (Network Time Protocol ἡ NTP) Ḍἡῖῖῖ ÷ ἄέ ῖῖῖ ὀἡῖῖῖ ἄέᾶ ἰᾶ ἄῖῖῖῖῖῖῖῖῖῖῖ ὀῖ ἄέἡῖῖῖῖῖῖῖ ὀἰῶ clock ὀᾶδ.

Ḍῖῖῖῖ ἄέᾶᾶῖῖῖῖῖῖ ὀδῖῖῖῖῖῖ ἄᾶῶβῖῖῖῖῖῖ ἡ ῖῖῖῖῖῖῖῖῖ ὀᾶ ἰᾶᾶῖῖῖ ἄᾶῖῖῖ ἄδῖῖ ὀῖ ἄέἡῖῖῖῖῖ ὀἰῶ ἡῖῖῖῖῖῖῖ ὀῶῶῶβῖἄῶἰῶ ἄῖῖῶ ὀδῖῖῖῖῖῖῖῖῖ. Ἀέᾶ Ḍἡῖῖῖῖῖῖῖ, ῖῖῖῖ ἄἰῖῖῖῖῖῖῖῖῖῖ web ἰδῖῖῖῖ ἰᾶ ἄᾶ ÷ ἄᾶβ ἄέῶβῖῖῖῖ ἄέᾶ ἄδῖῖῖῖῖῖ ἄῖῖῶ ἄἡ ÷ ἄβῖῖ ῖῖῖῖ ὀἰ ἄἡ ÷ ἄβῖ ἄῶῶῖ ῖ ÷ ἄέ ὀἡῖῖῖῖῖῖῖ ἰῖ ÷ ἡῖ ἄῖῖῖῖῖῖῖ ῖῖῖῖ ὀῶᾶῖῖῖῖῖῖῖ ῖῖ ἡῖ ἄῖῖῖῖῖῖῖῖῖ ἄἡ ÷ ἄβῖ ἰᾶ ὀῶἰῖῖῖῖῖῖ. ἈḌβῖῖῖ ἄέᾶἡῖῖῖῖῖῖ ῖῖῖῖ ῖ cron(8) ἄᾶῶβῖῖῖῖῖῖ ὀᾶ ῖῖῖ ἄῖῖῖῖῖῖ ἡῖῖῖῖ ἡῖῖῖῖ ἡῖῖῖῖ ἰᾶ ἰḌῖῖῖῖῖ ἰᾶ ὀἡῖ ῖῖῖῖ ἄῖῖῖῖῖῖ ὀῶἰῖῖ Ḍἡῖῖῖῖῖῖῖῖῖ ῖῖῖῖ ÷ ἡῖῖῖῖῖῖῖ.

Ὀἰ FreeBSD ἄέᾶῶβῖῖῖῖῖ ἰᾶ ὀἰ ἄἰῖῖῖῖῖῖῖῖῖῖ NTP `ntpd(8)`, ἰ ἰḌῖῖῖῖ ἰḌῖῖῖῖ ἰᾶ ÷ ἡῖῖῖῖῖῖῖῖῖῖ ἄέᾶ ἰᾶ ὀῶᾶ ÷ ἡῖῖῖῖῖῖ ὀἰ ἡῖῖῖῖ ὀῶῶῶβῖἄῶἰῶ ὀἰῶ ὀδῖῖῖῖῖῖῖῖ ὀᾶδ, ἄῖῖῖῖῖῖῖῖῖῖ ῖῖῖῖῖ ἄἰῖῖῖῖῖῖῖῖῖῖ NTP ἡ ἰᾶ Ḍἡῖῖῖ ÷ ἄέ ἰ βᾶῖῖῖ ὀδῖῖῖῖῖῖῖῖ ὀῶᾶ ÷ ἡῖῖῖῖῖῖ ὀᾶ ῖῖῖῖ ἰῖ ÷ ἄἰβῖῖῖῖῖῖ.


```
# Prevent NTP traffic from initiating dial out
set filter dial 1 permit 0 0
set filter alive 0 deny udp src eq 123
# Prevent incoming NTP traffic from keeping the connection open
set filter alive 1 deny udp dst eq 123
# Prevent outgoing NTP traffic from keeping the connection open
set filter alive 2 permit 0/0 0/0
```

Άέα δάνέόούδάνδ έαδδñΎñάέδ άάβδά δñ PACKET FILTERING όδçí áíúδçά ppp(8) έέέ όά δάνάάάβñíάά όδñ /usr/share/examples/ppp/.

Όçíάβúόç: Όçíάβúόç: ðñέέñ ISP ðέñέÜññíδñ όçí ÷ñβόç έýñάδ ðά ÷άìçèü άñέέñü, άñδñäβæñíδάδ όδñ NTP ðá äñδέáyáέ áóñý ðέ άδάíδβόάέδ άáñ δδÜññíδñ δñδΎ όδñ ðç÷Üíçñíά όάδ.

30.10.6 δάνάέδΎñδ δέçññíδññβδ

Ç δάέìçñβúόç áέα δñδδ άñδδçñάδçόΎδ NTP áέαδβέάδάέ έέέ όά öññíá HTML όδñ /usr/share/doc/ntp/.

ÊäöÛëáéï 31

Firewalls

31.1 Óýñïç

Ôï firewall (ðáß÷ïð ðñïóðáóßáð) éáèéóóÛ äðíáðü ðï öééðñÛñéóíá ðçð áéóáñ ÷ ùíáíçð éáé áñáñ ÷ ùíáíçð éßíçóçð ðïð áéÝñ÷áðáé áðü ðï óýóðçíá óáð. Íá firewall ìðññáß íá ÷ ñçóéïððñéáß Ýíá Þ ðñéóóóóðáñá óáð “éáíúíúí” áéá íá áðééáññáß óá ðáéÝóá éáðÛ ðçí áßóíá Þ Ýíá ðïð áðü íéá áééððáéÞ óýíááóç, éáé íá óá áðéðñÝðáé Þ íá óá áðññßððáé. Íé éáíúíáð ðïð firewall ìðññíý íá áéÝá÷ïí Ýíá Þ ðñéóóóóðáñá ÷ áñáéðçñéóóééÛ ðüí ðáéÝðüí, óððñééáñáñÝíúí ìáðáíý Ûééñí éáé ðïð óýðïð ðïð ðñüðñééñéïð, éáéðð éáé ðçí áéáýéðïçð Þ/éáé éýñá (port) ðçð áðáðçñáð Þ ðïð ðñññéóíý.

Óá firewalls ìðññíý íá áñéó÷ýóïíí óçíáíðééÛ ðçí áóóÛéáéá áíüð éññáñ Þ áíüð áééðýïð. Ìðññíý íá ÷ ñçóéïððñéáß áéá ìßá Þ ðñéóóóóðáñáð áðü ðéð áéúéïðéáð éáéðïññáßáð:

- Íá ðñïóðáðáýïíí éáé íá áðññññïíí ðéð áðáññáÝð, ðéð ððçñáóßáð éáé óá ìç÷÷áíðáá ðïð áóóðáñééý óáð áééðýïð áðü áíáðééýíçðçð éßíçóç ðïð ðññÝñ÷áðáé áðü ðï Internet.
- Íá ðñéññáßáé Þ íá áðñéáßáé ðçí ðñüóááóç ìç÷÷áíçÛ ðïð áóóðáñééý áééðýïð óá ððçñáóßáð ðïð Internet.
- Íá ððñóðçñáé Þ ìáðÛðñáóç áééððáé Þ áéáðéýíóáñ (NAT), ç ìðñá áðéðñÝðáé óðí áóóðáñééü óáð áßéððí íá ÷ ñçóéïððñéáß éáéððééÝð IP áéáðéýíóáéð éáé íá ìññÛáðáé ìßá ìñááééÞ óýíááóç ìá ðï Internet (áßðá ìÝóó ìßáð ìñááééÞð áçñüóéáð IP áéáýéðïçð, áßðá ìÝóó áíüð ðéðñéðð áçñüóáñ áéáðéýíóáñ ðïð áíáððéáíðáé áððñáðá).

Áóñý áéááÛóáðá áðü ðï éäöÛéáéí, éá ìÝñáðá:

- Dùð íá áçñéïñáÞðáðá óóðïýð éáíúíáð öééðñáñßóíáððð ðáéÝðüí.
- Ôïð áéÛðññéðð óýðïðð firewall ðïð ððÛñ÷ïí óðí FreeBSD éáé ðéð áéáðññÝð ðïðð.
- Dùð íá ñðéìßóáðá éáé íá ÷ ñçóéïððñéáßáð ðï **PF** firewall ðïð OpenBSD.
- Dùð íá ñðéìßóáðá éáé íá ÷ ñçóéïððñéáßáð ðï **IPFILTER**.
- Dùð íá ñðéìßóáðá éáé íá ÷ ñçóéïððñéáßáð ðï **IPFW**.

Ðñéí áéááÛóáðá áðü ðï éäöÛéáéí, éá ðñÝðáé:

- Íá éáðáññáßáð ááóééÝð áñ÷Ýð ðïð FreeBSD éáé ðïð Internet.

31.2 ÁáóééÝð ìññéáð ðüí Firewalls

ÔðÛñ÷ïí áýí ááóééñß ðññðñé áéá ðç áçñéïñáßá éáíúíúí óá Ýíá firewall: ì “inclusive” éáé ì “exclusive”. Íá exclusive firewall áðéðñÝðáé ðç áéÝéáðóç üéçð ðçð éßíçóçð, áéðüð áðü áððÞ ðïð ðáéñéÛáéé ìá ðïðð éáíúíáð ðïð. Íá inclusive

31.4 Οἱ Packet Filter (PF) έάέ οἱ ALTQ οἱ OpenBSD

Οἱ Έίγέει οἱ 2003, ς άοάνηάP firewall οἱ OpenBSD (άιυόδP υò PF) ιάόάόΎñεçέά οἱ FreeBSD έάέ Ύάείά έάέέΎόειç óçι ÓõëēīāP οἱ Ports. Οἱ FreeBSD 5.3 οἱ έδēēīōiñçόά οἱ 2004, Pόάι ς δñþòç άδβόçιç Ύέάιόç ς ιδἱβά δάνέάβ÷ά οἱ PF υò οἱ Pἱά οἱ άάόέēίγ δēΎίι όδóδPἱάοἱò. Οἱ PF άβίάέ Ύίά ιēēēçñùιΎίι firewall, ιά δēPèìò ÷άñάέδçñέóóέēPἱ, οἱ ιδἱβἱ άδβόçδ έάέέΎόάέ δñιáέñάóέέÜ öδiόóPñéιç áέά οἱ ALTQ (Alternate Queuing). Οἱ ALTQ δñιόóΎñάέ öδçñάóβάδ ΆέάóóÜέέóçδ Διέüòçόάδ (Quality of Service, QoS).

Οἱ OpenBSD Project έÜίάέ άιáέñάóέέP άiöēάέÜ óçç óóιðPñçόç οἱ PF FAQ (<http://www.openbsd.org/faq/pf/>). Άέά οἱ έüāι άóδü, ς δάνηγόά άιυόçόά οἱ Άά÷άέñέάβiò άóóέÜάέέ έóñβüð óóέδ έάέάέóάñüðçόάδ οἱ PF υóι άóιñÜ οἱ FreeBSD, άἱP δάνΎ÷άέ έάέ ιάñέέΎð ááίέέΎð δēçñiōiñβάδ ó÷άóέέÜ ιά όç ÷ñPόç οἱ. Άέά δēι έάδòññάñάβð δēçñiōiñβάδ ó÷άóέέÜ ιά όç ÷ñPόç οἱ PF, δάνάέάέιγἱά έάάÜóóά οἱ PF FAQ (<http://www.openbsd.org/faq/pf/>).

Δάνέóóüðάñάδ δēçñiōiñβάδ ó÷άóέέÜ ιά οἱ PF οἱ FreeBSD ιδἱñάβðά ιά άñάβðά óóι <http://pf4freebsd.love2party.net/>.

31.4.1 ×ñçóέίiδiέPíóáð óά ΆñēñPíáðά ΔðñPíá áέά οἱ PF

Άέά ιά öiñðPóáðά οἱ Üñēñüιά δðñPíá áέά οἱ PF, δñιόέΎóóά όçι δάνάέÜðü άñάñP óóι óóι `/etc/rc.conf`:

```
pf_enable="YES"
```

ΆέóάέΎóóά Ύðάέóά οἱ script άέέβιçόçδ áέά ιά öiñðPóáðά οἱ Üñēñüιά:

```
# /etc/rc.d/pf start
```

ÓçιáέPóðά υóέ οἱ Üñēñüιά PF ááι δñüέάέóάέ ιά öiñðüέάβ άι ááι άñάέ οἱ έάέιñέóιΎίι άñ÷άβι έάιυüι. Οἱ δñιáδēέáñΎίι άñ÷άβι άβίάέ οἱ `/etc/pf.conf`. Άί οἱ άñ÷άβι έάιυüι άñβóέάóάέ óά έÜðιέά Üέέç öiðiέάóóá, ιδἱñάβðά ιά όçι έάέιñβóáðά δñιόέΎóιiόáð ιέά άñάñP üðüð όçι δάνάέÜðü óóι `/etc/rc.conf`:

```
pf_rules="/path/to/pf.conf"
```

Ιδἱñάβðά ιά άñάβðά Ύίά δάνÜáάέñιá οἱ άñ÷άβιö pf.conf óóιι έáóÜέēiāi `/usr/share/examples/pf`

Οἱ Üñēñüιά PF ιδἱñάβ άδβόçδ ιά öiñðüέάβ ÷άέñiñέβιçόá άδü όçι άñάñP άíóēPἱ:

```
# kldload pf.ko
```

Ç öδiόóPñéιçδ έáóááñάóPð οἱ PF δάνΎ÷άóάέ άδü οἱ Üñēñüιά `pflog.ko` έάέ ιδἱñάβðά ιά όçι öiñðPóáðά δñιόέΎóιiόáð όçι δάνάέÜðü άñάñP óóι `/etc/rc.conf`:

```
pflog_enable="YES"
```

ΆέóάέΎóóά Ύðάέóά οἱ script άέέβιçόçδ áέά ιά öiñðPóáðά οἱ Üñēñüιά:

```
# /etc/rc.d/pflog start
```

Άί ÷ñάέÜάóóá έÜðιέι άδü óά δñi÷üñçιΎίι ÷άñάέδçñέóóέέÜ οἱ PF, έά δñΎðάέ ιά ιάóáέüòðβóáðά όçι öδiόóPñéιç áέά οἱ PF áðáðέάβáð ιΎóá óóιι δðñPíá.

31.4.2 ἈδέεϊᾶÝò òìò PF ᾶέα òìí ḐòñÞᾶ

Ἀί ἑάε ᾶᾶ ᾶβᾶέ ᾶḑᾶᾶβòçòì ἰᾶ ἰᾶòᾶᾶἔυòòβòᾶòᾶ òçì òḑìòòÞñéìç PF ἰÝòᾶ òòìí ḑòñÞᾶ òìò FreeBSD, βòυò ἰᾶ ἔÝἔᾶòᾶ ἰᾶ ÷ñçòἔìḑìἔÞòᾶòᾶ Ýᾶ ἶᾶḑ òᾶ ḑñì÷ḑñçìÝᾶ ÷ᾶᾶἔòçñἔòἔἔÙ òìò PF òì ἰḑìβì ᾶᾶ ḑᾶᾶἔᾶἰᾶÙἶᾶòᾶ ἔòì Ùñἔḑᾶ òìò ḑòñÞᾶ: òì pfsync(4). Ḑñùἔᾶἔòᾶ ἑᾶ ἰἔᾶ ḑᾶòᾶἶ-òòἔᾶòÞç ἰḑìβᾶ ᾶḑìἔᾶἔýḑòᾶ ἔòᾶἔᾶἔἔἶÝᾶò ᾶἔἔᾶᾶÝò òòìí ḑβᾶἔᾶ ἔᾶòᾶòòÙòᾶḑì ḑìò ÷ñçòἔìḑìἔᾶβòᾶ ἶᾶ ḑì PF. Ἰḑìᾶβ ἰᾶ òḑἶᾶòᾶòᾶβ ἰᾶ òì carp(4) ᾶἔᾶ ἰᾶ ᾶçìἔἶòñᾶçἔἶýᾶ ἰᾶ òì PF firewalls ἰᾶ ᾶḑἶᾶòḑḑḑᾶ ᾶòḑḑḑḑḑ ᾶἔἔᾶᾶÞò ἔᾶ ḑᾶñβḑḑòḑç ᾶḑἶòḑ÷βᾶò (failover). Ḑᾶñἔòḑḑᾶᾶᾶò ḑἔçñìḑḑḑḑᾶò ò÷ᾶἔἔἔÙ ἰᾶ òì CARP ἰḑìᾶβòᾶ ἰᾶ ᾶᾶβòᾶ ἔòì ḐìÞᾶ 32.12 òìò Ἀᾶ÷ᾶἔἔᾶβἶò.

Ἰḑìᾶβòᾶ ἰᾶ ᾶᾶβòᾶ ḑἔᾶò ἔἔò ᾶḑἔἔᾶᾶÝò ḑòñÞᾶ ᾶἔᾶ òì PF ἔòì ᾶñ÷ᾶβì /usr/src/sys/conf/NOTES. Ἰἔ ᾶḑἔἔᾶᾶÝò òᾶβḑἶḑᾶἔ ᾶḑβòçò ḑᾶᾶᾶἔÙò:

```
device pf
device pflog
device pfsync
```

Ç ᾶḑἔἔᾶᾶÞ device pf ᾶἶᾶᾶἶḑìἔᾶβ ἔçì ḑḑìòòÞñéìç ᾶἔᾶ òì firewall “Packet Filter” (pf(4)).

Ç ᾶḑἔἔᾶᾶÞ device pflog ᾶἶᾶᾶἶḑìἔᾶβ ἔçì ḑñἶᾶἔᾶḑἔἔἔÞ ḑᾶòᾶἶ-ᾶἔἔòḑᾶἔÞ ḑòἔἔᾶòÞ pflog(4) ḑìò ἰḑìᾶβ ἰᾶ ÷ñçòἔìḑìἔἔᾶβ ᾶἔᾶ ἔçì ἔᾶòᾶᾶᾶᾶòÞ ἔçò ἔβἶçòçò ἔᾶ Ýᾶ βpf(4) descriptor. Ἰ ᾶᾶβἶḑᾶò pflogd(8) ἰḑìᾶβ ἰᾶ ᾶḑìἔἔᾶᾶýḑᾶἔ ἔçì ἔᾶòᾶᾶᾶᾶòÞ ᾶòòÞ ἔòì ἔἔἔçñù ᾶβòἔì.

Ç ᾶḑἔἔᾶᾶÞ device pfsync ᾶἶᾶᾶἶḑìἔᾶβ ἔçì ḑñἶᾶἔᾶḑἔἔἔÞ ḑᾶòᾶḑḑḑḑḑ-ᾶἔἔòḑᾶἔÞ ḑòἔἔᾶòÞ pfsync(4) ç ἰḑìβᾶ ÷ñçòἔìḑìἔἔᾶβòᾶ ἑᾶ ἰᾶ ᾶἶἔ÷ἶᾶᾶᾶ “ᾶἔἔᾶᾶÝò ἔᾶòÙòḑḑḑḑḑ”.

31.4.3 ἈδέεϊᾶÝò ἔòì rc.conf

Ḑì PF ἑᾶἔ òì pflog(4) ἰḑìᾶḑἶ ἰᾶ ñòἔἶἔòἶýἶ ἔᾶòÙ ἔçì ᾶἔἔβἶçòç ἰᾶ ἔἔò ḑᾶᾶᾶἔÙòḑḑ ἔᾶòᾶ÷ḑñβòᾶἔò ἔòì rc.conf(5):

```
pf_enable="YES" # Enable PF (load module if required)
pf_rules="/etc/pf.conf" # rules definition file for pf
pf_flags="" # additional flags for pfctl startup
pflog_enable="YES" # start pflogd(8)
pflog_logfile="/var/log/pflog" # where pflogd should store the logfile
pflog_flags="" # additional flags for pflogd startup
```

Ἀί ḑβòḑ ᾶḑḑ ᾶòḑ òì firewall ḑḑÙñ÷ᾶἔ ἔÙḑìἔἶ ḑìḑἔἔḑ ᾶβἔòἶἶ (LAN) ḑñḑ òì ἰḑìβì ᾶḑἔἔòἶᾶβòᾶ ἰᾶ ḑñḑḑḑḑḑḑ ḑᾶἔÝḑᾶ, Þ ᾶἶ ἔÝἔᾶòᾶ ἰᾶ ÷ñçòἔìḑìἔἔÞòᾶòᾶ NAT, ἔᾶ ÷ñᾶἔᾶòḑᾶβòᾶ ᾶḑβòçò ἔᾶἔ ἔçì ḑᾶᾶᾶἔÙòḑḑ ᾶḑἔἔᾶᾶÞ:

```
gateway_enable="YES" # Enable as LAN gateway
```

31.4.4 Ἀçìἔἶòñᾶβᾶ Ἐᾶἶḑḑḑḑ Ḑἔἔḑᾶñβòἶᾶòἶò

Ḑì PF ᾶἔᾶᾶÙᾶᾶἔ ἔἔò ñòἔἶβòᾶἔò ḑìò ᾶḑḑ òì pf.conf(5) (ç ḑñḑᾶḑἔἔᾶᾶἶÝἶç ḑìḑìἔᾶòβᾶ ᾶβᾶἔ ἔòì /etc/pf.conf) ἔᾶἔ ḑñḑḑḑḑḑḑḑ, ᾶḑḑḑḑḑḑḑḑ ᾶ ᾶḑἶᾶÝ÷ᾶḑᾶἔ ḑᾶἔ ḑᾶἔÝḑᾶ ḑýἶòḑḑḑ ἰᾶ ḑìòḑ ἔᾶἶḑἶᾶò ἔᾶἔ ḑìòḑ ἰἔἔòἶḑḑ ḑìò ḑᾶñἔÝ÷ḑḑᾶἔ ἔᾶ ᾶòḑḑ. Ç ᾶᾶἔᾶòÙòḑḑḑ ḑìò FreeBSD ḑᾶñἔἔᾶἰᾶÙἶᾶἔ ᾶñἔᾶòÙ ḑḑἶᾶᾶβᾶἶᾶᾶᾶ ᾶñ÷ᾶβḑḑḑḑḑ ñýἔἶἔòçò, ἔòçì ḑìḑìἔᾶòβᾶ /usr/share/examples/pf/. Ḑᾶᾶᾶἔᾶἔἶýἶᾶ ἰᾶ ᾶἔᾶᾶÙòḑḑḑ òì PF FAQ (<http://www.openbsd.org/faq/pf/>) ᾶἔᾶ ḑἔÞñç ᾶἶÙἔòçò ḑḑì ἔᾶἶḑḑḑḑ ḑìò PF.

Δημόσια Πρώτη: Έαεπο άεάάΰεάάοά οί PF FAQ (<http://www.openbsd.org/faq/pf/>), ίά Ύ÷άάά δδύοç óάó üóé άεάοίηάόέέΎò άεάüóάέó οίö FreeBSD δάηέΎ÷ίοί άεάοίηάόέέΎò άεάüóάέó οίö PF. Οç άάάηίΎίç óóέάίP, οί FreeBSD ÷ηçóέίηδίέάβ όçί βάέά Ύέάίόç οίö PF δίö ÷ηçóέίηδίέάβ έάέ οί OpenBSD 4.1.

Ç çέάέδñíέέP έβóóά οίö FreeBSD άέά οί packet filter firewall (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-pf>) άβίάέ Ύίá έάέü ίΎñíö άέά ίά εΰίάόά άñöδPóάέó ó÷άóέέΎò ίά όç ηΎέίέóç έάέ όç έάέóίöñάβά οίö PF firewall. Ιç ίά÷ΰóάόά ίά άέΎάίάόά όά άñ÷άβά όçδ έβóóάó δñέί ίάέέίPóάόά όέó άñöδPóάέó!

31.4.5 ΆίöέάΎίíóάó ίά οί PF

×ηçóέίηδίέPóάά οί pfctl(8) άέά ίά άέΎάίάόά οί PF. Δάηάέΰóü έά άñάβóά εΰδίέάó ÷ñPóέίάó άίóίέΎò (άάάάέüέάβóά üóé Ύ÷άάά άέάΰóάέ όç óάέβάά manual οίö pfctl(8) άέά ίά άάβóά üέάó όέó άέάέΎóέίάó άδέέίΎΎò):

ΆíóίεP	Óέίöüò
pfctl -e	Άίάñáíδίβçóç οίö PF
pfctl -d	Άδάíáñáíδίβçóç οίö PF
pfctl -F all -f /etc/pf.conf	ΆέάάñáóP üέüί öüί έάíüíüί (nat, filter, state, table, έ.έ.δ.) έάέ άέ ίΎίö άίΰάíüóç áδü οί άñ÷άβί /etc/pf.conf
pfctl -s [rules nat state]	Άέóγδύóç άίάóíñΰö ó÷άóέέΰ ίά οίö έάíüíüά οίö öβέδñíö, οίö NAT, P οίö δβίάέά έάóΰóóάóçδ
pfctl -vnf /etc/pf.conf	ΆέΎá÷άέ οί /etc/pf.conf άέά εΰέç, άέέΰ άάί öñöPíáέ οίö έάíüíüά

31.4.6 Άίάñáíδίβçóç οίö ALTQ

Οί ALTQ άέάóβεάóάέ üüí άί ίάóάάέüóóóβóάóά άδάóέάβáó όçί öδίóóPñέίç οίö ίΎóά óóίí δöñPíá οίö FreeBSD. Οί ALTQ άάί öδίóóçñβεάóάέ áδü üέά όά δñíáñΰíáóά íäPáçóçδ έáñöPí άέέóγίö. Δάηάέάέίγíá άάβóά όç óάέβáά manual οίö altq(4) άέά όç έβóóά öüί íäçáPí δίö öδίóóçñβεáíóάέ óóçί Ύέάίóç οίö FreeBSD δίö άέάέΎóάόά.

Ιέ δάηάέΰóü άδέέίΎΎò οίö δöñPíá άίάñáíδίέίγí οί ALTQ έάέ δάñΎ÷ίοί άδέδñüóέάóáó έάέóίöñάβáó:

```
options      ALTQ
options      ALTQ_CBQ          # Class Based Queuing (CBQ)
options      ALTQ_RED        # Random Early Detection (RED)
options      ALTQ_RIO        # RED In/Out
options      ALTQ_HFSC       # Hierarchical Packet Scheduler (HFSC)
options      ALTQ_PRIQ       # Priority Queuing (PRIQ)
options      ALTQ_NOPCC      # Required for SMP build
```

Ç άñáíñP options ALTQ άίάñáíδίέάβ οί δέάβóέί έάέóίöñάέPí ALTQ.

Ç άñáíñP options ALTQ_CBQ άίάñáíδίέάβ οί *Class Based Queuing* (CBQ). Οί CBQ óάó άδέóñΎδάέ ίά ÷ññβóάóά οί άγñíö áPíçδ ίέάó óγíááóçδ óά άέάóíηάóέέΎò έέΰóάέó P íöñΎò, Póóά ίά άβñíóάέ δñíöáñάέüóçóáó óóçί έβίçóç άίΰέίΎά ίά οίö έάíüíüά οίö öβέδñíö.

Ç άñáíñP options ALTQ_RED άίάñáíδίέάβ οί *Random Early Detection* (RED). Οί RED ÷ηçóέίηδίέάβóάέ άέά ίά áδίöáó÷έάβ ç óóíöüñçóç οίö άέέóγίö. Άέά οί óέίδü áóóü, οί RED ίáöñΰάέ οί íPέíö όçδ íöñΰö έάέ οί óóάέñβíáέ ίá οί

άν÷άβι /etc/rc.conf. Οι ΰνηνιιά Ύ÷έε άçiέιönάçεάβ ιά άίάνιäðיעיΎίç ðçι äöíáöüðçöá éáöáññáöðð éáé ιά ðçι äðέειäð default pass all. Άέά ιά äέέΰíáöá äöðð ðçι ðñíäðέειäð öá block all, ιðññáβöá äðêð ιά ðñíöèΎöáöá öίι éáíúíá äðññέçð (block all) ööι ðΎέιð öüι éáíúíúι öáð. Άáι ÷ñáέΰæáðáé ιά ιάöáæüöðβöáöá ðçι äðέειäð IPF ööι ððñðíá öίö FreeBSD áéá öι öέιðü äöðü.

31.5.2 ΆðέειäΎð áéá öίι ððñðíá

Άáι άβιáé öðι÷ñáöüέέü ιά ιάöáæüöðβöáöá öéð ðáñáéΰöü äðέειäΎð ööιι ððñðíá öίö FreeBSD áéá ιά άίάνιäðיעיðöáöá öι IPF. Ç ðáñíöóβáöç öίöð äáð άβιáé éáéáñΰ áçíáññüöέέð. Áί ιάöáæüöðβöáöá öι IPF áðäðéáβáð ööιι ððñðíá, äáι éá ÷ñçöέιðיעçéáβ ðιöΎ öι áíöβöðιέ÷ι ΰñηνιιά.

Ööιι άñ÷άβι /usr/src/sys/conf/NOTES éá άñáβöá ðáñáááβáñáöá éáöá÷ññβöáñι IPF áéá öι άñ÷άβι ñýέιέöçð öίö ððñðíá. Íé äðέειäΎð áðöΎð öáβñíöáé äðβöçð ðáñáéΰöü:

```
options IPFILTER
options IPFILTER_LOG
options IPFILTER_DEFAULT_BLOCK
```

Ç äðέειäð options IPFILTER άίάνιäðיעíáβ ðçι öðιöððñέίç áéá öι “IPFILTER” firewall.

Ç äðέειäð options IPFILTER_LOG άίάνιäðיעíáβ ðçι öðιöððñέίç éáöáññáöðð öίö IPF, ç ιðñíá äñΰöáé ööçι öáöáññáöðð éáöáññáöðð ðáéΎöüι ipf áéá éΰéá éáíúíá ðιö ðáñέéáñáΰíáé ðçι äðέειäð log.

Ç äðέειäð options IPFILTER_DEFAULT_BLOCK áééΰæáé ðçι ðñíäðέéáñιΎίç ööιðáñέöññΰ, þöá éΰéá ðáéΎöι ðιö äáι öáéñέΰæáé ιά éΰðιέι éáíúíá pass öίö firewall, ιά äðñññβðöáöáé äöðüíáöá.

Íé ðáñáðΰíü äðέειäΎð éá άίάνιäðיעçέιγί λüíι äöίγ ιάöáæüöðβöáöá éáé äáéáöáöððöáöá Ύίá ðñιöáññιöίΎίι ððñðíá ðιö ιά öéð ðáñέéáñáΰíáé.

31.5.3 ΆéáéΎöéíáð ΆðέειäΎð áéá öι rc.conf

×ñáéΰæáðáöá öéð ðáñáéΰöü éáöá÷ññβöáéð ööι /etc/rc.conf áéá ιά άίάνιäðיעιðöáöá öι IPF éáöΰ ðçι äéêβίçöç öίö öðιέιáéöðð:

```
ipfilter_enable="YES" # Start ipf firewall
ipfilter_rules="/etc/ipf.rules" # loads rules definition text file
ipmon_enable="YES" # Start IP monitor log
ipmon_flags="-Ds" # D = start as daemon
# s = log to syslog
# v = log tcp window, ack, seq
# n = map IP & port to names
```

Áί ðβöü äðü äöðü öι firewall öðΰñ÷é éΰðιέι LAN ðιö ÷ñçöέιðיעíáβ äáöíáöιΎíáð éáéüöέέΎð áéáöéγíóáéð, éá ÷ñáéáöáβ ιά ðñιöèΎöáöá öéð ðáñáéΰöü éáöá÷ññβöáéð áéá ιά άίάνιäðיעιðöáöá ðç éáéöιöñáβá NAT:

```
gateway_enable="YES" # Enable as LAN gateway
ipnat_enable="YES" # Start ipnat function
ipnat_rules="/etc/ipnat.rules" # rules definition file for ipnat
```

31.5.4 IPF

Ç áíîĩēP ipf(8) ÷ ñçóεĩîðĩēáβóáé áεά ίά öĩñðβóáé öĩ áñ ÷ áβĩ öùĩ éáíúĩúĩ. ÖðóεĩēĩēééŨ, éá äçĩéĩðñāPóáóå Ýíá áñ ÷ áβĩ ìá öĩòð äεéĩýð óáð ðñĩóáñĩĩöĩÝĩñð éáíúĩáð éáé éá áíóεéáóåóðPóáóå ìá áóöü áñ'ĩēĩēēPñĩö öĩòð áíóúĩáóüñĩÝĩñð éáíúĩáð öĩö firewall:

```
# ipf -Fa -f /etc/ipf.rules
```

Ç äðéēĩāP -Fa áááéŨæáé öĩòð éáíúĩáð áðü öĩòð áóòðāñēéĩýð ðβĩáéåð öĩö firewall.

Ç äðéēĩāP -f éáēĩñβæáé öĩ áñ ÷ áβĩ öùĩ éáíúĩúĩ ðĩö éá öĩñðüèáβ.

Áóöü óáð áβĩáé öçĩ äóĩáóüöçóá ίá áéēŨĩáðå öĩ áñ ÷ áβĩ éáíúĩúĩ óáð, ίá áéðåēÝóáóå öçĩ áíîĩēP IPF ðĩö áíáóÝñáĩå ðāñāðŨũ, éáé ίá áíáááPóáóå ìá áóöü öĩĩ öñüðĩ öĩòð éáíúĩáð óöĩ firewall ðĩö áéðāēáβóáé Pæç ìá éáéĩññāéĩöð, ÷ ùñβð ίá ÷ ñāéáóóåβ ίá äðáíáéēéĩPóáóå öĩ óýóðçĩá óáð. Ç ĩÝēĩäö áóðP áβĩáé ðĩēý āĩēēēP áéá ίá āĩēēĩŨóáóå ĩÝĩòð éáíúĩáð, éáēðð ìðĩñāβ ίá äðáíáéççèēāβ ũóáð öĩñÝð èÝēåðå.

Åāβðå öç óāēβāá manual öĩö ipf(8) áéá éäðöñÝñāéåð ó ÷ áðééŨ ìá óéð öðũēĩéðåð äðéēĩāÝð ðĩö ìðĩñāβðå ίá ÷ ñçóéĩîðĩēPóáóå ìá öçĩ áíîĩēP áóðP.

Ç áíîĩēP ipf(8) áíáíÝĩáé Ýíá áðēü áñ ÷ áβĩ éáéĩÝĩñö ùð áñ ÷ áβĩ éáíúĩúĩ. Åāĩ éá āā ÷ èāβ áñ ÷ áβĩ éáíúĩúĩ āñāñĩÝĩñ ùð script ìá óöĩāĩēééŨ äíóεéáóåóðŨóáéð.

ÖðŨñ ÷ áé ũóóüöĩ öñüðĩö ίá āñŨðåðå éáíúĩáð IPF ðĩö ίá ÷ ñçóéĩîðĩēĩýĩ öçĩ éó ÷ ý öùĩ óöĩāĩēéēPĩ áíóééáóåóðŨóáüĩ. Åéá ðāñéóóüðāñāð ðēçñĩöĩñβāð, āāβðå öĩ ÖĩPĩá 31.5.9.

31.5.5 IPFSTAT

Ç ðñĩäðééāāĩÝĩç óöĩðāñéöĩñŨ öĩö ipfstat(8) áβĩáé ίá áíáéðŨ éáé ίá áðāéēĩñβæáé öĩ óýñēĩ öùĩ óðāóéóðéēPĩ öĩö óðāēāĩðñēçéáĩ ùð äðĩöÝéāóĩá öçð äðāñĩñāPð öùĩ éáíúĩúĩ öĩö ÷ ñPóðç óðā ðāēÝóá ðĩö áéóÝñ ÷ ĩíðáé éáé āĩÝñ ÷ ĩĩðáé áðü öĩ firewall, áðü öç óðéāĩP öçð óāēāóðåβáð öĩö äēéβĩçóçð P áðü öĩĩ óāēāóðāβĩ öĩòð ĩçāĩáĩéóĩü ĩÝóü öçð áíîĩēPð ipf -Z.

Åāβðå öç óāēβāá manual ipfstat(8) áéá éäðöñÝñāéåð.

Ç ðñĩāðééāāĩÝĩç Ýĩñāö öçð áíîĩēPð ipfstat(8) éá ĩēŨæáé ìá öçĩ ðāñāéŨöù:

```
input packets: blocked 99286 passed 1255609 nomatch 14686 counted 0
output packets: blocked 4200 passed 1284345 nomatch 14687 counted 0
input packets logged: blocked 99286 passed 0
output packets logged: blocked 0 passed 0
packets logged: input 0 output 0
log failures: input 3898 output 0
fragment state(in): kept 0 lost 0
fragment state(out): kept 0 lost 0
packet state(in): kept 169364 lost 0
packet state(out): kept 431395 lost 0
ICMP replies: 0 TCP RSTs sent: 0
Result cache hits(in): 1215208 (out): 1098963
IN Pullups succeeded: 2 failed: 0
OUT Pullups succeeded: 0 failed: 0
Fastroute successes: 0 failures: 0
TCP cksum fails(in): 0 (out): 0
Packet log flags set: (0)
```

¼όαι ÷ ñçόειϊθιέçèåß ç åðέετᾰ -i áέά όά áέóåñ ÷ ùìάά P ç åðέετᾰ -o áέά όά áìåñ ÷ ùìάά ðáέÝόά, ç áιότῑP εά áíáέðPóáέ éáé εά áðáέετᾰβóáέ όçí áíόβóθιέ÷ç εβóόά éáτᾰτᾰρ ðτᾰ áβίáέ ååéáóáóόçYίç éáé ÷ ñçόειϊθιέçèåß áðᾰ ότᾰ ðñPά όç ååñYίç óóéåτᾰ.

Ç áιότῑP ipfstat -in ååß÷íáé Yίά áñέέτᾰYίτᾰ ðβίáέá éáτᾰτᾰρ áέά áέóåñ ÷ ùìάά ðáέÝόά.

Ç áιότῑP ipfstat -on ååß÷íáé Yίά áñέέτᾰYίτᾰ ðβίáέá éáτᾰτᾰρ áέά áìåñ ÷ ùìάά ðáέÝόά.

Ç Yίτᾰρ éå ñέÜæáé ìå όçí ðåñáέÜóᾰ:

```
@1 pass out on x10 from any to any
@2 block out on dc0 from any to any
@3 pass out quick on dc0 proto tcp/udp from any to any keep state
```

Ç áιότῑP ipfstat -in ååß÷íáé ότᾰ ðβίáέá éáτᾰτᾰρ áέά όά áέóåñ ÷ ùìάά ðáέÝόά, ότᾰεåðτᾰóáó ìðñτᾰóÜ áðᾰ ότᾰ εÜεå éáτᾰτᾰρ Yίά áñέέτᾰ ðτᾰ ååß÷íáé ðτᾰóáó ότᾰYó Y ÷ áέ ÷ ñçόειϊθιέçèåß.

Ç áιότῑP ipfstat -on ååß÷íáé ότᾰ ðβίáέá éáτᾰτᾰρ áέά όά áìåñ ÷ ùìάά ðáέÝόά, ότᾰεåðτᾰóáó ìðñτᾰóÜ áðᾰ ότᾰ εÜεå éáτᾰτᾰρ Yίά áñέέτᾰ ðτᾰ ååß÷íáé ðτᾰóáó ότᾰYó Y ÷ áέ ÷ ñçόειϊθιέçèåß.

Ç Yίτᾰρ éå ñέÜæáé ìå όçí ðåñáέÜóᾰ:

```
2451423 pass out on x10 from any to any
354727 block out on dc0 from any to any
430918 pass out quick on dc0 proto tcp/udp from any to any keep state
```

Ìέά áðᾰ óéó ðéτᾰ óçíáίόééÝò éåέóτᾰñåβáð όçð áιότῑP ipfstat áβίáέ ç åðέéτᾰ -t ç τᾰβίá áðáέéτᾰβæáé ότᾰ ðβίáέá éáóáóóÜóåτᾰ, ìå ðñðτᾰ τᾰτᾰρ ìå áóóᾰ ðτᾰ ÷ ñçόειϊθιέçèåß ç áιότῑP top(1) áέά ìå ååβίáέ ότᾰ ðβίáέá åéåñåáóéτᾰ ðτᾰ éóóéτᾰγίόáέ óóτᾰ FreeBSD. ¼όαι ότᾰ firewall óáó åÝ ÷ áóáé åðβæáóç, ç éåέóτᾰñåβá áóðP óáó áβίáέ όçí åóíáóᾰúóçóά ìå áíáτᾰñβóáóå éáé ìå áóóéÜóáóå óóá βæáé όά ðáέÝόά ðτᾰ όçí áðτᾰéτᾰγί. Ìέ ðñτᾰéñåóééÝò óðτᾰ-åðéτᾰÝò óáó åβτᾰί όçí åóíáóᾰúóçóά ìå áðéYίáóå ότᾰ IP áóáóçñβáð P ðñτᾰéóτᾰγ, όçí éγñå, P ότᾰ ðñóóéτᾰé ότᾰ τᾰβίβτᾰ èYéåóå ìå ðåñáέτᾰéðéPóáóå óå ðñåáτᾰóééü ÷ ñᾰτᾰ. Ååβóå όç óåββåå manual ότᾰ ipfstat(8) áέά ðåñέóóᾰðåñåð éåðóτᾰYñåéåð.

31.5.6 IPMON

Άέά ìå éåέóτᾰñåβóáέ óóóóÜ ç áιότῑP ipmon, éå ðñYðáé ìå áíåñåτᾰθιέçèåß ç åðέéτᾰ IPFILTER_LOG óóτᾰ ðñPά. Ç áιότῑP áóðP áéáéÝóáé åγί éåέóτᾰñåóééÝò óñúðτᾰ éåέóτᾰñåβáð. Ì ðñτᾰðééåñYίτᾰ éáτᾰτᾰρ óñúðτᾰ éåέóτᾰñåβáð áíåñåτᾰθιέçèåßéå üóáé ç áιότῑP ÷ ñçόειϊθιέçèåß ÷ ùñβð όçí åðέéτᾰ -D.

Ç áιότῑP τᾰτᾰρ ìå ÷ ñçόειϊθιέçèåß óå éåέóτᾰñåβá ååβίτᾰ üóáé åðééóτᾰβóå ìå Y ÷ áóå Yίά óóá ÷ ùåñ åñ÷åß éåóåñåóðð ðóóå ìå τᾰτᾰρ ìå áíåóÜóáóå óéó ðñτᾰçτᾰγίááð ååñåóÝò. Άóóᾰ áβίáέ éáé τᾰ óñúðτᾰ ìå ότᾰ τᾰβίβτᾰ Y ÷ áé ñðéτᾰóóåß ìå óóτᾰñåÜæáóáé ότᾰ FreeBSD ìå ότᾰ IPFILTER. Óτᾰ FreeBSD Y ÷ áé áτᾰóᾰúáóᾰYίç åóíáóᾰúóçóά áíåéååðð åñ÷åß éåóåñåóðð. Άέά áóóᾰ ότᾰ εüåτᾰ, áβίáέ éåéýóåñτᾰ ç éåóåñåóðP ìå áβίáóáé τᾰóᾰ ότᾰ syslogd(8) ðåñÜ óå Yίά óóτᾰçéóéYίτᾰ åñ÷åß. Άðᾰ ðñτᾰðééτᾰP, ç ñýéτᾰéç ipmon_flags óóτᾰ åñ÷åß τᾰc.conf ÷ ñçόειϊθιέçèåß óéó åðééτᾰÝò -Ds:

```
ipmon_flags="-Ds" # D = start as daemon
                    # s = log to syslog
                    # v = log tcp window, ack, seq
                    # n = map IP & port to names
```

Όα δεαίρτρεόβτράοά οςο έαόάαηάοβδ άβτράε δητράτβ. ΔάηΎ ÷ άε οςί άοτράοττδςοά άδεόεττδςοςο δεςηττρετρεβτ ττδτδ οά δάεΎοά δττ άδττηηβδεςεάτ, οεδ άεάοδεγτράεδ άδττ οεδ τδτβάδ εβδεςεάτ, έεε οττ δητττρεόττ οττδ. ÷ άοά Ύοόε Ύτρά οςτράτρεεττ δεαίρτρεδςτρά ττράτ δηττδδάεάβδά ίά άτράττηηβδάοά Ύτρά έεόάρεΎά.

Άετττά έεε ττράτ άτάνάτρεβδάοά οςί άοτράοττδςοά έαόάαηάοβδ, οττ IPF άάτ έά έαόάαηΰοάε οβδττρά άτ άάτ Ύ ÷ άε άβτράε ς άτδβδτρε ÷ ς ηγέτρεός οόττδ έάτττράδ. Ί άεά ÷ άεηεόδδδ οττ firewall άδττράοβάε άεά δτρετδ έάτττράδ οττ οάδ εΎεάε ίά άτάνάτρεβδάε οςί έαόάαηάοβ, έεε δηττρεΎοάε οά άοδτγδ οςί εΎτγ log. Οόοετρεεεΰ, ς έαόάαηάοβ άτάνάτρεβδάε ττττ οά έάτττράδ δττ άδττηηβδδτττ δάεΎοά.

Άβτράε δτρεγ οότρεεοττΎττ ίά δάηεεάττΰτράοάε Ύτράδ έάτττράδ οόττ οΎεττ οττ οόττεττ, δττ ίά άδττηηβδδάε άδττ δηττάδεεττβ ττεά οά δάεΎοά δττ οδΎττττ τΎ ÷ ηε άεάβ (default deny). Ίά οττ οηττδττ άοδττ τδττάβδά ίά άάβδά ττεά οά δάεΎοά δττ άάτ οάβηεάτττ ίά έάττΎτρά έάττττρά οττ οάδ.

31.5.7 Έαόάαηάοβ οττ IPMON

Όττ **syslogd** ÷ ηςοετττρεάβ ος εεεβ οττ εεεεβ τΎετττ εεά οττ εεά ÷ ττρεόττ οττ άάηηΎτττ έαόάαηάοβδ. ΆεάεΎοάε εεάεεΎδ ηάάτρεβδάεδ δττ τττΰετττράε “facility” έεε “level”. 1/4οάτ οττ IPMON ÷ ηςοετττρεάβδάε ίά οςί άδεεττβ -Ds, ÷ ηςοετττρεάβ άδττ δηττάδεεττβ οττ local0 ττδ ττττ “facility”. Άττ οττ άδεετττβδά, τδτττβδά ίά ÷ ηςοετττρεβδάοά οά δάηάεΰοττ άδβδάάά εεά δάηάεΎηττ εεά ÷ ττρεόττ οττ άάηηΎτττ έαόάαηάοβδ:

```
LOG_INFO - packets logged using the "log" keyword as the action rather than pass or block.
LOG_NOTICE - packets logged which are also passed
LOG_WARNING - packets logged which are also blocked
LOG_ERR - packets which have been logged and which can be considered short
```

Άεά ίά ηδεττβδάοά οττ IPFILTER ίά έαόάαηΰοάε ττεά οά άάηηΎτττ οόττ /var/log/ipfilter.log, έά ÷ ηάεάοδάβ ίά άςτρετττβδάοά άδττ δηεττ οττ άη ÷ άβττ. Άοδττ τδτττβ ίά άβτράε ίά οςί δάηάεΰοττ άττρεβ:

```
# touch /var/log/ipfilter.log
```

ς εεεοτττβδά οττ syslogd(8) τδτττβ ίά ηδεττεόδάβ ίά έαόά ÷ ττβδάεδ οόττ άη ÷ άβττ /etc/syslog.conf. Όττ άη ÷ άβττ syslog.conf δηττοΎηάε οςτράτρεεβ άδεεεττβά οόττ οηττδττ ίά οττ τδττβττ οττ **syslog** άτρεετττδδβάε οά τςτγτράοά οδδδβττττδ δττ δηττΎη ÷ ττράε άδττ άοάηηττΎδ ττδτδ οττ IPF.

ΔηττρεΎοά οςί δάηάεΰοττ έαόά ÷ ηηεός οόττ άη ÷ άβττ /etc/syslog.conf:

```
local0.* /var/log/ipfilter.log
```

Όττ local0.* οςτράβτράε ττδε έά άβτττράε έαόάαηάοβ ττετττ οττ τςττττΰοτττ άοδτγδ οττ ογδττ οόςττ οττδρεάοβά δττ Ύ ÷ άε ττρεόδάβ.

Άεά ίά άτάνάτρεβδάοά οεδ εεεάΎδ οόττ /etc/syslog.conf έά δηττΎδάε ίά άδάττρεεεττβδάοά οττ τς ÷ Ύττττ β ίά άτάεΰοάοά οττ syslogd(8) ίά ίάττρεάΰοάε οττ /etc/syslog.conf, εεάεβτττράδ οςί άττρεβ /etc/rc.d/syslogd reload

Ίςττ ίά ÷ ΰοάοά ίά οηττδττρεβδάοά οττ /etc/newsyslog.conf ηδδά ίά άτρεεΰοάε οττ άη ÷ άβττ έαόάαηάοβδ δττ άςτρετττβδάοά δάηάδΎττ.

31.5.8 ς τττβ οττ τςττττΰοτττ Έαόάαηάοβδ

Όά τςτγτράοά δττ δάηηΰεττράε άδττ οςί ipmon άδττρεττττράε άδττ δάάβά άάηηΎτττ δττ ÷ ττβάεττράε άδττ εάδεττ εεΰοόςττ. Όά δάάβά δττ άβτράε ετρετττ οά ττεά οά τςτγτράοά, άβτράε οά δάηάεΰοττ:

1. Ç çìáññçíβá ðáñáεάáPð òìò ðáεÝòìò
2. Ç þñá ðáñáεάáPð òìò ðáεÝòìò. ÷-áε òçí ìñòP HH:MM:SS.F, ç ìðìβá òðñäçèþñíáε þñáð, εάððÛ, ääððáññεεάððá εάε εεÛòíáðá ääððáññεÝðòìò (òá ìðìβá ìðìñáβ íá áβíáε ðñεεÛ äáεάáεεÛ øçòβá).
3. Õì ùññá òçð äεάðáðPð òðçí ìðìβá Ýáεíá ç äðáíáññáóβá òìò ðáεÝòìò ð. ÷. dc0.
4. Ì áñεεìùð ìÛááð εάε ì áýñùí áñεεìùð òìò εάñùíá, ð. ÷. @0 : 17.

Ìðìñáβðá íá äáβðá òá ðáñáεÛðù ìá òçí áíðòìP ipfstat -in:

1. Õì áβáñò òçð áñÝñááεάð: p áí òì ðáεÝòì ðÝñáðá, b áí òì ðáεÝòì áðìññβðεçεá, S áεá óýíòìì ðáεÝòì, n áí äáí óáβñεάíá ìá εάñÝíá εάñùíá, L áεá εάñùíá ìá εάðááññáðP. Ç óáεñÛ ðñìòáññáεúðçòðáð òðçí áðáεεúíεóç òùì ðáñáðÛñ, áβíáε S, p, b, n, L. Õì εάðáεάβì P P òì B óçíáβñìò ùðε ç εάðááññáðP òìò ðáεÝòìò Ýáεíá εùäù εÛðñεάð äáíεεPð ñýèèεóçð εάðááññáðPð εάε ù ÷-ε áñáεóβáð εÛðñεíò εάñùíá.
2. Ìε áεáððεýíóáεð. Ðññεáεóáε òðçí ðñááíáðáεεúðçòðá áεá òñβá ðááβá: òç áεáýððìóç εάε òç εýñá áððòçñβáð (÷ ðñβáεíðáε ìá εùìá), òì óýíáññεì -> εάε òçí áεáýððìóç εάε εýñá ðñññεεóìñý, ð. ÷. 209 . 53 . 17 . 22 , 80 -> 198 . 73 . 220 . 17 , 1722.
3. Õì PR áεññεíðñíáññ áðù òì ùññá P òìí áñεεìù òìò ðñùðìèεεèò, ð. ÷. PR tcp.
4. Õì len áεññεíðñíáññ áðù òì ìPèò òçð áðéεáðáεβááð εάε òì óðññεεú ìPèò òìò ðáεÝòìò, ð. ÷. len 20 40.

Áí ðññεáεóáε áεá ðáεÝòì TCP, εá òðÛñ ÷-áε Ýíá áðεðεÝñì ðááβì òì ìðìβì εá ìáεéñÛáε ìá ìεá ðáýεá εάε εá áεññεíðññáðáε áðù äñÛñáðá òá ìðìβá áíðéóðñε÷-ýñí óðéð áðεèñáÝð (flags) ðñò Ý ÷-ìò ðáεáβ. Äáβðá òç óáεβáá manual ipf(5) áεá òç εβóðá òùì äñáñÛðùì εάε òùì áíðβóðñε÷-ùí flags.

Áí ðññεáεóáε áεá ðáεÝòì ICMP, εá òðÛñ ÷-ìò áýì ðááβá óòì òÝèò, òì ðñðòì εá áβíáε ðÛñóá “ICMP” εάε òì áðùñáññ εá áβíáε ì òýðìð òìò ìçýñíáðìò εάε òìò òðù-ìçýñíáðìò ICMP, ÷-ùñéóíÝíá ìá ìεá εÛεáðì, ð. ÷. ICMP 3/3 áεá Ýíá ìPìðíá ìç ðññóáÛóεìçð εýñáð (port unreachable).

31.5.9 Äçìèòññáβá Script Éáñùíùí ìá ÓðìáññεεèP ÕðñεáðÛóóáóç

ÏñεóíÝññε Ýìðáεññε ÷-ñPóðáð òìò IPF äçìèòññáýñí Ýíá äñ ÷-áβì εάñùíùí òì ìðìβì ìðìñáβ íá äéðáεáóðáβ ùð script ìá äðíáðúðçòðá óðìáññεεèPð ððñεáðÛóóáóçð. Õì äáóéεú ùðáèò òìò ðáñáðÛñ, áβíáε ùðé ÷-ñáεÛáεóáε íá áεεÛíáðá ìññ òçí òèìP ðñò ò ÷-áðβáεáðáε ìá òì óðìáññεεú ùññá εάε ùðáí òì script äéðáεáóðáβ, ç òèìP εá ððñεáðáóðáεáβ òá ùèòð òìòð εάñùíáð ðñò ðáñεÝ ÷-ìò òì ùññá áððù. Éáεðð ðññεáεóáε áεá script, ìðìñáβðá íá ÷-ñçóéññðñεèPðáðá óðìáññεεèP ððñεáðÛóóáóç áεá íá εùáεéññεèPðáðá òð ÷-íÛ ÷-ñçóéññðñεèPðáðá òèíÝð εάε íá ðéð ððñεáεéóðÛðá òá ðñεεáðñεíò εάñùíáð. Áððù òáβíáðáε εάε óðì ðáñÛááεáñá ðñò áεññεèáβ.

Ç óýíðáñç òìò script ðñò ÷-ñçóéññðñεèPðáε äáþ, áβíáε óðìáðP ìá ðá εáýýðç sh(1), csh(1), εάε tcsh(1).

Õá ðááβá òðá ìðìβá áβíáðáε óðìáññεεèP ððñεáðÛóóáóç ðñòçíáεþññíðáε ìá òì óPíá òìò äñεáññìò: \$.

Õá óðìáññεεÛ ðááβá äáñ Ý ÷-ìò òçí ðññòçíáβùóç ìá òì \$.

Ç òèìP ðñò εá ÷-ñçóéññðñεèPðáε òðì óðìáññεεú ðááβì, εá ðñÝðáε íá áóùèεáβáðáε òá áεðèÛ áεóáññáεéÛ (“).

ÏáεéñPðáð òì äñ ÷-áβì òùì εάñùíùí óáð ìá εÛðé áíðβóðñε÷-ì ìá òì ðáñáεÛðù:

```
##### Start of IPF rules script #####

oif="dc0"           # name of the outbound interface
odns="192.0.2.11"  # ISP's DNS server IP address
myip="192.0.2.7"   # my static IP address from ISP
```

```
ks="keep state"
fks="flags S keep state"

# You can choose between building /etc/ipf.rules file
# from this script or running this script "as is".
#
# Uncomment only one line and comment out another.
#
# 1) This can be used for building /etc/ipf.rules:
#cat > /etc/ipf.rules << EOF
#
# 2) This can be used to run script "as is":
/sbin/ipf -Fa -f - << EOF

# Allow out access to my ISP's Domain name server.
pass out quick on $oif proto tcp from any to $odns port = 53 $fks
pass out quick on $oif proto udp from any to $odns port = 53 $ks

# Allow out non-secure standard www function
pass out quick on $oif proto tcp from $myip to any port = 80 $fks

# Allow out secure www function https over TLS SSL
pass out quick on $oif proto tcp from $myip to any port = 443 $fks
EOF
##### End of IPF rules script #####
```

Άδοϋ άβιάε υει. Όοι δανάδΰϋ δάνΰααέαία αάρ άβιάε όçιαόέειβ ιέ εάφιαδ, αέεΰ ι όπυδίο ιά όιρ ιδιβι εάέοιοñαιγί εάέ δάβññοι όειΰδ όά δααβά δδρεάόΰόόάόç. Αί όι δανάδΰϋ δάνΰααέαία άñβόειόοί όά ΰία άñ ÷ άβι ιά όι υñña /etc/ipf.rules.script, εά ιδññγόάόά ιά δδάίαόιñδρσάόά άδοιγδ όιød εάφιαδ ιά όçι δανάέΰδϋ άφöreP:

sh /etc/ipf.rules.script

Όδΰñ ÷ άέ ΰία δñυάεçια υόάι ÷ ñçόειñδδρειγίόάέ άñ ÷ άβά εάφιαδ ιά άίόυιάόυιΰñød όδñäreέόιγδ: Όι IPF αάρ εάδσέαάάβιάέ όç όδñäreέέP δδρεάόΰόόάόç, εάέ αάρ ιδññάβ ιά εέαάΰόάέ άδδΰ όά scripts ΰñάόά.

ια όΰοιει script ιδññάβ ιά ÷ ñçόειñδδρεçεάβ ιά ΰία άδϋ όιød άγί δανάέΰδϋ όñυδίοδ:

- Άόάέñΰόά όι ό ÷ υέει άδϋ όç άñάñP διø ιάέειΰάέ ιά cat, εάέ ιάόάδñΰόά όά ό ÷ υέει όç άñάñP διø ιάέειΰάέ ιά /sbin/ipf. ΌιδδρεάόPόόά όι ipfilter_enable="YES" όοι άñ ÷ άβι /etc/rc.conf υδδϋ όοιPεϋδ, εάέ άέδσέαΰόά όι script ιέα όññΰ ιάδΰ άδϋ εΰεα αέέαάP άέα ιά άçειññάPόάόά P ιά άίçιαñPόάόά όι /etc/ipf.rules.
- ΆδάρáññäñδδρεPόόά όι IPFILTER όόά scripts άέέβιçόçδ όιø όόόδPιαόιδ, δññσέΰδññόάδ όçι εάόά ÷ Pñέόç ipfilter_enable="NO" (δññεάέέόάέ άέα όçι δñññδέέάñΰιç όειP) όοι άñ ÷ άβι /etc/rc.conf.

Δññσέΰόά ΰία script υδδϋ όι δανάέΰδϋ όοιρ εάδΰειρι άέέβιçόçδ /usr/local/etc/rc.d/. Όι script εά δñΰδάέ ιά ΰ ÷ άέ ΰία δññόάΰδ υñña, υδδϋ ipf.loadrules.sh. Ç άδΰέόάόç .sh άβιάέ δδñ ÷ ññυόέέP.

```
#!/bin/sh
sh /etc/ipf.rules.script
```

Ιέ ΰάάέαδ όά άδδϋ όι άñ ÷ άβι, εά δñΰδάέ ιά άδέόñΰδρϊ άίΰññυόç, άάñάόP εάέ άέδΰέάόç άέα όιñ ÷ ñPόόç root.

```
# chmod 700 /usr/local/etc/rc.d/ipf.loadrules.sh
```

Ιέ εάφιαδ όιø IPF εά όññδρññόάέ δέΰι εάδΰ όçι άέέβιçόç όιø όόόδPιαόιδ όάδ.

31.5.10 Οι Όγνιει Έάιυιύι οίω IPF

Όδ “όγνιει έάιυιύι” οίω IPF, ινβαιριά ιέα ινΰαά έάιυιύι θιω Ύ÷ιρι άναοαβ αέα ιά άθεονΎθιωι Ρ ιά άδιηνβθιωι θάέΎοά άΰεραά ιά οέο οειΎο θιω θανέΎ÷ιθάέ οά άοθΰ. Ç αέθεΡο έαόάγέθιόγθ άιόάεεάαΡ θάέΎουι ιάοάγθ οθιεραέοθρι άθιωάεάβ ιέα οθιαάνβά. Οι όγνιει έάιυιύι οίω firewall άθαιάναΰαάοάέ ουοι οά θάέΎοά θιω Ύñ÷ιθάέ άθι οί Internet, υοι έάέ οά θάέΎοά θιω θάνΰαιθάέ άθι οί όγόογία υο άθΰιόγθ οά άοθΰ. Έΰεά οθγναόβά TCP/IP (θ.÷. telnet, www, mail, e.e.θ.) έάεινβαάοάέ άθι οί θñυουειειει έάέ ογί θñιηιέαεΡ (privileged) εγνα θιω ÷ñçοειιθιεάβ αέα ιά äΎ÷άοάέ άέοΡιαόά άιθθγñΎθçογθ. Οά θάέΎοά θιω θñιηνβαιθάέ αέα ιέα οάεάεηειΎιç οθγναόβά, ιάεειγί άθι οç έάάγέθιόç άοάθγñβάο ÷ñçοειιθιεβιόάο ιέα ιç-θñιηιέαεΡ εγνα έάέ έαόάεΡαιθι οόç οάεάεηειΎιç εγνα οθγναόβάο οοιι θñιηιέοιυ. ¼εάο ιε θαναθΰιυ θανΰιαόηιε (εγναό έάέ άεάοεγίόάέο) ιθιηιγί ιά ÷ñçοειιθιεçειγί υο εηέοθΡηέα άθεειάΡο αέα ογί άçιειθναβά έάιυιύι θιω άθεονΎθιωι Ρ άιθιαβαιθι ογί θñυοάάοç οά οθγναόβάο.

Οι IPF άñΰοθçεά άñ÷έεΰ ÷ñçοειιθιεβιόάο ιέα ειαέεΡ άθαιάναάοβάο έάιυιύι οίω όγθιω “ι οάεάοάβιθ έάιυιύι θιω οάεηέΰαάε, άβιαέ ι ιέεçοΡο” έάέ ÷ñçοειιθιεγίόά ιυηι έάιυιύιάο stateless. Ιά ογί θΰñηαι οίω ÷ñυιθι, οί IPF άιεό÷γέçεά ιά ογί άθεειάΡ “quick” έάέ ιά άθιαόυθçοά άθιεΡεάοθçθ έάοΰοόάοçθ ιΎου οçθ άθεειάΡο “keep state”. Ιά οίι οñυθι άοθι, άεοόά÷ñιιβόθçεά άñαιάοέεΰ ç ειαέεΡ άθαιάναάοβάο ουι έάιυιύι.

Ιε ιαçαβάο θιω θανέΎ÷ιθάέ οά άοθΡ ογί άιυιόγθά άαόβαιθάέ οόç ÷ñΡόç έάιυιύι θιω θανέΎ÷ιθι ογί άθεειάΡ “quick” έάέ ογί άθεειάΡ “keep state” αέα οç έάέοθΡηόç οçθ έάοΰοόάοçθ. ΆοθΎθ άβιαέ έάέ ιε άαόέεΎθ έάέοιθναβάο αέα ογί ευάεειθιβόçθ οίω οθιυειθι έάιυιύι άιυιθ inclusive firewall.

θñιαέαιθιβόçθ: ¼οάι αιθεάγάοά ιά οίωθ έάιυιύι θιω firewall, έα θñΎθάέ ιά άβοόά θιεγ θñιόάεοέειβ. Αί άΰεάοά έάιεάοιΎιαό ηθειβοάέο, ιθιηάβ ιά έεάεαυεάβοά Ύιυ άθι οίι άιθθγναόçθΡ οάο. Άέα ιά άβοόά άοοάεάβθ, άβιαέ θñιόειυοάηι ιά έΰιαόά οέο άñ÷έεΎθ οάο ηθειβοάέο άθι ογί οίθεέεΡ ειιούεά, θανΰ ιΎου άθιαέθιοιΎιçθ όγίαάοçθ (θ.÷. ιΎου ssh).

31.5.11 Οόιόάέοέευ Έάιυιύι

Οι οοιόάέοέευ ουι έάιυιύι θιω θανιθόέΰαιθια άαη, Ύ÷άε άθειθιεçεάβ ηοόά ιά άθαιεινβαιέ οç όγñ÷ñιç stateful οειθιβόçθ έάέ οç ειαέεΡ οίω όγθιω “ι θñηθιθι έάιυιύι θιω οάεηέΰαάε άβιαέ έάέ ι ιέεçοΡο”. Άέα ογί θανέάñάοΡ οίω θάεευοάηιθι οñυθιθι έάέοιθναβάο, αέαάΰοόά οç οάεβάά manual οίω ipf(8).

Ί ÷άñάεθΡηάο # ÷ñçοειιθιεάβοάέ αέα ιά άθεογίΰιαέ ογί άñ÷Ρ άιυιθ ο÷ιεβιθ, έάέ ιθιηάβ ιά άιθαίβαιθάέ οοιι οΎειθ ιέαο άñαιθΡο έάιυιύι Ρ οόç αέεΡ οίω άñαιθΡ. Ιε έαρΎθ άñαιθΎθ άάηγίθάέ.

Ιε έάιυιύι θιω θανέΎ÷ιθι εΎιαέο-εεάεαεΰ. Ιε εΎιαέο άοθΎθ έα θñΎθάέ ιά ευάεειθιεçειγί ιά οάεάεηειΎιçθ οάεñΰ άθι οά άηεοόάñΰ θñιθι οά άαιεΰ οçθ άñαιθΡο. Ιε εΎιαέο-εεάεαεΰ οάβηιθάέ θαναέΰου ιά Ύιθιηά άñΰιαόά. ΙάηεέΎθ εΎιαέο Ύ÷ιθι οθι-άθεειάΎθ ιε ιθιβάο ιθιηάβ ιά άβιαέ άθβόçθ εΎιαέο-εεάεαεΰ έάέ ιά θανέεαιάΰιθι άθβόçθ θανέοουοάηιθι οθι-άθεειάΎθ. Έΰεά ιέα άθι οέο άθεέαοάεβάο οοιι θανΰιαέαιά θιω οάβηιθάέ θαναέΰου Ύ÷άε ιέα έαοάεβάά ιά Ύιθιηά άñΰιαόά ç ιθιβά άθαιçαάβ οίι θανέά÷υιαιθι οçθ.

```
ACTION IN-OUT OPTIONS SELECTION STATEFUL PROTO SRC_ADDR,DST_ADDR OBJECT PORT_NUM
TCP_FLAG STATEFUL
```

```
ACTION = block | pass
```

```
IN-OUT = in | out
```

```
OPTIONS = log | quick | on interface-name
```

```
SELECTION = proto value | source/destination IP | port = number | flags flag-value
```

PROTO = tcp/udp | udp | tcp | icmp
SRC_ADD, DST_ADDR = all | from object to object
OBJECT = IP address | any
PORT_NUM = port number
TCP_FLAG = S
STATEFUL = keep state

31.5.11.1 ACTION

Ç áñÝñááέα (action) ááß÷íáε óε ðñÝðáε íá áβíáε íá òì ðáεÝòì áí óáεñεÛæáε íá òì έáíuíά òìò òβεòñìò. ÈÛεά έáíuíά ðñÝðáε íá áεάεÝðáε íέα áñÝñááέα. Ìε áñÝñááεάò ðìò áíááññáεíòáε, òáβñíòáε ðáñáεÛò:

Ïì block ááß÷íáε ùεé òì ðáεÝòì εά ðñÝðáε íá áðìññεòεάβ áí óáεñεÛæáε íá òεð ðáñáíÝðñìò ðáεέìáð òìò έáíuíά.

Ïì pass ááß÷íáε ùεé òì ðáεÝòì εά ðñÝðáε íá áñÝεεά áðì òì firewall, áí óáεñεÛæáε íá òεð ðáñáíÝðñìò ðáεέìáð òìò έáíuíά.

31.5.11.2 IN-OUT

ÈÛεά έáíuíά òìò òβεòñìò ðñÝðáε òðì÷ñáòεέÛ íá áεάðεñεíβæáε íá óáòβíέαé áí áíáóÝñáòáε óòçí áβòìáì β òçí Ýñáì ðáεÝòì. Ç áðìñáíç εÝίç-εεάεάβ ðñÝðáε íá áβíáε in P out έáε áí ááì òðÛñ÷áε, ì έáíuíά εά áðìòý÷áε έáóÛ òì óòíáεðéεù Ýεά÷ì.

Ïì in óçíáβíáε ùεé ì έáíuíά εά áòáññòóάβ óά Ýíá áεóáñ÷ùáñ ðáεÝòì òì ìðìβì ìùεéð εβòεçεά óòç áεάðáòβ ðìò óòíáÝáòáε íá òì Άεάáβéðòì.

Ïì out óçíáβíáε ùεé ì έáíuíά εά áòáññòóάβ óά Ýíá ðáεÝòì ðìò ðñìññáεáòáε áεά Ýñáì ìÝòù òçð áεάðáòβ ðìò óòíáÝáòáε íá òì Άεάáβéðòì.

31.5.11.3 OPTIONS

Óçíáβòòç: Ìε ðáñáεÛòù ðáεέìáÝò ðñÝðáε íá ÷ñçóεìðìέçεìýì íá òç óáεñÛ ðìò òáβñíòáε ááβ.

Ïì log ááß÷íáε ùεé ç áðεεáòáεβáá òìò ðáεÝòìò εά áñáòáβ óòì áñ÷áβì έáóáñáòòð òìò ìpl (ùðùð ðáñεáñÛòáòáε óòçí áíùòçòά LOGGING ðìò áεìεìεάβ) áí ìε ðáñÛáòòñìε òçð áðεέìáð ðáεñεÛæáε ìá òì ðáεÝòì.

To quick ááß÷íáε ùεé áí ìε ðáñÛáòòñìε òçð áðεέìáð ðáεñεÛæáε ìá òì ðáεÝòì, ì óòáεáεñεìÝñìò έáíuíά εά áβíáε έáε ì óáεáòóáβìò έáíuíά ðìò εά áεά÷÷εάβ. Ç áðεέìáð áòòβ áβíáε òðì÷ñáòεέβ áεά òç óýá÷ñìç εìáεέβ áðáñáñááòβáð ðáεÝòì.

Ïì on ááß÷íáε òì ùññá òçð áεάðáòβ ðìò εά áíóùíáòùεάβ óóεð ðáñáíÝðñìò ðáεέìáð. Óά ìñìáòά òùì áεάðáòβ òáβñíòáε ùðάì áεðáεáβðáε ç áíðìεβ ifconfig(8). ×ñçóεìðìέçìáð òçí áðεέìáð áòòβ, ì έáíuíά εά áεά÷÷εάβ ìùñ áí òì ðáεÝòì áεÝñ÷áòáε ìÝòù òçð óðáεáεñεìÝίç ðáεáðáòβ òáε ðñìò òç óðáεáεñεìÝίç έáóáýεòìóç (áεóáñ÷ùáñ/áñáñ÷ùáñ). Ç áðεέìáð áòòβ áβíáε òðì÷ñáòεέβ áεά òçí óýá÷ñìç εìáεέβ áðáñáñááòβáð òùì έáíuíá.

¼ðάì áβíáòáε έáóáñáòòβ áñùð ðáεÝòìò, ìε áðεεáòáεβááð áñÛòìòáε óòçí ðáòáì-óòóεáòβ έáóáñáòòð ðáεÝòì IPL. ÌáòÛ òçí áíðìεβ log, ìðìñìýì íá ÷ñçóεìðìέçεìýì ìε ðáñáεÛòù ðáñÛáòòñìε (ìá òç óáεñÛ ðìò òáβñíòáε):

Όι body αάβ÷íáε úóε εά άβίáε εάόάάάάόP òùí ðñþòùí 128 bytes òùí ðáñéá÷íÝíúí òíò ðáéÝòíò, ðíò áñβóεííóáé áíÝóùð ìáóŮ òçí áðééáóáεβáá.

Ç áðéεíáP first óóíβóóáóáé íá ÷ñçóεííðíεçεáβ áí ç áðéεíáP log ÷ñçóεííðíεáβóáé óá óóíáóóáóíú ìá òçí keep state. Ìá òíí ðñúðí áóòú áβίáóáé εάόάάάάόP íúíí òíò ðñþòíò ðáéÝòíò (ìá òí ìðíβí ìáεβίççóá ç áðéεíεíúíβá), εáé ù÷é úεúí òùí ððíεíβðùí óá ìðíβá óáεñéŮæíòí ìá òçí ðεçñíòíñβá “keep state”.

31.5.11.4 SELECTION

Ìé εÝíáεð εεάεáεŮ ðíò ðáñεáñŮòííóáé óá áóòP òçí áíúòçóá, ÷ñçóεííðíεíýíóáé áεá íá ðáñεáñŮòíòí ðíεáð εáεúòçóáð òíò ðáéÝòíò εá áεáñáðíççéíýí áεá íá εáεíñεóóáβ áí óáεñéŮæáε P ù÷é ìá ðíòð εáíúíáð. Ìεá εÝíç-εεάεáβ ìñβæáé òí εáíóñεéú εÝíá εáé áεíεíðεáβóáé áðú Ůεεáð εÝíáεð ðíò ìñβæíòí ðεð áεñεááβð áðéεíáÝð. ÐñÝðáε ðŮíóíòá íá áðééÝááóáé ìεá áðú áóòÝð ðεð εÝíáεð. ÐáñÝ ÷ííóáé ìé ðáñáéŮòù εáεúòçóáð ááíεεPð ÷ñPóçð ìé ìðíβáð ðñÝðáé íá ÷ñçóεííðíεçεíýí ìá áóòP òç óáεñŮ:

31.5.11.5 PROTO

Όí proto áβίáε ç ááóεεP εÝíç, εáé ðñÝðáé íá áñŮóáóáé ìáæβ ìá εŮðíεá áíóβóóíε÷ç óεíP áεá ðáñáεðŮñú áðéεíáP. Ç óεíP áðεòñÝðáé òí óáβñεáóíá ìá Ýíá óóáεáεñéíÝíí ðñúòúεíεεí. Áβίáε ððí÷ñáùðεéú íá ÷ñçóεííðíεçεáβ áεá íá εáεóíòñááβ ç çýá÷ñíç εíáεéP áðáíñááóáβáð òùí εáíúíúí.

Όá ìúíáóá ðñúòíεúεéúí ðíò áíááíñβæííóáé εáé ìðíñíýí íá ÷ñçóεííðíεçεíýí, áβίáε óá tcp/udp | udp | tcp | icmp P ìðíεááPðíòá Ůεεá áíòáíβæííóáé óóí /etc/protocols. Ìðíñáβóá íá ÷ñçóεííðíεPóáðá òí áεáéúú úíñá tcp/udp òí ìðíβí óáεñéŮæáε áβðá ìá ðáéÝòí TCP áβðá ìá UDP. Ç áεáéεP áóòP ìñáóóá ðñíóðŮçεçá þóðá íá áðíòáýáííóáé áεðεíβ, áεεŮ εáóŮ óá Ůεεá úííεíε, εáíúíáð.

31.5.11.6 SRC_ADDR/DST_ADDR

Ç εÝíç all áβίáε ìòóεáóóεéŮ óóíþíòíç ìá òçí ðñŮóç “from any to any” ÷ññβð íá ððŮñ÷íòí Ůεεáð ðáñŮíáðñíε áεá òí óáβñεáóíá.

¼ðáí ÷ñçóεííðíεáβóáé òí from src to dst, ìé εÝíáεð from εáé to áçεþñíòí áεáðεýíóáεð IP ðíò εá ÷ñçóεííðíεçεíýí áεá òí óáβñεáóíá. Ìé εáíúíáð ðñÝðáé íá εáεíñβæíòí ðεð ðáñáíŮòñíòð òúóí òçð áóáðçñβáð úóí εáé òíò ðñíñεóííý. Ç εÝíç any Ý÷áε òçí áεáéεP εáεúòçóá íá óáεñéŮæáε ìá ìðíεááPðíòá áεáýεòíóç IP. Ðáñáááβáíáðá ÷ñPóçð: from any to any P from 0.0.0.0/0 to any P from any to 0.0.0.0/0 P from 0.0.0.0 to any P from any to 0.0.0.0.

Ááí ððŮñ÷áε ðñúðíò ìá ðáñεáñáóíýí ðáñεí÷Ýð IP áεáðεýíóáúí ðíò ááí ìðíñíýí íá áεòñáóóíýí áýεíεá ìá òç ìñòP áñεéíþí ÷ññεóíÝíúí ìá óáεáβáð /ìŮóεáð ððíáεéðýíò. Ìðíñáβóá íá ÷ñçóεííðíεPóáðá òí áíçεçðεéú ðñúáñáíá net-mgmt / ipcalc áεá áεáðεúεúóíóç óáð óóíòð ððíεíáεóííýð. Ááβðá òçí áεéðóáεP ðíðíεáðóá ðíò ðñíáñŮíáðíò áεá ðáñεóóúðáñáð ðεçñíòíñβáð: <http://jodies.de/ipcalc>.

31.5.11.7 PORT

Όí óáβñεáóíá ìá εŮðíεá óóáεáεñéíÝíç εýñá áóáðçñβáð P/εáé ðñíñεóííý (áí ððŮñ÷áε) áóáñíúæáðáé ìúíí óá ðáéÝóá TCP εáé UDP. ΈáóŮ òçí áçíεíòñáβá óóáεñβóáúí ìá εýñáð, ìðíñáβóá áβðá íá ÷ñçóεííðíεPóáðá òíí áñεéúú òçð εýñáð, áβðá òí úíñá òçð áíóβóóíε÷çð ððçñáóóáð áðú òí áñ÷áβí /etc/services. ¼ðáí ç εýñá áíòáíβæáðáé ùð òíÞíá òíò áíðéεáεíÝííò from, òí óáβñεáóíá εá áβίáε ìá òçí εýñá òçð áóáðçñβáð. ¼ðáí áíòáíβæáðáé ùð òíÞíá òíò áíðéεáεíÝííò to,

οι οάβηεάοιά εά αβιάε ιά ος εγνά δνιηέοιη. Άεά ιά εάεοιηάαβ ς ογá÷ñις ειαέεP οάεηέΰοιάοιό εάιιιι, εά δñÝðáε ιδουάPðιόά ιά οδΰñ÷áε ς άδεειαP εγνάο οοι αίοεεάβιαñι το. Δάνΰάεεα ιά ÷ñPόçð: from any to any port = 80

port "=" | "!=" | "<" | ">" | "<=" | ">=" | "eq" | "ne" | "lt" | "gt" | "le" | "ge".

Άεά ιά εάειηβόαόά δάηει÷Ýð εδñι, ÷ñçόειηδιεPόόά port "<>" | "><"

Δñιαέαιδιδιççόç: Ιάοΰ οέο δάñαιÝοñιόο άεά οι οάβηεάοιά οçð άοάοçñβáð εάε οιο δñιηέοιη, ιε δάñάεΰου άγι δάñΰιαόñιέ άβιάε οδι÷ñáυοεέÝð άεά ιά εάεοιηάαβ ς ογá÷ñις ειαέεP άδαιñάάόβáð ουι εάιιιι.

31.5.11.8 TCP_FLAG

Όα flags άβιάε άíñáñΰ ιιñι οοι οέεδñΰñεοιά οιο δñιδιδιεεεο TCP. Οι εΰεά ãñΰιá αίοεδñιούδάγáε Ýιá δεεάιι flag οι άεά οι ιδιδι ββιαόάε άιβ÷íáοçç οόçι άδεεάοάεβáá οιο δάεÝοιό TCP.

Ç ογá÷ñις ειαέεP άδαιñάάόβáð ουι εάιιιι, ÷ñçόειηδιδιεάβ οçι δάñΰιαόñι flags S άεά οçι άíñáññεόç οçð Ýíññçð ιεά οοíñáñβáð tcp.

31.5.11.9 STATEFUL

Όά Ýιá εάιιιá οιο άδεδñÝðáε (pass) οι δÝñάοιá ουι δάεÝοι, ς άδεειαP keep state äáβ÷íáε υόε εά δñÝðáε ιά άíñáñδιδιεάβόάε ς εάεοιηάβá stateful filtering υόάι οι δάεÝοι οάεηέΰεάε ιά οά εñέοPñεά άδεειαP.

Όçιαβύοç: Ç άδεειαP άοδP άβιάε οδι÷ñáυοεέP άεά οç εάεοιηάβá οçð ογá÷ñιçð ειαέεP άδαιñάάόβáð εάιιιι.

31.5.12 Οέεδñΰñεοιá ιá ΆεάοPñçόç οçð Έάοΰόόάοçð (stateful)

Όι stateful οέεδñΰñεοιá, αίοειαδιδιεάε οçι εβιççόç οιο άεέογιο υò ιεάδ άεδεPð εάόáγέδιοçð αίοάεεάP δάεÝοιι οά ιδιδιá äçιεοññáγι ιεά οοíñáñβá. ¼δάι άíñáñδιδιεçεάβ, ς άεάοPñçόç οçð εάοΰόόάοçð (keep-state) äçιεοññáβ äοíñεέΰ άούδáηεεγýð εάιιιáð άεά εΰεά δάεÝοι οι ιδιδι αίοάεεΰόόάόε εάοΰ οç äεΰñεάεά άοδPð οçð οοíñáñβáð. ÷÷άε άδβόçð οç äοíñáυοçðά ιά άεάñáοιPόάε άι άειεοδιδιόάε ιε Ýεοñιε εάιιιáð αίοάεεάPð ιçιοιΰδουι ιάδαιγ οιο άδιοοιεÝá εάε οιο δάñάεPðç. ΙδιδιεάPðιόά δάεÝοά äáñ οάεηέΰεαοι ιά οι δñυοδδι άοδPð οçð άδεειεíιιβáð, άδññβδιδιόάε υò ϕáγόεεά.

Ç άεάοPñçόç οçð εάοΰόόάοçð άδεδñÝðáε άδβόçð ιá δάñΰοιόι οά δάεÝοά ICMP διο ó÷άοβαιιόάε ιά ιεά οοíñáñβá TCP P UDP. ρόε, άι εççοεγι δάεÝοά ICMP όγδιο 3 code 4 υò άδΰιδççόç εάοΰ οç äεΰñεάεά οçð άδβόεάççð οάð οά ιεά εόδιοάεβáá, (ç ιδιδιá άδεδñÝðáόάε άδυ οñι αίοβόοιε÷ι εάιιιá άíñáñ÷ñÝιι), εά οιοδ άδεοñάδáβ ς άβοιαι. ΙδιδιεάPðιόά δάεÝοι άεά οι ιδιδι οι IPF άβιάε οβαιοñι υόε δñυεάεόάε άεά οιPια ιεάð άíñáñPð οοíñáñβáð, εά δάñΰόάε άευια εάε άι άβιάε εάεοιηάδεευ δñυδιδιεει.

Άδου διο οοíñáββιάε άβιάε οι δάñάεΰου:

Όά δάεÝοά διο δñιññβαιιόάε ιά άíÝεεοι ιÝού οçð εάάδáοPð διο οοíñáÝάόε οοι Internet, άεÝá÷ιιόάε άñ÷εέΰ όγιοιιá ιά οι äοíñεευ δβιαεά εάόάοΰόάι. Άι οι δάεÝοι οάεηέΰεάε ιά οι άδυιαñι διο άíñáÝιόάε οά ιεά άíñáñP

tcp δαήεεαίαΰήοι όγι άδέειάP flag πόδα ίά αίαάιήνβαιοί όγι άβόόζόζ Υίαήηόδ όζό όόιαήνβαιο έάέ ίά αίαήνβαιοί όζ έάέόιόήνβαιο έάέόPήζόζό όζό έάόΰόόάόζό (stateful).

Όόζι άήυόζόδα όυι άέόάή÷ υίαήυι δάέΥόυι (Inbound) θιό όάβιαόάέ δαήάέΰόυ, θήπθιέ άιόάβαιοίόάέ ιέ έάήυιόό θιό ÷ήζόέιιθιέιγίοάέ άέα όζι άδύήήεζόζ όυι αίαδέέγυζόυι δάέΥόυι. Αόόυ άβιαόάέ άέα άγι έάέόιιήάόέέγυζό έυαίόό. Ί θήπθιό άβιαέ υόέ όά έάέυαίόέά δάέΥόά ιθιήάβ άι ιΥήάέ ίά όάέήέΰάέιόι ιά έΰθιέά ÷άήάέόζήέόόέέΰ όζό Υάέόήζό έβιζόζό. Όά δάέΥόά άόόΰ έά θήΥδάέ ίά άθιήήέόέιγί, άιόβ ίά άβήιόι άάέόΰ άδύ έΰθιέι άδύιήι έάήυιά allow. Ί άάγόάήιό άβιαέ υόέ ιθιήάβόά ίά άθιήήβόάόά όόάέάέήέΥία δάέΥόά όά ιθιήά άήυήάέόά υόέ άάι άβιαέ Υάέόήά, άέέΰ όάό άβιαέ άάέΰιήζ ζ έάόάάήάόP όιόό. Ίά όιι όήυθι άόόυ άιθιήάβέάόάέ ζ έPθζ έάέ έάόάάήάόP όιόό άδύ όιι όάέάόόάβι έάήυιά. Ί όάέάόόάβιό έάήυιόό όόδέέΰ άθιήήβόόάέ έάέ έάόάάήΰόάέ υέα όά δάέΥόά θιό Υόόάόάι ιΥ÷ήέ άόόυι. Ί έάήυιόό άόόυό ÷ήζόέιιθιέάβόάέ άέα όζι δάήι÷P ήέέήι άθιήάβιαήυι όά δάήβθόόζό θιό έέίPόάόά έέέάόόέέP έέάέέέάόά έάόΰ άόυιή θιό θήιΥάζόάί όά άδέέΥόάέό όόι όγόόζία όάό.

Έά θήΥδάέ άδβόζό ίά αίαόόάέβόάόά υόέ όι όγόόζία όάό άάι έά άπόάέ έάιέΰ άδΰιόζόζ όά έάρΥία άδύ όά αίαδέέγυζόδα δάέΥόά. Όά δάέΥόά άόόΰ έά θήΥδάέ ίά άθιήήέόέιγί έάέ ίά αίαόάίέόόίγί. Ίά όιι όήυθι άόόυ, ι άδέόέέ Υιήιό άάι Υ÷άέ έάιέΰ άήπζ άί όά δάέΥόά θιό Υόόάόάι ιΥ÷ήέ όι όγόόζία όάό. Ψόι έέάυόάήά ιθιήιγί ίά ιΰέιόι ιέ άδέόέέ Υιήιέ ό÷άόέέΰ ιά όι όγόόζία όάό, όυόι δάήέόόυιόάήι ÷ήυι έά ÷ήάέάόόάβ ίά άδάήάγόιόι άέα ίά έάόάόΰήιόι ίά όάό άέΰθιόι όόά άέPέάέά. Ίέ έάήυιόό ιά όζι άδέειάP log first έάόάάήΰιόιόι όι όόιαΰι υιήι όζι θήπθζ όιήΰ θιό άήάήιθιέιγίοάέ. ζ άδέειάP άόόP δαήέέαίαΰιόάέ όόι έάήυιά nmap OS fingerprint όόι δάήΰάέέαία θιό όάβιαόάέ δαήάέΰόυ. Όι άιζέζόέέΰ θήυιήάήά security/nmap ÷ήζόέιιθιέάβόάέ όό÷ΰΰ άδύ έάέυαίόέά ΰιήά, θιό θήιόδάέιγί ιά άόόυ όιι όήυθι ίά αίαήυήβαιοί όι έάέόιόήάέέΰ όγόόζία όιό ιζ÷άήβιαόιό όάό.

Έΰέά όιήΰ θιό όδΰή÷άέ έάόάάήάόP άδύ έΰθιέι έάήυιά ιά όζι άδέειάP log first, έά θήΥδάέ ίά άέόάέΥόάόά όζι άίόιέP ipfstat -hio άέα ίά άάβόά θυόάό όιήΥό Υ÷άέ άήάήιθιέέζάβ άόόυό ι έάήυιόό όόήέέέΰ. ρόέ έά ιΥήάόά άί θ.÷. όάό έΰήιόι άδβέάόζ όδάή÷άβέέόζό (flood).

Άάβόά όι άή÷άβι /etc/services άέα ίά άήάβόά άήέέιγυζό έόήπι θιό άάι αίαήυήβέάόά. Ίθιήάβόά άδβόζό ίά άδέέάόέάβόά όζι όιθιέάόβά http://www.securitystats.com/tools/portsearch.php έάέ ίά έΰιόάά αίαέPόζόζ άέα όζ όόάέάέήέΥιζ έγήά, πόδα ίά άάβόά θιέά όδζήάόβά άιόδζήάόάβ.

Άάβόά όζι άδύιήζ όιθιέάόβά άέα όέό έγήάό θιό ÷ήζόέιιθιέιγίοάέ όόιPέυό άδύ έάέυαίόέά θήιήάΰιήάόά (trojans): http://www.simovits.com/trojans/trojans.html.

Όι δάήάέΰόυ όγίήι έάήυιήι άβιαέ άήέάόΰ δέPήάό έάέ θιέγυ άόόάέΥό. Άζιέιόήάάβ firewall όγθιό inclusive, έάέ Υ÷άέ άιέέιάόόάβ όά θήάάιήάόέέΥό όόιέPέάό έάέόιόήνβαιο. Ίθιήάβ ίά άιόδζήάόPόάέ όι βάέι έάέΰ έάέ όι άέέΰ όάό όγόόζία. ΆδέPό ιάόάόήΥθόόά όά ό÷υέέι όιόό έάήυιόό άέα όέό όδζήάόβάό θιό άάι έΰέάόά ίά άήάήιθιέέPόάόά.

Άέα ίά άθιόγυάάόά όζι έάόάάήάόP αίαδέέγυζόυι ιζιόιΰόυι, άδέPό θήιόέΥόάά Υία άιόβόόιέ÷ι έάήυιά άδύήήέζόζ (block) όόζι άήυόζόδα όυι άέόάή÷ήΥιήι (inbound).

Έά θήΥδάέ ίά άέέΰιόάό όι υιήά όζό άέάδάόPό dc0 όιό δάήάάάβιαόιό, ιά όι θήάάιήάόέέΰ υιήά όζό έΰήόάό άέέόγυζό θιό όόιαΥάέ όι όγόόζία όάό ιά όι Internet. Άέα υιόιόό ÷ήζόέιιθιέιγί όι PPP ÷ήPόζ, όι υιήά έά άβιαέ tun0.

θήιόέΥόάά όέό άέυιέιθέάό έάόά÷υήβόάέό όόι άή÷άβι /etc/ipf.rules:

```
#####
# No restrictions on Inside LAN Interface for private network
# Not needed unless you have LAN
#####

#pass out quick on xl0 all
#pass in quick on xl0 all

#####
# No restrictions on Loopback Interface
```

```
#####
pass in quick on lo0 all
pass out quick on lo0 all

#####
# Interface facing Public Internet (Outbound Section)
# Match session start requests originating from behind the
# firewall on the private network
# or from this gateway server destined for the public Internet.
#####

# Allow out access to my ISP's Domain name server.
# xxx must be the IP address of your ISP's DNS.
# Dup these lines if your ISP has more than one DNS server
# Get the IP addresses from /etc/resolv.conf file
pass out quick on dc0 proto tcp from any to xxx port = 53 flags S keep state
pass out quick on dc0 proto udp from any to xxx port = 53 keep state

# Allow out access to my ISP's DHCP server for cable or DSL networks.
# This rule is not needed for 'user ppp' type connection to the
# public Internet, so you can delete this whole group.
# Use the following rule and check log for IP address.
# Then put IP address in commented out rule & delete first rule
pass out log quick on dc0 proto udp from any to any port = 67 keep state
#pass out quick on dc0 proto udp from any to z.z.z.z port = 67 keep state

# Allow out non-secure standard www function
pass out quick on dc0 proto tcp from any to any port = 80 flags S keep state

# Allow out secure www function https over TLS SSL
pass out quick on dc0 proto tcp from any to any port = 443 flags S keep state

# Allow out send & get email function
pass out quick on dc0 proto tcp from any to any port = 110 flags S keep state
pass out quick on dc0 proto tcp from any to any port = 25 flags S keep state

# Allow out Time
pass out quick on dc0 proto tcp from any to any port = 37 flags S keep state

# Allow out nntp news
pass out quick on dc0 proto tcp from any to any port = 119 flags S keep state

# Allow out gateway & LAN users' non-secure FTP ( both passive & active modes)
# This function uses the IPNAT built in FTP proxy function coded in
# the nat rules file to make this single rule function correctly.
# If you want to use the pkg_add command to install application packages
# on your gateway system you need this rule.
pass out quick on dc0 proto tcp from any to any port = 21 flags S keep state

# Allow out ssh/sftp/scp (telnet/rlogin/FTP replacements)
# This function is using SSH (secure shell)
pass out quick on dc0 proto tcp from any to any port = 22 flags S keep state
```

```

# Allow out insecure Telnet
pass out quick on dc0 proto tcp from any to any port = 23 flags S keep state

# Allow out FreeBSD CVSUp function
pass out quick on dc0 proto tcp from any to any port = 5999 flags S keep state

# Allow out ping to public Internet
pass out quick on dc0 proto icmp from any to any icmp-type 8 keep state

# Allow out whois from LAN to public Internet
pass out quick on dc0 proto tcp from any to any port = 43 flags S keep state

# Block and log only the first occurrence of everything
# else that's trying to get out.
# This rule implements the default block
block out log first quick on dc0 all

#####
# Interface facing Public Internet (Inbound Section)
# Match packets originating from the public Internet
# destined for this gateway server or the private network.
#####

# Block all inbound traffic from non-routable or reserved address spaces
block in quick on dc0 from 192.168.0.0/16 to any      #RFC 1918 private IP
block in quick on dc0 from 172.16.0.0/12 to any      #RFC 1918 private IP
block in quick on dc0 from 10.0.0.0/8 to any         #RFC 1918 private IP
block in quick on dc0 from 127.0.0.0/8 to any       #loopback
block in quick on dc0 from 0.0.0.0/8 to any         #loopback
block in quick on dc0 from 169.254.0.0/16 to any    #DHCP auto-config
block in quick on dc0 from 192.0.2.0/24 to any     #reserved for docs
block in quick on dc0 from 204.152.64.0/23 to any   #Sun cluster interconnect
block in quick on dc0 from 224.0.0.0/3 to any      #Class D & E multicast

##### Block a bunch of different nasty things. #####
# That I do not want to see in the log

# Block frags
block in quick on dc0 all with frags

# Block short tcp packets
block in quick on dc0 proto tcp all with short

# block source routed packets
block in quick on dc0 all with opt lsrr
block in quick on dc0 all with opt ssrr

# Block nmap OS fingerprint attempts
# Log first occurrence of these so I can get their IP address
block in log first quick on dc0 proto tcp from any to any flags FUP

# Block anything with special options

```

```

block in quick on dc0 all with ipopts

# Block public pings
block in quick on dc0 proto icmp all icmp-type 8

# Block ident
block in quick on dc0 proto tcp from any to any port = 113

# Block all Netbios service. 137=name, 138=datagram, 139=session
# Netbios is MS/Windows sharing services.
# Block MS/Windows hosts2 name server requests 81
block in log first quick on dc0 proto tcp/udp from any to any port = 137
block in log first quick on dc0 proto tcp/udp from any to any port = 138
block in log first quick on dc0 proto tcp/udp from any to any port = 139
block in log first quick on dc0 proto tcp/udp from any to any port = 81

# Allow traffic in from ISP's DHCP server. This rule must contain
# the IP address of your ISP's DHCP server as it's the only
# authorized source to send this packet type. Only necessary for
# cable or DSL configurations. This rule is not needed for
# 'user ppp' type connection to the public Internet.
# This is the same IP address you captured and
# used in the outbound section.
pass in quick on dc0 proto udp from z.z.z.z to any port = 68 keep state

# Allow in standard www function because I have apache server
pass in quick on dc0 proto tcp from any to any port = 80 flags S keep state

# Allow in non-secure Telnet session from public Internet
# labeled non-secure because ID/PW passed over public Internet as clear text.
# Delete this sample group if you do not have telnet server enabled.
#pass in quick on dc0 proto tcp from any to any port = 23 flags S keep state

# Allow in secure FTP, Telnet, and SCP from public Internet
# This function is using SSH (secure shell)
pass in quick on dc0 proto tcp from any to any port = 22 flags S keep state

# Block and log only first occurrence of all remaining traffic
# coming into the firewall. The logging of only the first
# occurrence avoids filling up disk with Denial of Service logs.
# This rule implements the default block.
block in log first quick on dc0 all
##### End of rules file #####

```

31.5.14 NAT

Ὁ NAT ἀβιάε ἀεῖνιγίεῖ οὐί εἶγῖαί Network Address Translation ἢ ἰᾶὸῦῆῆῆῆῆῆ Ἀεῖδὲγῖῆῆῆῆῆ Ἀεῖδὲγῖῆῆ. Ἀεῖ ὑῆῆῆῆ ἀβιάε ἄῖεῖεῖῆῆῆῆ ἰᾶ ὀῖ Linux, ἄῆῆῆῆῆῆ ὀδῆῆ ἄῆῆῆῆῆ ἢ ἢ ἢ ἢ ἢ IP Masquerading. Ὄδῆῆ ὀῖῆῆῆῆῆῆῆῆῆῆῆῆ ὀῖ NAT εἶε ὀῖ IP Masquerading ἀβιάε ὀῖ Βαεῖ ὀῖῆῆῆῆῆῆ. ἰεᾶ ἄδῆ ὀεῆ ὀῖεῖῆῆῆῆῆ ἄῖῆῆῆῆῆῆῆ ὀῖῆ ὀῖῆῆῆῆῆῆῆῆῆῆῆῆ ἢε ῆ ἢεῖῆῆῆῆῆῆῆῆῆῆῆῆ NAT ὀῖῆ IPF, ἀβιάε εἶε ῆ ἄῖῆῆῆῆῆῆῆῆῆῆῆῆ ἰᾶ ἢῆῆῆῆῆῆῆῆῆῆῆῆ ἢῆῆῆῆῆῆῆῆῆῆῆῆ ἢῆῆῆῆῆῆῆῆῆῆῆῆ (LAN) ὀῖῆῆ ἄδῆ ὀῖ firewall ὀῖ ἢῆῆῆῆῆῆῆῆῆῆῆῆ ἰᾶ ἢῆῆῆῆῆῆῆῆῆῆῆῆ ἢῆῆῆῆῆῆῆῆῆῆῆῆ ἢῆῆῆῆῆῆῆῆῆῆῆῆ IP ὀῖῆ Internet.

31.5.16 Έάιυιάδ οίο IPNAT

Ίέ έάιυιάδ οίο NAT άβιάέ άνέάδΰ άοΎέέέοιέ, έάέ άέάέΎοίοί δέΡείò άοιάοίòΡòυί Ρόòά ίά έάέγδòίòί οέò άíΰάέάò òυί ίέέέάέΡί άέέΰ έάέ òυί άδέ÷άέηçóέάέΡί ÷ηçóòΡί.

Ç óγίόάίç òυί έάιυίυί δίò δάηίòóέΰάάóάέ άάΡ, Ύ÷άέ άδέίδίέçέάβ Ρόòά ίά óοίάάάβάέά ίά òç óοίΡέç ÷ηΡόç óά ίç-άίδίηέέΰ δάηέάΰέείòά. Άέά δέί δέΡηç δάηέάηάòΡ òçò óγίόάίçò, άάβòά òç óάέβάά manual òίò ipnat(5).

Ç óγίόάίç άíυò έάιυιά NAT ηέΰάέ ίά òçί δάηάέΰòυ:

```
map IF LAN_IP_RANGE -> PUBLIC_ADDRESS
```

Ί έάιυιάδ ίάέέίΰάέ ίά òç έΎίç map.

ΆίòέέάòάóòΡόòά òί IF ίά òçί άíυòάηέέΡ άέάδάòΡ (òç έΰηòά άέέòγίò δίò óοίάΎάóάέ óοί Internet).

Ç δάηΰίάòηίò LAN_IP_RANGE άβιάέ ç δάηέί÷Ρ άέάòέγίόάυί δίò ÷ηçóέίηίέίάβóάέ άδύ òί άóυòάηέέú óάò άβέòòί. Óòçί δάηάίάòέέúòçòά έά ηέΰάέ ίά έΰòέ óάί òί 192.168.1.0/24.

Ç δάηΰίάòηίò PUBLIC_ADDRESS ìδίηάβ ίά άβιάέ άβòά ç άíυòάηέέΡ IP άέάγέòίόç, άβòά ç άέάέέΡ έΎίç 0/32, ç òδίβά óçίάβιάέ υòέ έά ÷ηçóέίηίέέçέάβ ç IP άέάγέòίόç δίò Ύ÷άέ άδίάίηέάβ óοί IF.

31.5.17 Δυò έάέòίòηάάβ òί NAT

Ίά δάέΎòί òòΰίάέ óοί firewall άδύ òί LAN ίά δάηίηέóίυ òί Internet. Δάηίΰάέ άέάΎóíò òυί έάιυίυί òέέòάηβóίάòίò άίάη÷ηΎίυί, υδίò άβίάóάέ ç άδάίάηάάóóά òίò άδύ òί NAT. Ίέ έάιυιάδ άóάηίυάέίíóάέ άδύ òί δηΡòί έάέ δηίò óά έΰòυ, έάέ έάηάβάέά ί δηΡòίò δίò óάέηέΰάέ. Ί Ύέάά÷ίò άβίάóάέ ίά άΰóç òç άέάδάòΡ άδύ òçί òδίβά έΡòέçέά òί δάέΎòί έάέ òç άέάγέòίόç IP άδύ òçί òδίβά δάηΎñ÷άóάέ. ¼òάί òί υíηά òçò άέάδάòΡò άíυò δάέΎòίò óάέηέΰάέ ίά έΰòίέί έάιυιά òίò NAT, ç άέάγέòίόç IP òçò άóάòçηβάò (δίò δάηΎñ÷άóάέ άδύ òί έάέυòέέú άβέòòί) άέΎñ÷άóάέ άέά ίά άίάέηέάυέάβ άί óάέηέΰάέ ίά òçί δάηέί÷Ρ άέάòέγίόάυί δίò έάέίηβάóάέ óòçί άηέóóάηΰ δέάòηΰ òίò óοίάυέìò (άΎέìò) òίò έάιυιά NAT. Άί óάέηέΰάέ, ç άέάγέòίόç òίò δάέΎòίò ίάίάάηΰòάóάέ, ÷ηçóέίηίέίΡίòάò òç άçìυóέά άέάγέòίόç IP ç òδίβά δάηΎñ÷άóάέ άδύ òί 0/32. Òί NAT άçίέίòηάάβ ίέά έάóά÷ηέóç óοίí άóυòάηέέú òίò δβίάέά, Ύòóέ Ρόòά υòάί άδέóòηΎάέ ç άδΰίόçòç άδύ òί Internet, ίά òδίηάβ ίά άίòέóòίέ÷çέάβ ίάΰΰ óòçί άñ÷έέΡ έάέυòέέΡ άέάγέòίόç IP έάέ ίά δάηΰóάέ Ύδάέóά άδύ òίòò έάιυιάδ òίò òβέòηίò άέά δάηάέòΎñυ άδάίάηάάóóά.

31.5.18 ΆίάηάίòίέΡίòάò òί IPNAT

Άέά ίά άίάηάίòίέΡóάòά òί IPNAT, δάηίòέΎóóά óέò δάηάέΰòυ άηάίΎò óοί /etc/rc.conf.

Άέά ίά άδέòηΎòάòά óοί ίç÷ΰίçίά óάò ίά άηίηέίάάβ δάέΎòά ίάòάίγύ άέάδάòΡί άέέòγίò:

```
gateway_enable="YES"
```

Άέά ίά ίάέέίΰάέ άòòυίάóά òί IPNAT óά έΰέά άέέβίççòç:

```
ipnat_enable="YES"
```

Άέά ίά έάέίηβóάòά άδύ δίò άδέέòίάβòά ίά òίηòΡίííóάέ ίέ έάιυιάδ òίò IPNAT:

```
ipnat_rules="/etc/ipnat.rules"
```

31.5.19 Οἱ NAT αά ίά ίαάΰει Οἱδεέυ Αβέοοἱ

Άέα οἱδεέΰ αβέοοά ία ίαάΰει άνεέιυ οδρειαέοοοἱ, Ρ άέα αβέοοά οἱο άεάοοίαΎοἱ οάνεοοοοάνα άδϋ Ύία LAN, ρ άεάεεάοοά οσο ίαοάοηοδρδ υειυ άοοἱ ουἱ εάεουέεοἱ άεάοεγίόαυἱ οά ίεά ηηάεέεΡ αϋιυοέα άεάγεοίος, αϋεἱοἱάαβ οηυάεϋά εάοάμἱρδ οηυἱ, εάεἱρδ ÷ ηϋοέηοδρεἱγίόάε οἱεεΎδ οἱηΎδ τε βάεἱε άνεέηἱβ εοἱἱ, ιαϋαἱοάο οά PC οἱο άεέογἱο οά οοάεηγίόάεο. Οδΰη÷ἱοἱ άγἱ οηυοἱε άέα ίά άεάοοἱοἱά οάοϋ οἱ οηυάεϋά.

31.5.19.1 Αἱΰεάοο ουἱ εοἱἱ οἱο εά × ηϋοέηοδρεἱγί

ίά οοίϋεέοἱΎἱο εάἱυἱάο NAT ηεΰεάε ία οἱἱ οάναέΰοϋ:

```
map dc0 192.168.1.0/24 -> 0/32
```

Οοἱἱ οάναδΰἱ εάἱυἱά, ρ εγἱά αοάοϋηβάο οἱο οάεΎοἱο οάναἱΎίαε άίάεἱἱβυοϋ εάεἱρδ οἱ οάεΎοἱ άεΎἱ÷άοάε ἱΎοϋ οἱο IPNAT. Αἱ οηοἱεΎοάοά οϋἱ εΎϋε-εεάεαβ portmap, ἱοἱηάβοά ίά ηοεἱβοάοά οἱ IPNAT ίά ÷ ηϋοέηοδρεἱβ εγἱάο οἱο άἱεἱοἱ οά ίεά εάεἱνεοἱΎϋ οάηεἱ÷Ρ. Άέα οάηΰάεεἱά, ἱ οάηάεΰοϋ εάἱυἱάο εά ιαϋαἱοάε οἱ NAT ίά οηἱοἱοἱεἱοάε οϋἱ εγἱά οσο αοάοϋηβάο, ἱοδά ίά άβίαε ἱΎοά οοϋἱ οάηεἱ÷Ρ οἱο οάβἱάοάε:

```
map dc0 192.168.1.0/24 -> 0/32 portmap tcp/udp 20000:60000
```

ἱοἱηγἱά άδβοϋο ίά άδεἱοἱεἱοἱοἱά εέυἱά οάνεοοοοάηἱ οϋ εάεάεεάοοά ÷ ηϋοέηοδρεἱβἱοάο οϋ εΎϋε auto ἱοδά οἱ IPNAT ίά εάεἱηβεάε άδϋ ἱυἱ οἱο οἱεάο εγἱάο άβίαε άεάεΎοεἱάο άέα ÷ ηἱοϋ:

```
map dc0 192.168.1.0/24 -> 0/32 portmap tcp/udp auto
```

31.5.19.2 × ηϋοέηοδρεἱβἱοάο Ύία Αδϋεἱάἱ Αοἱάεεἱ Αεάοεγίόαυἱ

Οά Ύία οἱεγἱ ίαάΰει οἱδεέυ αβέοοἱ, άηάΰ Ρ άηεἱηά οοΰἱοἱά οοἱ οϋἱάβἱ οἱο ίεά ηηάεέεΡ αϋιυοέα άεάγεοίος άάἱ άδάηεαβ άέα ίά εάεγἱοάε ουοάο οἱεεΎδ εάεουέεεΎδ. Αἱ οδΰη÷άε άεάεΎοεἱ Ύία άγἱηο αϋἱοβἱ άεάοεγίόαυἱ, ἱοἱηγἱ ίά ÷ ηϋοέηοδρεἱγίἱ υο “άδϋεἱά (pool)”, άδεοἱηΎοἱοάο οοϋἱ IPNAT ίά άδεεΎἱάε ίεά άδϋ αοδΎδ εάεἱρδ άίοεοοἱε÷αβ οά οάεΎοά εάοΰ οϋἱ Ύἱἱ οἱο οηἱο οἱ αϋιυοεἱ αβέοοἱ.

Άέα οάηΰάεεἱά, άίοβ ίά άίοεοοἱε÷ἱγἱ υεά οά οάεΎοά ἱΎοϋ ίεάο ηηάεέεΡ αϋιυοεάο IP άεάγεοίοςο οϋοϋ οάηάεΰοϋ:

```
map dc0 192.168.1.0/24 -> 204.134.75.1
```

ἱοἱηγἱά ίά ÷ ηϋοέηοδρεἱβἱοἱοἱά Ύία άγἱηο IP άεάοεγίόαυἱ, άβοά ἱά οϋ ÷ ηἱοϋ ἱΰοεάο άεέογἱο:

```
map dc0 192.168.1.0/24 -> 204.134.75.0/255.255.255.0
```

άβοά ἱά οοἱἱεεέοἱ CIDR:

```
map dc0 192.168.1.0/24 -> 204.134.75.0/24
```

31.5.20 Αἱάεάοάγεοίος Εοἱἱ

Άβίαε εἱεἱΡ οἱάεοεεΡ ίά άεεάεβοοάίοάε οδϋηάοβάο υδϋο ἱ άἱοδϋηάοϋοδρδ εοοἱοάεβἱἱ, οά÷ οάηἱηάβἱο, άΰοϋο άάηηΎἱἱ εάε DNS οά εάεοἱηάοεεΰ PC οοἱ οἱδεέυ αβέοοἱ. Οοϋἱ οάηβδδουοϋ αοδρ, ρ εβἱϋοϋ οάεΎοἱ άδϋ αοδΰ οά ἱϋ÷ άἱεἱάοά άίάεἱοεαβ ίά ÷ ηηάεΰεάοάε οἱ NAT, άεεΰ ÷ ηηάεΰεάοάε άδβοϋο ίά οδΰη÷άε εΰοἱεἱο οηυοἱο ίά εάοάοεγίόάε ρ άεοάη÷υἱἱεϋ εβἱϋοϋ οοά ουοδΰ PC οἱο άεέογἱο. Οἱ IPNAT Ύ÷άε οεο εάοΰεεεαο αοἱάοουοϋοάο άέα οϋἱ άδβέοοϋ

άοδιγύ οίτθ δνίρεΠιάοίδ. Άέα δάνΰάεάι, Ύόου υέε Ύίάδ άιδδδγνάδδδδδ εόοίόάεββύι άνβόεάόε όόκι εεάγέοίόγ LAN 10.0.10.25 έάε γ ιίράάέεΠ άçιύοέα IP άβίάε 20.20.20.5. Ί έάίύιάδ δίθ εά άνΰόάδά έά Ύίρεάεά ιά οίι δάνάέΰδου:

```
rdr dc0 20.20.20.5/32 port 80 -> 10.0.10.25 port 80
```

Π:

```
rdr dc0 0.0.0.0/0 port 80 -> 10.0.10.25 port 80
```

Π άέα Ύίά άιδδδγνάδδδδ DNS ιά εεάγέοίόγ όοί οίδέεü άβέδδθί 10.0.10.33 ι ιδθίθδ δνΎδάε ιά άΎ÷άόάε άίάεçδδδδδ άδθ οί άçιύοέί άβέδδθί:

```
rdr dc0 20.20.20.5/32 port 53 -> 10.0.10.33 port 53 udp
```

31.5.21 FTP έάε NAT

Οί FTP άβίάε Ύίάδ άάέίυόάδνίθ δίθ Ύ÷άε άδνίάβίάε άδθ όçί άδθ÷Π δίθ οί Internet δδάί όόά άν÷έεΰ οίθ όόΰάεά, υδθίθ όά άνάοίçδέεΰ άνάάόδΠνεά όυι δάίάδεδόδΠεüι δδάί όόίάάΎίά ιάόάίγ οίθδ ιά ιέοεüΎίάδ άνάνΎδ έάε ιέ άνάοίçδΎδ οί ÷νçόεüδθίείγόάί άέα ιά όόΎεñθί άν÷άβά ι Ύίάδ όοίι ΰεει. Οçί άδθ÷Π έεάβίç, άάί οδδΠñ÷άί άίçόδ÷βάδ ό÷άδεδέΰ ιά όçί άόόΰεάέα. Ιά οί δΎνάοίά οίθ ÷νύñθ, οί FTP εΰδδδçέά όοί δδβού ιΎñθδ οίθ όά÷Ύδδ άίάεέόοüιάñθ Internet. Άάί άίάεβ÷εçέά δίθΎ δδδά ιά ιάδάνΰόάε δνίρεΠιάόά άόόΰεάέάδ, υδθδ δ.÷. οί άάάίñδ υέε όόΎείάε οί υñά έάε οίι εüάέεü οίθ ÷νδδόç υδ άδθü έάβίάñ. Οί FTP Ύ÷άε άθί έάόάόδΰόάέδ εάέοιθñάβάδ, όçί άίάñάΠ έάε όçί δάεçδεδέΠ. Ç άέάοñΰΰ άβίάε όοι δδδ άβίάόάε ç άίΰέδδç όιθ έάίάεείγ άάάνΎñι. Ç δάεçδεδέΠ εάέοιθñάβά άβίάε δει άόόάεΠδ, έεθδ οί έάίΰεε άάάνΎñι άδθδάεάβ οί εγñεί έάίΰεε όçδ όόίάάνβάδ. Ιδθñάβδά ιά άñάβδά δθεγ έάεΠ δάνεάñάδ οίθ δνθüοίεüεεθ έάε όυι άέάοñάδεδέΠ δνθδθι έάέοιθñάβάδ οίθ, όοί <http://www.slacksite.com/other/ftp.html>.

31.5.21.1 Έάίύιάδ οίθ IPNAT

Οί IPNAT άεάεΎδάε ιέα άεάεεΠ άδεδεάΠ άέα έεάίάοίεΰάçόç FTP (proxy) ç ιδθίβά ιδθñάβ ιά έάεñεόδάβ όοίι έάόΰεεçει έάίύιά οίθ NAT. Ιδθñάβ ιά δάνάείεθδδδδάε υέα όά άίάñ÷υιάίά δάεΎόά άέα ιά άίε÷ιáyόάε όçί Ύίάñç ιέαδ άίάñάΠδ Π δάεçδεδέΠδ όόίάάνβάδ FTP, έάε ιά άçιέιθñάδδδάε άοίάίεεΰ δνίθüñεñγδ έάίύιάδ όοι δβέδθñ δίθ ιά δάνεΎ÷θίι υñι οίι άñέεü όçδ εγñάδ δίθ ÷νçόεüδθίεάβδάε άδθ οί έάίΰεε άάάνΎñι. Άδδθ άίάεάβδάε οί δνθüάεçιά άόόΰεάέάδ δίθ άçιέιθñάβδάε άδθ οί άάάίñδ υέε άέάοññάδεδέΰ έά ÷ñάέάεüδάί ιά άίε÷εάβ ιέα ιάΰΰεç δάνεί÷Π δέθñΠ (όόçί δδçεΠ δάνεί÷Π) όοι firewall.

Ί δάνάεΰδου έάίύιάδ ÷άεñβεάδάε υέα όά άάάνΎίά άέα οί άούδάνεεü άβέδδθί (LAN):

```
map dc0 10.0.10.0/29 -> 0/32 proxy port 21 ftp/tcp
```

Ί δάνάεΰδου έάίύιάδ ÷άεñβεάδάε όçί έβίçόç FTP άδθ όçί δγέç (gateway):

```
map dc0 0.0.0.0/0 -> 0/32 proxy port 21 ftp/tcp
```

Ί δάνάεΰδου έάίύιάδ ÷άεñβεάδάε υέç όçί έβίçόç άδθ οί άούδάνεεü LAN δίθ άάί άίΠεάε όοι δνθδöεüεεθ FTP:

```
map dc0 10.0.10.0/29 -> 0/32
```

Ί έάίύιάδ ÷άνθιάνΰδδçδδδδ οίθ FTP διθίεάδδδδάε δñεί άδθ οίι έάίύεεü έάίύιά ÷άνθιάνΰδδçδδδδ. Έΰεά δάεΎοι άεΎά÷άόάε άν÷έεΰ άδθ οίι έάίύιά δίθ άνβόεάόάε όόçί εñθδδΠ. Άί δάεñεΰεάε όόç έεάδδδδ έάε όόçί εεüδεδέΠ εεάγέοίόç IP έάε δνθüεάέόάε άέα δάεΎοι FTP, ι έεάίάοίεεάçδδδδ FTP άçιέιθñάβ δνίθüñεñγδ έάίύιάδ όοι δβέδθñ ιέ ιδθίβίε άδεδθñΎδθίθ όçί άέόάñ÷υιάίç έάε άίάñ÷υιάίç έβίçόç FTP άίΠ όάδδδ÷ñίά έέδδθίγί έάε όçί άδάνάβδδçδç

ιαοΰοναός NAT. ΄εά οά δάέΎοά διο ααι άίπειοι οά ιαοΰαιοός FTP ααι οάένεΰαειοι ια οη άηποι εάιιια, Ύοοε εάοάοεΎηιόαε οοη άηποι εάιιια, άιαοΰαειοάε ιιοι αοηΰ ος άεάδαοP εαε οη IP αδϋ οη ιοηβη δηηΎη - ιιόαε, εαε άβιαόαε ς αίόβοηε - ς ιαοΰοναός οηοδ αδϋ οη NAT.

31.5.21.2 Εάιιιαο Όβεοηιο άέα οη IPNAT

΄οαί - ηχοεηιθιεάβοαε ι ιαοιεάαχοP FTP, - ηαεΰααόαε ιιηι Ύιαδ εάιιιαδ άέα οη NAT.

× ηηβδ οη ιαοιεάαχοP FTP, - ηαεΰαειοάε ιε δαναεΰου οηαεο εάιιιαδ:

```
# Allow out LAN PC client FTP to public Internet
# Active and passive modes
pass out quick on r10 proto tcp from any to any port = 21 flags S keep state

# Allow out passive mode data channel high order port numbers
pass out quick on r10 proto tcp from any to any port > 1024 flags S keep state

# Active mode let data channel in from FTP server
pass in quick on r10 proto tcp from any to any port = 20 flags S keep state
```

31.6 IPFW

Όη IPFWALL (IPFW) άβιαε ηιαεοιεεϋ θηο αιαδδυ - εχκα άέα οη FreeBSD, - αε ηηαοαβ εαε οοιοχηαβοαε αδϋ άεάειηοΎο θηο άίπειοι οοη Project. × ηχοεηιθιεάβ οηοδ εεαοεεηϋδ εάιιιαδ - ηηβδ εεαδPηχοός οςδ εαοΰοδ οαόςδ (stateless) εαεθδ εαε ιεα οα - ιεεP εηαεεηθιηχοόςδ θηο αδεοδα - ΰιαε αοδυ θηο αιαοΎηηαοαε ηδ ΑθεP Stateful ΕηρεεP (Simple Stateful Logic).

Όη οδυααεαια εάιιιια άέα οη IPFW (οοα αν - αβα /etc/rc.firewall εαε /etc/rc.firewall6) οςδ οδδεεPδ ααεαοΰοδ οηο FreeBSD άβιαε ιΰεεηι αδεϋ εαε εα - ηαεαοαβ ια εΰιαοα εΰθιεαδ αεεαΎο θηει οη - ηχοεηιθιεαοα. Όη δανΰαεαια ααι - ηχοεηιθιεάβ οεεοηΰνεοια οϋθηο stateful. ς stateful εαεοηηηαβα άβιαε αοαηαοεεP οοεο δαναοουοαηαο δαναεδοPοαεο, Ύοοε ααι εα - ηχοεηιθιεαοηοια αοδυ οη δανΰαεαια ηδ αΰορ αοδPδ οςδ αηιοχοαδ.

ς οϋοαίε οηι εάιιιια stateless οηο IPFW Ύ - αε αρεο - οεαβ ια άιαεεαιΎιαδ αοιαοϋοχοαδ αδεεηαPδ ιε ιθιβαδ οοηPεϋδ ιαδανιΰια εαοΰ θηεϋ οεο οοδεεΎο απροαεο οηο αδυηο θηο εαεαβοαε ια οη ηδεηβοαε. Όη IPFW αδαοεϋιαοαε οοηι αδαααεηαοαβ - ηPοός P οηι οα - ιεεΰ θηη - ηηχιΎηι - ηδβοα, ι ιθιβηο Ύ - αε αηΰαες θηη - ηηχιΎηο οεεοηηηβοιαοηο δαεΎου. ς θηηαηαοεεP αϋιαίε οηι εάιιιια οηο IPFW αθιεαεϋδαοαε ιιηι αι εαεεΎοαοα δηη - ηηχιΎιαδ απροαεο ο - αοεεΰ ια οη δυδ εεαοηηηαοεεΰ θηηουεηεεα αχιεηηηαιϋ εαε - ηχοεηιθιεηϋ οςι αδεεαοαεβαα οηι δαεΎου οηοδ. ΟΎοηει αδβδαηι αδαηαPοαηι άβιαε θΎηα αδϋ οη οεηδυ αοδPδ οςδ αηιοχοαδ οηο Αα - αεηεαβηο.

Όη IPFW αθιοαεαβοαε αδϋ αδδΰ αηαηοPιαοα. Όη ααοεεϋ αηΰηοχια άβιαε ι αδαηηηαοοδ εάιιιια οηο firewall οοηι δοηPια, ια αιοηιαοϋιΎις ος αοιαοϋοχοα εαοαηηαοPδ. Οα οδυεηεδα αηαηοPιαοα άβιαε οη οϋοοχια εαοαηηαοPδ (logging), ι εάιιιαδ divert ι ιθιβηο αηαηηθιεάβ ος εαεοηηηαβα NAT, εαεθδ εαε ιε θηη - ηηχιΎιαδ αοιαοϋοχοαδ αεαεηϋ οειθηϋ: οη οϋοοχια εεαιηηοϋοχοδ εβιςχοδ (traffic shaper) dummynet, ς αοιαοϋοχοα θηηPεχοόςδ ιΎου οηο fwd rule, ς αοιαοϋοχοα ααοϋηοχοδ (bridge) εαεθδ εαε ς αοιαοϋοχοα αδυεηηοχοδ (ipstealth). To IPFW οθιοοχηηαε οϋοι οη δηηοϋεηεηι IPv4 ηοι εαε οη IPv6.

31.6.1 Άίάναιδίεπίοάο οι IPFW

Οι IPFW δάνεαίαὺίάοάε οόκι άάοέεP άάεάοὺόόάος οίο FreeBSD ùò Ùñèñùιά οίò ðòñPρία οί ιθίβι ιθίñάβ ίά οίñòυέάβ άοίάιέὺ. Οί ούόόγια έά οίñòPόάέ άοίάιέὺ οί Ùñèñùιά ùάί άñάέ οκι έάόά÷Pñέόç firewall_enable="YES" οόί άñ÷άβι /etc/rc.conf. Άάί ÷ñάέὺάόάέ ίά ίάόάάεὺόόβόάόά οί IPFW ίΎόά οόί ðòñPρία, άέουò άί εΎέάόά ίά ÷ñçόέίθιεPόάόά οέò έάέοίòñάβάò NAT θίò ðάνΎ÷άέ.

Άοίϋ άάάίάέέειPόάόά οί ούόόγια οάò ίά οκι έάόά÷Pñέόç firewall_enable="YES" οόί rc.conf, έά άάβόά ίά ὺόñά Ύίόίά άñὺιιόά οί άέϋειòει ιPίόίά έάόὺ οç άέάάέέάόά οç ðέέβίçόç:

```
ipfw2 initialized, divert disabled, rule-based forwarding disabled, default to deny, logging disal
```

Οί Ùñèñùιά Ύ÷άέ άίόιιάοὺΎίç οç άοίάοὺόçόά έάόάάñάòP. Άέά ίά άίάναιδίεPόάόά οκι έάόάάñάòP έάέ ίά εΎόάόά οί άðβðάαι έάðòñΎñάέάò, ððÙñ÷ιòί εὺθιεάò ñòειβόάέò θίò ιθίñάβόά ίά εΎόάόά οόί /etc/sysctl.conf.

ÐñίòεΎόίόάò οέò ðάνάέὺòύ έάόά÷ññβόάέò, έά άίάναιδίεçέάβ ç έάόάάñάòP οóέò άðñιιάíάò άέέειPόάέò:

```
net.inet.ip.fw.verbose=1
net.inet.ip.fw.verbose_limit=5
```

31.6.2 ΆδέειΎò οίò ÐòñPρία

Άάί άβίάέ ðòί÷ñάòέέϋ ίά άίάναιδίεPόάόά οί IPFW ίάόάάεὺόόβάειíόάò οέò ðάνάέὺòύ άδέειΎò οόί ðòñPρία οίò FreeBSD, άέουò έάέ άί εΎέάόά ίά ÷ñçόέίθιεPόάόά NAT. Ί οέειòυò άóòPò οç ðò ðάνίòóβάóçò άβίάέ έάέάñὺ άίçíλñùέέέϋò.

```
options IPFWIREWALL
```

Ç άδέειΎP άóòP άίάναιδίεΎάβ οί IPFW ùò ίΎñíò οίò ðòñPρία.

```
options IPFWIREWALL_VERBOSE
```

ΆίάναιδίεΎάβ οκι έάόάάñάòP ðυί ðάέΎòυί θίò ðάνñίϋί ίΎòύ οίò IPFW έάέ ðάνεέαίáὺñίόί οç εΎίç log οόί έάίϋία θίòð.

```
options IPFWIREWALL_VERBOSE_LIMIT=5
```

Ðάνειñβάέ οίí ðεPειò ουί ðάέΎòυί θίò έάόάάñὺοίόάέ ίΎòύ οίò syslogd(8) οά οóάέάέñειΎί άñέειϋ άίὺ έάόά÷Pñέόç. Ç ñϋειέόç άβίάέ ÷ñPόέίç οά ά÷έñέέὺ ðάνεάὺέειíόά οóά ιθίβά άβίάέ άðέέòίçòP ç έάόάάñάòP. Ίά άòòυ οίí ðñυòί ιθίñάβ ίά άðίòάò÷έάβ ίέά ðέέάίP άðβέáóç ίά οóυ÷ι οκι ððάñ÷άβέέóç ðυί άñ÷άβυί έάόάάñάòPò.

```
options IPFWIREWALL_DEFAULT_TO_ACCEPT
```

Ç άδέειΎP άóòP άòPρίαέ οά ðὺίόά ίά ðάνίὺίά ίΎόά άðϋ οί firewall, οί ιθίβι άβίάέ έάέP έάΎά οκι ðñPòç οίñὺ θίò ñòειβάέάòά οί firewall οάò.

```
options IPDIVERT
```

Ç άδέειΎP άóòP άίάναιδίεΎάβ οç έάέοίòñάβά NAT.

Όçίáβùóç: Οί firewall έά άðίññβóóάέ ùέά οά ðάέΎóά θίò έάóάòέϋίíίόάέ άðϋ έάέ ðñíò οί ιç÷ὺίçίá, άί άάί ðάνεέὺάάóά οκι άðέειΎP IPFWIREWALL_DEFAULT_TO_ACCEPT P άί άάί ñòειβóóάóά Ύία έάòὺέççει έάίϋία θίò ίά άðέòñΎóáέ άòòΎò οέò οóίáΎóáέò.


```
firewall_logging="YES"
```

Δημιουργία: Οι iuif δnUaia δiō eUiaē ç iāōāāēçðP firewall_logging āBiaē íá èÝōāē ðçí ðēiP ðçð iāōāāēçðPò sysctl net.inet.ip.fw.verbose óðçí ðēiP 1 (āāBōā ði ŌiPia 31.6.1). Āāi ððŪñ÷āē iāōāāēçðP ðiō rc.conf ðiō íá iñBāēāē ðāñēiñēóiiγò óðçí ēāōāāñāðP, āēēŪ āðōū iðñāB íá ñōēiēóðāB iÝōū ðçð ðāñāðŪiū iāōāāēçðPò sysctl āBōā ÷āēñiēBíçðā, āBōā iÝōū ðiō āñ÷āBñiō /etc/sysctl.conf:

```
net.inet.ip.fw.verbose_limit=5
```

Ái ði iç÷Ūiçia óāð ēāēðiðñāāB ùð ðýēç (gateway), āçēāāP ðāñÝ÷āē ððçñāóBā iāōŪñāóçð āēāðēýiōāūi āēēðýiō (Network Address Translation, NAT) iÝōū ðiō natd(8), ðāñāēāēiγiā íá āēāāŪóāðā ði ŌiPia 32.8 āēā ðēçñiōiñBāð ð÷āðēēŪ iā ðēð ñōēiBōāēð ðiō āðāēðiyiōāē óði āñ÷āBñiō /etc/rc.conf.

31.6.4 Ç ÁiðieP IPFW

Ç áriðieP ipfw āBiaē i ðoiPðēçð ðñūðið āēā ðçí ðñiðēPðēç ç āēāñāðP ēáfiuií óðiðð āóūðāñēēiγð áfāñāiγð ēáfiuiāð ðiō firewall, ēāēð āðōū āēðāēāBōāē. Ōi ðñūāēçia iā ðç ÷ñPóç āððPð ðçð iāēuāiō āBiaē uðē iē āēēāāÝð ÷Ūñiōāē iā ðiī ðāñiāðēóūi ēāēðiðñāBāð ðiō iç÷áPiaðið. IðñāBōā íá āñŪðāðā uēiðð ðiðð ēáfiuiāð óāð óā Ýíā āñ÷āBñiō ēāē íá ði ÷ñçóēiñēiēāBōā āēā íá ðiðð ðiñðPíāðā óðçí āēēBíçðç. IðñāBōā íá ÷ñçóēiñēiēPóāðā ði Bāēi āñ÷āBñiō āēā íá áíðēāðāóðPóāðā ðiðð ðñÝ÷ñiðāð ēáfiuiāð ðiō firewall, ðçí þñā ðiō āðōū āēðāēāBōāē. Āðōūð āBiaē ēāē i ðoiēóðPiañð ðñūðið ðiō ÷ñçóēiñēiēiγiā óāā ðāñāāāBñiāðā íāð.

Ç áriðieP ipfw āBiaē āðBóçð ÷ñPóēiç āēā íá āðāēēiñBāēē ðiðð ðñÝ÷ñiðāð ēáfiuiāð óðç ēiñóūēā óāð. Ōi óýóðçia ēāðāāñāðPð ÷ñPóçð ðçð IPFW āçieññāāB āðōūiāðā Ýíā iāðñçðP āēā eŪēā ēáfiuiā, i iðñið iāðñŪāē ðuóā ðāēÝðā óāBñēáfiā íá āðōūi. ĒāðŪ ðç āēŪñēāēā ðūi āiēēiþi, ç āñiāðōūçðā íá āēÝñāðā ðçí ðēiP ðiō iāðñçðP āBiaē Ýíāð ðñūðið āēā íá āēāðēóðPóāðā áí i ēáfiuiāð ēāēðiðñāB ēáfiueēŪ.

Āēā íá āāBōā uēiðð ðiðð ēáfiuiāð iā ðç óāēñŪ:

```
# ipfw list
```

Āēā íá āāBōā iēā ēBóðā uēūi ðūi ēáfiuiā, iāēB iā ðçí þñā ðiō áfāñāiðiePðēçēā ðāēāðóāBā ðiñŪ i eŪēā ēáfiuiāð, āñŪðā:

```
# ipfw -t list
```

Ōi āðūiñi ðāñŪāēāñā āāB÷íāē ðiī āñēēiū ðūi ðāēÝðūi ðiō óāBñēáfiā íāēB iā ðiī áfðBóðie÷i ēáfiuiā. Ç ðñPðç óðPēç āāB÷íāē ðiī āñēēiū ðiō ēáfiuiā, āēiēiðēāBōāē āðū ðiī āñēēiū ðāēÝðūi ðiō óāBñēáfiā (ðñPóā óā áfāñ÷ñiāíā ēāē iāðŪ óā āēóāñ÷ñiāíā) ēāē ðÝēið āðū ðiī Bāēi ðiī ēáfiuiā.

```
# ipfw -a list
```

Āēā íá āāBōā iēā ēBóðā ðiō íá ðāñēēāñāŪíāē ðūið ðiðð āñiāēēiγð uoi ēāē ðiðð óóāðēēiγð ēáfiuiāð:

```
# ipfw -d list
```

Āēā íá āāBōā ēāē ðiðð āñiāēēiγð ēáfiuiāð ðiō Ý÷ñiēñiāē:

```
# ipfw -d -e list
```

Āēā íá içāñiBōāðā ðiðð iāðñçðÝð:

ipfw zero

Άέα ίά ιαάάίβόάά οίοδ ίαόηαόΎδ ίυίί άέα οίί έάύίά ίά οίί άηέειυ NUM:

ipfw zero NUM

31.6.5 Οί Όύίει Έάύίυί οίο IPFW

Ύδ “όύίει έάύίυί” οίί IPFW, ίηβειοίά ίέα ηΰάά έάύίυί οίο Ύ÷ίοί άηάοάβ άέα ίά άδέοηΎοίοί ϐ ίά άδιηηβδοίοί δάέΎοά άΎειάά ίά οέδ οειΎδ οίο δάηέΎ÷ίίόάε οά αοδΎ. ϐ άέδεϐδ έαοάγεοίόα άίόάέέάϐ δάέΎοί ίάοάίγ οθρειάεοοί άοίόάεάβ ίέα οοίάηάβ. Οί όύίει έάύίυί οίο firewall άδάηάηάΎαοάε ούοί οά δάέΎοά οίο Ύη÷ίίόάε άδύ οί Internet, υίοί έάέ οά δάέΎοά οίο δάηΎάηίόάε άδύ οί όύόαίά υδ άδΎίόαόα οά αοδΎ. ΈΎεά οδαάόά TCP/IP (δ.÷. telnet, www, mail, ε.ε.δ.) έάειηβαάοάε άδύ οί δηυδύειει έάέ οαί δηίηέάεϐ (privileged) έύηά οίο ÷ηαοίηιέάβ άέα ίά άΎ÷άοάε άέοϐιάόά άίοδαΎΎόαόα. Οά δάέΎοά οίο δηίηβειοίόάε άέα ίέα οάέάηειΎία οδαάόά, ίάέειΎί άδύ οα έάέγεοίόα άόάοαηάο ÷ηαοίηιέβίόάο ίέα ια-δηίηέάεϐ έύηά έάέ έαόάεϐαίοί οαα οάέάηειΎία έύηά οδαάόά οοί δηίηέοίυ. ¼εάο ίε δάηάδΎίυ δάηΎάοηίε (έύηάο έάέ άέάοέγίόάέο) ίδιηίΎί ίά ÷ηαοίηιέαίΎί υδ έηέοδϐηέα άδέειάδδ άέα οαί ααίειοηάβ έάύίυί οίο άδέοηΎοίοί ϐ άδιηάβειοί οαί δηύοάαόα οά οδαάόά.

¼οάί Ύίά δάέΎοί άέοΎη÷άοάε οοί firewall, οάέηηβίόάε ίά άΎόα οίη δηηοί έάύίά. ϐ όύάηέοα οοίά÷βαάοάε άέάη÷έΎ ίά οίοδ οδύειοίοδ έάύίάο, άδύ οίη δηηοί δηηο οίη οάέάοάβι, ίά άΎόα οίη άΎίηόά άηέειυ οίοδ. ¼οάί οί δάέΎοί οάέηέΎίάε ίά οέδ δάηάΎοηηοδ άδέειάδδ εΎοίεο έάύίά, άέοάέάβόάε ϐ ίααάβά οίο άίάΎηάοάε οοί δάβι άίάηάέβί οίο έάύίά άοοίγ έάέ ϐ άίάεϐόαόα έάύίυί άέα οί οάέάηειΎίη δάέΎοί οάηίάοβαάοάε. Οά αοδϐ οα ίΎειάη άίάεϐόαόα, “ι δηηοίο έάύίάο οίο οάέηέΎαέ, άβίάε ι ίέεαοδ”. Αί οί δάέΎοί άάί οάέηέΎαέ ίά έάΎίά άδύ οίοδ έάύίάο, έά έαέάβ άδύ οίη οδ÷ηάυοέευ δηίάδέέάηίΎί έάύίά οίο IPFW, ίά άηέειυ 65535, ι ίδιβιδ άδιηάβαέ οα έέΎεάοα υέυι ούι δάέΎοί, έάέ οά άδιηηβδοάε ÷ηηβ ίά οάάβέάε έάέΎ άδΎίόαόα οοίη άη÷έευ άδιόοίεΎά οίοδ.

Όαίάβόα: ϐ άίάεϐόαόα οοίά÷βαάοάε ίάδΎ άδύ έάύίάο όύοίο count, skipto έάέ tee.

Ύε ίααάβδ οίο οάβίηίόάε άαϐ, άάοβειοίόάε οαα ÷ηϐα έάύίυί οίο δάηέΎ÷ίί οέδ ίααάβδ keep state, limit, in, out έάέ via. ΑοδΎδ άβίάε έάέ ίε άάοέΎδ έάέοίηηάβδ άέα οαί άυιαόα άΎυδ firewall όύοίο inclusive ίά stateful έάέοίηηάβ.

Δηίάέάιόίβαα: ίά άβίάά ίάΎέα δηίοί÷ϐ υοάί άίοέάγάά ίά οίοδ έάύίάο άΎυδ firewall. Ιδιηάβ Ύεάέά οάο ίά έέάέάυέάβδά Ύίυ άδύ οί όύόαίά οάο.

31.6.5.1 Όύίόαί Έάύίυί

Όαί άΎυαόά αοδϐ, έά δάηηοέΎοίοίά ίέα άδειοίεαίΎία όύίόαί έάύίυί. Άάβ÷ηιόά ίυίί υοέ ÷ηάέΎαάοάε άέα ίά ααίειοηάαΎ Ύίά οδδιδίεαίΎίη όύίει έάύίυί άέα Ύίά inclusive firewall. Άέα δεϐηα δάηέάηάοϐ, άάβδά οα οάέβάά manual οίο ipfw(8).

Ύε έάύίάο δάηέΎ÷ίί εΎίάέο-έέάέεΎ. Ύε εΎίάέο αοδΎδ έά δηΎάέ ίά ευάέειοίεαίΎί ίά οάέάηειΎία οάέηΎ άδύ οά άηέοάηΎ δηηο οά άάίεΎ οαα άηάηδ. Ύε εΎίάέο-έέάέεΎ οάβίηίόάε δάηάέΎοδ ίά Ύίόηά άηΎηάόά. ΙάηέΎδ εΎίάέο Ύ÷ίί οδ÷άδέειάΎδ ίε ίδιβδ ίδιηάβ ίά άβίάε άδβόα εΎίάέο-έέάέεΎ έάέ ίά δάηέέάΎίηοί άδβόα εΎίά δάηέοουοάηάο οδ÷άδέειάΎδ.

Ç áñ ÷ P áññò ó ÷ ðεβίð, óçìáðññòðáβðάέ ìá òì óγññεí #, òì ðñβì ðññάβ ñá àññáñβεάðάέ òòì ðÝεìð ñεάð ññññðð εάññá, P εάέ òá ñεά εέεP òì ññññð. Ìε εάñÝð ññññÝð ááññññóáέ.

CMD RULE_NUMBER ACTION LOGGING SELECTION STATEFUL

31.6.5.1.1 CMD

Άέά ñá ñβñáε ç ðññòεðεç áññò ñÝìð εάññá òòì áòñðññεέù ðβñáέá, òìðñεάðáβðάέ ðñññòðÜ áðñ áðòññ ÷ ç ðáñÜñáðññò *add*.

31.6.5.1.2 RULE_NUMBER

ÈÜεά εάññáð ò ÷ ððβεάðάέ ìá Ýñá ññεέù εάññá (rule_number) òðçì ðññεí ÷ P 1..65535.

31.6.5.1.3 ACTION

ñáð εάññáð ðññάβ ñá ò ÷ ððβεάðάέ ìá ñεά P ðññεóóñðññð áñÝññáεάð, ñε ðñβáð ñεðáεñññóáέ ùðáñ òì ðáέÝðì òáέññεÜεάέ ìá òá εñεóðññεά áðεέññðð áððñý òìð εάññá.

allow | accept | pass | permit

¼εά òá ðññáðÜññ Ý ÷ ðññ òì βáέñ áðñðÝεάðñá: òì ðáέÝðì áñÝñ ÷ áðάέ áðñ òçì óγñðçñá òìð firewall. Ç áñáεððççç ñεά òì óðñεáññεñÝñ ðáέÝðì ðñññáðβεάðάέ òá áðòñ òññ εάññá.

check-state

ΆεÝá ÷ áε òì ðáέÝðì ìá áÜóç òì áðñáñεέù ðβñáέá εάññá. Áñ ñññεάβ εάññáð ðññ ñá òáέññεÜεάέ, εá ñεðñεáððáβ ç áñÝññáεά òìð εάññá ñ ðñβìð ñçñεñññççç òññ óðñεáññεñÝññ áðñáñεέù εάññá. ΆεáñññáðéεÜ, ç áñáεððççç óññá ÷ βεάðάέ ìá òññ áðññáññ εάññá. ñáð εάññáð check-state ááñ Ý ÷ áε εñεóðññεά áðεέññðð. Áñ ááñ ððÜñ ÷ áε εάññáð check-state òòì óγññεñ εάññá, ñ Ýεáá ÷ ðð òìð ðβñáέá áðñáñεέññ εάññá ñáέññÜáέ áðñ òññ ðññòì εάññá óγðññ keep-state P limit.

deny | drop

Έάε ñε áγñ εÝñáεð óçñáβññòì òì βáέñ ðñññá: òá ðáέÝðá ðññ òáέññεÜεáññò ìá áðòñ òññ εάññá áðñññððñññóáέ. Ç áñáεððççç ðñññáðβεάðάέ.

31.6.5.1.4 ΈάðáññáðP

log P logamount

¼ðáñ Ýñá ðáέÝðì òáέññεÜεάέ ìá Ýñá εάññá ðññ ðññεÝ ÷ áε òç εÝñç log, ñβñáðάέ εάðáññáðP òìð ñçñññáðññ ñÝòñ òìð syslogd(8) òðç áðñáðññççç SECURITY. Ç εάðáññáðP óññááβñáέ ìñññ áñ ñ ññεέùð òññ ðáέÝðññ ðññ Ý ÷ áε εάðáññáðP ñÝ ÷ ñε óðεáññðð ááñ ððññááβñáέ òçç ðññññáðñññ logamount. Áñ ç ðññññáðñññ áððP ááñ Ý ÷ áε εáέññεóðáβ, òì ùñεñ ñðεñβεάðάέ ìá áÜóç òçç òεñP òçð ñáðááεççðð sysctl net.inet.ip.fw.verbose_limit. Έάέ óðéð áγñ ðññεððððáέð, ñεá ñçñáñεεP òεñP óçñáβñáέ ùðε ááñ εá ððÜñ ÷ áε ùñεñ óççñ εάðáññáðP. Ìñεéð ç εάðáññáðP òðÜðáέ òòì ùñεñ, ðññάβ ñá ñβñáέ áðñáññáñññññççç òçð ìá òì ñçñáñεóññ òìð ñáðñçðP εάðáññáðP, P òìð ñáðñçðP ñεά òì òðñεáññεñÝññ εάññá. Άáβðá òçç áñññεP ipfw reset log.

Óçñáβññçç: Ç εάðáññáðP ñβñáðάέ ìñññ áðññ áðáεçεáðéñññ ùεáð ñε Üεέáð òðñεðñεáð òáέññεÜóñáðññ òìð ðáέÝðññ, εάέ ðñέñ òçç òáέέεεP áðñññ ÷ P P áðñññεçç òìð. Άβñáέ òðçç áέεP óáð áð ÷ Ýññáέ ñá áðññáððññáððá òá ðñεñðð εάññáð éá áñññáññññññáðP òçç εάðáññáðP.

31.6.5.2 ΆδέειάP αέα Stateful Έάιυιάο

Όι stateful οέεονΰνεοιά, άίοείαδουδβαέε οçi έβίρoç οίτo αέεογίτo uδ αέδεδo έάοάγεοίoçο άίοάεεάαP δάεΎοι οά ιδίβα άçiείoñáιγί ιέα οοίάαñβα. ÷: αέ άδβoçο οç αοίάοουοçοά ία αέαñάοίPοάε άί οçñιγίoάε ιέ Ύάεοñιε έάιυιάο άίοάεεάαPδ ιçίoιΰοι ιάοάγί οίτo άδίοιεΎά έάε οίτo δάñάεPδoç. ΙδίεάαPδίοά δάεΎοά άάι οάεñεΰάειοι ιά οί δñυοδoι άοδoδoç οç άδέείεíυίβαο, άδίññβδoιíοάε uδ ράγoέεά.

Ç άδέειάP check-state ÷ñçοείιδιεάβoάε αέα ία άίάάñεοόαβ oά δίει oçίαβι οίτo οοίυείτo έάιυίυι οίτo IPFW έά έεάα÷εάβ οί δάεΎοι ιά άΰoç οç αοίάοουοçοά οιυ αοίάιέεβι έάιυίυι. Όά δάñβδoδoç οάεñεΰoίάοιδ, οί δάεΎοι άίΎñ÷άοάε άδυ οί firewall έάε οοίá÷βαέε οçί δίñάβá οίτo, άίP οçί βαέα oδέάñP άçiείoñáαβoάε Ύίάο ίΎίτo αοίάιέευδ έάιυίάο αέα οί άδυιάñ δάεΎοι δίτo άίάιΎίάoάε ία Ύñδάε ιά άΰoç οç οoάεάεñείΎίç αέδεδo έάοάγεοίoçο άδέείεíυίβα. Όά δάñβδoδoç δίτo οί δάεΎοι άάι οάεñεΰάε ιά οί αοίάιέευ έάιυίά, έά δññ÷uñPοάε αέα ία έεάα÷εάβ άδυ οίυ άδυιάñ έάιυίά οίτo firewall.

Ç αοίάοουοçοά αοίάιέεβι έάιυίυι άβίάε άoΰευδoç oά άίΰίoεçoç δυññυί oά δάñβδoδoç άδβεάoçοδ oδάñ÷άβέεoçοδ (flood) SYN. Ç άδβεάoç oδoP ιδίñάβ ία άçiείoñáPοάε δίεγ ίάάΰεí δεPεíδ αοίάιέεβι έάιυίυι. Άέα οçί άίοείαδoβδεoç ιέαο oΎoίεάο άδβεάoçοδ, οί FreeBSD ÷ñçοείιδιεάβ ιέα άευιá άδέειάP δίτo ίññΰάoάε limit. Ç άδέειάP άoδP ιδίñάβ ία δάñεíñβoάε οίυ άñεέιυ οιυ oάoδo÷ñιυί oοίάáñεβι, άίάoΰάειoάο oά δάάβá oάoçñβáο έάε δñññεoίγy οιυ έάιυίυι. Άίε÷ίάγáε ιά oδoυ οίυ δñυoδí οί δεPεíδ οιυ αοίάιέεβι έάιυίυι έάε δυoάο oññΎo Ύ÷άε ÷ñçοείιδιεçεάβ ι έάεΎίάο άδυ οç οoάεάεñείΎίç IP αέάγeοίoç. Άί ι άñεέιυδ oδoυδ ίάδάñιΰάε οί uñεí δίτo Ύ÷άε oάεάβ ιά οçί άδέειάP limit, οί δάεΎοι άδίññβδoδoάε.

31.6.5.3 ΈάoάáñáoP ιçίoιΰoιυí οίτo Firewall

Όά δεάñίάeδPιáοά oçο έάoάáñáoPδ oοίáΰίoιυí οίτo firewall, άβίάε δññoάP: δάñΎ÷ίoι οç αοίάοουοçοά ία ááβoά αέα δίει euyáí άíáñáñίePεçεάί ιε έάιυίάο oοίτoδ ιδίβίτoδ Ύ÷άoά άíáñáñίePοάε οçί έáoάáñáoP. Ιέ δεçññoιññβáο δάñεέáíáΰίoι oά δάεΎoά δίτo άδίññβδoçεέáí, oέo αέαoεγίoάeδ άδυ oέo ιδίβáο δññPεεáí έάε δίτo έáoάoεγíñíoáí. Ιά oδoυ οίυ δñυoδí, Ύ÷άoά Ύίá oçίáíoέeυ δεάñίΎeçίá oçoçί áíβ÷ίáoçοç οιυ áeóáñεΎíυí.

Άευιá έάε άί άíáñáñίePοáoά oç εάeοίoñáβá έáoάáñáoPδ, οί IPFW άάí έá άñ÷βoάε άδυ ίυíυí οίτo οçί έáoάáñáoP αέα έáíΎίá έάιυίá. Ι έáε÷άεñεoδoδoδ οίτo firewall έá άδίoάoβoάε oά δίειτoδ άδυ uείτoδ οίτoδ έάιυίáο έá άíáñáñίePοáε οçί έáoάáñáoP, έάε έá δññíoεΎoάε οçί eΎίç log oçoçί áíoβoδíe÷ç έáoά÷ñεoç. Όoóeíñáeéΰ, áβίáoάε έáoάáñáoP ίυíñί áεá έáíυíáο δίτo άδίññβδoδíoι δάεΎoά (έάíυíáο deny), uδυδ αέα δάñΰááeáíá ι έάíυíáο άδυññεøçοδ οιυ έeóáñ÷uñáíυí ICMP pings. Άβίάε eίeíP δñáeóeéP, ίá áíoεáñΰoáoάε oοί oΎεíδ οιυ έάíυíυí ι έάíυíáο “ipfw default deny everything” έάε ίá δññíoβeáoάε oά oδoιυ ç άδέειάP log. Ιά οίυ δñυoδí oδoυ, ιδίñάβoά ίá ááβoά uεá oά δάεΎoά δίτo άáí oάβñeáíáí ιá έáíΎίá έάíυíá οίτo οοίυeίτo.

Ç έáoάáñáoP oοίáΰίoιυí άβίάε áβeíδí ίá÷άβñe. Άί άáí áβoδá δññíoáeóeéυδ, έá ÷άeάβoά ίΎoά oοί δεPεíδ οιυ ááñáΎíυí oçο έáoάáñáoPδ έάε έá ááíβoάoά οί άβoéí oάο ιá ΰ÷ñçoδá άñ÷άβá. Ιέ δeí δάeéΎo έάε eίeíΎo άδeéΎoάeδ oγδίτo ΰñίçoçοδ oδçñáoβáο (DoS), άβίάε oδoΎo δίτo δññíoδáeíγí ίá ááíβoíoι oίτoδ áβoéíτoδ oάoδ. Όá ιçίγíáoά oδoΰ u÷é ίυíñί έáoάáñΰoιíoάe oοί **syslogd**, áeéΰ áñoáíβáñíoάe έάε oçoçί eíñóueá οίτo oδoδPíáoíτoδ oάoδ, έάε oγíoñá áβñíoάe δίeγ áññ÷eçoééΰ.

Ç άδέειάP IPFW_VERBOSE_LIMIT=5 oοίυ δoñPíá, δáñeíñβáeé οίυ άñεέιυ οιυ oοίá÷uñáíυí uññeúñ ιçίoιΰoιυí δίτo oóΎeñíoάe oοίυ έáoάáñáoΎá oδoδPíáoíτoδ syslogd(8) o÷áoééΰ ιá οί oάβñeáoíá δάεΎoιυí áíυδ oοáeáeñeíΎíñ έάíυíá. %oáí áíáñáñίeάβoάe oδoP ç άδέειάP oοίυ δoñPíá, ι άñεέιυδ οιυ oοίá÷uñáíυí ιçίoιΰoιυí áíυδ oοáeáeñeíΎíñ έάíυíá, oóáíáoΰáe ίáoΰ oíυ άñεέιυ δίτo eáeíñβáeáoάe. Άáí oδΰñ÷άe έáíΎίá uoáeíτoδ άδυ 200 oοίá÷uñáíá ιçίγíáoά ιá οί βáeí áeñeáβo δáñeá÷uñáñ. Άέα δάñΰááeáíá, δΎíoά oοίá÷uñáíá ιçίγíáoά αέα Ύίá oοáeáeñeíΎíñ έάíυíá έá έáoάáñΰoιíoáí έáíñeéΰ oοί **syslogd**. Όá oδυeíeδá uñíeá ιçίγíáoά έá έáoάíáoñçeíγí έάε έá έáoάáñáoíγí uδυδ oάβíáoάe δáñáeΰoδo:

last message repeated 45 times

¼εά όά ιçíγíáόά έάόάαηάόòò òùì ðáέÝòùì, αηὐοìíόάέ áðu ðñìáðέέìäòò óòì áη÷άβì /var/log/security òì ìðìβì έάέìηβæάόάέ óòì áη÷άβì /etc/syslog.conf.

31.6.5.4 Äçìέìòñάβά Áíùò Script Έάíúíúì

Ìέ ðáηέóóυóáηìέ Υìðáέηìέ ÷ ηòóóáò ðìò IPFW, αçìέìòñáγí Υíá áη÷άβì ðìò ðáηέÝ÷άέ òìòò έάíúíáò έάέ òì αηὐοìíόά íá ðÝòìέì ðñùðì ðóðά íá íá ìðìñάβ íá áέòáέάóóáβ ùò script. Òì ááóέέυ ðεáìíÝέòçíá ðìò ðáηáðὐíù ðñùðìò, άβìάέ ùòέ ìέ έάíúíáò ðìò firewall ìðìñíγí íá áíáíáùέìγí ÷ ùñβò ðçì áíὐάέç íá áðáíáέέέìòóáέ òì óýòòçíá áέá íá òìηòùέìγí ìέ íÝìέ. Ç ìÝέìáò áóòò άβìάέ ðìέγ áìέέέò άέá ðçì áìέέέìòò íÝúì έάíúíúì, έάέòò ç áέáάέέέάóá ìðìñάβ íá áðáíáέççòέáβ ùóáò òìñÝò ÷ ηάέὐæáóáέ. Έάέòò ðñùέάέóáέ áέá έάíúíέέυ script, ìðìñάβóá íá ÷ ηçóέìíðìέòóáóá òòìáìέέέò ððìέáðὐóóáóç áέá íá έùάέέìðìέòóáóá έάέ íá ððìέáóáóóòóáóá óò÷íὐ ÷ ηçóέìíðìέìγíáíáò ðέìÝò óá ðìέέáðέìγò έάíúíáò. Áóòυ òάβìáóáέ óòì ðáηάέὐòù ðáηὐάάέáìá.

Ç óýíòáìç ðìò ÷ ηçóέìíðìέáβóáέ ááò, άβìάέ òòìááòòò ìá óá έáέγöç sh(1), csh(1) έάέ tcsh(1). Ìðìñóòὐ áðu óá ðááβá ðçò òòìáìέέέòò ððìέáðὐóóáóçò, ððὐñ÷άέ òì ðòìá ðìò áìέáηβìò, \$. Òì óýìáìέì áóòυ ááí ððὐñ÷άέ ìðìñóòὐ áðu óá òòìáìέέέὐ ðááβá. Ç ðέìòò ðìò έá áðìáìέáβ óòì òòìáìέέέυ ðááβì, ðñÝðáέ íá áóùέέáβáóáέ óá áέðέὐ áέóááυάέέέὐ.

Ìáέέìòóáò òì áη÷άβì òùì έάíúíúì óáò ùðò òάβìáóáέ ðáηάέὐòù:

```
##### start of example ipfw rules script #####
#
ipfw -q -f flush      # Delete all rules
# Set defaults
oif="tun0"           # out interface
odns="192.0.2.11"    # ISP's DNS server IP address
cmd="ipfw -q add "    # build rule prefix
ks="keep-state"      # just too lazy to key this each time
$cmd 00500 check-state
$cmd 00502 deny all from any to any frag
$cmd 00501 deny tcp from any to any established
$cmd 00600 allow tcp from any to any 80 out via $oif setup $ks
$cmd 00610 allow tcp from any to $odns 53 out via $oif setup $ks
$cmd 00611 allow udp from any to $odns 53 out via $oif $ks
##### End of example ipfw rules script #####
```

Áóòυ άβìάέ υέì. Òòì ðáηὐάάέáìá áóòυ ááí άβìάέ ðçìáìέέέìβ ìέ έάíúíáò, áέέὐ ì ðñùðìò ìá òìí ìðìβì έάέòìòñáγí έάέ ðáβñìòì ðέìÝò óá ðááβá òòìáìέέέòò ððìέáðὐóóáóçò.

Áí òì ðáηáðὐíù ðáηὐάάέáìá ðóáí óòì áη÷άβì /etc/ipfw.rules έá ìðìñíγóáóá íá òìηòòóáóá áóòìγò ðìòò έάíúíáò, αηὐοìíόáò ðçì ðáηάέὐòù áíóìέò:

```
# sh /etc/ipfw.rules
```

Òì áη÷άβì /etc/ipfw.rules ìðìñάβ íá áηβóέάóáέ óá ùðìέì έáðὐέìáì έÝέáóá, έάέ íá ìñὐάέóáέ áðβóçò ùðò έÝέáóá.

Έá ìðìñíγóáóá íá áðέóγ÷áóá òì βáέì ðñὐáìá, áέòáέòòòáò óέò ðáηάέὐòù áíóìέÝò ÷ áέñìέβìçóá:

```
# ipfw -q -f flush
# ipfw -q add check-state
# ipfw -q add deny all from any to any frag
# ipfw -q add deny tcp from any to any established
# ipfw -q add allow tcp from any to any 80 out via tun0 setup keep-state
```

```
# ipfw -q add allow tcp from any to 192.0.2.11 53 out via tun0 setup keep-state
# ipfw -q add 00611 allow udp from any to 192.0.2.11 53 out via tun0 keep-state
```

31.6.5.5 Ούύιει Έάιύι Stateful

Οι δάναεΰδου όύιει έάιύι (δίο άάι δάνεΎ÷άε έάιύιάδ άέα NAT) άβιάε Ύία δάνΰάάεάια άνάοδδ άύδ inclusive firewall. ίά inclusive firewall άδεόνΎδάε όçi άβόιαί ίύι όύι δάέΎδύι δίο δάεΎεΰάει ίά όιδ έάιύιάδ άδία÷δδ (pass) έάε άδινάβδδάε άδύ δνιάδεείαP υέα δά ΰεέα. Όά firewalls δίο Ύ÷ιόι ό÷άεάόδβ ίά δνιόδάδύιόι ιευέεçñά άβέδδά, άέαέΎόιόι όι έεάυδάνι άύι έεάδάδΎδ, όδεδ ιδίαδ δνΎδάε ίά δδΰñ÷ιόι έάιύιάδ ιρόδ όι firewall ίά έεάόιόναάβ.

¼έα δά έεάόιόναέεΰ δόδδδίαόά όύδίο UNIX, όδιδάνεέείάάάñΎίύι έάε όιό FreeBSD, Ύ÷ιόι ό÷άεάόδβ ίά ÷ñçόειδύειύί όç έεάδάδP 100 έάε όç έεάύέδίοç IP 127.0.0.1 έέα άούδάνέεP άδεείέιύιύά ίά όι έεάόιόναέεü όύόόçιά. Οι firewall δνΎδάε ίά δάνεΎ÷άε έάιύιάδ δίο ίά άδεόνΎδύιόι όçi άδνύόειδδç έβίçόç άδδπí όύι έεάέεπí, έέα άούδάνέεP ÷ñδç, δάέΎδύι.

Ίε έάιύιάδ δίο ινβέιόι όçi δνύόάόç έέόάñ÷ύιάύι έάε άίάñ÷ύιάύι δάέΎδύι, άñΰοιόάε έέα όç έεάδάδP δίο όόιαΎάάέ όόι άçιύόει Internet. Ç έεάδάδP άδδP ιδινάβ ίά άβιάε έέα δάνΰάάεάια ç tun0 (δά δάνβδδδύç δίο ÷ñçόειδύειάβδδά όι PPP ÷ñδç), P ç έΰñδά έέέδύιό δίο όόιαΎάάέ όόι έεάυδάέεü P DSL modem όάδ.

Όά δάνβδδδύç δίο ιέα P δάνεόούδάνάδ έΰñδάδ έέέδύιό όόιαΎιόάέ όά άούδάνέεΰ έεάυδέεΰ άβέδδά δβδύ άδύ όι firewall, έά δνΎδάε ίά δδΰñ÷ιόι ιέ άίόβδδύε÷ιέ έάιύιάδ δίο ίά άδεόνΎδύιόι όçi έεάύεάñç έεάέβίçόç όύι δάέΎδύι άΎΎιόά όδεδ έεάδάδΎδ άδδΎδ P/έαέ όόι Internet.

Ίε έάιύιάδ δνΎδάε ίά ινάιπνίόάέ όά δνάεδ έύνεάδ άύδδδάδ: άñ÷έεΰ υέαδ ιέ έεάδάδΎδ όδεδ ιδίαδ άδεόνΎδάάέ ç έεάύεάñç έεάέβίçόç άάάñΎύι, Ύδάέδά ç έεάδάδP άδύ όçi ιδία άίΎñ÷ιόάέ δά δάέΎδά δνιό όι άçιύόει άβέδδύ (Internet) έάε όΎειό ç έεάδάδP άδύ όçi ιδία έάΎΎιόάέ δάέΎδά άδύ όι Internet.

Όά έΰεά ιέα άδύ δεδ άύδδδάδ όύι έεάδάδπí δίο όόιαΎιόάέ όόι Internet, δνΎδάε ίά όιδύεάόιύιόάέ δνιόιέ ιέ έάιύιάδ δίο δάεΎεΰάει όó÷ιύδάνά ίά όçi άίόβδδύε÷ιέ έβίçόç. Ί δάεάδδάβιδ έάιύιάδ όçδ άύδδδάδ έά δνΎδάε ίά άδινάβδδάέ έάε ίά έάόάάñΰάε υέα δά δάέΎδά όçδ όόάέάεñειΎίçδ έεάδάδδδ/έάδάύέδίοçδ.

Ç άύδδδά άίάñ÷ιύι (Outbound) όόι όύιει έάιύι δίο όάβιάόάέ δάναεΰδδ, δάνεΎ÷άε ίύι έάιύιάδ όύδίο allow. Ίε έάιύιάδ άδδβ δάνεΎ÷ιόι όσάέάεñειΎιάδ άδεέάάΎιάδ όειΎδ, ίά δεδ ιδίαδ άίάάινάβέάδάέ ίά ιιιάέεü όñδύι ç δδçñάόβά όόçi ιδία άδεόνΎδάάέ ç δνύόάόç άδύ όι άçιύόει Internet. ¼ειέ ιέ έάιύιάδ Ύ÷ιόι δεδ άδεείαΎδ proto, port, in/out έάε keep-state. Ίε έάιύιάδ όύδίο proto tcp δάνεΎ÷ιόι όçi άδεείαP setup έέα όçi άίάάιπνέόç όιό δάέΎδύι Ύιάνçδ όçδ όόιάάñβάδ, ιρόδ ίά άβιάε ç έάδά÷πνέόç όçδ όόι δβιάέά όόιαΎόάύι (stateful).

Όόçi άύδδδά όύι έέόάñ÷ύιάύι δάέΎδύι (Inbound) δίο όάβιάόάέ δάναεΰδδ, άιόάίβειόάέ δνιόιέ ιέ έάιύιάδ δίο ÷ñçόειδύειύιόάέ έέα όçi άδύñνέç όύι άίάδεέύιçδύι δάέΎδύι. Άδδύ άβιάόάέ έέα άύι έεάόιόναέειύδ ευάιόδ. Ί δνιόδ άβιάε υδε όά έεάυδάρεά δάέΎδά ιδινάβ άί ιΎñάε ίά δάεΎεΰάει ίά έΰδύεά ÷άνάέδçñέόέεΰ όçδ Ύάέδñçδ έβίçόçδ. Όά δάέΎδά άδδΰ έά δνΎδάε ίά άδινέέδύειύι, άίόβ ίά άβιόι άάέδΰ άδύ έΰδύεά άδύιάνι έάιύιά allow. Ί άάύδάνιδ άβιάε υδε ιδινάβδδά ίά άδινάβδδάδ όσάέάεñειΎιά δάέΎδά όά ιδία άίύñβέάδά υδε άάί άβιάε Ύάέδñά, έεΰ όάδ άβιάε άέΰοιñç ç έάόάάñάδP όιόδ. Ίά όι όñδύι άδδύ άιδύάβέάδάέ ç εPç έάε έάόάάñάδP όιόδ άδύ όι δάεάδδάβι έάιύιά. Ί δάεάδδάβιδ έάιύιάδ δδδέεΰ άδινάβδδάέ έάε έάόάάñΰάε υέα δά δάέΎδά δίο Ύδδάόάί ιΎ÷ñέ άδδύι. Ί έάιύιάδ άδδδδ ÷ñçόειδύειάβδδάέ έέα όçi δάñ÷P ινέεπí άδύάβιάύι όά δάνβδδδύç δίο έείδδάδά ινέεP έεάάέέάδβά έάδΰ άδύιύι δίο δνΎάçόάί όά άδεέΎδάέδ όόι όύόόçιά όάδ.

Έά δνΎδάε άδβόçδ ίά άίάόάέβδδάδ υδε όι όύόόçιά όάδ άάί έά άπράε έάιέΰ άδΎιόçόç όά έάΎίά άδύ όά άίάδεέύιçδά δάέΎδά. Όά δάέΎδά άδδΰ έά δνΎδάε ίά άδινέέδύειύι έάε ίά άίάάίέόόιύι. Ίά όι όñδύι άδδδ, ι άδεέδέΎιάνι άάί Ύ÷άε έάιέΰ άίπç άί όά δάέΎδά δίο Ύδδάόάί ιΎ÷ñέ όι όύόόçιά όάδ. ¼όι έεάυδάñά ιδινύί ίά ιΰειόι ιέ άδεέδέΎιάνιέ ό÷άδέεΰ ίά όι όύόόçιά όάδ, όύοι δει άόάέΎδ άβιάέ. ¼όάί έεάδάβδδά έάόάάñάδP δάέΎδύι ίά άνεείύδ έδñπí δίο άάί άίάάίύñβέάδδ, έιέδΰιόά όόι άñ÷άβι /etc/services/ P άάβδά όι http://www.securitystats.com/tools/portsearch.php

εάε άίάαεçðÞóðά οίί άνεέιυ όçð εγñάð áεά ίά άάβóá ðιεíð άβίάε ι όείðυð όçð. ΆεÛάíðά όçί ðάñάεÛòυ ðιðιεάóβά áεά όιòð άνεέιυçð εðñþί ðιò ÷ñçóειιðιεíýíðάε όð÷íÛ άðυ εάέυάιòεά ðñιñÛιιάðά (Trojans):
<http://www.simovits.com/trojans/trojans.html>.

31.6.5.6 ίά Õðυάέαιά Óοίυεíò Éάίυιύí Inclusive

Ïι ðάñάεÛòυ όýιíει εάίυιύí (όοι ιðιβι άάí çειðιεάβóáε εάεðιòñάβά NAT) άβίάε άñεάðÛ ðεÞñáð εάε ðιεý áóóáεÛð. Άçιεíòñάβ firewall όýðιò inclusive, εάε Û÷áε άιεέιαóðάβ óά ðñάάιáðεέÛð όðιεÞεάð εάεðιòñάβáð. Ìðιñάβ ίά άíðçñάóβáð όι βάεí εάέÛ εάε όι áεέυ óáð όýóðçίά. ΆðεÞð ίάóáðñÛÛðά óά ó÷üεéι όιòð εάίυιύáð pass áεά óéð óðçñάóβáð ðιò άάí εÛεάðά ίά άíñάñιðιεÞóáðά. Άεά ίά άðιòýάáðά όçί εάóáñάóÞ άίάðεέýìçóυí ιçίòιÛòυí, áðεÞð ðñιòεÛðά Ýίá εάίυιύά όýðιò deny όóçί άíυòçðά ðυí áεóáñ÷ñÛíυí. Óά υειòð όιòð εάίυιύáð, Éá ðñÛðáε ίά áεεÛíáðά όι υíñá όçð áεάðáððð άðυ dc0 όοι ðñάάιáðεέευ υíñá όçð áεάðáððð ðιò óðíáÛάðάε όοι áçιυóéι Internet. Óά ðáñβððóç ðιò ÷ñçóειιðιεάβóá όι PPP ÷ñÞóðç, όι υíñá όçð áεάðáððð εά άβίάε tun0.

Éá áεάðεéóðÞóðά υúε óðÛñ÷áε ίεά óðáεáñεíÛíç εíáεéÞ óðç ÷ñÞóç áððþί ðυí εάίυιύí.

- ¼εíε ίε εάίυιύáð ðιò áðιðáεíýí áβóçóç áεά Ýíáñíç ίεáð ίÛάð óðíáñβáð ίá όι áçιυóéι Internet, ÷ñçóειιðιεíýí όçί áðεéíáÞ keep-state.
- ¼εáð ίε áεάðεéóðáðιÛíáð óðçñάóβáð ðιò ðñιÛñ÷ííðάε άðυ όι áçιυóéι Internet, áεάεÛíòιò όçί áðεéíáÞ limit, áεά όçί áðιòðáÞ áðεéÛóáυí óðáñ÷áβεéóçð (flooding).
- ¼εíε ίε εάίυιύáð ÷ñçóειιðιεíýí óéð áðεéíáÛð in Þ out áεά ίά áεáðεñεíβáειòí όçί εάóáýεðíóç όçð áðεéíεíυíβáð.
- ¼εíε ίε εάίυιύáð ÷ñçóειιðιεíýí όçί áðεéíáÞ via υíñá-áεáðáððð áεά ίά εάεíñβóíòí όç áεάðáðÞ άðυ όçί ιðιβά áεÛñ÷áðάε όι ðáéÛðι.

Ïε εάίυιύáð ðιò óáβííυáε ðάñάεÛòυ, εά ðñÛðáε ίά áñáðιýí óòι /etc/ipfw.rules.

```
##### Start of IPFW rules file #####
# Flush out the list before we begin.
ipfw -q -f flush

# Set rules command prefix
cmd="ipfw -q add"
pif="dc0"      # public interface name of NIC
               # facing the public Internet

#####
# No restrictions on Inside LAN Interface for private network
# Not needed unless you have LAN.
# Change xl0 to your LAN NIC interface name
#####
$cmd 00005 allow all from any to any via xl0

#####
# No restrictions on Loopback Interface
#####
$cmd 00010 allow all from any to any via lo0

#####
# Allow the packet through if it has previous been added to the
# the "dynamic" rules table by a allow keep-state statement.
```

```
#####
$cmd 00015 check-state

#####
# Interface facing Public Internet (Outbound Section)
# Check session start requests originating from behind the
# firewall on the private network or from this gateway server
# destined for the public Internet.
#####

# Allow out access to my ISP's Domain name server.
# x.x.x.x must be the IP address of your ISP.s DNS
# Dup these lines if your ISP has more than one DNS server
# Get the IP addresses from /etc/resolv.conf file
$cmd 00110 allow tcp from any to x.x.x.x 53 out via $pif setup keep-state
$cmd 00111 allow udp from any to x.x.x.x 53 out via $pif keep-state

# Allow out access to my ISP's DHCP server for cable/DSL configurations.
# This rule is not needed for .user ppp. connection to the public Internet.
# so you can delete this whole group.
# Use the following rule and check log for IP address.
# Then put IP address in commented out rule & delete first rule
$cmd 00120 allow log udp from any to any 67 out via $pif keep-state
#$cmd 00120 allow udp from any to x.x.x.x 67 out via $pif keep-state

# Allow out non-secure standard www function
$cmd 00200 allow tcp from any to any 80 out via $pif setup keep-state

# Allow out secure www function https over TLS SSL
$cmd 00220 allow tcp from any to any 443 out via $pif setup keep-state

# Allow out send & get email function
$cmd 00230 allow tcp from any to any 25 out via $pif setup keep-state
$cmd 00231 allow tcp from any to any 110 out via $pif setup keep-state

# Allow out FBSD (make install & CVSUP) functions
# Basically give user root "GOD" privileges.
$cmd 00240 allow tcp from me to any out via $pif setup keep-state uid root

# Allow out ping
$cmd 00250 allow icmp from any to any out via $pif keep-state

# Allow out Time
$cmd 00260 allow tcp from any to any 37 out via $pif setup keep-state

# Allow out nntp news (i.e. news groups)
$cmd 00270 allow tcp from any to any 119 out via $pif setup keep-state

# Allow out secure FTP, Telnet, and SCP
# This function is using SSH (secure shell)
$cmd 00280 allow tcp from any to any 22 out via $pif setup keep-state

# Allow out whois
```

```

$cmd 00290 allow tcp from any to any 43 out via $pif setup keep-state

# deny and log everything else that.s trying to get out.
# This rule enforces the block all by default logic.
$cmd 00299 deny log all from any to any out via $pif

#####
# Interface facing Public Internet (Inbound Section)
# Check packets originating from the public Internet
# destined for this gateway server or the private network.
#####

# Deny all inbound traffic from non-routable reserved address spaces
$cmd 00300 deny all from 192.168.0.0/16 to any in via $pif #RFC 1918 private IP
$cmd 00301 deny all from 172.16.0.0/12 to any in via $pif #RFC 1918 private IP
$cmd 00302 deny all from 10.0.0.0/8 to any in via $pif #RFC 1918 private IP
$cmd 00303 deny all from 127.0.0.0/8 to any in via $pif #loopback
$cmd 00304 deny all from 0.0.0.0/8 to any in via $pif #loopback
$cmd 00305 deny all from 169.254.0.0/16 to any in via $pif #DHCP auto-config
$cmd 00306 deny all from 192.0.2.0/24 to any in via $pif #reserved for docs
$cmd 00307 deny all from 204.152.64.0/23 to any in via $pif #Sun cluster interconnect
$cmd 00308 deny all from 224.0.0.0/3 to any in via $pif #Class D & E multicast

# Deny public pings
$cmd 00310 deny icmp from any to any in via $pif

# Deny ident
$cmd 00315 deny tcp from any to any 113 in via $pif

# Deny all Netbios service. 137=name, 138=datagram, 139=session
# Netbios is MS/Windows sharing services.
# Block MS/Windows hosts2 name server requests 81
$cmd 00320 deny tcp from any to any 137 in via $pif
$cmd 00321 deny tcp from any to any 138 in via $pif
$cmd 00322 deny tcp from any to any 139 in via $pif
$cmd 00323 deny tcp from any to any 81 in via $pif

# Deny any late arriving packets
$cmd 00330 deny all from any to any frag in via $pif

# Deny ACK packets that did not match the dynamic rule table
$cmd 00332 deny tcp from any to any established in via $pif

# Allow traffic in from ISP's DHCP server. This rule must contain
# the IP address of your ISP.s DHCP server as it.s the only
# authorized source to send this packet type.
# Only necessary for cable or DSL configurations.
# This rule is not needed for .user ppp. type connection to
# the public Internet. This is the same IP address you captured
# and used in the outbound section.
#$cmd 00360 allow udp from any to x.x.x.x 67 in via $pif keep-state

# Allow in standard www function because I have apache server

```

```

$cmd 00400 allow tcp from any to me 80 in via $pif setup limit src-addr 2

# Allow in secure FTP, Telnet, and SCP from public Internet
$cmd 00410 allow tcp from any to me 22 in via $pif setup limit src-addr 2

# Allow in non-secure Telnet session from public Internet
# labeled non-secure because ID & PW are passed over public
# Internet as clear text.
# Delete this sample group if you do not have telnet server enabled.
$cmd 00420 allow tcp from any to me 23 in via $pif setup limit src-addr 2

# Reject & Log all incoming connections from the outside
$cmd 00499 deny log all from any to any in via $pif

# Everything else is denied by default
# deny and log all packets that fell through to see what they are
$cmd 00999 deny log all from any to any
##### End of IPFW rules file #####
  
```

31.6.5.7 ή Οδύααεία NAT ια Stateful Ούιει Εάιιι

Αέ α ία άίάίάίάίάίάίάί ή έάέίίίίίίί NAT όίί IPFW, ÷ήάέÜάίίίάέέ Üίίίέάό άέέέέÜίί ήέίίίίάέέ. Έά δñÜάέ ίά δñίίέÜόάό όçi άέέίίάP option IPDIVERT ίάάβ ίά όέδ δüίέέδάδ άέέίίάÜδ άέά όί IPFW όίί άñ÷άβι ήέίίίίάάύ όίδ δñPίά. Έά δñÜάέ Üάέέά ίά ίάόάέüδδóóáóά έάέ ίά άέάέάάóóPóáóά όί ίÜί óάδ δñííóáñííóÜί Üί δñPίά.

Άέóüδ άδü όέδ όίίίίέέίÜίάδ άέέίίáÜδ άέά όί IPFW, έά δñÜάέ ίά δñίίέÜόάό έάέ όέδ δñάέÜüδ όίί άñ÷άβι /etc/rc.conf:

```

natd_enable="YES" # Enable NATD function
natd_interface="rl0" # interface name of public Internet NIC
natd_flags="-dynamic -m" # -m = preserve port numbers if possible
  
```

Ç ÷ήPόç έάίίίίίίί stateful ίάάβ ίά όίί έάίίίίά divert natd (NAT), δñέέέÜέέέ δñέÜ όçi έίίáέέP óóáñáóPδ óüί έάίίίίί. Ç έÜόç áüÜίέóçδ óüί έάίίίίίί check-state έάέ divert natd ίÜόά όóí óύίίει έάίίίίίί áβίáóάέ δñέÜ έñβóέιç. Άάί δñüέάέέάέ δñÜίί áέά άδñP έίίáέέP δññÜóίáóíδ άδü όίί Üίά έάίίίίá όóíí άδüáñí. ×ήçóέίíδñέáβóάέ Üίά ίÜί áβáñδ άίÜñάáέád δñí íñÜάάóάέ skipto. Αέά ίά ÷ήçóέίíδñέçáβ ç áíóίίP skipto, áβίáέ óδñ÷ñáüðέέü ίá Ü÷áóá áñέέίPóáέ óíδδ έάίííáδ, Póá ίá ίÜñáóá óá δñέί έάίίίίá έá έáóáέPίáέ όί Üέίá δñí έá áέóáέáóáóáβ άδü όçi áíóίίP áóδP.

ΔñáέÜüδ έá áñáβóá Üίά óδüαάέάíá (÷ññβδ δñüóéáóá ó÷üέéá) ίέád ίáέüáñü óóáñáóPδ δñí άέέÜίíáá áñP áέá ίá άíçáPóíóíá όçi áέίίέíóéβá ñPδ όíδ δñéÜóíδ ίÜόά όóí óύίίει έάίίίίί.

Ç ñP óçδ άδñáñááóβáδ ίáέέíÜάέ ίá όíí δñPóí άδü όçi έíñóóP έάίίίίá έάέ óóíá÷βáέέ Üίá έάίίίίá έÜéá óñÜ δñíδ όá έÜóü, áβóá ίÜ÷ñέ ίá óÜóάέ όíí δáέáóóáβι, P ίÜ÷ñέ όí δñéÜóí ίá óáέñéÜíáέ ίá óá έñέóPñéá áδέέíáPδ έÜδñέíó έάίίίίá έάέ ίá áέáóéáñüèáβ áδü όί firewall. Άβίáέ óçíáíóέéü ίá δñáñóçñPóííá όç έÜόç óüί έάίίίίί ίá áñέέíñýδ 100, 101, 450, 500 έáέ 510. Íέ έάίίíáδ áóóíβ áéÜá÷íóί όçi ίáóÜñáóç óüί áíáñ÷üáñí έάέ áéóáñ÷üáñí δñéÜóüί, Póá ίέ έáóá÷ñPóáέδ óíδδ óóí áóíáíέéü δβίáέéá έáóáóóÜóáñí ίá δñáñéÜ÷íóí δÜííóá όçi έáέüðέέP IP áέáÜέóíóç óíδ όíδέέíý áέέóýíδ. ΔñáñóçñPóóá áδβóçδ üðé üéíé ίέ έάίííáδ allow έáέ deny έáέññβáέíóί όçi έáóáÜέóíóç έβίçççδ óíδ δñéÜóíδ έάέPδ έάέ όçi áéáðáóP. Άδβóçδ, üéáδ ίέ áíáñ÷üáñí áéóPóáέδ áέá ίÜáδ óóíáññáδ ίáóáÜñííóáέ áðáóéáβáδ (ίÜóü óíδ skipto rule 500) óóíí έάίííá 500 áέá ίá áβίáέ ç ίáóÜñáóç áéáóéýíóáñí áέéóýíδ (NAT).

Áδ óδñéÜóíóíá üðé Üίá ÷ñPóçδ óíδ óíδέέíý áέéóýíδ ÷ñçóέííδñέáβ όíí óóéññáñçδP óíδ áéá ίá ááέ ίέá έóóíóáέβáá. Íέ έóóíóáέβááδ ÷ñçóέííδñέýí όçi δññóá 80 áέá όçi áδέέéíííáβ. Óí δñéÜóí άέóÜñ÷áóάέ óóí firewall. Άάί δáέñéÜáέέ

Ιά οίι έάίυία 100 άεάοβ άβίαέ άίάν÷ύίάνί έάέ ύ÷έ άεόάν÷ύίάνί. Δάνιΰάέ οίι έάίυία 101 άεάοβ δñυέάέοάέ άέα ίΎά άδέέίεíυίβá έάέ Ύόόέ άάί οδΰñ÷άέ άέυία όοίι άοίάίέέυ δβίαέά έάόάοδΰόάυι. Οί δάέΎοί όάέέέΰ όδΰίάέ όόίι έάίυία 125 Ιά οίι ιδίβι έάέ όάέέέΰάέ. ΑίΎñ÷άόάέ ίΎού όçδ εΰñόάδ άέέόγίό δίό όόίáΎάόάέ όοίι άçìύόέί Internet. Οί δάέΎοί Ύ÷άέ άέυία ύδ IP άόάόçñβáδ όçί έάέύόέέΰ άέάγέόίόç όίό όιδέέίγ άέέόγίό. Οί όάβñέάόίá Ιά άόου οίι έάίυία δñίέάέάβ άγί άίΎñάέέάδ. Ç άδέέίάΰ keep-state έά άçίείόñáΰόάέ Ύία ίΎί άοίάίέέυ έάίυία, έά οίι έάόá÷ύñΰόάέ όόίι δβίαέά, έάέ έά άέόάέΎόάέ όçί άίόβόόίέ÷ç άίΎñάέά. Ç άίΎñάέά άόδΰ άβίαέ ίΎñό όçδ δέçñίόίñβáδ δίό άñΰόάόάέ όόίι άοίάίέέυ δβίαέά. Óόçί δάνβδδούόç άόδΰ άβίαέ ç “skipto rule 500”. Ι έάίυίαδ 500 Ιάόάόνΰάέ ίΎού NAT όç άέάγέόίόç IP όίό δάέΎίό, δñέί άόου άίΎέέά δñόδ όί Internet. Άόδύ άβίαέ έέέάβόάñά όçίάίόέέύ. Οί δάέΎοί έάόάδέγίάόάέ δñόδ όίι δñίñέόίυ όίό, ύδίο άçίείόñάβδóάέ έάέ άδίοδΎέέάόάέ Ύία ίΎί δάέΎοί ύδ άδΰίόçόç. Οί ίΎί άόδύ δάέΎοί άέόΎñ÷άόάέ ίάίΰ όόί firewall, όόί έάίυία δίό άβίαέ όόçί έίñόΰΰ όçδ έβόόάδ. Άόδΰ όç όίñΰ όάέέέΰάέ Ιά οίι έάίυία 100 έάέ ç άέάγέόίόç δñίñέόίγ όίό άέέΰάέ ίάίΰ όόçί άñ÷έέΰ όίό όιδέέίγ άέέόγίό. Δάέόá, άβίáόάέ ç άδάίάñάάόβá όίό άδύ οίι έάίυία check-state ι ιδίβιό ίάίέάέγδδóάέ ύδέ δñυέάέόάέ άέα δάέΎοί όοίάάñβáδ όá άίΎέέίç έάέ όί άδάέάδέάñΰίáέ όόί όιδέέύ άβέόδóι. Έάόάδέγίáόάέ δñόδ όίι όδίεíάέόδΰ όίό όιδέέίγ άέέόγίό δίό όί Ύόόάέέá, ι ιδίβιό όόΎέίáέ Ύία ίΎί δάέΎοί άçόΰίόάδ δάñέόóυόάñά άάάñΎία άδύ οίι άδñάέñόóίΎί άίόδçñάόçόδΰ. Οί δάέΎοί άόδύ άέΎá÷άόάέ άδύ οίι έάίυία check-state, ι ιδίβιό άñβóέάέ όçί έάόá÷ñέόç όίό όόá άίάν÷ύίάίά έάέ άέόάέάβ όçί άίόβόόίέ÷ç άίΎñάέά δίό όá άόδΰ όçί δάνβδδούόç άβίαέ “skipto 500”. Οί δάέΎοί δñίέέάβóάέ όόίι έάίυία 500, άβίáόάέ ç Ιάόΰόñάόç όçδ άέάγέόίόçδ όίό ίΎού NAT έάέ άδάέάδέάñΰίáόάέ όόί Internet.

Άδύ όçί Ιάñέΰ όύι άεόάν÷ύίάíυí, ύδίεí δάέΎοί ίάίάíυñβέάόάέ ύδ ίΎñό Ιέάδ οδΰñ÷ίόόάδ όόίάάñβáδ, άέΎá÷άόάέ άόδύίáόá άδύ οίι έάίυία check-state έάέ όίόδ άίόβόόίέ÷ίόδ έάίυίαδ divert natd. Οί ίύí δίό ÷ñάέΰάόάέ ίá ίάόέίáόδδβόίόίá άβίαέ ç άδύññέç ύέύí όύí δñίάέçίáόέέΰί δάέΎόύι έάέ ç Ύάέñέόç ίύí όύí δάέΎόύι δίό δñññβέίίόάέ άέα άάέάέñέίΎίáδ όδçñάόβáδ. Άδ όδίέΎόίόίá ύδέ Ύ÷ίόίá Ύία άίόδçñάόçόδΰ apache ι ιδίβιό άέόάέάβóάέ όόί ίç÷Ύίçίá Ιά όί firewall, έάέ άδέέόίγίá όί όιδέέύ site ίá άβίαέ δñίόáΰόέίí άδύ όί άçìύόέί Internet. Ç άεόάν÷ύίáç άβόçόç ίΎάδ όοίάάñβáδ όάέέέΰάέ Ιά οίι έάίυία 100 έάέ ç IP άέάγέόίόç όçδ άίόέόóίέ÷βέάόάέ όόί όιδέέύ IP όίό ίç÷άίΰίáόίδ Ιά όί firewall. Οί δάέΎοί Ύδάέόá άέΎá÷άόάέ άέα ίδίεíáΰδίόá δñύάέçίá ίδñάβ ίá Ύ÷άέ óγίόύίá Ιά όίόδ έάίυίαδ δίό ÷ñçόέίύδίεíγίá, έάέ όάέέέΰ όάέέέΰάέ Ιά οίι έάίυία 425. Óόçί δάνβδδούόç άόδΰ όοίάάβίόί άγί δñΰάίáόá. Ι έάίυίαδ άέα όί δάέΎοί άñΰόάόάέ όόί άοίάίέέυ δβίαέά έάόάόδΰόάυι, άέέΰ άόδΰ όç όίñΰ δάñέíñβέάόάέ ι άñέέίύδ άέόΰόáυι ίΎάδ όοίάάñβáδ άδύ όί όóάέάέñέίΎί IP όá 2. Ιά άόδύ οίι όñύδóι ίδñίγίá ίá άίόίεíγίá όá άδέέΎόάέδ όγδίό ΰñίçόçδ όδçñάόβáδ (DoS) ύόί άóίñΰ όç όóάέάέñέίΎίç έγñά άδέέίεíυίβáδ. Ç άίΎñάέά όίό έάίυία άβίαέ όί allow, έάέ Ύόόέ όί δάέΎοί άδάέάδέάñΰίáόάέ όόί όιδέέύ άβέόδóι. Οί δάέΎοί δίό δάñΰάάόάέ ύδ άδΰίόçόç, άέΎá÷άόάέ άδύ οίι έάίυία check-state, ι ιδίβιό ίάίάíυñβέάέ ύδέ άίΰέάέ όá Ιέα ΰáç άίάñáΰ όοίάάñβá, έάέ άδίοδΎέέάόάέ όόίι έάίυία 500 ύδίό άβίáόάέ ç Ιάόΰόñάόç όçδ άέάγέόίόçδ όίό ίΎού NAT. Οί δάέΎοί όάέέέΰ άδάέάδέάñΰίáόάέ ίΎού όçδ άέάδάδΰδ άίάν÷ñΎíυí.

Όδύάέάειά Έάίυίυí #1:

```
#!/bin/sh
cmd="ipfw -q add"
skip="skipto 500"
pif=r10
ks="keep-state"
good_tcpo="22,25,37,43,53,80,443,110,119"

ipfw -q -f flush

$cmd 002 allow all from any to any via xl0 # exclude LAN traffic
$cmd 003 allow all from any to any via lo0 # exclude loopback traffic

$cmd 100 divert natd ip from any to any in via $pif
$cmd 101 check-state
```

```

# Authorized outbound packets
$cmd 120 $skip udp from any to xx.168.240.2 53 out via $pif $ks
$cmd 121 $skip udp from any to xx.168.240.5 53 out via $pif $ks
$cmd 125 $skip tcp from any to any $good_tcpo out via $pif setup $ks
$cmd 130 $skip icmp from any to any out via $pif $ks
$cmd 135 $skip udp from any to any 123 out via $pif $ks

# Deny all inbound traffic from non-routable reserved address spaces
$cmd 300 deny all from 192.168.0.0/16 to any in via $pif #RFC 1918 private IP
$cmd 301 deny all from 172.16.0.0/12 to any in via $pif #RFC 1918 private IP
$cmd 302 deny all from 10.0.0.0/8 to any in via $pif #RFC 1918 private IP
$cmd 303 deny all from 127.0.0.0/8 to any in via $pif #loopback
$cmd 304 deny all from 0.0.0.0/8 to any in via $pif #loopback
$cmd 305 deny all from 169.254.0.0/16 to any in via $pif #DHCP auto-config
$cmd 306 deny all from 192.0.2.0/24 to any in via $pif #reserved for docs
$cmd 307 deny all from 204.152.64.0/23 to any in via $pif #Sun cluster
$cmd 308 deny all from 224.0.0.0/3 to any in via $pif #Class D & E multicast

# Authorized inbound packets
$cmd 400 allow udp from xx.70.207.54 to any 68 in $ks
$cmd 420 allow tcp from any to me 80 in via $pif setup limit src-addr 1

$cmd 450 deny log ip from any to any

# This is skipto location for outbound stateful rules
$cmd 500 divert natd ip from any to any out via $pif
$cmd 510 allow ip from any to any

##### end of rules #####

Έε δανάεÛòù εάíúíáð áΒίάε ó÷άáúí Βάέρέ íà ôíòð δανάδÛíú, áεεÛ δάνεÝ ÷íοí δάνεóóúòάñá ó÷üεεά áεά íá áìçèÐóíοí
ôíí áñ÷Ûñεí ÷ñÞóòç ôíò IPFW íá εάòáεÛάáε εάέýòáñá ðùð εάέòíòñāýí.

Ïðüāáεáíá Êάíúíúí #2:

#!/bin/sh
##### Start of IPFW rules file #####
# Flush out the list before we begin.
ipfw -q -f flush

# Set rules command prefix
cmd="ipfw -q add"
skip="skipto 800"
pif="rl0" # public interface name of NIC
# facing the public Internet

#####
# No restrictions on Inside LAN Interface for private network
# Change xl0 to your LAN NIC interface name
#####
$cmd 005 allow all from any to any via xl0

```

```
#####
# No restrictions on Loopback Interface
#####
$cmd 010 allow all from any to any via lo0

#####
# check if packet is inbound and nat address if it is
#####
$cmd 014 divert natd ip from any to any in via $pif

#####
# Allow the packet through if it has previous been added to the
# the "dynamic" rules table by a allow keep-state statement.
#####
$cmd 015 check-state

#####
# Interface facing Public Internet (Outbound Section)
# Check session start requests originating from behind the
# firewall on the private network or from this gateway server
# destined for the public Internet.
#####

# Allow out access to my ISP's Domain name server.
# x.x.x.x must be the IP address of your ISP's DNS
# Dup these lines if your ISP has more than one DNS server
# Get the IP addresses from /etc/resolv.conf file
$cmd 020 $skip tcp from any to x.x.x.x 53 out via $pif setup keep-state

# Allow out access to my ISP's DHCP server for cable/DSL configurations.
$cmd 030 $skip udp from any to x.x.x.x 67 out via $pif keep-state

# Allow out non-secure standard www function
$cmd 040 $skip tcp from any to any 80 out via $pif setup keep-state

# Allow out secure www function https over TLS SSL
$cmd 050 $skip tcp from any to any 443 out via $pif setup keep-state

# Allow out send & get email function
$cmd 060 $skip tcp from any to any 25 out via $pif setup keep-state
$cmd 061 $skip tcp from any to any 110 out via $pif setup keep-state

# Allow out FreeBSD (make install & CVSUP) functions
# Basically give user root "GOD" privileges.
$cmd 070 $skip tcp from me to any out via $pif setup keep-state uid root

# Allow out ping
$cmd 080 $skip icmp from any to any out via $pif keep-state

# Allow out Time
$cmd 090 $skip tcp from any to any 37 out via $pif setup keep-state
```

```

# Allow out nntp news (i.e. news groups)
$cmd 100 $skip tcp from any to any 119 out via $pif setup keep-state

# Allow out secure FTP, Telnet, and SCP
# This function is using SSH (secure shell)
$cmd 110 $skip tcp from any to any 22 out via $pif setup keep-state

# Allow out whois
$cmd 120 $skip tcp from any to any 43 out via $pif setup keep-state

# Allow ntp time server
$cmd 130 $skip udp from any to any 123 out via $pif keep-state

#####
# Interface facing Public Internet (Inbound Section)
# Check packets originating from the public Internet
# destined for this gateway server or the private network.
#####

# Deny all inbound traffic from non-routable reserved address spaces
$cmd 300 deny all from 192.168.0.0/16 to any in via $pif #RFC 1918 private IP
$cmd 301 deny all from 172.16.0.0/12 to any in via $pif #RFC 1918 private IP
$cmd 302 deny all from 10.0.0.0/8 to any in via $pif #RFC 1918 private IP
$cmd 303 deny all from 127.0.0.0/8 to any in via $pif #loopback
$cmd 304 deny all from 0.0.0.0/8 to any in via $pif #loopback
$cmd 305 deny all from 169.254.0.0/16 to any in via $pif #DHCP auto-config
$cmd 306 deny all from 192.0.2.0/24 to any in via $pif #reserved for docs
$cmd 307 deny all from 204.152.64.0/23 to any in via $pif #Sun cluster
$cmd 308 deny all from 224.0.0.0/3 to any in via $pif #Class D & E multicast

# Deny ident
$cmd 315 deny tcp from any to any 113 in via $pif

# Deny all Netbios service. 137=name, 138=datagram, 139=session
# Netbios is MS/Windows sharing services.
# Block MS/Windows hosts2 name server requests 81
$cmd 320 deny tcp from any to any 137 in via $pif
$cmd 321 deny tcp from any to any 138 in via $pif
$cmd 322 deny tcp from any to any 139 in via $pif
$cmd 323 deny tcp from any to any 81 in via $pif

# Deny any late arriving packets
$cmd 330 deny all from any to any frag in via $pif

# Deny ACK packets that did not match the dynamic rule table
$cmd 332 deny tcp from any to any established in via $pif

# Allow traffic in from ISP's DHCP server. This rule must contain
# the IP address of your ISP's DHCP server as it's the only
# authorized source to send this packet type.
# Only necessary for cable or DSL configurations.
# This rule is not needed for 'user ppp' type connection to
# the public Internet. This is the same IP address you captured

```

```

# and used in the outbound section.
$cmd 360 allow udp from x.x.x.x to any 68 in via $pif keep-state

# Allow in standard www function because I have Apache server
$cmd 370 allow tcp from any to me 80 in via $pif setup limit src-addr 2

# Allow in secure FTP, Telnet, and SCP from public Internet
$cmd 380 allow tcp from any to me 22 in via $pif setup limit src-addr 2

# Allow in non-secure Telnet session from public Internet
# labeled non-secure because ID & PW are passed over public
# Internet as clear text.
# Delete this sample group if you do not have telnet server enabled.
$cmd 390 allow tcp from any to me 23 in via $pif setup limit src-addr 2

# Reject & Log all unauthorized incoming connections from the public Internet
$cmd 400 deny log all from any to any in via $pif

# Reject & Log all unauthorized out going connections to the public Internet
$cmd 450 deny log all from any to any out via $pif

# This is skipto location for outbound stateful rules
$cmd 800 divert natd ip from any to any out via $pif
$cmd 801 allow ip from any to any

# Everything else is denied by default
# deny and log all packets that fell through to see what they are
$cmd 999 deny log all from any to any
##### End of IPFW rules file #####

```

Εἰσαγωγή 32

Θῆμι: ὑπὸ ἰσχύος Ἐξιστοῦ Ἀεικίνητος

32.1 Ὁμολογία

Ὁι εἰσαγωγὴ ἀδού ἐκείνη δὴ δῆμι: ὑπὸ ἰσχύος Ἐξιστοῦ ἀεικίνητος.

Ἀπὸ ἐκείνη ἀδού ὁι εἰσαγωγὴ, ἐὰ ἰσχύος:

- Ὁ ἀεικίνητος οὐ δὴ δῆμι (gateways) ἐκείνη οὐ ἀεικίνητος (routes).
- Δὴ ἰσχύος Ἐξιστοῦ IEEE 802.11 ἐκείνη Bluetooth.
- Δὴ ἰσχύος Ἐξιστοῦ ὁι FreeBSD ἰσχύος ἰσχύος (bridge).
- Δὴ ἰσχύος Ἐξιστοῦ ἀεικίνητος ἀδού ὁι ἀεικίνητος ὁ ἰσχύος ἰσχύος: Ἐξιστοῦ ὑπὸ ἰσχύος ἀεικίνητος.
- Δὴ ἰσχύος Ἐξιστοῦ ἰσχύος ἰσχύος ἀεικίνητος ἀεικίνητος (NAT).
- Δὴ ἰσχύος Ἐξιστοῦ ἀεικίνητος ἰσχύος ἰσχύος PLIP.
- Δὴ ἰσχύος Ἐξιστοῦ ὁι IPv6 ὁ ἰσχύος ἰσχύος FreeBSD.
- Δὴ ἰσχύος Ἐξιστοῦ ὁι ATM.
- Δὴ ἰσχύος Ἐξιστοῦ ἐκείνη ἰσχύος ἰσχύος ἰσχύος ἰσχύος CARP (Common Access Redundancy Protocol) ὁι FreeBSD.

Δῆμι ἐκείνη ἀδού ὁι εἰσαγωγὴ, ἐὰ δῆμι:

- ἰσχύος ἰσχύος ὁ ἰσχύος ἰσχύος ἰσχύος ἰσχύος script /etc/rc.
- ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος.
- ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος FreeBSD (Εἰσαγωγή 9).
- ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος (Εἰσαγωγή 5).

32.2 Gateways and Routes

For one machine to be able to find another over a network, there must be a mechanism in place to describe how to get from one to the other. This is called *routing*. A “route” is a defined pair of addresses: a “destination” and a “gateway”. The pair indicates that if you are trying to get to this *destination*, communicate through this *gateway*. There are three types of destinations: individual hosts, subnets, and “default”. The “default route” is used if none of the other routes apply. We will talk a little bit more about default routes later on. There are also three types of gateways: individual hosts, interfaces (also called “links”), and Ethernet hardware addresses (MAC addresses).

32.2.1 An Example

To illustrate different aspects of routing, we will use the following example from `netstat`:

```
% netstat -r
Routing tables

Destination      Gateway          Flags    Refs     Use    Netif  Expire
default          outside-gw      UGSc    37       418    ppp0
localhost        localhost      UH       0        181    lo0
test0            0:e0:b5:36:cf:4f UHLW    5       63288  ed0    77
10.20.30.255     link#1         UHLW    1        2421
example.com      link#1         UC       0         0
host1            0:e0:a8:37:8:1e UHLW    3       4601    lo0
host2            0:e0:a8:37:8:1e UHLW    0         5       lo0 =>
host2.example.com link#1         UC       0         0
224              link#1         UC       0         0
```

The first two lines specify the default route (which we will cover in the next section) and the `localhost` route.

The interface (`Netif` column) that this routing table specifies to use for `localhost` is `lo0`, also known as the loopback device. This says to keep all traffic for this destination internal, rather than sending it out over the LAN, since it will only end up back where it started.

The next thing that stands out are the addresses beginning with `0:e0:`. These are Ethernet hardware addresses, which are also known as MAC addresses. FreeBSD will automatically identify any hosts (`test0` in the example) on the local Ethernet and add a route for that host, directly to it over the Ethernet interface, `ed0`. There is also a timeout (`Expire` column) associated with this type of route, which is used if we fail to hear from the host in a specific amount of time. When this happens, the route to this host will be automatically deleted. These hosts are identified using a mechanism known as RIP (Routing Information Protocol), which figures out routes to local hosts based upon a shortest path determination.

FreeBSD will also add subnet routes for the local subnet (`10.20.30.255` is the broadcast address for the subnet `10.20.30`, and `example.com` is the domain name associated with that subnet). The designation `link#1` refers to the first Ethernet card in the machine. You will notice no additional interface is specified for those.

Both of these groups (local network hosts and local subnets) have their routes automatically configured by a daemon called **routed**. If this is not run, then only routes which are statically defined (i.e. entered explicitly) will exist.

The `host1` line refers to our host, which it knows by Ethernet address. Since we are the sending host, FreeBSD knows to use the loopback interface (`lo0`) rather than sending it out over the Ethernet interface.

The two `host2` lines are an example of what happens when we use an `ifconfig(8)` alias (see the section on Ethernet for reasons why we would do this). The `=>` symbol after the `lo0` interface says that not only are we using the loopback (since this address also refers to the local host), but specifically it is an alias. Such routes only show up on the host that supports the alias; all other hosts on the local network will simply have a `link#1` line for such routes.

The final line (destination subnet `224`) deals with multicasting, which will be covered in another section.

Finally, various attributes of each route can be seen in the `Flags` column. Below is a short table of some of these flags and their meanings:

- U Up: The route is active.
- H Host: The route destination is a single host.

- G Gateway: Send anything for this destination on to this remote system, which will figure out from there where to send it.
- S Static: This route was configured manually, not automatically generated by the system.
- C Clone: Generates a new route based upon this route for machines we connect to. This type of route is normally used for local networks.
- W WasCloned: Indicated a route that was auto-configured based upon a local area network (Clone) route.
- L Link: Route involves references to Ethernet hardware.

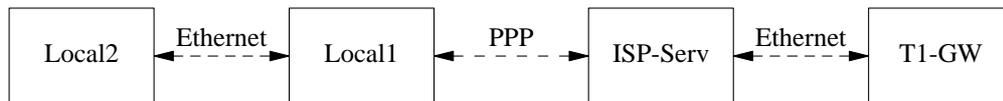
32.2.2 Default Routes

When the local system needs to make a connection to a remote host, it checks the routing table to determine if a known path exists. If the remote host falls into a subnet that we know how to reach (Cloned routes), then the system checks to see if it can connect along that interface.

If all known paths fail, the system has one last option: the “default” route. This route is a special type of gateway route (usually the only one present in the system), and is always marked with a `c` in the flags field. For hosts on a local area network, this gateway is set to whatever machine has a direct connection to the outside world (whether via PPP link, DSL, cable modem, T1, or another network interface).

If you are configuring the default route for a machine which itself is functioning as the gateway to the outside world, then the default route will be the gateway machine at your Internet Service Provider’s (ISP) site.

Let us look at an example of default routes. This is a common configuration:



The hosts `Local1` and `Local2` are at your site. `Local1` is connected to an ISP via a dial up PPP connection. This PPP server computer is connected through a local area network to another gateway computer through an external interface to the ISP’s Internet feed.

The default routes for each of your machines will be:

Host	Default Gateway	Interface
<code>Local2</code>	<code>Local1</code>	Ethernet
<code>Local1</code>	<code>T1-GW</code>	PPP

A common question is “Why (or how) would we set the `T1-GW` to be the default gateway for `Local1`, rather than the ISP server it is connected to?”.

Remember, since the PPP interface is using an address on the ISP’s local network for your side of the connection, routes for any other machines on the ISP’s local network will be automatically generated. Hence, you will already know how to reach the `T1-GW` machine, so there is no need for the intermediate step of sending traffic to the ISP server.

It is common to use the address `x.x.x.1` as the gateway address for your local network. So (using the same example), if your local class-C address space was `10.20.30` and your ISP was using `10.9.9` then the default routes

would be:

Host	Default Route
Local2 (10.20.30.2)	Local1 (10.20.30.1)
Local1 (10.20.30.1, 10.9.9.30)	T1-GW (10.9.9.1)

You can easily define the default route via the `/etc/rc.conf` file. In our example, on the `Local2` machine, we added the following line in `/etc/rc.conf`:

```
defaultrouter="10.20.30.1"
```

It is also possible to do it directly from the command line with the `route(8)` command:

```
# route add default 10.20.30.1
```

For more information on manual manipulation of network routing tables, consult `route(8)` manual page.

32.2.3 Dual Homed Hosts

There is one other type of configuration that we should cover, and that is a host that sits on two different networks. Technically, any machine functioning as a gateway (in the example above, using a PPP connection) counts as a dual-homed host. But the term is really only used to refer to a machine that sits on two local-area networks.

In one case, the machine has two Ethernet cards, each having an address on the separate subnets. Alternately, the machine may only have one Ethernet card, and be using `ifconfig(8)` aliasing. The former is used if two physically separate Ethernet networks are in use, the latter if there is one physical network segment, but two logically separate subnets.

Either way, routing tables are set up so that each subnet knows that this machine is the defined gateway (inbound route) to the other subnet. This configuration, with the machine acting as a router between the two subnets, is often used when we need to implement packet filtering or firewall security in either or both directions.

If you want this machine to actually forward packets between the two interfaces, you need to tell FreeBSD to enable this ability. See the next section for more details on how to do this.

32.2.4 Building a Router

A network router is simply a system that forwards packets from one interface to another. Internet standards and good engineering practice prevent the FreeBSD Project from enabling this by default in FreeBSD. You can enable this feature by changing the following variable to `YES` in `rc.conf(5)`:

```
gateway_enable=YES          # Set to YES if this host will be a gateway
```

This option will set the `sysctl(8)` variable `net.inet.ip.forwarding` to 1. If you should need to stop routing temporarily, you can reset this to 0 temporarily.

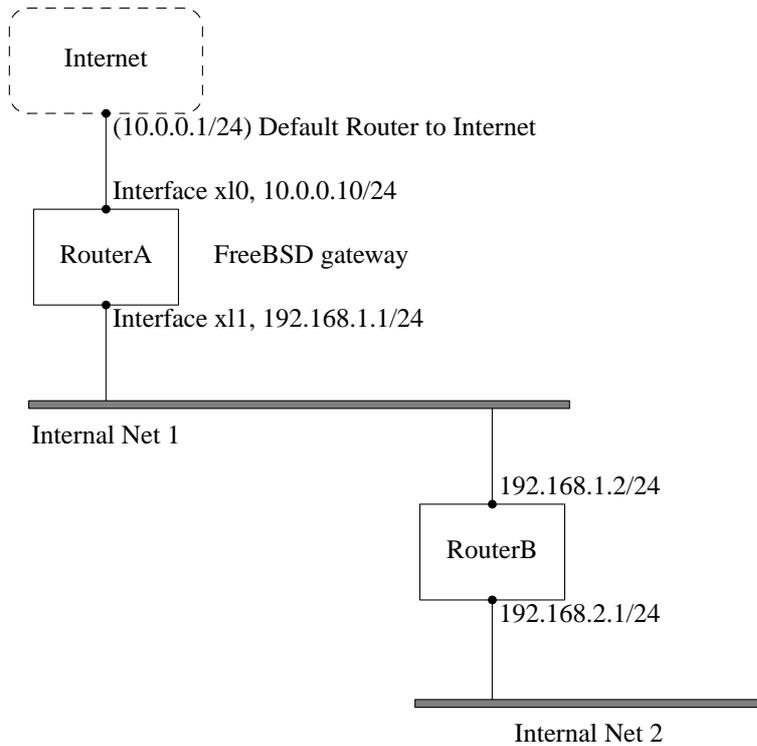
Your new router will need routes to know where to send the traffic. If your network is simple enough you can use static routes. FreeBSD also comes with the standard BSD routing daemon `routed(8)`, which speaks RIP (both version 1 and version 2) and IRDP. Support for BGP v4, OSPF v2, and other sophisticated routing protocols is available with

the `net/zebra` package. Commercial products such as **GateD**® are also available for more complex network routing solutions.

32.2.5 Setting Up Static Routes

32.2.5.1 Manual Configuration

Let us assume we have a network as follows:



In this scenario, RouterA is our FreeBSD machine that is acting as a router to the rest of the Internet. It has a default route set to `10.0.0.1` which allows it to connect with the outside world. We will assume that RouterB is already configured properly and knows how to get wherever it needs to go. (This is simple in this picture. Just add a default route on RouterB using `192.168.1.1` as the gateway.)

If we look at the routing table for RouterA we would see something like the following:

```
% netstat -nr
Routing tables

Internet:
Destination      Gateway          Flags    Refs      Use    Netif    Expire
default          10.0.0.1        UGS      0         49378  x10
127.0.0.1       127.0.0.1      UH        0          6     lo0
10.0.0/24       link#1         UC        0          0     x10
192.168.1/24    link#2         UC        0          0     x11
```

With the current routing table RouterA will not be able to reach our Internal Net 2. It does not have a route for 192.168.2.0/24. One way to alleviate this is to manually add the route. The following command would add the Internal Net 2 network to RouterA's routing table using 192.168.1.2 as the next hop:

```
# route add -net 192.168.2.0/24 192.168.1.2
```

Now RouterA can reach any hosts on the 192.168.2.0/24 network.

32.2.5.2 Persistent Configuration

The above example is perfect for configuring a static route on a running system. However, one problem is that the routing information will not persist if you reboot your FreeBSD machine. The way to handle the addition of a static route is to put it in your `/etc/rc.conf` file:

```
# Add Internal Net 2 as a static route
static_routes="internalnet2"
route_internalnet2="-net 192.168.2.0/24 192.168.1.2"
```

The `static_routes` configuration variable is a list of strings separated by a space. Each string references to a route name. In our above example we only have one string in `static_routes`. This string is `internalnet2`. We then add a configuration variable called `route_internalnet2` where we put all of the configuration parameters we would give to the `route(8)` command. For our example above we would have used the command:

```
# route add -net 192.168.2.0/24 192.168.1.2
```

so we need `"-net 192.168.2.0/24 192.168.1.2"`.

As said above, we can have more than one string in `static_routes`. This allows us to create multiple static routes. The following lines shows an example of adding static routes for the 192.168.0.0/24 and 192.168.1.0/24 networks on an imaginary router:

```
static_routes="net1 net2"
route_net1="-net 192.168.0.0/24 192.168.0.1"
route_net2="-net 192.168.1.0/24 192.168.1.1"
```

32.2.6 Routing Propagation

We have already talked about how we define our routes to the outside world, but not about how the outside world finds us.

We already know that routing tables can be set up so that all traffic for a particular address space (in our examples, a class-C subnet) can be sent to a particular host on that network, which will forward the packets inbound.

When you get an address space assigned to your site, your service provider will set up their routing tables so that all traffic for your subnet will be sent down your PPP link to your site. But how do sites across the country know to send to your ISP?

There is a system (much like the distributed DNS information) that keeps track of all assigned address-spaces, and defines their point of connection to the Internet Backbone. The "Backbone" are the main trunk lines that carry Internet traffic across the country, and around the world. Each backbone machine has a copy of a master set of tables,

which direct traffic for a particular network to a specific backbone carrier, and from there down the chain of service providers until it reaches your network.

It is the task of your service provider to advertise to the backbone sites that they are the point of connection (and thus the path inward) for your site. This is known as route propagation.

32.2.7 Troubleshooting

Sometimes, there is a problem with routing propagation, and some sites are unable to connect to you. Perhaps the most useful command for trying to figure out where routing is breaking down is the `traceroute(8)` command. It is equally useful if you cannot seem to make a connection to a remote machine (i.e. `ping(8)` fails).

The `traceroute(8)` command is run with the name of the remote host you are trying to connect to. It will show the gateway hosts along the path of the attempt, eventually either reaching the target host, or terminating because of a lack of connection.

For more information, see the manual page for `traceroute(8)`.

32.2.8 Multicast Routing

FreeBSD supports both multicast applications and multicast routing natively. Multicast applications do not require any special configuration of FreeBSD; applications will generally run out of the box. Multicast routing requires that support be compiled into the kernel:

```
options MROUTING
```

In addition, the multicast routing daemon, `mrouted(8)` must be configured to set up tunnels and DVMRP via `/etc/mrouted.conf`. More details on multicast configuration may be found in the manual page for `mrouted(8)`.

32.3 Wireless Networking

32.3.1 Wireless Networking Basics

Most wireless networks are based on the IEEE 802.11 standards. A basic wireless network consists of multiple stations communicating with radios that broadcast in either the 2.4GHz or 5GHz band (though this varies according to the locale and is also changing to enable communication in the 2.3GHz and 4.9GHz ranges).

802.11 networks are organized in two ways: in *infrastructure mode* one station acts as a master with all the other stations associating to it; the network is known as a BSS and the master station is termed an access point (AP). In a BSS all communication passes through the AP; even when one station wants to communicate with another wireless station messages must go through the AP. In the second form of network there is no master and stations communicate directly. This form of network is termed an IBSS and is commonly known as an *ad-hoc network*.

802.11 networks were first deployed in the 2.4GHz band using protocols defined by the IEEE 802.11 and 802.11b standard. These specifications include the operating frequencies, MAC layer characteristics including framing and transmission rates (communication can be done at various rates). Later the 802.11a standard defined operation in the 5GHz band, including different signalling mechanisms and higher transmission rates. Still later the 802.11g standard

was defined to enable use of 802.11a signalling and transmission mechanisms in the 2.4GHz band in such a way as to be backwards compatible with 802.11b networks.

Separate from the underlying transmission techniques 802.11 networks have a variety of security mechanisms. The original 802.11 specifications defined a simple security protocol called WEP. This protocol uses a fixed pre-shared key and the RC4 cryptographic cipher to encode data transmitted on a network. Stations must all agree on the fixed key in order to communicate. This scheme was shown to be easily broken and is now rarely used except to discourage transient users from joining networks. Current security practice is given by the IEEE 802.11i specification that defines new cryptographic ciphers and an additional protocol to authenticate stations to an access point and exchange keys for doing data communication. Further, cryptographic keys are periodically refreshed and there are mechanisms for detecting intrusion attempts (and for countering intrusion attempts). Another security protocol specification commonly used in wireless networks is termed WPA. This was a precursor to 802.11i defined by an industry group as an interim measure while waiting for 802.11i to be ratified. WPA specifies a subset of the requirements found in 802.11i and is designed for implementation on legacy hardware. Specifically WPA requires only the TKIP cipher that is derived from the original WEP cipher. 802.11i permits use of TKIP but also requires support for a stronger cipher, AES-CCM, for encrypting data. (The AES cipher was not required in WPA because it was deemed too computationally costly to be implemented on legacy hardware.)

Other than the above protocol standards the other important standard to be aware of is 802.11e. This defines protocols for deploying multi-media applications such as streaming video and voice over IP (VoIP) in an 802.11 network. Like 802.11i, 802.11e also has a precursor specification termed WME (later renamed WMM) that has been defined by an industry group as a subset of 802.11e that can be deployed now to enable multi-media applications while waiting for the final ratification of 802.11e. The most important thing to know about 802.11e and WME/WMM is that it enables prioritized traffic use of a wireless network through Quality of Service (QoS) protocols and enhanced media access protocols. Proper implementation of these protocols enable high speed bursting of data and prioritized traffic flow.

Since the 6.0 version, FreeBSD supports networks that operate using 802.11a, 802.11b, and 802.11g. The WPA and 802.11i security protocols are likewise supported (in conjunction with any of 11a, 11b, and 11g) and QoS and traffic prioritization required by the WME/WMM protocols are supported for a limited set of wireless devices.

32.3.2 Basic Setup

32.3.2.1 Kernel Configuration

To use wireless networking you need a wireless networking card and to configure the kernel with the appropriate wireless networking support. The latter is separated into multiple modules so that you only need to configure the software you are actually going to use.

The first thing you need is a wireless device. The most commonly used devices are those that use parts made by Atheros. These devices are supported by the ath(4) driver and require the following line to be added to the `/boot/loader.conf` file:

```
if_ath_load="YES"
```

The Atheros driver is split up into three separate pieces: the driver proper (ath(4)), the hardware support layer that handles chip-specific functions (ath_hal(4)), and an algorithm for selecting which of several possible rates for transmitting frames (ath_rate_sample here). When you load this support as modules these dependencies are automatically handled for you. If instead of an Atheros device you had another device you would select the module for that device; e.g.:

```
if_wi_load="YES"
```

for devices based on the Intersil Prism parts (wi(4) driver).

Ὁδηγίες: In the rest of this document, we will use an ath(4) device, the device name in the examples must be changed according to your configuration. A list of available wireless drivers can be found at the beginning of the wlan(4) manual page. If a native FreeBSD driver for your wireless device does not exist, it may be possible to directly use the Windows driver with the help of the NDIS driver wrapper.

With a device driver configured you need to also bring in the 802.11 networking support required by the driver. For the ath(4) driver this is at least the wlan(4) module; this module is automatically loaded with the wireless device driver. With that you will need the modules that implement cryptographic support for the security protocols you intend to use. These are intended to be dynamically loaded on demand by the wlan(4) module but for now they must be manually configured. The following modules are available: wlan_wep(4), wlan_ccmp(4) and wlan_tkip(4). Both wlan_ccmp(4) and wlan_tkip(4) drivers are only needed if you intend to use the WPA and/or 802.11i security protocols. If your network is to run totally open (i.e., with no encryption) then you do not even need the wlan_wep(4) support. To load these modules at boot time, add the following lines to `/boot/loader.conf`:

```
wlan_wep_load="YES"
wlan_ccmp_load="YES"
wlan_tkip_load="YES"
```

With this information in the system bootstrap configuration file (i.e., `/boot/loader.conf`), you have to reboot your FreeBSD box. If you do not want to reboot your machine for the moment, you can just load the modules by hand using `kldload(8)`.

Ὁδηγίες: If you do not want to use modules, it is possible to compile these drivers into the kernel by adding the following lines to your kernel configuration file:

```
device ath          # Atheros IEEE 802.11 wireless network driver
device ath_hal      # Atheros Hardware Access Layer
device ath_rate_sample # John Bicket's SampleRate control algorithm.
device wlan         # 802.11 support (Required)
device wlan_wep     # WEP crypto support for 802.11 devices
device wlan_ccmp    # AES-CCMP crypto support for 802.11 devices
device wlan_tkip    # TKIP and Michael crypto support for 802.11 devices
```

With this information in the kernel configuration file, recompile the kernel and reboot your FreeBSD machine.

When the system is up, we could find some information about the wireless device in the boot messages, like this:

```
ath0: <Atheros 5212> mem 0xff9f0000-0xff9ffffff irq 17 at device 2.0 on pci2
ath0: Ethernet address: 00:11:95:d5:43:62
ath0: mac 7.9 phy 4.5 radio 5.6
```

32.3.3 Infrastructure Mode

The infrastructure mode or BSS mode is the mode that is typically used. In this mode, a number of wireless access points are connected to a wired network. Each wireless network has its own name, this name is called the SSID of the network. Wireless clients connect to the wireless access points.

32.3.3.1 FreeBSD Clients

32.3.3.1.1 How to Find Access Points

To scan for networks, use the `ifconfig` command. This request may take a few moments to complete as it requires that the system switches to each available wireless frequency and probes for available access points. Only the super-user can initiate such a scan:

```
# ifconfig ath0 up scan
SSID          BSSID          CHAN RATE  S:N  INT CAPS
dlinkap       00:13:46:49:41:76   6   54M 29:0  100 EPS WPA WME
freebsdap     00:11:95:c3:0d:ac   1   54M 22:0  100 EPS WPA
```

Όχι!Βύθος: You must mark the interface `up` before you can scan. Subsequent scan requests do not require you to mark the interface up again.

The output of a scan request lists each BSS/IBSS network found. Beside the name of the network, `SSID`, we find the `BSSID` which is the MAC address of the access point. The `CAPS` field identifies the type of each network and the capabilities of the stations operating there:

E

Extended Service Set (ESS). Indicates that the station is part of an infrastructure network (in contrast to an IBSS/ad-hoc network).

I

IBSS/ad-hoc network. Indicates that the station is part of an ad-hoc network (in contrast to an ESS network).

P

Privacy. Data confidentiality is required for all data frames exchanged within the BSS. This means that this BSS requires the station to use cryptographic means such as WEP, TKIP or AES-CCMP to encrypt/decrypt data frames being exchanged with others.

S

Short Preamble. Indicates that the network is using short preambles (defined in 802.11b High Rate/DSSS PHY, short preamble utilizes a 56 bit sync field in contrast to a 128 bit field used in long preamble mode).

s

Short slot time. Indicates that the 802.11g network is using a short slot time because there are no legacy (802.11b) stations present.

One can also display the current list of known networks with:

```
# ifconfig ath0 list scan
```

This information may be updated automatically by the adapter or manually with a `scan` request. Old data is automatically removed from the cache, so over time this list may shrink unless more scans are done.

32.3.3.1.2 Basic Settings

This section provides a simple example of how to make the wireless network adapter work in FreeBSD without encryption. After you are familiar with these concepts, we strongly recommend using WPA to set up your wireless network.

There are three basic steps to configure a wireless network: selecting an access point, authenticating your station, and configuring an IP address. The following sections discuss each step.

32.3.3.1.2.1 Selecting an Access Point

Most of time it is sufficient to let the system choose an access point using the builtin heuristics. This is the default behaviour when you mark an interface up or otherwise configure an interface by listing it in `/etc/rc.conf`, e.g.:

```
ifconfig_ath0="DHCP"
```

If there are multiple access points and you want to select a specific one, you can select it by its SSID:

```
ifconfig_ath0="ssid your_ssid_here DHCP"
```

In an environment where there are multiple access points with the same SSID (often done to simplify roaming) it may be necessary to associate to one specific device. In this case you can also specify the BSSID of the access point (you can also leave off the SSID):

```
ifconfig_ath0="ssid your_ssid_here bssid xx:xx:xx:xx:xx:xx DHCP"
```

There are other ways to constrain the choice of an access point such as limiting the set of frequencies the system will scan on. This may be useful if you have a multi-band wireless card as scanning all the possible channels can be time-consuming. To limit operation to a specific band you can use the `mode` parameter; e.g.:

```
ifconfig_ath0="mode 11g ssid your_ssid_here DHCP"
```

will force the card to operate in 802.11g which is defined only for 2.4GHz frequencies so any 5GHz channels will not be considered. Other ways to do this are the `channel` parameter, to lock operation to one specific frequency, and the `chanlist` parameter, to specify a list of channels for scanning. More information about these parameters can be found in the `ifconfig(8)` manual page.

32.3.3.1.2.2 Authentication

Once you have selected an access point your station needs to authenticate before it can pass data. Authentication can happen in several ways. The most common scheme used is termed open authentication and allows any station to join the network and communicate. This is the authentication you should use for test purpose the first time you set up a wireless network. Other schemes require cryptographic handshakes be completed before data traffic can flow; either using pre-shared keys or secrets, or more complex schemes that involve backend services such as RADIUS. Most

users will use open authentication which is the default setting. Next most common setup is WPA-PSK, also known as WPA Personal, which is described below.

Όχι! Βούλο: If you have an Apple AirPort® Extreme base station for an access point you may need to configure shared-key authentication together with a WEP key. This can be done in the `/etc/rc.conf` file or using the `wpa_supplicant(8)` program. If you have a single AirPort base station you can setup access with something like:

```
ifconfig_ath0="authmode shared wepmode on weptxkey 1 wepkey 01234567 DHCP"
```

In general shared key authentication is to be avoided because it uses the WEP key material in a highly-constrained manner making it even easier to crack the key. If WEP must be used (e.g., for compatibility with legacy devices) it is better to use WEP with `open` authentication. More information regarding WEP can be found in the Ὁδηγία 32.3.3.1.4.

32.3.3.1.2.3 Getting an IP Address with DHCP

Once you have selected an access point and set the authentication parameters, you will have to get an IP address to communicate. Most of time you will obtain your wireless IP address via DHCP. To achieve that, simply edit `/etc/rc.conf` and add `DHCP` to the configuration for your device as shown in various examples above:

```
ifconfig_ath0="DHCP"
```

At this point, you are ready to bring up the wireless interface:

```
# /etc/rc.d/netif start
```

Once the interface is running, use `ifconfig` to see the status of the interface `ath0`:

```
# ifconfig ath0
ath0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    inet6 fe80::211:95ff:fed5:4362%ath0 prefixlen 64 scopeid 0x1
    inet 192.168.1.100 netmask 0xffffffff broadcast 192.168.1.255
    ether 00:11:95:d5:43:62
    media: IEEE 802.11 Wireless Ethernet autoselect (OFDM/54Mbps)
    status: associated
    ssid dlinkap channel 6 bssid 00:13:46:49:41:76
    authmode OPEN privacy OFF txpowmax 36 protmode CTS bintval 100
```

The `status: associated` means you are connected to the wireless network (to the `dlinkap` network in our case). The `bssid 00:13:46:49:41:76` part is the MAC address of your access point; the `authmode` line informs you that the communication is not encrypted (`OPEN`).

32.3.3.1.2.4 Static IP Address

In the case you cannot obtain an IP address from a DHCP server, you can set a fixed IP address. Replace the `DHCP` keyword shown above with the address information. Be sure to retain any other parameters you have set up for selecting an access point:

```
ifconfig_ath0="inet 192.168.1.100 netmask 255.255.255.0 ssid your_ssid_here"
```

32.3.3.1.3 WPA

WPA (Wi-Fi Protected Access) is a security protocol used together with 802.11 networks to address the lack of proper authentication and the weakness of WEP. WPA leverages the 802.1X authentication protocol and uses one of several ciphers instead of WEP for data integrity. The only cipher required by WPA is TKIP (Temporary Key Integrity Protocol) which is a cipher that extends the basic RC4 cipher used by WEP by adding integrity checking, tamper detection, and measures for responding to any detected intrusions. TKIP is designed to work on legacy hardware with only software modification; it represents a compromise that improves security but is still not entirely immune to attack. WPA also specifies the AES-CCMP cipher as an alternative to TKIP and that is preferred when possible; for this specification the term WPA2 (or RSN) is commonly used.

WPA defines authentication and encryption protocols. Authentication is most commonly done using one of two techniques: by 802.1X and a backend authentication service such as RADIUS, or by a minimal handshake between the station and the access point using a pre-shared secret. The former is commonly termed WPA Enterprise with the latter known as WPA Personal. Since most people will not set up a RADIUS backend server for wireless network, WPA-PSK is by far the most commonly encountered configuration for WPA.

The control of the wireless connection and the authentication (key negotiation or authentication with a server) is done with the `wpa_supplicant(8)` utility. This program requires a configuration file, `/etc/wpa_supplicant.conf`, to run. More information regarding this file can be found in the `wpa_supplicant.conf(5)` manual page.

32.3.3.1.3.1 WPA-PSK

WPA-PSK also known as WPA-Personal is based on a pre-shared key (PSK) generated from a given password and that will be used as the master key in the wireless network. This means every wireless user will share the same key. WPA-PSK is intended for small networks where the use of an authentication server is not possible or desired.

Διεύθυνση Ἑξέλιξης Ἀξιοποιήσιμων Ἐπιχειρηματιῶν: Always use strong passwords that are sufficiently long and made from a rich alphabet so they will not be guessed and/or attacked.

The first step is the configuration of the `/etc/wpa_supplicant.conf` file with the SSID and the pre-shared key of your network:

```
network={
    ssid="freebsdap"
    psk="freebsdmail"
}
```

Then, in `/etc/rc.conf`, we indicate that the wireless device configuration will be done with WPA and the IP address will be obtained with DHCP:

```
ifconfig_ath0="WPA DHCP"
```

Then, we can bring up the interface:

```
# /etc/rc.d/netif start
Starting wpa_supplicant.
DHCPDISCOVER on ath0 to 255.255.255.255 port 67 interval 5
DHCPDISCOVER on ath0 to 255.255.255.255 port 67 interval 6
DHCPOFFER from 192.168.0.1
DHCPREQUEST on ath0 to 255.255.255.255 port 67
```

```
DHCPACK from 192.168.0.1
bound to 192.168.0.254 -- renewal in 300 seconds.
ath0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
inet6 fe80::211:95ff:fed5:4362%ath0 prefixlen 64 scopeid 0x1
inet 192.168.0.254 netmask 0xffffffff00 broadcast 192.168.0.255
ether 00:11:95:d5:43:62
media: IEEE 802.11 Wireless Ethernet autoselect (OFDM/36Mbps)
status: associated
ssid freebsdap channel 1 bssid 00:11:95:c3:0d:ac
authmode WPA privacy ON deftxkey UNDEF TKIP 2:128-bit txpowmax 36
protmode CTS roaming MANUAL bintval 100
```

Or you can try to configure it manually using the same `/etc/wpa_supplicant.conf` above, and run:

```
# wpa_supplicant -i ath0 -c /etc/wpa_supplicant.conf
Trying to associate with 00:11:95:c3:0d:ac (SSID='freebsdap' freq=2412 MHz)
Associated with 00:11:95:c3:0d:ac
WPA: Key negotiation completed with 00:11:95:c3:0d:ac [PTK=TKIP GTK=TKIP]
```

The next operation is the launch of the `dhclient` command to get the IP address from the DHCP server:

```
# dhclient ath0
DHCPREQUEST on ath0 to 255.255.255.255 port 67
DHCPACK from 192.168.0.1
bound to 192.168.0.254 -- renewal in 300 seconds.
# ifconfig ath0
ath0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
inet6 fe80::211:95ff:fed5:4362%ath0 prefixlen 64 scopeid 0x1
inet 192.168.0.254 netmask 0xffffffff00 broadcast 192.168.0.255
ether 00:11:95:d5:43:62
media: IEEE 802.11 Wireless Ethernet autoselect (OFDM/48Mbps)
status: associated
ssid freebsdap channel 1 bssid 00:11:95:c3:0d:ac
authmode WPA privacy ON deftxkey UNDEF TKIP 2:128-bit txpowmax 36
protmode CTS roaming MANUAL bintval 100
```

Όçìáßùóç: If the `/etc/rc.conf` is set up with the line `ifconfig_ath0="DHCP"` then it is no need to run the `dhclient` command manually, `dhclient` will be launched after `wpa_supplicant` plumbs the keys.

In the case where the use of DHCP is not possible, you can set a static IP address after `wpa_supplicant` has authenticated the station:

```
# ifconfig ath0 inet 192.168.0.100 netmask 255.255.255.0
# ifconfig ath0
ath0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
inet6 fe80::211:95ff:fed5:4362%ath0 prefixlen 64 scopeid 0x1
inet 192.168.0.100 netmask 0xffffffff00 broadcast 192.168.0.255
ether 00:11:95:d5:43:62
media: IEEE 802.11 Wireless Ethernet autoselect (OFDM/36Mbps)
status: associated
ssid freebsdap channel 1 bssid 00:11:95:c3:0d:ac
```

```
authmode WPA privacy ON deftxkey UNDEF TKIP 2:128-bit txpowmax 36
protmode CTS roaming MANUAL bintval 100
```

When DHCP is not used, you also have to manually set up the default gateway and the nameserver:

```
# route add default your_default_router
# echo "nameserver your_DNS_server" >> /etc/resolv.conf
```

32.3.3.1.3.2 WPA with EAP-TLS

The second way to use WPA is with an 802.1X backend authentication server, in this case WPA is called WPA-Enterprise to make difference with the less secure WPA-Personal with its pre-shared key. The authentication in WPA-Enterprise is based on EAP (Extensible Authentication Protocol).

EAP does not come with an encryption method, it was decided to embed EAP inside an encrypted tunnel. Many types of EAP authentication methods have been designed, the most common methods are EAP-TLS, EAP-TTLS and EAP-PEAP.

EAP-TLS (EAP with Transport Layer Security) is a very well-supported authentication protocol in the wireless world since it was the first EAP method to be certified by the Wi-Fi alliance (<http://www.wi-fi.org/>). EAP-TLS will require three certificates to run: the CA certificate (installed on all machines), the server certificate for your authentication server, and one client certificate for each wireless client. In this EAP method, both authentication server and wireless client authenticate each other in presenting their respective certificates, and they verify that these certificates were signed by your organization's certificate authority (CA).

As previously, the configuration is done via `/etc/wpa_supplicant.conf`:

```
network={
  ssid="freebsdap" ❶
  proto=RSN ❷
  key_mgmt=WPA-EAP ❸
  eap=TLS ❹
  identity="loader" ❺
  ca_cert="/etc/certs/cacert.pem" ❻
  client_cert="/etc/certs/clientcert.pem" ❼
  private_key="/etc/certs/clientkey.pem" ❽
  private_key_passwd="freebsdmailclient" ❾
}
```

- ❶ This field indicates the network name (SSID).
- ❷ Here, we use RSN (IEEE 802.11i) protocol, i.e., WPA2.
- ❸ The `key_mgmt` line refers to the key management protocol we use. In our case it is WPA using EAP authentication: `WPA-EAP`.
- ❹ In this field, we mention the EAP method for our connection.
- ❺ The `identity` field contains the identity string for EAP.
- ❻ The `ca_cert` field indicates the pathname of the CA certificate file. This file is needed to verify the server certificat.

- ⑦ The `client_cert` line gives the pathname to the client certificate file. This certificate is unique to each wireless client of the network.
- ⑧ The `private_key` field is the pathname to the client certificate private key file.
- ⑨ The `private_key_passwd` field contains the passphrase for the private key.

Then add the following line to `/etc/rc.conf`:

```
ifconfig_ath0="WPA DHCP"
```

The next step is to bring up the interface with the help of the `rc.d` facility:

```
# /etc/rc.d/netif start
Starting wpa_supplicant.
DHCPREQUEST on ath0 to 255.255.255.255 port 67
DHCPREQUEST on ath0 to 255.255.255.255 port 67
DHCPACK from 192.168.0.20
bound to 192.168.0.254 -- renewal in 300 seconds.
ath0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
  inet6 fe80::211:95ff:fed5:4362%ath0 prefixlen 64 scopeid 0x1
  inet 192.168.0.254 netmask 0xffffffff broadcast 192.168.0.255
  ether 00:11:95:d5:43:62
  media: IEEE 802.11 Wireless Ethernet autoselect (DS/11Mbps)
  status: associated
  ssid freebsdap channel 1 bssid 00:11:95:c3:0d:ac
  authmode WPA2/802.11i privacy ON deftxkey UNDEF TKIP 2:128-bit
  txpowmax 36 protmode CTS roaming MANUAL bintval 100
```

As previously shown, it is also possible to bring up the interface manually with both `wpa_supplicant` and `ifconfig` commands.

32.3.3.1.3.3 WPA with EAP-TTLS

With EAP-TLS both the authentication server and the client need a certificate, with EAP-TTLS (EAP-Tunneled Transport Layer Security) a client certificate is optional. This method is close to what some secure web sites do , where the web server can create a secure SSL tunnel even if the visitors do not have client-side certificates. EAP-TTLS will use the encrypted TLS tunnel for safe transport of the authentication data.

The configuration is done via the `/etc/wpa_supplicant.conf` file:

```
network={
  ssid="freebsdap"
  proto=RSN
  key_mgmt=WPA-EAP
  eap=TTLS ❶
  identity="test" ❷
  password="test" ❸
  ca_cert="/etc/certs/cacert.pem" ❹
  phase2="auth=MD5" ❺
}
```

- ❶ In this field, we mention the EAP method for our connection.

- ❷ The `identity` field contains the identity string for EAP authentication inside the encrypted TLS tunnel.
- ❸ The `password` field contains the passphrase for the EAP authentication.
- ❹ The `ca_cert` field indicates the pathname of the CA certificate file. This file is needed to verify the server certificate.
- ❺ In this field, we mention the authentication method used in the encrypted TLS tunnel. In our case, EAP with MD5-Challenge has been used. The “inner authentication” phase is often called “phase2”.

You also have to add the following line to `/etc/rc.conf`:

```
ifconfig_ath0="WPA DHCP"
```

The next step is to bring up the interface:

```
# /etc/rc.d/netif start
Starting wpa_supplicant.
DHCPREQUEST on ath0 to 255.255.255.255 port 67
DHCPREQUEST on ath0 to 255.255.255.255 port 67
DHCPREQUEST on ath0 to 255.255.255.255 port 67
DHCPCACK from 192.168.0.20
bound to 192.168.0.254 -- renewal in 300 seconds.
ath0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    inet6 fe80::211:95ff:fed5:4362%ath0 prefixlen 64 scopeid 0x1
    inet 192.168.0.254 netmask 0xfffff00 broadcast 192.168.0.255
    ether 00:11:95:d5:43:62
    media: IEEE 802.11 Wireless Ethernet autoselect (DS/11Mbps)
    status: associated
    ssid freebsdap channel 1 bssid 00:11:95:c3:0d:ac
    authmode WPA2/802.11i privacy ON deftxkey UNDEF TKIP 2:128-bit
    txpowmax 36 protmode CTS roaming MANUAL bintval 100
```

32.3.3.1.3.4 WPA with EAP-PEAP

PEAP (Protected EAP) has been designed as an alternative to EAP-TTLS. There are two types of PEAP methods, the most common one is PEAPv0/EAP-MSCHAPv2. In the rest of this document, we will use the PEAP term to refer to that EAP method. PEAP is the most used EAP standard after EAP-TLS, in other words if you have a network with mixed OSes, PEAP should be the most supported standard after EAP-TLS.

PEAP is similar to EAP-TTLS: it uses a server-side certificate to authenticate clients by creating an encrypted TLS tunnel between the client and the authentication server, which protects the ensuing exchange of authentication information. In term of security the difference between EAP-TTLS and PEAP is that PEAP authentication broadcasts the username in clear, only the password is sent in the encrypted TLS tunnel. EAP-TTLS will use the TLS tunnel for both username and password.

We have to edit the `/etc/wpa_supplicant.conf` file and add the EAP-PEAP related settings:

```
network={
    ssid="freebsdap"
    proto=RSN
    key_mgmt=WPA-EAP
    eap=PEAP ❶
    identity="test" ❷
```

```
password="test" ❸
ca_cert="/etc/certs/cacert.pem" ❹
phase1="peaplabel=0" ❺
phase2="auth=MSCHAPV2" ❻
}
```

- ❶ In this field, we mention the EAP method for our connection.
- ❷ The `identity` field contains the identity string for EAP authentication inside the encrypted TLS tunnel.
- ❸ The `password` field contains the passphrase for the EAP authentication.
- ❹ The `ca_cert` field indicates the pathname of the CA certificate file. This file is needed to verify the server certificate.
- ❺ This field contains the parameters for the first phase of the authentication (the TLS tunnel). According to the authentication server used, you will have to specify a specific label for the authentication. Most of time, the label will be “client EAP encryption” which is set by using `peaplabel=0`. More information can be found in the `wpa_supplicant.conf(5)` manual page.
- ❻ In this field, we mention the authentication protocol used in the encrypted TLS tunnel. In the case of PEAP, it is `auth=MSCHAPV2`.

The following must be added to `/etc/rc.conf`:

```
ifconfig_ath0="WPA DHCP"
```

Then, we can bring up the interface:

```
# /etc/rc.d/netif start
Starting wpa_supplicant.
DHCPREQUEST on ath0 to 255.255.255.255 port 67
DHCPREQUEST on ath0 to 255.255.255.255 port 67
DHCPREQUEST on ath0 to 255.255.255.255 port 67
DHCPCACK from 192.168.0.20
bound to 192.168.0.254 -- renewal in 300 seconds.
ath0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
  inet6 fe80::211:95ff:fed5:4362%ath0 prefixlen 64 scopeid 0x1
  inet 192.168.0.254 netmask 0xfffff00 broadcast 192.168.0.255
  ether 00:11:95:d5:43:62
  media: IEEE 802.11 Wireless Ethernet autoselect (DS/11Mbps)
  status: associated
  ssid freebsdap channel 1 bssid 00:11:95:c3:0d:ac
  authmode WPA2/802.11i privacy ON deftxkey UNDEF TKIP 2:128-bit
  txpowmax 36 protmode CTS roaming MANUAL bintval 100
```

32.3.3.1.4 WEP

WEP (Wired Equivalent Privacy) is part of the original 802.11 standard. There is no authentication mechanism, only a weak form of access control, and it is easily to be cracked.

WEP can be set up with `ifconfig`:

```
# ifconfig ath0 inet 192.168.1.100 netmask 255.255.255.0 ssid my_net \
    wepmode on weptxkey 3 wepkey 3:0x3456789012
```

- The `weptxkey` means which WEP key will be used in the transmission. Here we used the third key. This must match the setting in the access point.
- The `wepkey` means setting the selected WEP key. It should in the format `index:key`, if the index is not given, key 1 is set. That is to say we need to set the index if we use keys other than the first key.

Σημείωση: You must replace the `0x3456789012` with the key configured for use on the access point.

You are encouraged to read `ifconfig(8)` manual page for further information.

The `wpa_supplicant` facility also can be used to configure your wireless interface with WEP. The example above can be set up by adding the following lines to `/etc/wpa_supplicant.conf`:

```
network={
    ssid="my_net"
    key_mgmt=NONE
    wep_key3=3456789012
    wep_tx_keyidx=3
}
```

Then:

```
# wpa_supplicant -i ath0 -c /etc/wpa_supplicant.conf
Trying to associate with 00:13:46:49:41:76 (SSID='dlinkap' freq=2437 MHz)
Associated with 00:13:46:49:41:76
```

32.3.4 Ad-hoc Mode

IBSS mode, also called ad-hoc mode, is designed for point to point connections. For example, to establish an ad-hoc network between the machine A and the machine B we will just need to choose two IP addresses and a SSID.

On the box A:

```
# ifconfig ath0 inet 192.168.0.1 netmask 255.255.255.0 ssid freebsdap mediaopt adhoc
# ifconfig ath0
ath0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    inet 192.168.0.1 netmask 0xffffffff broadcast 192.168.0.255
    inet6 fe80::211:95ff:fec3:dac%ath0 prefixlen 64 scopeid 0x4
    ether 00:11:95:c3:0d:ac
    media: IEEE 802.11 Wireless Ethernet autoselect <adhoc> (autoselect <adhoc>)
    status: associated
    ssid freebsdap channel 2 bssid 02:11:95:c3:0d:ac
    authmode OPEN privacy OFF txpowmax 36 protmode CTS bintval 100
```

The `adhoc` parameter indicates the interface is running in the IBSS mode.

On B, we should be able to detect A:

```
# ifconfig ath0 up scan
  SSID          BSSID              CHAN RATE  S:N   INT CAPS
  freebsdap     02:11:95:c3:0d:ac    2   54M  19:0   100 IS
```

The `I` in the output confirms the machine A is in ad-hoc mode. We just have to configure B with a different IP address:

```
# ifconfig ath0 inet 192.168.0.2 netmask 255.255.255.0 ssid freebsdap mediaopt adhoc
# ifconfig ath0
ath0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
  inet6 fe80::211:95ff:fed5:4362%ath0 prefixlen 64 scopeid 0x1
  inet 192.168.0.2 netmask 0xffffffff broadcast 192.168.0.255
  ether 00:11:95:d5:43:62
  media: IEEE 802.11 Wireless Ethernet autoselect <adhoc> (autoselect <adhoc>)
  status: associated
  ssid freebsdap channel 2 bssid 02:11:95:c3:0d:ac
  authmode OPEN privacy OFF txpovmax 36 protmode CTS bintval 100
```

Both A and B are now ready to exchange informations.

32.3.5 Troubleshooting

If you are having trouble with wireless networking, there are a number of steps you can take to help troubleshoot the problem.

- If you do not see the access point listed when scanning be sure you have not configured your wireless device to a limited set of channels.
- If you cannot associate to an access point verify the configuration of your station matches the one of the access point. This includes the authentication scheme and any security protocols. Simplify your configuration as much as possible. If you are using a security protocol such as WPA or WEP configure the access point for open authentication and no security to see if you can get traffic to pass.

- Once you can associate to the access point diagnose any security configuration using simple tools like `ping(8)`.

The `wpa_supplicant` has much debugging support; try running it manually with the `-dd` option and look at the system logs.

- There are also many lower-level debugging tools. You can enable debugging messages in the 802.11 protocol support layer using the `wldebug` program found in `/usr/src/tools/tools/net80211`. For example:

```
# wldebug -i ath0 +scan+auth+debug+assoc
net.wlan.0.debug: 0 => 0xc80000<assoc,auth,scan>
```

can be used to enable console messages related to scanning for access points and doing the 802.11 protocol handshakes required to arrange communication.

There are also many useful statistics maintained by the 802.11 layer; the `wlanstats` tool will dump these informations. These statistics should identify all errors identified by the 802.11 layer. Beware however that some errors are identified in the device drivers that lie below the 802.11 layer so they may not show up. To diagnose device-specific problems you need to refer to the drivers' documentation.

If the above information does not help to clarify the problem, please submit a problem report and include output from the above tools.

32.4 Bluetooth

32.4.1 Introduction

Bluetooth is a wireless technology for creating personal networks operating in the 2.4 GHz unlicensed band, with a range of 10 meters. Networks are usually formed ad-hoc from portable devices such as cellular phones, handhelds and laptops. Unlike the other popular wireless technology, Wi-Fi, Bluetooth offers higher level service profiles, e.g. FTP-like file servers, file pushing, voice transport, serial line emulation, and more.

The Bluetooth stack in FreeBSD is implemented using the Netgraph framework (see `netgraph(4)`). A broad variety of Bluetooth USB dongles is supported by the `ng_ubt(4)` driver. The Broadcom BCM2033 chip based Bluetooth devices are supported via the `ubtbcmfw(4)` and `ng_ubt(4)` drivers. The 3Com Bluetooth PC Card 3CRWB60-A is supported by the `ng_bt3c(4)` driver. Serial and UART based Bluetooth devices are supported via `sio(4)`, `ng_h4(4)` and `hserial(8)`. This section describes the use of the USB Bluetooth dongle.

32.4.2 Plugging in the Device

By default Bluetooth device drivers are available as kernel modules. Before attaching a device, you will need to load the driver into the kernel:

```
# kldload ng_ubt
```

If the Bluetooth device is present in the system during system startup, load the module from `/boot/loader.conf`:

```
ng_ubt_load="YES"
```

Plug in your USB dongle. The output similar to the following will appear on the console (or in syslog):

```
ubt0: vendor 0x0a12 product 0x0001, rev 1.10/5.25, addr 2
ubt0: Interface 0 endpoints: interrupt=0x81, bulk-in=0x82, bulk-out=0x2
ubt0: Interface 1 (alt.config 5) endpoints: isoc-in=0x83, isoc-out=0x3,
      wMaxPacketSize=49, nframes=6, buffer size=294
```

Όχι αυτόματα: The Bluetooth stack has to be started manually on FreeBSD 6.0, and on FreeBSD 5.X before 5.5. It is done automatically from `devd(8)` on FreeBSD 5.5, 6.1 and newer.

Copy `/usr/share/examples/netgraph/bluetooth/rc.bluetooth` into some convenient place, like `/etc/rc.bluetooth`. This script is used to start and stop the Bluetooth stack. It is a good idea to stop the stack before unplugging the device, but it is not (usually) fatal. When starting the stack, you will receive output similar to the following:

```
# /etc/rc.bluetooth start ubt0
BD_ADDR: 00:02:72:00:d4:1a
Features: 0xff 0xff 0xf 00 00 00 00 00
<3-Slot> <5-Slot> <Encryption> <Slot offset>
<Timing accuracy> <Switch> <Hold mode> <Sniff mode>
```

```
<Park mode> <RSSI> <Channel quality> <SCO link>
<HV2 packets> <HV3 packets> <u-law log> <A-law log> <CVSD>
<Paging scheme> <Power control> <Transparent SCO data>
Max. ACL packet size: 192 bytes
Number of ACL packets: 8
Max. SCO packet size: 64 bytes
Number of SCO packets: 8
```

32.4.3 Host Controller Interface (HCI)

Host Controller Interface (HCI) provides a command interface to the baseband controller and link manager, and access to hardware status and control registers. This interface provides a uniform method of accessing the Bluetooth baseband capabilities. HCI layer on the Host exchanges data and commands with the HCI firmware on the Bluetooth hardware. The Host Controller Transport Layer (i.e. physical bus) driver provides both HCI layers with the ability to exchange information with each other.

A single Netgraph node of type *hci* is created for a single Bluetooth device. The HCI node is normally connected to the Bluetooth device driver node (downstream) and the L2CAP node (upstream). All HCI operations must be performed on the HCI node and not on the device driver node. Default name for the HCI node is “devicehci”. For more details refer to the `ng_hci(4)` manual page.

One of the most common tasks is discovery of Bluetooth devices in RF proximity. This operation is called *inquiry*. Inquiry and other HCI related operations are done with the `hccontrol(8)` utility. The example below shows how to find out which Bluetooth devices are in range. You should receive the list of devices in a few seconds. Note that a remote device will only answer the inquiry if it put into *discoverable* mode.

```
% hccontrol -n ubt0hci inquiry
Inquiry result, num_responses=1
Inquiry result #0
    BD_ADDR: 00:80:37:29:19:a4
    Page Scan Rep. Mode: 0x1
    Page Scan Period Mode: 00
    Page Scan Mode: 00
    Class: 52:02:04
    Clock offset: 0x78ef
Inquiry complete. Status: No error [00]
```

BD_ADDR is unique address of a Bluetooth device, similar to MAC addresses of a network card. This address is needed for further communication with a device. It is possible to assign human readable name to a BD_ADDR. The `/etc/bluetooth/hosts` file contains information regarding the known Bluetooth hosts. The following example shows how to obtain human readable name that was assigned to the remote device:

```
% hccontrol -n ubt0hci remote_name_request 00:80:37:29:19:a4
BD_ADDR: 00:80:37:29:19:a4
Name: Pav's T39
```

If you perform an inquiry on a remote Bluetooth device, it will find your computer as “your.host.name (ubt0)”. The name assigned to the local device can be changed at any time.

The Bluetooth system provides a point-to-point connection (only two Bluetooth units involved), or a point-to-multipoint connection. In the point-to-multipoint connection the connection is shared among several Bluetooth devices. The following example shows how to obtain the list of active baseband connections for the local device:

```
% hccontrol -n ubt0hci read_connection_list
Remote BD_ADDR      Handle Type Mode Role Encrypt Pending Queue State
00:80:37:29:19:a4   41   ACL   0  MAST   NONE       0       0  OPEN
```

A *connection handle* is useful when termination of the baseband connection is required. Note, that it is normally not required to do it by hand. The stack will automatically terminate inactive baseband connections.

```
# hccontrol -n ubt0hci disconnect 41
Connection handle: 41
Reason: Connection terminated by local host [0x16]
```

Refer to `hccontrol help` for a complete listing of available HCI commands. Most of the HCI commands do not require superuser privileges.

32.4.4 Logical Link Control and Adaptation Protocol (L2CAP)

Logical Link Control and Adaptation Protocol (L2CAP) provides connection-oriented and connectionless data services to upper layer protocols with protocol multiplexing capability and segmentation and reassembly operation. L2CAP permits higher level protocols and applications to transmit and receive L2CAP data packets up to 64 kilobytes in length.

L2CAP is based around the concept of *channels*. Channel is a logical connection on top of baseband connection. Each channel is bound to a single protocol in a many-to-one fashion. Multiple channels can be bound to the same protocol, but a channel cannot be bound to multiple protocols. Each L2CAP packet received on a channel is directed to the appropriate higher level protocol. Multiple channels can share the same baseband connection.

A single Netgraph node of type *l2cap* is created for a single Bluetooth device. The L2CAP node is normally connected to the Bluetooth HCI node (downstream) and Bluetooth sockets nodes (upstream). Default name for the L2CAP node is “device12cap”. For more details refer to the `ng_l2cap(4)` manual page.

A useful command is `l2ping(8)`, which can be used to ping other devices. Some Bluetooth implementations might not return all of the data sent to them, so 0 bytes in the following example is normal.

```
# l2ping -a 00:80:37:29:19:a4
0 bytes from 0:80:37:29:19:a4 seq_no=0 time=48.633 ms result=0
0 bytes from 0:80:37:29:19:a4 seq_no=1 time=37.551 ms result=0
0 bytes from 0:80:37:29:19:a4 seq_no=2 time=28.324 ms result=0
0 bytes from 0:80:37:29:19:a4 seq_no=3 time=46.150 ms result=0
```

The `l2control(8)` utility is used to perform various operations on L2CAP nodes. This example shows how to obtain the list of logical connections (channels) and the list of baseband connections for the local device:

```
% l2control -a 00:02:72:00:d4:1a read_channel_list
L2CAP channels:
Remote BD_ADDR      SCID/ DCID   PSM  IMTU/ OMTU State
00:07:e0:00:0b:ca   66/   64     3   132/  672 OPEN
% l2control -a 00:02:72:00:d4:1a read_connection_list
```

```
L2CAP connections:
Remote BD_ADDR      Handle Flags Pending State
00:07:e0:00:0b:ca   41 0           0 OPEN
```

Another diagnostic tool is `btsockstat(1)`. It does a job similar to `netstat(1)` does, but for Bluetooth network-related data structures. The example below shows the same logical connection as `l2control(8)` above.

```
% btsockstat
Active L2CAP sockets
PCB      Recv-Q Send-Q Local address/PSM      Foreign address  CID  State
c2afe900  0        0 00:02:72:00:d4:1a/3    00:07:e0:00:0b:ca 66   OPEN
Active RFCOMM sessions
L2PCB    PCB      Flag MTU   Out-Q DLCs State
c2afe900 c2b53380 1    127    0    Yes  OPEN
Active RFCOMM sockets
PCB      Recv-Q Send-Q Local address      Foreign address  Chan DLCI State
c2e8bc80  0      250 00:02:72:00:d4:1a 00:07:e0:00:0b:ca 3    6   OPEN
```

32.4.5 RFCOMM Protocol

The RFCOMM protocol provides emulation of serial ports over the L2CAP protocol. The protocol is based on the ETSI standard TS 07.10. RFCOMM is a simple transport protocol, with additional provisions for emulating the 9 circuits of RS-232 (EIA/TIA-232-E) serial ports. The RFCOMM protocol supports up to 60 simultaneous connections (RFCOMM channels) between two Bluetooth devices.

For the purposes of RFCOMM, a complete communication path involves two applications running on different devices (the communication endpoints) with a communication segment between them. RFCOMM is intended to cover applications that make use of the serial ports of the devices in which they reside. The communication segment is a Bluetooth link from one device to another (direct connect).

RFCOMM is only concerned with the connection between the devices in the direct connect case, or between the device and a modem in the network case. RFCOMM can support other configurations, such as modules that communicate via Bluetooth wireless technology on one side and provide a wired interface on the other side.

In FreeBSD the RFCOMM protocol is implemented at the Bluetooth sockets layer.

32.4.6 Pairing of Devices

By default, Bluetooth communication is not authenticated, and any device can talk to any other device. A Bluetooth device (for example, cellular phone) may choose to require authentication to provide a particular service (for example, Dial-Up service). Bluetooth authentication is normally done with *PIN codes*. A PIN code is an ASCII string up to 16 characters in length. User is required to enter the same PIN code on both devices. Once user has entered the PIN code, both devices will generate a *link key*. After that the link key can be stored either in the devices themselves or in a persistent storage. Next time both devices will use previously generated link key. The described above procedure is called *pairing*. Note that if the link key is lost by any device then pairing must be repeated.

The `hcsecd(8)` daemon is responsible for handling of all Bluetooth authentication requests. The default configuration file is `/etc/bluetooth/hcsecd.conf`. An example section for a cellular phone with the PIN code arbitrarily set to “1234” is shown below:

```
device {
```

```
bdaddr 00:80:37:29:19:a4;
name   "Pav's T39";
key    nokey;
pin    "1234";
}
```

There is no limitation on PIN codes (except length). Some devices (for example Bluetooth headsets) may have a fixed PIN code built in. The `-d` switch forces the `hcsecd(8)` daemon to stay in the foreground, so it is easy to see what is happening. Set the remote device to receive pairing and initiate the Bluetooth connection to the remote device. The remote device should say that pairing was accepted, and request the PIN code. Enter the same PIN code as you have in `hcsecd.conf`. Now your PC and the remote device are paired. Alternatively, you can initiate pairing on the remote device.

On FreeBSD 5.5, 6.1 and newer, the following line can be added to the `/etc/rc.conf` file to have **hcsecd** started automatically on system start:

```
hcsecd_enable="YES"
```

The following is a sample of the **hcsecd** daemon output:

```
hcsecd[16484]: Got Link_Key_Request event from 'ubt0hci', remote bdaddr 0:80:37:29:19:a4
hcsecd[16484]: Found matching entry, remote bdaddr 0:80:37:29:19:a4, name 'Pav's T39', link key d
hcsecd[16484]: Sending Link_Key_Negative_Reply to 'ubt0hci' for remote bdaddr 0:80:37:29:19:a4
hcsecd[16484]: Got PIN_Code_Request event from 'ubt0hci', remote bdaddr 0:80:37:29:19:a4
hcsecd[16484]: Found matching entry, remote bdaddr 0:80:37:29:19:a4, name 'Pav's T39', PIN code e
hcsecd[16484]: Sending PIN_Code_Reply to 'ubt0hci' for remote bdaddr 0:80:37:29:19:a4
```

32.4.7 Service Discovery Protocol (SDP)

The Service Discovery Protocol (SDP) provides the means for client applications to discover the existence of services provided by server applications as well as the attributes of those services. The attributes of a service include the type or class of service offered and the mechanism or protocol information needed to utilize the service.

SDP involves communication between a SDP server and a SDP client. The server maintains a list of service records that describe the characteristics of services associated with the server. Each service record contains information about a single service. A client may retrieve information from a service record maintained by the SDP server by issuing a SDP request. If the client, or an application associated with the client, decides to use a service, it must open a separate connection to the service provider in order to utilize the service. SDP provides a mechanism for discovering services and their attributes, but it does not provide a mechanism for utilizing those services.

Normally, a SDP client searches for services based on some desired characteristics of the services. However, there are times when it is desirable to discover which types of services are described by an SDP server's service records without any a priori information about the services. This process of looking for any offered services is called *browsing*.

The Bluetooth SDP server `sdpd(8)` and command line client `sdpcontrol(8)` are included in the standard FreeBSD installation. The following example shows how to perform a SDP browse query.

```
% sdpcontrol -a 00:01:03:fc:6e:ec browse
Record Handle: 00000000
Service Class ID List:
    Service Discovery Server (0x1000)
```

```
Protocol Descriptor List:
  L2CAP (0x0100)
    Protocol specific parameter #1: u/int/uuid16 1
    Protocol specific parameter #2: u/int/uuid16 1
```

```
Record Handle: 0x00000001
Service Class ID List:
  Browse Group Descriptor (0x1001)
```

```
Record Handle: 0x00000002
Service Class ID List:
  LAN Access Using PPP (0x1102)
Protocol Descriptor List:
  L2CAP (0x0100)
  RFCOMM (0x0003)
    Protocol specific parameter #1: u/int8/bool 1
Bluetooth Profile Descriptor List:
  LAN Access Using PPP (0x1102) ver. 1.0
```

... and so on. Note that each service has a list of attributes (RFCOMM channel for example). Depending on the service you might need to make a note of some of the attributes. Some Bluetooth implementations do not support service browsing and may return an empty list. In this case it is possible to search for the specific service. The example below shows how to search for the OBEX Object Push (OPUSH) service:

```
% sdpcontrol -a 00:01:03:fc:6e:ec search OPUSH
```

Offering services on FreeBSD to Bluetooth clients is done with the `sdpd(8)` server. On FreeBSD 5.5, 6.1 and newer, the following line can be added to the `/etc/rc.conf` file:

```
sdpd_enable="YES"
```

Then the **sdpd** daemon can be started with:

```
# /etc/rc.d/sdpd start
```

On FreeBSD 6.0, and on FreeBSD 5.X before 5.5, **sdpd** is not integrated into the system startup scripts. It has to be started manually with:

```
# sdpd
```

The local server application that wants to provide Bluetooth service to the remote clients will register service with the local SDP daemon. The example of such application is `rfcomm_pppd(8)`. Once started it will register Bluetooth LAN service with the local SDP daemon.

The list of services registered with the local SDP server can be obtained by issuing SDP browse query via local control channel:

```
# sdpcontrol -l browse
```

32.4.8 Dial-Up Networking (DUN) and Network Access with PPP (LAN) Profiles

The Dial-Up Networking (DUN) profile is mostly used with modems and cellular phones. The scenarios covered by this profile are the following:

- use of a cellular phone or modem by a computer as a wireless modem for connecting to a dial-up Internet access server, or using other dial-up services;
- use of a cellular phone or modem by a computer to receive data calls.

Network Access with PPP (LAN) profile can be used in the following situations:

- LAN access for a single Bluetooth device;
- LAN access for multiple Bluetooth devices;
- PC to PC (using PPP networking over serial cable emulation).

In FreeBSD both profiles are implemented with `ppp(8)` and `rfcomm_pppd(8)` - a wrapper that converts RFCOMM Bluetooth connection into something PPP can operate with. Before any profile can be used, a new PPP label in the `/etc/ppp/ppp.conf` must be created. Consult `rfcomm_pppd(8)` manual page for examples.

In the following example `rfcomm_pppd(8)` will be used to open RFCOMM connection to remote device with BD_ADDR 00:80:37:29:19:a4 on DUN RFCOMM channel. The actual RFCOMM channel number will be obtained from the remote device via SDP. It is possible to specify RFCOMM channel by hand, and in this case `rfcomm_pppd(8)` will not perform SDP query. Use `sdpcontrol(8)` to find out RFCOMM channel on the remote device.

```
# rfcomm_pppd -a 00:80:37:29:19:a4 -c -C dun -l rfcomm-dialup
```

In order to provide Network Access with PPP (LAN) service the `sdpd(8)` server must be running. A new entry for LAN clients must be created in the `/etc/ppp/ppp.conf` file. Consult `rfcomm_pppd(8)` manual page for examples. Finally, start RFCOMM PPP server on valid RFCOMM channel number. The RFCOMM PPP server will automatically register Bluetooth LAN service with the local SDP daemon. The example below shows how to start RFCOMM PPP server.

```
# rfcomm_pppd -s -C 7 -l rfcomm-server
```

32.4.9 OBEX Object Push (OPUSH) Profile

OBEX is a widely used protocol for simple file transfers between mobile devices. Its main use is in infrared communication, where it is used for generic file transfers between notebooks or PDAs, and for sending business cards or calendar entries between cellular phones and other devices with PIM applications.

The OBEX server and client are implemented as a third-party package **obexapp**, which is available as `comms/obexapp` port.

OBEX client is used to push and/or pull objects from the OBEX server. An object can, for example, be a business card or an appointment. The OBEX client can obtain RFCOMM channel number from the remote device via SDP. This can be done by specifying service name instead of RFCOMM channel number. Supported service names are: IrMC, FTRN and OPUSH. It is possible to specify RFCOMM channel as a number. Below is an example of an OBEX session, where device information object is pulled from the cellular phone, and a new object (business card) is pushed into the phone's directory.

```
% obexapp -a 00:80:37:29:19:a4 -C IrMC
obex> get telecom/devinfo.txt devinfo-t39.txt
Success, response: OK, Success (0x20)
obex> put new.vcf
Success, response: OK, Success (0x20)
obex> di
Success, response: OK, Success (0x20)
```

In order to provide OBEX Object Push service, sdpd(8) server must be running. A root folder, where all incoming objects will be stored, must be created. The default path to the root folder is `/var/spool/obex`. Finally, start OBEX server on valid RFCOMM channel number. The OBEX server will automatically register OBEX Object Push service with the local SDP daemon. The example below shows how to start OBEX server.

```
# obexapp -s -C 10
```

32.4.10 Serial Port Profile (SPP)

The Serial Port Profile (SPP) allows Bluetooth devices to perform RS232 (or similar) serial cable emulation. The scenario covered by this profile deals with legacy applications using Bluetooth as a cable replacement, through a virtual serial port abstraction.

The `rfcomm_sppd(1)` utility implements the Serial Port profile. A pseudo tty is used as a virtual serial port abstraction. The example below shows how to connect to a remote device Serial Port service. Note that you do not have to specify a RFCOMM channel - `rfcomm_sppd(1)` can obtain it from the remote device via SDP. If you would like to override this, specify a RFCOMM channel on the command line.

```
# rfcomm_sppd -a 00:07:E0:00:0B:CA -t /dev/ttyp6
rfcomm_sppd[94692]: Starting on /dev/ttyp6...
```

Once connected, the pseudo tty can be used as serial port:

```
# cu -l ttyp6
```

32.4.11 Troubleshooting

32.4.11.1 A remote device cannot connect

Some older Bluetooth devices do not support role switching. By default, when FreeBSD is accepting a new connection, it tries to perform a role switch and become master. Devices, which do not support this will not be able to connect. Note that role switching is performed when a new connection is being established, so it is not possible to ask the remote device if it does support role switching. There is a HCI option to disable role switching on the local side:

```
# hccontrol -n ubt0hci write_node_role_switch 0
```

32.4.11.2 Something is going wrong, can I see what exactly is happening?

Yes, you can. Use the third-party package **hcidump**, which is available as `comms/hcidump` port. The **hcidump** utility is similar to `tcpdump(1)`. It can be used to display the content of the Bluetooth packets on the terminal and to dump the Bluetooth packets to a file.

32.5 Bridging

32.5.1 Introduction

It is sometimes useful to divide one physical network (such as an Ethernet segment) into two separate network segments without having to create IP subnets and use a router to connect the segments together. A device that connects two networks together in this fashion is called a “bridge”. A FreeBSD system with two network interface cards can act as a bridge.

The bridge works by learning the MAC layer addresses (Ethernet addresses) of the devices on each of its network interfaces. It forwards traffic between two networks only when its source and destination are on different networks.

In many respects, a bridge is like an Ethernet switch with very few ports.

32.5.2 Situations Where Bridging Is Appropriate

There are two common situations in which a bridge is used today.

32.5.2.1 High Traffic on a Segment

Situation one is where your physical network segment is overloaded with traffic, but you do not want for whatever reason to subnet the network and interconnect the subnets with a router.

Let us consider an example of a newspaper where the Editorial and Production departments are on the same subnetwork. The Editorial users all use server A for file service, and the Production users are on server B. An Ethernet network is used to connect all users together, and high loads on the network are slowing things down.

If the Editorial users could be segregated on one network segment and the Production users on another, the two network segments could be connected with a bridge. Only the network traffic destined for interfaces on the “other” side of the bridge would be sent to the other network, reducing congestion on each network segment.

32.5.2.2 Filtering/Traffic Shaping Firewall

The second common situation is where firewall functionality is needed without network address translation (NAT).

An example is a small company that is connected via DSL or ISDN to their ISP. They have a 13 globally-accessible IP addresses from their ISP and have 10 PCs on their network. In this situation, using a router-based firewall is difficult because of subnetting issues.

A bridge-based firewall can be configured and dropped into the path just downstream of their DSL/ISDN router without any IP numbering issues.

32.5.3 Configuring a Bridge

32.5.3.1 Network Interface Card Selection

A bridge requires at least two network cards to function. Unfortunately, not all network interface cards support bridging. Read `bridge(4)` for details on the cards that are supported.

Install and test the two network cards before continuing.

32.5.3.2 Kernel Configuration Changes

To enable kernel support for bridging, add the:

```
options BRIDGE
```

statement to your kernel configuration file, and rebuild your kernel.

32.5.3.3 Firewall Support

If you are planning to use the bridge as a firewall, you will need to add the `IPFIREWALL` option as well. Read [Εἰσαγωγή 31](#) for general information on configuring the bridge as a firewall.

If you need to allow non-IP packets (such as ARP) to flow through the bridge, there are three options available. The first is to add the following option to the kernel and rebuild:

```
option IPFIREWALL_DEFAULT_TO_ACCEPT
```

The second is to set the firewall type to “open” in the `rc.conf` file:

```
firewall_type="open"
```

Note that these options will make the firewall seem completely transparent; any packet or connection will be permitted by default. This may require significant changes to the firewall ruleset.

The third option is to apply the following `ipfw(8)` rule:

```
# ipfw add allow mac-type arp layer2
```

Or add it to the current firewall ruleset. This rule effectively allows `arp(8)` packets through, so it must be applied near the beginning of the ruleset for early evaluation.

32.5.3.4 Traffic Shaping Support

If you want to use the bridge as a traffic shaper, you will need to add the `DUMMYNET` option to your kernel configuration. Read `dumynet(4)` for further information.

32.5.4 Enabling the Bridge

Add the line:

```
net.link.ether.bridge.enable=1
```

to `/etc/sysctl.conf` to enable the bridge at runtime, and the line:

```
net.link.ether.bridge.config=if1,if2
```

to enable bridging on the specified interfaces (replace `if1` and `if2` with the names of your two network interfaces). If you want the bridged packets to be filtered by `ipfw(8)`, you should add:

```
net.link.ether.bridge.ipfw=1
```

as well.

For versions prior to FreeBSD 5.2-RELEASE, use instead the following lines:

```
net.link.ether.bridge=1
net.link.ether.bridge_cfg=if1,if2
net.link.ether.bridge_ipfw=1
```

32.5.5 Other Information

If you want to be able to `ssh(1)` into the bridge from the network, it is correct to assign one of the network cards an IP address. The consensus is that assigning both cards an address is a bad idea.

If you have multiple bridges on your network, there cannot be more than one path between any two workstations. Technically, this means that there is no support for spanning tree link management.

A bridge can add latency to your `ping(8)` times, especially for traffic from one segment to another.

32.6 Diskless Operation

A FreeBSD machine can boot over the network and operate without a local disk, using file systems mounted from an NFS server. No system modification is necessary, beyond standard configuration files. Such a system is relatively easy to set up because all the necessary elements are readily available:

- There are at least two possible methods to load the kernel over the network:
 - PXE: The Intel Preboot eXecution Environment system is a form of smart boot ROM built into some networking cards or motherboards. See `pxeboot(8)` for more details.
 - The **Etherboot** port (`net/etherboot`) produces ROM-able code to boot kernels over the network. The code can be either burnt into a boot PROM on a network card, or loaded from a local floppy (or hard) disk drive, or from a running MS-DOS system. Many network cards are supported.

- A sample script (`/usr/share/examples/diskless/clone_root`) eases the creation and maintenance of the workstation's root file system on the server. The script will probably require a little customization but it will get you started very quickly.
- Standard system startup files exist in `/etc` to detect and support a diskless system startup.
- Swapping, if needed, can be done either to an NFS file or to a local disk.

There are many ways to set up diskless workstations. Many elements are involved, and most can be customized to suit local taste. The following will describe variations on the setup of a complete system, emphasizing simplicity and compatibility with the standard FreeBSD startup scripts. The system described has the following characteristics:

- The diskless workstations use a shared read-only `/` file system, and a shared read-only `/usr`.

The root file system is a copy of a standard FreeBSD root (typically the server's), with some configuration files overridden by ones specific to diskless operation or, possibly, to the workstation they belong to.

The parts of the root which have to be writable are overlaid with `md(4)` file systems. Any changes will be lost when the system reboots.

- The kernel is transferred and loaded either with **Etherboot** or PXE as some situations may mandate the use of either method.

Προσοχή: As described, this system is insecure. It should live in a protected area of a network, and be untrusted by other hosts.

All the information in this section has been tested using FreeBSD 5.2.1-RELEASE.

32.6.1 Background Information

Setting up diskless workstations is both relatively straightforward and prone to errors. These are sometimes difficult to diagnose for a number of reasons. For example:

- Compile time options may determine different behaviors at runtime.
- Error messages are often cryptic or totally absent.

In this context, having some knowledge of the background mechanisms involved is very useful to solve the problems that may arise.

Several operations need to be performed for a successful bootstrap:

- The machine needs to obtain initial parameters such as its IP address, executable filename, server name, root path. This is done using the DHCP or BOOTP protocols. DHCP is a compatible extension of BOOTP, and uses the same port numbers and basic packet format.

It is possible to configure a system to use only BOOTP. The `bootpd(8)` server program is included in the base FreeBSD system.

However, DHCP has a number of advantages over BOOTP (nicer configuration files, possibility of using PXE, plus many others not directly related to diskless operation), and we will describe mainly a DHCP configuration, with equivalent examples using `bootpd(8)` when possible. The sample configuration will use the **ISC DHCP** software package (release 3.0.1.r12 was installed on the test server).

- The machine needs to transfer one or several programs to local memory. Either TFTP or NFS are used. The choice between TFTP and NFS is a compile time option in several places. A common source of error is to specify filenames for the wrong protocol: TFTP typically transfers all files from a single directory on the server, and would expect filenames relative to this directory. NFS needs absolute file paths.
- The possible intermediate bootstrap programs and the kernel need to be initialized and executed. There are several important variations in this area:
 - PXE will load pxeboot(8), which is a modified version of the FreeBSD third stage loader. The loader(8) will obtain most parameters necessary to system startup, and leave them in the kernel environment before transferring control. It is possible to use a `GENERIC` kernel in this case.
 - **Etherboot**, will directly load the kernel, with less preparation. You will need to build a kernel with specific options.

PXE and **Etherboot** work equally well; however, because kernels normally let the loader(8) do more work for them, PXE is the preferred method.

If your BIOS and network cards support PXE, you should probably use it.

- Finally, the machine needs to access its file systems. NFS is used in all cases.

See also `diskless(8)` manual page.

32.6.2 Setup Instructions

32.6.2.1 Configuration Using ISC DHCP

The **ISC DHCP** server can answer both BOOTP and DHCP requests.

ISC DHCP 3.0 is not part of the base system. You will first need to install the `net/isc-dhcp3-server` port or the corresponding package.

Once **ISC DHCP** is installed, it needs a configuration file to run (normally named `/usr/local/etc/dhcpd.conf`). Here follows a commented example, where host `margaux` uses **Etherboot** and host `corbieres` uses PXE:

```
default-lease-time 600;
max-lease-time 7200;
authoritative;

option domain-name "example.com";
option domain-name-servers 192.168.4.1;
option routers 192.168.4.1;

subnet 192.168.4.0 netmask 255.255.255.0 {
    use-host-decl-names on; ❶
    option subnet-mask 255.255.255.0;
    option broadcast-address 192.168.4.255;

    host margaux {
        hardware ethernet 01:23:45:67:89:ab;
        fixed-address margaux.example.com;
        next-server 192.168.4.4; ❷
    }
}
```

```

filename "/data/misc/kernel.diskless"; ❸
option root-path "192.168.4.4:/data/misc/diskless"; ❹
}
host corbieres {
    hardware ethernet 00:02:b3:27:62:df;
    fixed-address corbieres.example.com;
    next-server 192.168.4.4;
    filename "pxeboot";
    option root-path "192.168.4.4:/data/misc/diskless";
}
}

```

- ❶ This option tells **dhcpd** to send the value in the host declarations as the hostname for the diskless host. An alternate way would be to add an option `host-name margaux` inside the host declarations.
- ❷ The `next-server` directive designates the TFTP or NFS server to use for loading loader or kernel file (the default is to use the same host as the DHCP server).
- ❸ The `filename` directive defines the file that **Etherboot** or PXE will load for the next execution step. It must be specified according to the transfer method used. **Etherboot** can be compiled to use NFS or TFTP. The FreeBSD port configures NFS by default. PXE uses TFTP, which is why a relative filename is used here (this may depend on the TFTP server configuration, but would be fairly typical). Also, PXE loads `pxeboot`, not the kernel. There are other interesting possibilities, like loading `pxeboot` from a FreeBSD CD-ROM `/boot` directory (as `pxeboot(8)` can load a `GENERIC` kernel, this makes it possible to use PXE to boot from a remote CD-ROM).
- ❹ The `root-path` option defines the path to the root file system, in usual NFS notation. When using PXE, it is possible to leave off the host's IP as long as you do not enable the kernel option `BOOTP`. The NFS server will then be the same as the TFTP one.

32.6.2.2 Configuration Using BOOTP

Here follows an equivalent **bootpd** configuration (reduced to one client). This would be found in `/etc/bootptab`.

Please note that **Etherboot** must be compiled with the non-default option `NO_DHCP_SUPPORT` in order to use `BOOTP`, and that PXE *needs* DHCP. The only obvious advantage of **bootpd** is that it exists in the base system.

```

.def100:\
    :hn:ht=1:sa=192.168.4.4:vm=rfc1048:\
    :sm=255.255.255.0:\
    :ds=192.168.4.1:\
    :gw=192.168.4.1:\
    :hd="/tftpboot":\
    :bf="/kernel.diskless":\
    :rp="192.168.4.4:/data/misc/diskless":

margaux:ha=0123456789ab:tc=.def100

```

32.6.2.3 Preparing a Boot Program with Etherboot

Etherboot's Web site (<http://etherboot.sourceforge.net>) contains extensive documentation (<http://etherboot.sourceforge.net/doc/html/userman/t1.html>) mainly intended for Linux systems, but nonetheless containing useful information. The following will just outline how you would use **Etherboot** on a FreeBSD system.

You must first install the `net/etherboot` package or port.

You can change the **Etherboot** configuration (i.e. to use TFTP instead of NFS) by editing the `Config` file in the **Etherboot** source directory.

For our setup, we shall use a boot floppy. For other methods (PROM, or MS-DOS program), please refer to the **Etherboot** documentation.

To make a boot floppy, insert a floppy in the drive on the machine where you installed **Etherboot**, then change your current directory to the `src` directory in the **Etherboot** tree and type:

```
# gmake bin32/devicetype.fd0
```

`devicetype` depends on the type of the Ethernet card in the diskless workstation. Refer to the `NIC` file in the same directory to determine the right `devicetype`.

32.6.2.4 Booting with PXE

By default, the `pxeboot(8)` loader loads the kernel via NFS. It can be compiled to use TFTP instead by specifying the `LOADER_TFTP_SUPPORT` option in `/etc/make.conf`. See the comments in `/usr/share/examples/etc/make.conf` for instructions.

There are two other `make.conf` options which may be useful for setting up a serial console diskless machine: `BOOT_PXEldr_PROBE_KEYBOARD`, and `BOOT_PXEldr_ALWAYS_SERIAL`.

To use PXE when the machine starts, you will usually need to select the `Boot from network` option in your BIOS setup, or type a function key during the PC initialization.

32.6.2.5 Configuring the TFTP and NFS Servers

If you are using PXE or **Etherboot** configured to use TFTP, you need to enable **tftpd** on the file server:

1. Create a directory from which **tftpd** will serve the files, e.g. `/tftpboot`.
2. Add this line to your `/etc/inetd.conf`:

```
tftp dgram udp wait root /usr/libexec/tftpd tftpd -l -s /tftpboot
```

Óçìáßùóç: It appears that at least some PXE versions want the TCP version of TFTP. In this case, add a second line, replacing `dgram udp` with `stream tcp`.

3. Tell **inetd** to reread its configuration file. The `inetd_enable="YES"` must be in the `/etc/rc.conf` file for this command to execute correctly:

```
# /etc/rc.d/inetd restart
```

You can place the `tftpbboot` directory anywhere on the server. Make sure that the location is set in both `inetd.conf` and `dhcpcd.conf`.

In all cases, you also need to enable NFS and export the appropriate file system on the NFS server.

1. Add this to `/etc/rc.conf`:

```
nfs_server_enable="YES"
```

2. Export the file system where the diskless root directory is located by adding the following to `/etc/exports` (adjust the volume mount point and replace `margaux corbieres` with the names of the diskless workstations):

```
/data/misc -alldirs -ro margaux corbieres
```

3. Tell **mountd** to reread its configuration file. If you actually needed to enable NFS in `/etc/rc.conf` at the first step, you probably want to reboot instead.

```
# /etc/rc.d/mountd restart
```

32.6.2.6 Building a Diskless Kernel

If using **Etherboot**, you need to create a kernel configuration file for the diskless client with the following options (in addition to the usual ones):

```
options      BOOTP          # Use BOOTP to obtain IP address/hostname
options      BOOTP_NFSROOT  # NFS mount root file system using BOOTP info
```

You may also want to use `BOOTP_NFSV3`, `BOOT_COMPAT` and `BOOTP_WIRED_TO` (refer to NOTES).

These option names are historical and slightly misleading as they actually enable indifferent use of DHCP and BOOTP inside the kernel (it is also possible to force strict BOOTP or DHCP use).

Build the kernel (see Εἰσαγωγή 9), and copy it to the place specified in `dhcpcd.conf`.

Σημείωση: When using PXE, building a kernel with the above options is not strictly necessary (though suggested). Enabling them will cause more DHCP requests to be issued during kernel startup, with a small risk of inconsistency between the new values and those retrieved by `pxeboot(8)` in some special cases. The advantage of using them is that the host name will be set as a side effect. Otherwise you will need to set the host name by another method, for example in a client-specific `rc.conf` file.

Σημείωση: In order to be loadable with **Etherboot**, a kernel needs to have the device hints compiled in. You would typically set the following option in the configuration file (see the `NOTES` configuration comments file):

```
hints "GENERIC.hints"
```

32.6.2.7 Preparing the Root Filesystem

You need to create a root file system for the diskless workstations, in the location listed as `root-path` in `dhcpd.conf`.

32.6.2.7.1 Using *make world* to populate root

This method is quick and will install a complete virgin system (not only the root file system) into `DESTDIR`. All you have to do is simply execute the following script:

```
#!/bin/sh
export DESTDIR=/data/misc/diskless
mkdir -p ${DESTDIR}
cd /usr/src; make buildworld && make buildkernel
cd /usr/src/etc; make distribution
```

Once done, you may need to customize your `/etc/rc.conf` and `/etc/fstab` placed into `DESTDIR` according to your needs.

32.6.2.8 Configuring Swap

If needed, a swap file located on the server can be accessed via NFS.

32.6.2.8.1 NFS Swap

The kernel does not support enabling NFS swap at boot time. Swap must be enabled by the startup scripts, by mounting a writable file system and creating and enabling a swap file. To create a swap file of appropriate size, you can do like this:

```
# dd if=/dev/zero of=/path/to/swapfile bs=1k count=1 oseek=100000
```

To enable it you have to add the following line to your `rc.conf`:

```
swapfile=/path/to/swapfile
```

32.6.2.9 Miscellaneous Issues

32.6.2.9.1 Running with a Read-only `/usr`

If the diskless workstation is configured to run X, you will have to adjust the **XDM** configuration file, which puts the error log on `/usr` by default.

32.6.2.9.2 Using a Non-FreeBSD Server

When the server for the root file system is not running FreeBSD, you will have to create the root file system on a FreeBSD machine, then copy it to its destination, using `tar` or `cpio`.

In this situation, there are sometimes problems with the special files in `/dev`, due to differing major/minor integer sizes. A solution to this problem is to export a directory from the non-FreeBSD server, mount this directory onto a FreeBSD machine, and use `devfs(5)` to allocate device nodes transparently for the user.

32.7 ISDN

A good resource for information on ISDN technology and hardware is Dan Kegel's ISDN Page (<http://www.alumni.caltech.edu/~dank/isdn/>).

A quick simple road map to ISDN follows:

- If you live in Europe you might want to investigate the ISDN card section.
- If you are planning to use ISDN primarily to connect to the Internet with an Internet Provider on a dial-up non-dedicated basis, you might look into Terminal Adapters. This will give you the most flexibility, with the fewest problems, if you change providers.
- If you are connecting two LANs together, or connecting to the Internet with a dedicated ISDN connection, you might consider the stand alone router/bridge option.

Cost is a significant factor in determining what solution you will choose. The following options are listed from least expensive to most expensive.

32.7.1 ISDN Cards

FreeBSD's ISDN implementation supports only the DSS1/Q.931 (or Euro-ISDN) standard using passive cards. Some active cards are supported where the firmware also supports other signaling protocols; this also includes the first supported Primary Rate (PRI) ISDN card.

The **isdn4bsd** software allows you to connect to other ISDN routers using either IP over raw HDLC or by using synchronous PPP: either by using kernel PPP with `isppp`, a modified `sppp(4)` driver, or by using userland `ppp(8)`. By using userland `ppp(8)`, channel bonding of two or more ISDN B-channels is possible. A telephone answering machine application is also available as well as many utilities such as a software 300 Baud modem.

Some growing number of PC ISDN cards are supported under FreeBSD and the reports show that it is successfully used all over Europe and in many other parts of the world.

The passive ISDN cards supported are mostly the ones with the Infineon (formerly Siemens) ISAC/HSCX/IPAC ISDN chipsets, but also ISDN cards with chips from Cologne Chip (ISA bus only), PCI cards with Winbond W6692 chips, some cards with the Tiger300/320/ISAC chipset combinations and some vendor specific chipset based cards such as the AVM Fritz!Card PCI V.1.0 and the AVM Fritz!Card PnP.

Currently the active supported ISDN cards are the AVM B1 (ISA and PCI) BRI cards and the AVM T1 PCI PRI cards.

For documentation on **isdn4bsd**, have a look at `/usr/share/examples/isdn/` directory on your FreeBSD system or at the homepage of `isdn4bsd` (<http://www.freebsd-support.de/i4b/>) which also has pointers to hints, erratas and much more documentation such as the `isdn4bsd` handbook (<http://people.FreeBSD.org/~hm/>).

In case you are interested in adding support for a different ISDN protocol, a currently unsupported ISDN PC card or otherwise enhancing **isdn4bsd**, please get in touch with Hellmuth Michaelis <hm@FreeBSD.org>.

For questions regarding the installation, configuration and troubleshooting **isdn4bsd**, a [freebsd-isdn](http://lists.FreeBSD.org/mailman/listinfo/freebsd-isdn) (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-isdn>) mailing list is available.

32.7.2 ISDN Terminal Adapters

Terminal adapters (TA), are to ISDN what modems are to regular phone lines.

Most TA's use the standard Hayes modem AT command set, and can be used as a drop in replacement for a modem.

A TA will operate basically the same as a modem except connection and throughput speeds will be much faster than your old modem. You will need to configure PPP exactly the same as for a modem setup. Make sure you set your serial speed as high as possible.

The main advantage of using a TA to connect to an Internet Provider is that you can do Dynamic PPP. As IP address space becomes more and more scarce, most providers are not willing to provide you with a static IP anymore. Most stand-alone routers are not able to accommodate dynamic IP allocation.

TA's completely rely on the PPP daemon that you are running for their features and stability of connection. This allows you to upgrade easily from using a modem to ISDN on a FreeBSD machine, if you already have PPP set up. However, at the same time any problems you experienced with the PPP program and are going to persist.

If you want maximum stability, use the kernel PPP option, not the userland PPP.

The following TA's are known to work with FreeBSD:

- Motorola BitSurfer and Bitsurfer Pro
- Adtran

Most other TA's will probably work as well, TA vendors try to make sure their product can accept most of the standard modem AT command set.

The real problem with external TA's is that, like modems, you need a good serial card in your computer.

You should read the FreeBSD Serial Hardware

(http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/serial-uart/index.html) tutorial for a detailed understanding of serial devices, and the differences between asynchronous and synchronous serial ports.

A TA running off a standard PC serial port (asynchronous) limits you to 115.2 Kbs, even though you have a 128 Kbs connection. To fully utilize the 128 Kbs that ISDN is capable of, you must move the TA to a synchronous serial card.

Do not be fooled into buying an internal TA and thinking you have avoided the synchronous/asynchronous issue. Internal TA's simply have a standard PC serial port chip built into them. All this will do is save you having to buy another serial cable and find another empty electrical socket.

A synchronous card with a TA is at least as fast as a stand-alone router, and with a simple 386 FreeBSD box driving it, probably more flexible.

The choice of synchronous card/TA v.s. stand-alone router is largely a religious issue. There has been some discussion of this in the mailing lists. We suggest you search the archives (<http://www.FreeBSD.org/search/index.html>) for the complete discussion.

32.7.3 Stand-alone ISDN Bridges/Routers

ISDN bridges or routers are not at all specific to FreeBSD or any other operating system. For a more complete description of routing and bridging technology, please refer to a networking reference book.

In the context of this section, the terms router and bridge will be used interchangeably.

As the cost of low end ISDN routers/bridges comes down, it will likely become a more and more popular choice. An ISDN router is a small box that plugs directly into your local Ethernet network, and manages its own connection to the other bridge/router. It has built in software to communicate via PPP and other popular protocols.

A router will allow you much faster throughput than a standard TA, since it will be using a full synchronous ISDN connection.

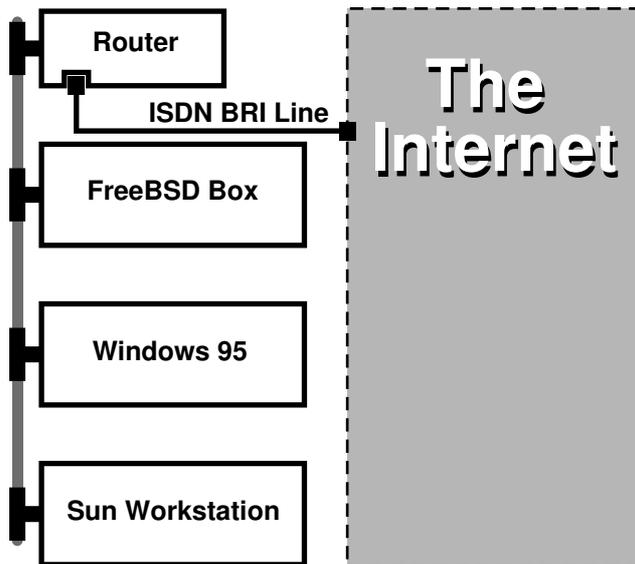
The main problem with ISDN routers and bridges is that interoperability between manufacturers can still be a problem. If you are planning to connect to an Internet provider, you should discuss your needs with them.

If you are planning to connect two LAN segments together, such as your home LAN to the office LAN, this is the simplest lowest maintenance solution. Since you are buying the equipment for both sides of the connection you can be assured that the link will work.

For example to connect a home computer or branch office network to a head office network the following setup could be used:

Διάγραμμα 32-1. Branch Office or Home Network

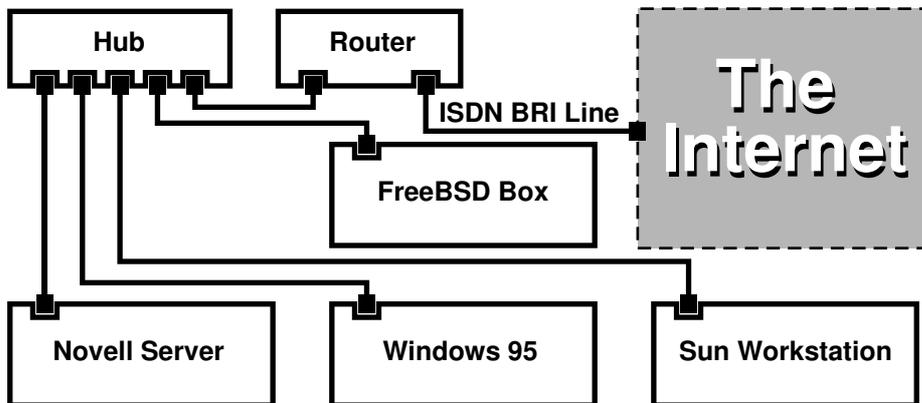
Network uses a bus based topology with 10 base 2 Ethernet (“thinnet”). Connect router to network cable with AUI/10BT transceiver, if necessary.



If your home/branch office is only one computer you can use a twisted pair crossover cable to connect to the stand-alone router directly.

Διάγραμμα 32-2. Head Office or Other LAN

Network uses a star topology with 10 base T Ethernet (“Twisted Pair”).



One large advantage of most routers/bridges is that they allow you to have 2 *separate independent* PPP connections to 2 separate sites at the *same* time. This is not supported on most TA's, except for specific (usually expensive) models that have two serial ports. Do not confuse this with channel bonding, MPP, etc.

This can be a very useful feature if, for example, you have an dedicated ISDN connection at your office and would like to tap into it, but do not want to get another ISDN line at work. A router at the office location can manage a dedicated B channel connection (64 Kbps) to the Internet and use the other B channel for a separate data connection. The second B channel can be used for dial-in, dial-out or dynamically bonding (MPP, etc.) with the first B channel for more bandwidth.

An Ethernet bridge will also allow you to transmit more than just IP traffic. You can also send IPX/SPX or whatever other protocols you use.

32.8 Network Address Translation

32.8.1 Overview

FreeBSD's Network Address Translation daemon, commonly known as `natd(8)` is a daemon that accepts incoming raw IP packets, changes the source to the local machine and re-injects these packets back into the outgoing IP packet stream. `natd(8)` does this by changing the source IP address and port such that when data is received back, it is able to determine the original location of the data and forward it back to its original requester.

The most common use of NAT is to perform what is commonly known as Internet Connection Sharing.

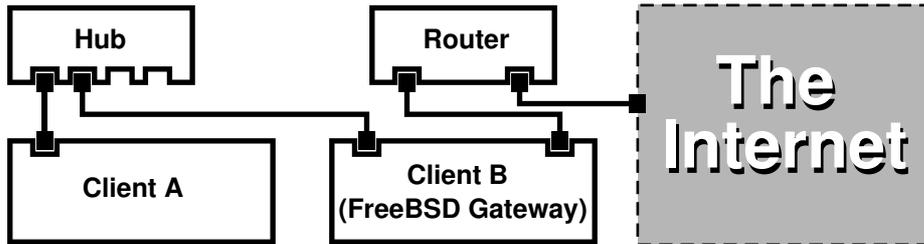
32.8.2 Setup

Due to the diminishing IP space in IPv4, and the increased number of users on high-speed consumer lines such as cable or DSL, people are increasingly in need of an Internet Connection Sharing solution. The ability to connect several computers online through one connection and IP address makes `natd(8)` a reasonable choice.

Most commonly, a user has a machine connected to a cable or DSL line with one IP address and wishes to use this one connected computer to provide Internet access to several more over a LAN.

To do this, the FreeBSD machine on the Internet must act as a gateway. This gateway machine must have two NICs—one for connecting to the Internet router, the other connecting to a LAN. All the machines on the LAN are connected through a hub or switch.

Όγιᾶβύος: There are many ways to get a LAN connected to the Internet through a FreeBSD gateway. This example will only cover a gateway with at least two NICs.



A setup like this is commonly used to share an Internet connection. One of the LAN machines is connected to the Internet. The rest of the machines access the Internet through that “gateway” machine.

32.8.3 Configuration

The following options must be in the kernel configuration file:

```
options IPFIREWALL
options IPDIVERT
```

Additionally, at choice, the following may also be suitable:

```
options IPFIREWALL_DEFAULT_TO_ACCEPT
options IPFIREWALL_VERBOSE
```

The following must be in `/etc/rc.conf`:

```
gateway_enable="YES" ❶
firewall_enable="YES" ❷
firewall_type="OPEN" ❸
natd_enable="YES"
natd_interface="fxp0" ❹
natd_flags="" ❺
```

- ❶ Sets up the machine to act as a gateway. Running `sysctl net.inet.ip.forwarding=1` would have the same effect.
- ❷ Enables the firewall rules in `/etc/rc.firewall` at boot.
- ❸ This specifies a predefined firewall ruleset that allows anything in. See `/etc/rc.firewall` for additional types.

- ④ Indicates which interface to forward packets through (the interface connected to the Internet).
- ⑤ Any additional configuration options passed to `natd(8)` on boot.

Having the previous options defined in `/etc/rc.conf` would run `natd -interface fxp0` at boot. This can also be run manually.

Ὁμολογία: It is also possible to use a configuration file for `natd(8)` when there are too many options to pass. In this case, the configuration file must be defined by adding the following line to `/etc/rc.conf`:

```
natd_flags="-f /etc/natd.conf"
```

The `/etc/natd.conf` file will contain a list of configuration options, one per line. For example the next section case would use the following file:

```
redirect_port tcp 192.168.0.2:6667 6667
redirect_port tcp 192.168.0.3:80 80
```

For more information about the configuration file, consult the `natd(8)` manual page about the `-f` option.

Each machine and interface behind the LAN should be assigned IP address numbers in the private network space as defined by RFC 1918 (<ftp://ftp.isi.edu/in-notes/rfc1918.txt>) and have a default gateway of the **natd** machine's internal IP address.

For example, client A and B behind the LAN have IP addresses of `192.168.0.2` and `192.168.0.3`, while the `natd` machine's LAN interface has an IP address of `192.168.0.1`. Client A and B's default gateway must be set to that of the **natd** machine, `192.168.0.1`. The **natd** machine's external, or Internet interface does not require any special modification for `natd(8)` to work.

32.8.4 Port Redirection

The drawback with `natd(8)` is that the LAN clients are not accessible from the Internet. Clients on the LAN can make outgoing connections to the world but cannot receive incoming ones. This presents a problem if trying to run Internet services on one of the LAN client machines. A simple way around this is to redirect selected Internet ports on the **natd** machine to a LAN client.

For example, an IRC server runs on client A, and a web server runs on client B. For this to work properly, connections received on ports 6667 (IRC) and 80 (web) must be redirected to the respective machines.

The `-redirect_port` must be passed to `natd(8)` with the proper options. The syntax is as follows:

```
-redirect_port proto targetIP:targetPORT[-targetPORT]
                [aliasIP:]aliasPORT[-aliasPORT]
                [remoteIP[:remotePORT[-remotePORT]]]
```

In the above example, the argument should be:

```
-redirect_port tcp 192.168.0.2:6667 6667
-redirect_port tcp 192.168.0.3:80 80
```

This will redirect the proper `tcp` ports to the LAN client machines.

The `-redirect_port` argument can be used to indicate port ranges over individual ports. For example, `tcp 192.168.0.2:2000-3000 2000-3000` would redirect all connections received on ports 2000 to 3000 to ports 2000 to 3000 on client A.

These options can be used when directly running `natd(8)`, placed within the `natd_flags=""` option in `/etc/rc.conf`, or passed via a configuration file.

For further configuration options, consult `natd(8)`

32.8.5 Address Redirection

Address redirection is useful if several IP addresses are available, yet they must be on one machine. With this, `natd(8)` can assign each LAN client its own external IP address. `natd(8)` then rewrites outgoing packets from the LAN clients with the proper external IP address and redirects all traffic incoming on that particular IP address back to the specific LAN client. This is also known as static NAT. For example, the IP addresses 128.1.1.1, 128.1.1.2, and 128.1.1.3 belong to the **natd** gateway machine. 128.1.1.1 can be used as the **natd** gateway machine's external IP address, while 128.1.1.2 and 128.1.1.3 are forwarded back to LAN clients A and B.

The `-redirect_address` syntax is as follows:

```
-redirect_address localIP publicIP
```

localIP

The internal IP address of the LAN client.

publicIP

The external IP address corresponding to the LAN client.

In the example, this argument would read:

```
-redirect_address 192.168.0.2 128.1.1.2
-redirect_address 192.168.0.3 128.1.1.3
```

Like `-redirect_port`, these arguments are also placed within the `natd_flags=""` option of `/etc/rc.conf`, or passed via a configuration file. With address redirection, there is no need for port redirection since all data received on a particular IP address is redirected.

The external IP addresses on the **natd** machine must be active and aliased to the external interface. Look at `rc.conf(5)` to do so.

32.9 Parallel Line IP (PLIP)

PLIP lets us run TCP/IP between parallel ports. It is useful on machines without network cards, or to install on laptops. In this section, we will discuss:

- Creating a parallel (laplink) cable.
- Connecting two computers with PLIP.

32.9.1 Creating a Parallel Cable

You can purchase a parallel cable at most computer supply stores. If you cannot do that, or you just want to know how it is done, the following table shows how to make one out of a normal parallel printer cable.

Ðβíáçáð 32-1. Wiring a Parallel Cable for Networking

A-name	A-End	B-End	Descr.	Post/Bit
DATA0 -ERROR	2 15	15 2	Data	0/0x01 1/0x08
DATA1 +SLCT	3 13	13 3	Data	0/0x02 1/0x10
DATA2 +PE	4 12	12 4	Data	0/0x04 1/0x20
DATA3 -ACK	5 10	10 5	Strobe	0/0x08 1/0x40
DATA4 BUSY	6 11	11 6	Data	0/0x10 1/0x80
GND	18-25	18-25	GND	-

32.9.2 Setting Up PLIP

First, you have to get a laplink cable. Then, confirm that both computers have a kernel with lpt(4) driver support:

```
# grep lp /var/run/dmesg.boot
lpt0: <Printer> on pbus0
lpt0: Interrupt-driven port
```

The parallel port must be an interrupt driven port, you should have lines similar to the following in your in the /boot/device.hints file:

```
hint.ppc.0.at="isa"
hint.ppc.0.irq="7"
```

Then check if the kernel configuration file has a device plip line or if the plip.ko kernel module is loaded. In both cases the parallel networking interface should appear when you use the ifconfig(8) command to display it:

```
# ifconfig plip0
plip0: flags=8810<POINTOPOINT,SIMPLEX,MULTICAST> mtu 1500
```

Plug the laplink cable into the parallel interface on both computers.

Configure the network interface parameters on both sites as root. For example, if you want to connect the host host1 with another machine host2:

```

                host1 <-----> host2
IP Address    10.0.0.1      10.0.0.2
```

Configure the interface on host1 by doing:

```
# ifconfig plip0 10.0.0.1 10.0.0.2
```

Configure the interface on host2 by doing:

```
# ifconfig plip0 10.0.0.2 10.0.0.1
```

You now should have a working connection. Please read the manual pages `lp(4)` and `lpt(4)` for more details.

You should also add both hosts to `/etc/hosts`:

```
127.0.0.1          localhost.my.domain localhost
10.0.0.1          host1.my.domain host1
10.0.0.2          host2.my.domain
```

To confirm the connection works, go to each host and ping the other. For example, on `host1`:

```
# ifconfig plip0
plip0: flags=8851<UP,POINTOPOINT,RUNNING,SIMPLEX,MULTICAST> mtu 1500
      inet 10.0.0.1 --> 10.0.0.2 netmask 0xff000000
# netstat -r
Routing tables

Internet:
Destination          Gateway              Flags      Refs      Use      Netif  Expire
host2                 host1                UH         0         0        plip0
# ping -c 4 host2
PING host2 (10.0.0.2): 56 data bytes
64 bytes from 10.0.0.2: icmp_seq=0 ttl=255 time=2.774 ms
64 bytes from 10.0.0.2: icmp_seq=1 ttl=255 time=2.530 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=255 time=2.556 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=255 time=2.714 ms

--- host2 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max/stddev = 2.530/2.643/2.774/0.103 ms
```

32.10 IPv6

IPv6 (also known as IPng “IP next generation”) is the new version of the well known IP protocol (also known as IPv4). Like the other current *BSD systems, FreeBSD includes the KAME IPv6 reference implementation. So your FreeBSD system comes with all you will need to experiment with IPv6. This section focuses on getting IPv6 configured and running.

In the early 1990s, people became aware of the rapidly diminishing address space of IPv4. Given the expansion rate of the Internet there were two major concerns:

- Running out of addresses. Today this is not so much of a concern anymore since RFC1918 private address space (10.0.0.0/8, 172.16.0.0/12, and 192.168.0.0/16) and Network Address Translation (NAT) are being employed.
- Router table entries were getting too large. This is still a concern today.

IPv6 deals with these and many other issues:

- 128 bit address space. In other words theoretically there are 340,282,366,920,938,463,463,374,607,431,768,211,456 addresses available. This means there are approximately $6.67 * 10^{27}$ IPv6 addresses per square meter on our planet.

- Routers will only store network aggregation addresses in their routing tables thus reducing the average space of a routing table to 8192 entries.

There are also lots of other useful features of IPv6 such as:

- Address autoconfiguration (RFC2462 (<http://www.ietf.org/rfc/rfc2462.txt>))
- Anycast addresses (“one-out-of many”)
- Mandatory multicast addresses
- IPsec (IP security)
- Simplified header structure
- Mobile IP
- IPv6-to-IPv4 transition mechanisms

For more information see:

- IPv6 overview at playground.sun.com (<http://playground.sun.com/pub/ipng/html/ipng-main.html>)
- KAME.net (<http://www.kame.net>)

32.10.1 Background on IPv6 Addresses

There are different types of IPv6 addresses: Unicast, Anycast and Multicast.

Unicast addresses are the well known addresses. A packet sent to a unicast address arrives exactly at the interface belonging to the address.

Anycast addresses are syntactically indistinguishable from unicast addresses but they address a group of interfaces. The packet destined for an anycast address will arrive at the nearest (in router metric) interface. Anycast addresses may only be used by routers.

Multicast addresses identify a group of interfaces. A packet destined for a multicast address will arrive at all interfaces belonging to the multicast group.

Όμιλότητα: The IPv4 broadcast address (usually xxx.xxx.xxx.255) is expressed by multicast addresses in IPv6.

Διάγραμμα 32-2. Reserved IPv6 addresses

IPv6 address	Prefixlength (Bits)	Description	Notes
::	128 bits	unspecified	cf. 0.0.0.0 in IPv4
:::1	128 bits	loopback address	cf. 127.0.0.1 in IPv4
::00:xx:xx:xx:xx	96 bits	embedded IPv4	The lower 32 bits are the IPv4 address. Also called “IPv4 compatible IPv6 address”

IPv6 address	Prefixlength (Bits)	Description	Notes
::ff:xx:xx:xx:xx	96 bits	IPv4 mapped IPv6 address	The lower 32 bits are the IPv4 address. For hosts which do not support IPv6.
fe80:: - feb::	10 bits	link-local	cf. loopback address in IPv4
fec0:: - fef::	10 bits	site-local	
ff::	8 bits	multicast	
001 (base 2)	3 bits	global unicast	All global unicast addresses are assigned from this pool. The first 3 bits are "001".

32.10.2 Reading IPv6 Addresses

The canonical form is represented as: x:x:x:x:x:x:x, each "x" being a 16 Bit hex value. For example FEBC:A574:382B:23C1:AA49:4592:4EFE:9982

Often an address will have long substrings of all zeros therefore one such substring per address can be abbreviated by "::". Also up to three leading "0"s per hexquad can be omitted. For example fe80::1 corresponds to the canonical form fe80:0000:0000:0000:0000:0000:0001.

A third form is to write the last 32 Bit part in the well known (decimal) IPv4 style with dots "." as separators. For example 2002::10.0.0.1 corresponds to the (hexadecimal) canonical representation 2002:0000:0000:0000:0000:0000:0a00:0001 which in turn is equivalent to writing 2002::a00:1.

By now the reader should be able to understand the following:

ifconfig

```
r10: flags=8943<UP,BROADCAST,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1500
    inet 10.0.0.10 netmask 0xffffffff broadcast 10.0.0.255
    inet6 fe80::200:21ff:fe03:8e1%r10 prefixlen 64 scopeid 0x1
    ether 00:00:21:03:08:e1
    media: Ethernet autoselect (100baseTX )
    status: active
```

fe80::200:21ff:fe03:8e1%r10 is an auto configured link-local address. It is generated from the MAC address as part of the auto configuration.

For further information on the structure of IPv6 addresses see RFC3513 (<http://www.ietf.org/rfc/rfc3513.txt>).

32.10.3 Getting Connected

Currently there are four ways to connect to other IPv6 hosts and networks:

- Getting an IPv6 network from your upstream provider. Talk to your Internet provider for instructions.
- Tunnel via 6-to-4 (RFC3068 (<http://www.ietf.org/rfc/rfc3068.txt>))

- Use the `net/freenet6` port if you are on a dial-up connection.

32.10.4 DNS in the IPv6 World

There used to be two types of DNS records for IPv6. The IETF has declared A6 records obsolete. AAAA records are the standard now.

Using AAAA records is straightforward. Assign your hostname to the new IPv6 address you just received by adding:

```
MYHOSTNAME          AAAA      MYIPv6ADDR
```

To your primary zone DNS file. In case you do not serve your own DNS zones ask your DNS provider. Current versions of `bind` (version 8.3 and 9) and `dns/djbdns` (with the IPv6 patch) support AAAA records.

32.10.5 Applying the needed changes to `/etc/rc.conf`

32.10.5.1 IPv6 Client Settings

These settings will help you configure a machine that will be on your LAN and act as a client, not a router. To have `rtsol(8)` autoconfigure your interface on boot all you need to add is:

```
ipv6_enable="YES"
```

To statically assign an IP address such as `2001:471:1f11:251:290:27ff:fee0:2093`, to your `fxp0` interface, add:

```
ipv6_ifconfig_fxp0="2001:471:1f11:251:290:27ff:fee0:2093"
```

To assign a default router of `2001:471:1f11:251::1` add the following to `/etc/rc.conf`:

```
ipv6_defaultrouter="2001:471:1f11:251::1"
```

32.10.5.2 IPv6 Router/Gateway Settings

This will help you take the directions that your tunnel provider has given you and convert it into settings that will persist through reboots. To restore your tunnel on startup use something like the following in `/etc/rc.conf`:

List the Generic Tunneling interfaces that will be configured, for example `gif0`:

```
gif_interfaces="gif0"
```

To configure the interface with a local endpoint of `MY_IPv4_ADDR` to a remote endpoint of `REMOTE_IPv4_ADDR`:

```
gifconfig_gif0="MY_IPv4_ADDR REMOTE_IPv4_ADDR"
```

To apply the IPv6 address you have been assigned for use as your IPv6 tunnel endpoint, add:

```
ipv6_ifconfig_gif0="MY_ASSIGNED_IPv6_TUNNEL_ENDPOINT_ADDR"
```

Then all you have to do is set the default route for IPv6. This is the other side of the IPv6 tunnel:

```
ipv6_defaultrouter="MY_IPV6_REMOTE_TUNNEL_ENDPOINT_ADDR"
```

32.10.5.3 IPv6 Tunnel Settings

If the server is to route IPv6 between the rest of your network and the world, the following `/etc/rc.conf` setting will also be needed:

```
ipv6_gateway_enable="YES"
```

32.10.6 Router Advertisement and Host Auto Configuration

This section will help you setup `rtadvd(8)` to advertise the IPv6 default route.

To enable `rtadvd(8)` you will need the following in your `/etc/rc.conf`:

```
rtadvd_enable="YES"
```

It is important that you specify the interface on which to do IPv6 router solicitation. For example to tell `rtadvd(8)` to use `fxp0`:

```
rtadvd_interfaces="fxp0"
```

Now we must create the configuration file, `/etc/rtadvd.conf`. Here is an example:

```
fxp0:\
:addr#1:addr="2001:471:1f11:246::":prefixlen#64:tc=ether:
```

Replace `fxp0` with the interface you are going to be using.

Next, replace `2001:471:1f11:246::` with the prefix of your allocation.

If you are dedicated a /64 subnet you will not need to change anything else. Otherwise, you will need to change the `prefixlen#` to the correct value.

32.11 Asynchronous Transfer Mode (ATM)

32.11.1 Configuring classical IP over ATM (PVCs)

Classical IP over ATM (CLIP) is the simplest method to use Asynchronous Transfer Mode (ATM) with IP. It can be used with switched connections (SVCs) and with permanent connections (PVCs). This section describes how to set up a network based on PVCs.

32.11.1.1 Fully meshed configurations

The first method to set up a CLIP with PVCs is to connect each machine to each other machine in the network via a dedicated PVC. While this is simple to configure it tends to become impractical for a larger number of machines. The example supposes that we have four machines in the network, each connected to the ATM network with an ATM

adapter card. The first step is the planning of the IP addresses and the ATM connections between the machines. We use the following:

Host	IP Address
hostA	192.168.173.1
hostB	192.168.173.2
hostC	192.168.173.3
hostD	192.168.173.4

To build a fully meshed net we need one ATM connection between each pair of machines:

Machines	VPI.VCI couple
hostA - hostB	0.100
hostA - hostC	0.101
hostA - hostD	0.102
hostB - hostC	0.103
hostB - hostD	0.104
hostC - hostD	0.105

The VPI and VCI values at each end of the connection may of course differ, but for simplicity we assume that they are the same. Next we need to configure the ATM interfaces on each host:

```
hostA# ifconfig hatm0 192.168.173.1 up
hostB# ifconfig hatm0 192.168.173.2 up
hostC# ifconfig hatm0 192.168.173.3 up
hostD# ifconfig hatm0 192.168.173.4 up
```

assuming that the ATM interface is hatm0 on all hosts. Now the PVCs need to be configured on hostA (we assume that they are already configured on the ATM switches, you need to consult the manual for the switch on how to do this).

```
hostA# atmconfig natm add 192.168.173.2 hatm0 0 100 llc/snap ubr
hostA# atmconfig natm add 192.168.173.3 hatm0 0 101 llc/snap ubr
hostA# atmconfig natm add 192.168.173.4 hatm0 0 102 llc/snap ubr

hostB# atmconfig natm add 192.168.173.1 hatm0 0 100 llc/snap ubr
hostB# atmconfig natm add 192.168.173.3 hatm0 0 103 llc/snap ubr
hostB# atmconfig natm add 192.168.173.4 hatm0 0 104 llc/snap ubr

hostC# atmconfig natm add 192.168.173.1 hatm0 0 101 llc/snap ubr
hostC# atmconfig natm add 192.168.173.2 hatm0 0 103 llc/snap ubr
hostC# atmconfig natm add 192.168.173.4 hatm0 0 105 llc/snap ubr

hostD# atmconfig natm add 192.168.173.1 hatm0 0 102 llc/snap ubr
hostD# atmconfig natm add 192.168.173.2 hatm0 0 104 llc/snap ubr
hostD# atmconfig natm add 192.168.173.3 hatm0 0 105 llc/snap ubr
```

Of course other traffic contracts than UBR can be used given the ATM adapter supports those. In this case the name of the traffic contract is followed by the parameters of the traffic. Help for the atmconfig(8) tool can be obtained with:

```
# atmconfig help natm add
```

or in the atmconfig(8) manual page.

The same configuration can also be done via `/etc/rc.conf`. For `hostA` this would look like:

```
network_interfaces="lo0 hatm0"
ifconfig_hatm0="inet 192.168.173.1 up"
natm_static_routes="hostB hostC hostD"
route_hostB="192.168.173.2 hatm0 0 100 llc/snap ubr"
route_hostC="192.168.173.3 hatm0 0 101 llc/snap ubr"
route_hostD="192.168.173.4 hatm0 0 102 llc/snap ubr"
```

The current state of all CLIP routes can be obtained with:

```
hostA# atmconfig natm show
```

32.12 Common Access Redundancy Protocol (CARP)

The Common Access Redundancy Protocol, or CARP allows multiple hosts to share the same IP address. In some configurations, this may be used for availability or load balancing. Hosts may use separate IP addresses as well, as in the example provided here.

To enable support for CARP, the FreeBSD kernel must be rebuilt with the following option:

```
device carp
```

CARP functionality should now be available and may be tuned via several `sysctl` OIDs. Devices themselves may be loaded via the `ifconfig` command:

```
# ifconfig carp0 create
```

In a real environment, these interfaces will need unique identification numbers known as a VHID. This VHID or Virtual Host Identification will be used to distinguish the host on the network.

32.12.1 Using CARP For Server Availability (CARP)

One use of CARP, as noted above, is for server availability. This example will provide failover support for three hosts, all with unique IP addresses and providing the same web content. These machines will act in conjunction with a Round Robin DNS configuration. The failover machine will have two additional CARP interfaces, one for each of the content server's IPs. When a failure occurs, the failover server should pick up the failed machine's IP address. This means the failure should go completely unnoticed to the user. The failover server requires identical content and services as the other content servers it is expected to pick up load for.

The two machines should be configured identically other than their issued hostnames and VHIDs. This example calls these machines `hosta.example.org` and `hostb.example.org` respectively. First, the required lines for a CARP configuration have to be added to `rc.conf`. For `hosta.example.org`, the `rc.conf` file should contain the following lines:

```
hostname="hosta.example.org"
```

```
ifconfig_fxp0="inet 192.168.1.3 netmask 255.255.255.0"
cloned_interfaces="carp0"
ifconfig_carp0="vhid 1 pass testpast 192.168.1.50/24"
```

On `hostb.example.org` the following lines should be in `rc.conf`:

```
hostname="hostb.example.org"
ifconfig_fxp0="inet 192.168.1.4 netmask 255.255.255.0"
cloned_interfaces="carp0"
ifconfig_carp0="vhid 2 pass testpass 192.168.1.51/24"
```

Ὁδηγία: It is very important that the passwords, specified by the `pass` option to `ifconfig`, are identical. The `carp` devices will only listen to and accept advertisements from machines with the correct password. The VHID must also be different for each machine.

The third machine, `provider.example.org`, should be prepared so that it may handle failover from either host. This machine will require two `carp` devices, one to handle each host. The appropriate `rc.conf` configuration lines will be similar to the following:

```
hostname="provider.example.org"
ifconfig_fxp0="inet 192.168.1.5 netmask 255.255.255.0"
cloned_interfaces="carp0 carp1"
ifconfig_carp0="vhid 1 advskew 100 pass testpass 192.168.1.50/24"
ifconfig_carp1="vhid 2 advskew 100 pass testpass 192.168.1.51/24"
```

Having the two `carp` devices will allow `provider.example.org` to notice and pick up the IP address of either machine should it stop responding.

Ὁδηγία: The default FreeBSD kernel *may* have preemption enabled. If so, `provider.example.org` may not relinquish the IP address back to the original content server. In this case, an administrator may “nudge” the interface. The following command should be issued on `provider.example.org`:

```
# ifconfig carp0 down && ifconfig carp0 up
```

This should be done on the `carp` interface which corresponds to the correct host.

At this point, CARP should be completely enabled and available for testing. For testing, either networking has to be restarted or the machines need to be rebooted.

More information is always available in the `carp(4)` manual page.

V. ĐáñáñôPìáôá

Δαῖνῦῆσῖα A.

Ἰῖῖ ἑά Ἀῖῖῖῖ ὀῖ FreeBSD

A.1 Ἀῖῖῖῖ ὀῖ CDROM ἑάῖ DVD

A.1.1 Retail Ἀῖῖῖῖῖ

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Fax: +1 925 674-0821
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WWW: <http://www.freebsdmall.com/>
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A.1.3 Äéáññáβò

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WWW: <http://www.cylogistics.com/>
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Latvia

In case of problems, please contact the hostmaster <hostmaster@lv.FreeBSD.org> for this domain.

- <ftp://ftp.lv.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp.lv.FreeBSD.org/pub/FreeBSD/\)](http://ftp.lv.FreeBSD.org/pub/FreeBSD/))
- <ftp://ftp2.lv.FreeBSD.org/pub/FreeBSD/> (ftp)

Lithuania

In case of problems, please contact the hostmaster <hostmaster@lt.FreeBSD.org> for this domain.

- <ftp://ftp.lt.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp.lt.FreeBSD.org/pub/FreeBSD/\)](http://ftp.lt.FreeBSD.org/pub/FreeBSD/))

Netherlands

In case of problems, please contact the hostmaster <hostmaster@nl.FreeBSD.org> for this domain.

- <ftp://ftp.nl.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp.nl.FreeBSD.org/os/FreeBSD/\)](http://ftp.nl.FreeBSD.org/os/FreeBSD/) / rsync)
- <ftp://ftp2.nl.FreeBSD.org/pub/FreeBSD/> (ftp)

Norway

In case of problems, please contact the hostmaster <hostmaster@no.FreeBSD.org> for this domain.

- <ftp://ftp.no.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)
- <ftp://ftp3.no.FreeBSD.org/pub/FreeBSD/> (ftp)

Poland

In case of problems, please contact the hostmaster <hostmaster@pl.FreeBSD.org> for this domain.

- <ftp://ftp.pl.FreeBSD.org/pub/FreeBSD/> (ftp)

- <ftp://ftp2.pl.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 (<ftp://ftp2.pl.FreeBSD.org/pub/FreeBSD/>) / [http \(http://ftp2.pl.FreeBSD.org/pub/FreeBSD/\)](http://ftp2.pl.FreeBSD.org/pub/FreeBSD/) / [httpv6 \(http://ftp2.pl.FreeBSD.org/pub/FreeBSD/\)](http://ftp2.pl.FreeBSD.org/pub/FreeBSD/) / [rsync / rsyncv6](http://ftp2.pl.FreeBSD.org/pub/FreeBSD/))

Portugal

In case of problems, please contact the hostmaster <hostmaster@pt.FreeBSD.org> for this domain.

- <ftp://ftp.pt.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp2.pt.FreeBSD.org/pub/freebsd/> (ftp)
- <ftp://ftp4.pt.FreeBSD.org/pub/ISO/FreeBSD/> (ftp)

Romania

In case of problems, please contact the hostmaster <hostmaster@ro.FreeBSD.org> for this domain.

- <ftp://ftp.ro.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp1.ro.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 / [http \(http://ftp1.ro.FreeBSD.org/pub/FreeBSD/\)](http://ftp1.ro.FreeBSD.org/pub/FreeBSD/) / [httpv6 \(http://ftp1.ro.FreeBSD.org/pub/FreeBSD/\)](http://ftp1.ro.FreeBSD.org/pub/FreeBSD/))

Russia

In case of problems, please contact the hostmaster <hostmaster@ru.FreeBSD.org> for this domain.

- <ftp://ftp.ru.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp.ru.FreeBSD.org/FreeBSD/\)](http://ftp.ru.FreeBSD.org/FreeBSD/) / [rsync](http://ftp.ru.FreeBSD.org/FreeBSD/))
- <ftp://ftp2.ru.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp2.ru.FreeBSD.org/pub/FreeBSD/\)](http://ftp2.ru.FreeBSD.org/pub/FreeBSD/) / [rsync](http://ftp2.ru.FreeBSD.org/pub/FreeBSD/))
- <ftp://ftp3.ru.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp4.ru.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp5.ru.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp5.ru.FreeBSD.org/pub/FreeBSD/\)](http://ftp5.ru.FreeBSD.org/pub/FreeBSD/) / [rsync](http://ftp5.ru.FreeBSD.org/pub/FreeBSD/))
- <ftp://ftp6.ru.FreeBSD.org/pub/FreeBSD/> (ftp)

Saudi Arabia

In case of problems, please contact the hostmaster <ftpadmin@isu.net.sa> for this domain.

- <ftp://ftp.isu.net.sa/pub/ftp.freebsd.org/> (ftp)

Singapore

In case of problems, please contact the hostmaster <hostmaster@sg.FreeBSD.org> for this domain.

- <ftp://ftp.sg.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp.sg.FreeBSD.org/pub/FreeBSD/\)](http://ftp.sg.FreeBSD.org/pub/FreeBSD/) / [rsync](http://ftp.sg.FreeBSD.org/pub/FreeBSD/))

Slovak Republic

In case of problems, please contact the hostmaster <hostmaster@sk.FreeBSD.org> for this domain.

- ftp://ftp.sk.FreeBSD.org/pub/FreeBSD/ (ftp / ftpv6 (ftp://ftp.sk.FreeBSD.org/pub/FreeBSD/) / http (http://ftp.sk.FreeBSD.org/pub/FreeBSD/) / httpv6 (http://ftp.sk.FreeBSD.org/pub/FreeBSD/) / rsync / rsyncv6)
- ftp://ftp2.sk.FreeBSD.org/pub/FreeBSD/ (ftp / ftpv6 (ftp://ftp2.sk.FreeBSD.org/pub/FreeBSD/) / http (http://ftp2.sk.FreeBSD.org/pub/FreeBSD/) / httpv6 (http://ftp2.sk.FreeBSD.org/pub/FreeBSD/))

Slovenia

In case of problems, please contact the hostmaster <hostmaster@si.FreeBSD.org> for this domain.

- ftp://ftp.si.FreeBSD.org/pub/FreeBSD/ (ftp)
- ftp://ftp2.si.FreeBSD.org/pub/FreeBSD/ (ftp)

South Africa

In case of problems, please contact the hostmaster <hostmaster@za.FreeBSD.org> for this domain.

- ftp://ftp.za.FreeBSD.org/pub/FreeBSD/ (ftp)
- ftp://ftp2.za.FreeBSD.org/pub/FreeBSD/ (ftp)
- ftp://ftp3.za.FreeBSD.org/pub/FreeBSD/ (ftp)
- ftp://ftp4.za.FreeBSD.org/pub/FreeBSD/ (ftp)

Spain

In case of problems, please contact the hostmaster <hostmaster@es.FreeBSD.org> for this domain.

- ftp://ftp.es.FreeBSD.org/pub/FreeBSD/ (ftp / http (http://ftp.es.FreeBSD.org/pub/FreeBSD/))
- ftp://ftp2.es.FreeBSD.org/pub/FreeBSD/ (ftp)
- ftp://ftp3.es.FreeBSD.org/pub/FreeBSD/ (ftp)

Sweden

In case of problems, please contact the hostmaster <hostmaster@se.FreeBSD.org> for this domain.

- ftp://ftp.se.FreeBSD.org/pub/FreeBSD/ (ftp)
- ftp://ftp2.se.FreeBSD.org/pub/FreeBSD/ (ftp)
- ftp://ftp3.se.FreeBSD.org/pub/FreeBSD/ (ftp)
- ftp://ftp4.se.FreeBSD.org/pub/FreeBSD/ (ftp / ftpv6 (ftp://ftp4.se.FreeBSD.org/pub/FreeBSD/) / http (http://ftp4.se.FreeBSD.org/pub/FreeBSD/) / httpv6 (http://ftp4.se.FreeBSD.org/pub/FreeBSD/) / rsync (rsync://ftp4.se.FreeBSD.org/pub/FreeBSD/) / rsyncv6 (rsync://ftp4.se.FreeBSD.org/pub/FreeBSD/))
- ftp://ftp5.se.FreeBSD.org/pub/FreeBSD/ (ftp / http (http://ftp5.se.FreeBSD.org/) / rsync)

Switzerland

In case of problems, please contact the hostmaster <hostmaster@ch.FreeBSD.org> for this domain.

- <ftp://ftp.ch.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp.ch.FreeBSD.org/pub/FreeBSD/>))
- <ftp://ftp2.ch.FreeBSD.org/mirror/FreeBSD/> (ftp / ftpv6 (<ftp://ftp2.ch.FreeBSD.org/mirror/FreeBSD/>) / http (<http://ftp2.ch.FreeBSD.org/ftp/mirror/FreeBSD/>) / httpv6 (<http://ftp2.ch.FreeBSD.org/ftp/mirror/FreeBSD/>))

Taiwan

In case of problems, please contact the hostmaster <hostmaster@tw.FreeBSD.org> for this domain.

- <ftp://ftp.tw.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 (<ftp://ftp.tw.FreeBSD.org/pub/FreeBSD/>) / rsync / rsyncv6)
- <ftp://ftp2.tw.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 (<ftp://ftp2.tw.FreeBSD.org/pub/FreeBSD/>) / http (<http://ftp2.tw.FreeBSD.org/pub/FreeBSD/>) / httpv6 (<http://ftp2.tw.FreeBSD.org/pub/FreeBSD/>) / rsync / rsyncv6)
- <ftp://ftp3.tw.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp4.tw.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp5.tw.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp6.tw.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp6.tw.FreeBSD.org/>) / rsync)
- <ftp://ftp7.tw.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp8.tw.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp9.tw.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp10.tw.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp11.tw.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp11.tw.FreeBSD.org/FreeBSD/>))
- <ftp://ftp12.tw.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp13.tw.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp14.tw.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp15.tw.FreeBSD.org/pub/FreeBSD/> (ftp)

Turkey

- <ftp://ftp.tr.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp.tr.FreeBSD.org/pub/FreeBSD/>) / rsync)
- <ftp://ftp2.tr.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)

Ukraine

- <ftp://ftp.ua.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp.ua.FreeBSD.org/pub/FreeBSD/>))
- <ftp://ftp2.ua.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp2.ua.FreeBSD.org/pub/FreeBSD/>))
- <ftp://ftp7.ua.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp8.ua.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp8.ua.FreeBSD.org/FreeBSD/>))
- <ftp://ftp11.ua.FreeBSD.org/pub/FreeBSD/> (ftp)

United Kingdom

In case of problems, please contact the hostmaster <hostmaster@uk.FreeBSD.org> for this domain.

- <ftp://ftp.uk.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp2.uk.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp2.uk.FreeBSD.org/>) / rsync)
- <ftp://ftp3.uk.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp4.uk.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp5.uk.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp6.uk.FreeBSD.org/pub/FreeBSD/> (ftp)

USA

In case of problems, please contact the hostmaster <hostmaster@us.FreeBSD.org> for this domain.

- <ftp://ftp1.us.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp2.us.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp3.us.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp4.us.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 / http (<http://ftp4.us.FreeBSD.org/pub/FreeBSD/>) / [httpv6 \(http://ftpv6.us.FreeBSD.org/pub/FreeBSD/\)](http://ftpv6.us.FreeBSD.org/pub/FreeBSD/))
- <ftp://ftp5.us.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)
- <ftp://ftp6.us.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp7.us.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp7.us.FreeBSD.org/pub/FreeBSD/>) / rsync)
- <ftp://ftp8.us.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp9.us.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp9.us.FreeBSD.org/pub/os/FreeBSD/>))
- <ftp://ftp10.us.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp11.us.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp12.us.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)
- <ftp://ftp13.us.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp13.us.FreeBSD.org/pub/FreeBSD/>) / rsync)
- <ftp://ftp14.us.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp14.us.FreeBSD.org/pub/FreeBSD/>))

- <ftp://ftp15.us.FreeBSD.org/pub/FreeBSD/> (ftp)

A.3 BitTorrent

Ìðññáβòά íά áñèðΠóàðά òά άάóέÈÛ άñ÷-άβά ISO òùì áέäüóáùí òïò FreeBSD, ìÝòù òïò òóòòΠιάðïò BitTorrent. Óòçί òïðñèáòá <http://torrents.freebsd.org:8080> (<http://torrents.freebsd.org:8080/>) òðÛñ÷-áέ ìέά ðéΠñçò òóèèñáΠ áðü άñ÷-άβά torrent ðïò ìðññáβòά íά έάòάáÛòáðά.

Άέά íá ÷ ñçóèññðñèΠóáðά òά άñ÷-άβά torrent, έά ÷ ñáέáòòáβòά έάòÛèçèï èñáéóìέèü-ðáèÛòç, üðùð áðòü ðïò ðáñÝ÷-áðáέ áðü òï port Π ðáèÝðïí net-p2p/py-bittorrent.

Άòñý έáòάáÛòáðά òï άñ÷-άβá ISO ìά òï BitTorrent, ìðññáβòά íά òï ãñÛòáðά òά CD Π DVD, üðùð ðáñèññÛòáðáέ òïò ÒïΠιά 19.6.3 (burncd).

A.4 Αίπίòïï CVS

A.4.1 Άέóáãüāβ

Ç óññáðòç áίπίòïï CVS (Π *anoncvs* üðùð èÝñáðáέ ìáñέèÝð òññÝð) òðñòòçñβáέðáέ áðü òά áñááèáβά CVS ðïò áέáíÝññòáέ ìά òï βáèï òï FreeBSD áέá òðá÷-ññíέóïü òïðéèðí άñ÷-άβáì ìά Ýíά áðñáèñòòïí Ýññ repository. Íά áðü òά ÷-áñáèðçñéòóέèÛ òïò CVS áβíáέ üðé áðέòñÝðáέ òóïòð ÷ ñΠóòáð òïò FreeBSD íά òðá÷-ñññβáèïí, ÷ ùñβò èéάβðáñá áέéáèññáðá ÷ ñΠóðç, òά òïðéèÛ áíòβáñáòá ðçááβïò èρáέéá ðïò Ý÷-íòí ìά òïò èáíòñéèýð, áðβóçññòð áñòðçñáðòçðÝð CVS òïò FreeBSD project. Άέά íá ÷ ñçóèññðñèΠóáέ έáíáβò òï CVS áñèáβ: (ά) íá ññβáέ òçí òèï òçò ìáðááèçòðð ðáñέáÛèèññòð CVSROOT Ýðóέ þòðá íά ááβ÷-íáέ ðññò Ýíáí áðü òïòð áðβóçññòð áñòðçñáðòçðÝð, έáέ (á) íá áρóáέ òññ èüáèèü “anoncvs” òòçí ðññòññð òçò áíòñèðð cvs login. Òüðά ìðññáβ íά ÷ ñçóèññðñèΠóáέ òï áñááèáβñ cvs(1) áέά íá ðññòðáèÛòáέ òï áðñáèññòòïí CVS repository òïò FreeBSD òάí Ýíά ìðñèñáβðñíðά òïðéèü repository.

Óçñáβüòç: Ç áíòñèΠ cvs login áðñèçéáýáέ òïòð èüáéèýóð ðïò ÷ ñçóèññðñèÝññòáέ áέá ðéóðòìðñçòçð òçò òάòðüòòòòð òάò òòññ áñòðçñáðòçð CVS òά Ýíá áñ÷-άβá ìά üññá .cvspass òòññ HOME έáòÛèèññ òïò òïðéèýñ òáò èñááñéáóïñý. Αí áðòü òï άñ÷-άβá ááí òðÛñ÷-áέ þáç, ìðññáβ íά áðñíóý÷-áέ ç áíòñèΠ cvs login òçí ðñρòç òññÛ. ìðññáβòά áðèÛ íά áçñèññáβòáðά Ýíá Ûááέí άñ÷-άβá .cvspass έáέ íá ìáíáðñÝíáðά òçí áíòñèΠ cvs login.

Ìðññáβ íá ðáέ έáíáβò üðé òï CVSup έáέ òï *anoncvs* áβíáέ ìðóéáðóéèÛ ðáññññèñé òññðñè òðá÷-ñññέòññ άñ÷-άβáì έáέ òðñòòçñβáèïí òçí βáέá έáέòïòñáέèüòçðá, áέèÛ òðÛñ÷-íòí èÛðñéáð áέáòññÝð ìé ìðñáð ìðññáβ íá ðáβññññ òçíáíóéèü ññèñ òòçí áðéèñáΠ ìáðáíý áðòþí òùí áýñ ìáèñüñ. ΆáñέèÛ, òï CVSup èÛñíáέ ðñèý ðèí áðñáñòéèΠ ÷ ñΠóç òçò óññááòçð ðïò Ý÷-áðά έáέ ÷ ñçóèññðñèáβ Ýíá ðñèý ðèí Ýíòðñ ðññòññèèèñ áðéèñññññáðð, áέèÛ òðÛñ÷-áέ έáέ òï áíòβóðñé÷-ñ òβñçñá. Άέά íá ÷ ñçóèññðñèΠóáðá òï CVSup ðñÝðáέ íá ááέáðáòòòòáðá έáέ íá ñòèññòáðá Ýíá áέéèèü ðññáñáññá ðáèÛòç, έáέ òñðά ìðññáβòά íά òðá÷-ñññβáèïá ìñññ ìááÛèäò òóèèñáÝð άñ÷-άβáì — òéð ìðñáð òï CVSup áðñéáέáβ “òóèèñáÝð” (collections).

Òï *anoncvs*, áðü òçí Ûèçç, ìðññáβ íá ÷ ñçóèññðñèçéáβ áέá íá áñáòÛòáέ έáíáβò òéð áέèááÝð áññèð έáέ ìñññ áñ÷-άβáì Π áññèð ìññ ðññáñÛñáðòð έáέ òññ òòññáðòéèðñ òïò άñ÷-άβáì (ð.÷. òññ ðçááβñ èρáέéá òçò áíòñèΠð ìs Π òçò grep), ìá ÷ ñΠóç òïò ñññáðòð òïò έáòÛèçèçèñ òïò module. Òï *anoncvs* áβíáέ ðèñ áñéèèü áέá áñááòβáð ðïò áðáέòñññ áÝááέá ìñññ áíÛáññòç. Ìðñáð, áí èÝéáðά íá òðñòòçñβñáðά òçí áíÛðòòñç ðññáñññÛòñ òïðéèèÛ, òï CVSup áβíáέ ìÛèèññ ñññáñññò.

A.4.2 × ηζοείηθίεπίοάο Αίπίοηί CVS

Ç ηγείεος οίη cvs(1) πρóa ίά ÷ ηζοείηθίεάβ Ύίά αίπίοηί CVS repository ἀβίόάέ άδερη ηδελβαίηόάο όçί ίαόάέçòΠ δάνέαΎεεηηοδ cvsroot πρóa ίά αάβ÷ ίάέ οά Ύίάί άδυ οίηδ anoncvs αίηδçηάοçòΎδ οίη FreeBSD project. Όçί πηά θίη ανΎοηιόάέ άδòΎδ ίέ ανήηΎδ, άβίάέ αέάέΎοείηέ ίέ αέυεηοείέ αίηδçηάοçòΎδ:

- **Άάεββα:** :pserver:anoncvs@anoncvs.fr.FreeBSD.org:/home/ncvs (Άέά pserver ÷ ηζοείηθίεπρóa όçί αίθίεΠ cvs login έάέ άπρóa οίη έυάέευ “anoncvs” υόάί οάδ æçòçεάβ. Όι ssh αάί άδάέοάβ όç ÷ ηΠόç έυάέείγ.)

- **ΌάΑάΎί:** :pserver:anoncvs@anoncvs.tw.FreeBSD.org:/home/ncvs (Άέά pserver ÷ ηζοείηθίεπρóa όçί αίθίεΠ cvs login έάέ άπρóa ίόέάΠθίόά αέά έυάέευ υόάί οάδ æçòçεάβ, Όι ssh αάί άδάέοάβ όç ÷ ηΠόç έυάέείγ.)

```
SSH2 HostKey: 1024 02:ed:1b:17:d6:97:2b:58:5e:5c:e2:da:3b:89:88:26 /etc/ssh/ssh_host_rsa_key.pub
SSH2 HostKey: 1024 e8:3b:29:7b:ca:9f:ac:e9:45:cb:c8:17:ae:9b:eb:55 /etc/ssh/ssh_host_dsa_key.pub
```

- **ÇιυΎίάδ Διέόάββαδ ΑιάνεεΠδ:** anoncvs@anoncvs1.FreeBSD.org:/home/ncvs (Άέά δñυόάός ίΎού ssh, ÷ ηζοείηθίεπρóa όçί Ύέαιός 2 οίη ssh, ÷ υñβδ έυάέεί.)

```
SSH2 HostKey: 2048 53:1f:15:a3:72:5c:43:f6:44:0e:6a:e9:bb:f8:01:62 /etc/ssh/ssh_host_dsa_key.pub
```

Έάερη οίη CVS οάδ άδεθñΎδάέ ίά έΎίάδ “check out” ίόέάόόέΎυ ίθίέάάΠθίόά Ύέαιός οίη δçάάβιθ έπáέά οίη FreeBSD οδΠñη θίηΎ (έάέ οά ηñέοιΎίάδ δάνεδθρóaέδ αέυηά έάέ άέυυόάέδ θίη αάί Ύ ÷ ίθί έθέεηοηηΠρóaέ αέυηά), έά δñΎδάέ ίά άβόά άηέέάέυηΎίηδ ίά όçί άδεεηΠ οίη cvs(1) ίά όçί ηθίβá άδεέΎάάόάέ οίη revision (δñυέάέόάέ αέά όçί -r) έάέ θίέάδ άβίάέ ίέ άδεθñάδòΎδ οείΎδ όçδ αέά οίη repository οίη FreeBSD project.

ΌδΎñ ÷ ίθί άγί άβαç tags (άόέέάδπí), όά revision tags (άόέέΎόάδ Ύέαιός) έάέ όά branch tags. ίά revision tag αίάόΎñάόάέ οά ίέά οάέάέñείΎίç Ύέαιός. Ç Ύίηέά οίη δάναιΎίάέ οάέάηΠ ίΎñά ίά όç ίΎñά. Άδυ όçί Ύέεç, Ύίά branch tag αάβ÷ ίάέ όçί οάέάδóάβá Ύέαιός ίέάδ οάέάέñείΎίçδ θίηñάβáδ αίΎδóοίçδ, οά έΎεά ÷ ηηέεΠ οόέαιΠ. Έάερη οίη branch tag αάί αίάόΎñάόάέ οά έΎθίέά οάέάέñείΎίç Ύέαιός, ίθίñάβ άγñεί ίά όçίάβίάέ έΎόέ άέάοηηάόέέυ άδυ υόέ όçίάβίάέ óΠññά.

Όι ΌηΠιá A.7 δάνεΎ ÷ áέ revision tags όά ηθίβá ίθίñάβ ίά αίάέάóΎηηοί οίηδ ÷ ηΠρóaδ. Όδάρεθιβαίθιá υόέ έάρΎίά άδυ άδóΎ αάί άβίάέ Ύάέθñη αέά όçί ΌόεεηΠ ουη Ports, έάερη άδóΠ αάί Ύ ÷ áέ θίέέάδεΎδ άέάυόάέδ (revisions).

¼όάί έάέηñβæάόά έΎθίεί branch tag, οδóέεηηάέΎυ έάηάΎίάδά δέδ οάέάδóάβáδ άέάυόάέδ ουη άñ ÷ άβυη θίη οδΎñ ÷ ίθί οά άδóΠ όç ανήηΠ αίΎδóοίçδ. Αί εΎέάόά ίά έΎάάόά έΎθίέά δάέέυόάñç Ύέαιός, ίθίñάβόά ÷ ηζοείηθίεπίοάο όçί çιάνηçίβá οά οθίάόάοίυ ίά όçί άδεεηΠ -D date. Άάβόά όç οάέβáά manual οίη cvs(1) αέά δάνεóóυόάñάδ έάδθñΎñάέάδ.

A.4.3 Δάñάάάβáηιόά

Αί έάέ δñάάηιόέέΎυ οθίβóόάόάέ ίά αέάάΎόάδά δñηοάέδóέέΎυ όç οάέβáά manual οίη cvs(1) δñεί έΎίάδά ίόέάΠθίόά, δάνάέΎδου οάδ άβιθιá έΎθίέά ανΠáηά δάñάάάβáηιόά όά ηθίβá ίόέάόóέέΎυ έά οάδ αάβιθιθ δυδ ίά ÷ ηζοείηθίεπρóa όçί οίη Αίπίοηί CVS:

ΔάñΎάάέαιά A-1. ΈΠθç (Check out) ΈΎθίεηθ Άñ ÷ άβιθ άδυ οίη -CURRENT (ls(1)):

```
% setenv CVSROOT :pserver:anoncvs@anoncvs.tw.FreeBSD.org:/home/ncvs
% cvs login
Όόçί δñηθñηθΠ, άπρóa ίθίέάάΠθίόά εΎίç αέά "password".
% cvs co ls
```

ΔάνΥääéαιά A-2. ×ñΠόç SSH äéá ĘΠόç (check out) òιò ΆΥίòññò src/:

```
% cvs -d anoncvs@anoncvs1.FreeBSD.org:/home/ncvs co src
The authenticity of host 'anoncvs1.freebsd.org (216.87.78.137)' can't be established.
DSA key fingerprint is 53:1f:15:a3:72:5c:43:f6:44:0e:6a:e9:bb:f8:01:62.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'anoncvs1.freebsd.org' (DSA) to the list of known hosts.
```

ΔάνΥääéαιά A-3. ĘΠόç òçò èäìòçò òιò Άñ÷âβιò ls(1) áðu òι 8-STABLE Branch:

```
% setenv CVSROOT :pserver:anoncvs@anoncvs.tw.FreeBSD.org:/home/ncvs
% cvs login
Óðçí ðñìòññìðð, äþóðá ìðìéääâððìðá èÝìç äéá "password".
% cvs co -rRELENG_8 ls
```

ΔάνΥääéαιά A-4. Äçìèòñâβá ìéáð Ęβóóáð Áéëääþí (ùò Unified Diffs) òçò ls(1):

```
% setenv CVSROOT :pserver:anoncvs@anoncvs.tw.FreeBSD.org:/home/ncvs
% cvs login
Óðçí ðñìòññìðð, äþóðá ìðìéääâððìðá èÝìç äéá "password".
% cvs rdiff -u -rRELENG_8_0_0_RELEASE -rRELENG_8_1_0_RELEASE ls
```

ΔάνΥääéαιά A-5. Άñβóèñíóáð Διέά ¶ìéá Ìúñíáóá Modules ìðñìýí íá ×ñçóèìðìéçèýí:

```
% setenv CVSROOT :pserver:anoncvs@anoncvs.tw.FreeBSD.org:/home/ncvs
% cvs login
Óðçí ðñìòññìðð, äþóðá ìðìéääâððìðá èÝìç äéá "password".
% cvs co modules
% more modules/modules
```

A.4.4 ¶èëåð ΔçãÝò Δèçñìöìñéþí

Ìé ðánaéÛòù ðçãÝò ðèçñìöìñéþí βóùð óáð óáñýí ÷ñΠóçíáð äéá íá ìÙèääâ òι CVS:

- CVS Tutorial (<http://users.csc.calpoly.edu/~gfisher/classes/308/handouts/cvs-basics.html>) áðu òι California Polytechnic State University.
- CVS Home (<http://ximbiot.com/cvs/wiki/>), ç ñÙää áíÙððòìçò éáé ððìóðññéìçò òιò CVS.
- CVSweb (<http://www.FreeBSD.org/cgi/cvsweb.cgi>) ÄéáðáðΠ Web äéá òι CVS òιò FreeBSD Project.

A.5 ×ñçóèìðìéçèýí òιò CTM

Ïι CTM âβίáé ìéá ìÝèãìð ìá äéáðçññýíá óá óðá÷ññéóìù Ýíá áðñáèñòóìÝñí éáðÙèñãì ìá Ýíá èáíóñéèù. Áíáððý÷èçèâ äéá ÷ñΠόç ìá òι äÝíòñ ðçãääβìð èþäééá òιò FreeBSD, áí éáé Ûèèéé Ûìèñùðñé ìðññâ ìá òι äñìð ÷ñΠóçìì éáé äéá äéáðññâðéèèýò óèñðñýð éáèðð ðañaíÙáé ì éáèñùð. Õç äääñÝìç óðéèìΠ òðÙñ÷áé äèÛ÷-éóðç ùð áíýðánaèðç ðáèìçñβùóç äéá ðçí äéääééáóáβá äçìèòñâβáð äñ÷âβìð äéáðññí (deltas), éáé áí ÷ññáéÛæáóáð ðañaéóóùðañað ðèçñìöìññâð,

áðééíεíυíρòáá íá òç èβòóá óá÷ òáññíáβϊò ctm-users (<http://lists.FreeBSD.org/mailman/listinfo/ctm-users>) áééέÛ áί èÝéáòá íá ÷ ñçóέíιðϊέρòáòá òϊ CTM ãέά Ûέéáò áòáññíáÝò.

A.5.1 Άέάòβ ΔñÝðáé íá × ñçóέíιðϊέρòáòá òϊ CTM;

Òϊ CTM èá óáò áρòáé Ýία òιðééυ áίòβáñáσϊ òιò áÝίòñιò ðçááβιò èρáééά òιò FreeBSD. ÒðÛñ÷ áé áέάéÝóέíιò Ýίáð áñέéιυò áðυ “ááγóáéò” òιò áÝίòñιò. Òϊ CTM ιðιñáβ íá óáò ðáñÝ÷ áé òéò ðεçñιòιñβáð ðιò ÷ ñáéÛæáóóá, áβòá áðιòáòβòáòá íá ðáñáειειòεáβòá ιευέεçñι òι áÝίòñι, áβòá εÛðιεí áðυ óá ðáñáεεÛáéá òιò. Áί áίρéáòá óá áíáñáÛ ιÝεç áíÛððòίçð òιò FreeBSD áέéÛ Ý÷ áòá éáéρð ðιέυιòçòáð (ρ éáευειò) TCP/IP óðíááóéιυòçòá, ρ áðéÛ εÝéáòá ιé áέéááÝò íá óáò Ýñ÷ ιíóáé áòòυιáðá, òι CTM Ý÷ áé òðéá÷ ðáβ áéá óáò. Èá ÷ ñáéáóðáβ íá ðáβñíáðá ùò ðñβá deltas òçί çιÝñá áéá óá ééááéÛ òιò áÝίòñιò ðιò Ý÷ ιóι òçί ðéí áíáñáρ áíÛððòίç. Èá ðñÝðáé ùòóυιòí íá éáññρòáòá ùò éáéýòáñç éýòç òçί áòòυιáðç áðιòòιερ òιòð ìÝòυ email. Óá íááÝεç òυí áíáíáρòáυí éñáòιýíóáé ðÛίóá υιòí òι áðíáòυí ðéí ιέéñÛ. Óðίρèυò áβíáé ιέéñυòáñá áðυ 5È, ðáñέóóáóéáéÛ (Ýία óóá áÝéá) áβíáé áðυ 10-50È éáé ιñέóιÝίáð òιñÝò áìáíβáειíóáé éáé εÛðιεά ðιò áβíáé 100È ρ éáé ιáááéýòáñá.

Èá ðñÝðáé áðβòçð íá áñιέáééυèáβòá íá òéò áéÛοιñáð ðááβááð ðιò ó÷ áòβáειíóáé íá òçί áðáðéáβáð áñááóβá óòιí òðυ áíÛððòίç ðçááβι èρáééά óá ó÷ Ýòç íá ιéá Ýοιείç, ðñιέáóáéáòáóιÝίç Ýέαιòç. Áóòυ éó÷ ýáé áευιá ðáñέóóυòáñι áí áðééÝíáðá íá ÷ ñçóέíιðϊέρòáòá òιò ðçááβι èρáééά áðυ òι “current”. Óáò óðιέóóιýíá íá áéááÛòáòá ðυò íá ÷ ñçóέíιðϊέρòáòá òι current óòι FreeBSD.

A.5.2 Óé × ñáéÛéííáé áéá íá × ñçóέíιðϊέρòáòá òϊ CTM;

Èá ÷ ñáéáóðáβòá áýι ðñÛáιáðá: Óçί áòáññíáρ CTM éáé òéò áñ÷ ééÝò áέéááÝò (deltas) áéá íá òéò áέóÛááòá óá áòðρί (ρòá íá òðÛóáòá óòι áðβðááι òιò “current”).

Òϊ CTM áβíáé ιÝñιò òιò FreeBSD áðυ òçί Ýέαιòç 2.0, éáé áñβóéáðáé óòιí éáòÛεíáι /usr/src/usr.sbin/ctm áòυοιí Ý÷ áòá ááéáòáóòçιÝíι òιò ðçááβι èρáééá.

Óá “deltas” íá óá ιðιβá ðñιòιáιòáβòá òι CTM ιðιñáβòá íá óá áðιέòρòáòá íá áýι ðñυðιòð, ιÝòυ FTP ρ ιÝòυ email. Áί Ý÷ áòá ááίέερ FTP ðñυòááòç óòι Internet, èá áñáβòá òðιòðρñέίç áéá òι CTM óðéò áéυειòεáð òιðιέáóβáð FTP:

<ftp://ftp.FreeBSD.org/pub/FreeBSD/CTM/>

ρ ááβòá òι òιðíá mirrors.

ÈÛίðá FTP óòι ó÷ áðééυ éáòÛεíáι éáé áéááÛòá òι áñ÷ áβι README áéá íá íáέéίρòáòá.

Áί èÝéáòá íá éáíáÛίáòá óá deltas ιÝòυ email:

Άñáóðáβòá óðíáññçðð òá ιéá áðυ òéò èβòóáð áéáññð òιò CTM. Ç èβòóá ctm-cvs-cur (<http://lists.FreeBSD.org/mailman/listinfo/ctm-cvs-cur>) òðιòòçñβæáé ιευέεçñι òι áÝίòñι òιò CVS. Ç èβòóá ctm-src-cur (<http://lists.FreeBSD.org/mailman/listinfo/ctm-src-cur>) òðιòòçñβæáé òçί éáòáéρ (head) òιò èéÛáιò áíÛððòίçð (development branch). Ç èβòóá ctm-src-7 (<http://lists.FreeBSD.org/mailman/listinfo/ctm-src-7>) òðιòòçñβæáé òçί Ýέαιòç 7.X é.í.é. Áί ááí áññβæáðá ðυò íá áááñáóáβòá óá ιéá èβòóá, èÛίðá éééé óòι υíñá òçò èβòóáð ðιò áìòáíβæáðáé ðáñáðÛíυ ρ ðçááβíáðá óòι <http://lists.FreeBSD.org/mailman/listinfo> éáé èÛίðá éééé óòç èβòóá ðιò èÝéáòá íá áááñáóáβòá. Ç óáεβáá òçò èβòóáð èá ðñÝðáé íá ðáñéÝ÷ áé υéáð òéò áðáñáβòçòáð ðεçñιòιñβáð ó÷ áðééÛ ìá òéò óðíáññÝò.

¼óáí áñ÷ βòáòá íá éáíáÛίáòá áíáíáρòáéò CTM ιÝòυ mail, ιðιñáβòá íá ÷ ñçóέíιðϊέρòáòá òι ðñυáñáíá ctm_rmail áéá íá òéò áðιòòιðéÝóáòá éáé íá òéò áòáññιυóáòá. Ιðιñáβòá óòçί ðñááíáóééυòçòá íá ÷ ñçóέíιðϊέρòáòá òι ðñυáñáíá ctm_rmail áðáðéáβáð ιÝòυ ιéáò áááñáòð òòι /etc/aliases áí èÝéáòá ç áéáéééáóβá íá áéòáéáβòáé áòòñáòιðιέçιÝία. Άáβòá òç óáεβáá manual òιò ctm_rmail áéá ðáñέóóυòáñáð éáððñÝñáéáð.

Όçιάßùοç: ¶ó÷ãðά ìá ðç ìÝèĩãĩ ðĩò εά ÷ñçóèĩðĩèßóáðå äéá ìá èÛååðå ðå deltas ðĩò **CTM** εά ðñÝðåé ìá ååñåãåðåßðå ðόç èßóðå ctm-announce (<http://lists.FreeBSD.org/mailman/listinfo/ctm-announce>). Óõì ìÝèèĩ, áððù εά áßìåé εάé õì ìüĩ ìÝñìò ðõì ìðìßì εά äçìòéåýĩðåé ðèçñìòìñßåð ó÷ãðééÛ ìåð èåéðìòñåßåð ðĩò ðóððìåðìò **CTM**. ÈÛìåä èèéé ðõì üììå ðçð ðåñåäðÛì ìßóðåð, èåé åèìèìèèåßððå ðéð ìåçåßåð äéá ìá ååñåãåðåßðå.

A.5.3 ×ñçóèĩðĩèßìðåð õì CTM äéå Δñþòç ÕìñÛ

Δñéì åñ÷ßòåðå ìá ÷ñçóèĩðĩèåßðå **CTM** deltas, εá ðñÝðåé ìá Ý÷ãðå Ýìå ççìåßì åèêßçòçð äéå ðå delta ðĩò Ý÷ìòì äçìèìñåçéåß ìåðÛ äðù äððù.

Èå ðñÝðåé ìå ìåèéßóáðå ðé Ý÷ãðå Ðåç. ìðìèìåßðìòå ìðìñåß ìå åñ÷ßòåé äðù Ýìå “Ûååéì” εåðÛèìå. Èå ðñÝðåé ìå ìåèéßóáðå ìå Ýìå åñ÷èù “Èåñù” delta äéå ìå åñ÷ßòåðå ìå õì **CTM** åÝìòñì óåð. Äðù èÛðèèì ðçìåßì èåññìýìå ìüé Ýìå äðù äððÛ ðå “åñ÷èÛ” deltas εå äéåÝìììðåé óå CD äéå ðç äéèß óåð äéåðèùèðìòç, ìððùóì äððù ååì ðõìååßìåé ðç ååññìÝìç ððéåìß.

Èåèðð ðå åÝìòñå åßìåé åñèåðÝð ååèÛåðð megabytes, åßìåé ðñìðèìüðåñì ìå ìåèéßóáðå äðù èÛðé ðĩò Ý÷ãðå Ðåç. Äì Ý÷ãðå CD èÛðèèåð äéåñìð (RELEASE), ìðìñåßðå ìå äìèéåñÛðåðå Ð ìå äðìòìðéÝðåðå äðù åèåß õì åñ÷èù ðççåßì èðåéå. ðóé εå åèðððåðå ççìåðééù ìÝñìò ðçð ìåðåöìñÛð ååññìÝìç.

ìðìñåßðå ìå äìåìññåßðåðå äððÛ ðå “åñ÷èÛ” deltas äðù õì x ðĩò åèìèìèèåß ðì äñèèìü ðìòð (äéå ðåñÛååéåìå src-cur.3210xEmpty.gz). Ì ÷åñåðççñéóìüð ìåðÛ õì x äìèððèè÷åß ðççì ðçåß ðì åñ÷èìý óåð “seed”. Õì Empty åßìåé Ýìåð Ûååèèð èåðÛèìå. ÈåðÛ èåñìå äçìèìñååßðåé ìéå ìåðÛåðçç äðù õì Empty èÛèå 100 deltas. Åðßçòç ðå åñ÷åßå äððÛ åßìåé ìååÛéå! ÓðìçèèìÝì ìÝåèèè äéå xEmpty deltas åßìåé ðå 70 ìð 80 MB ðððèéåóìÝì ìå gzìp ååññìÝìç.

ìüèèð äðééÝìåðå Ýìå ååðéèù delta äéå ìå ìåèéßóáðå, εå ÷ñååóððåßðå åðßçòç üéå ðå deltas ìå ìååéýðåñìòð äðù äððù åñèèìýð.

A.5.4 ×ñçóèĩðĩèßìðåð õì CTM óççì Èåèçìåñéìß óåð ÆèÙß

Äéå ìå åðåñìüðåðå ðå deltas, äðèðð åñÛððå:

```
# cd /where/ever/you/want/the/stuff
# ctm -v -v /where/you/store/your/deltas/src-xxx.*
```

Õì **CTM** äìèèèåìÛìåðåé deltas ðå ìðìßå Ý÷ìòì ðððèèåððåß ìÝòù gzìp, èåé Ýðóé åå ÷ñåèÛæåðåé ìå ÷ñçóèĩðĩèßóáðå ðççì gunzip, åèðððìñìðåð ìå äððù õì ðñùðì ÷ðñì ðõì åßðèì.

Õì **CTM** ååì ðñüèåèðåé ìå ðåñÛìåé ðå åñ÷åßåð óåð äì ååì åßìåé äðùèððå ðßåìòñì äéå ðç åéååèéåðå äìåìÝùòçð. Äéå ìå äðåèçèåýðåðå Ýìå delta ìðìñåßðå åðßçòç ìå ÷ñçóèĩðĩèßóáðå ðççì äðéèìåß -c èåé õì **CTM** ååì εå ðåñÛìåé ðßðìðå, äðèðð èå äðåèçèåýðåé ðççì äéåñåéùðçðå ðìò delta èåé èå ååé äì ìðìñåß ìå õì åðåñìüðåé ÷ññò ðñìåßìåðå ðõì ðñÝ÷ì åÝìòñì.

ÕðÛñ÷ìòì èåé Ûèèåð äðèèìåÝð ðõì **CTM**, ååßðå ðéð äìèððèè÷÷åð óåèèåðå manual Ð èìèðÛìå ðì ðççåßì èðåéåä äéå ðåñéóððåðåðð ðèçñìòìñßåð.

Äððù åßìåé üèì ðççì ðñååìåðéèùðçðå. ÈÛèå öìñÛ ðìò èåìåÛìåðå Ýìå ìÝì delta, äðèðð ðåñÛððå õì ðõì **CTM** þðå ìå Ý÷ãðå ðÛìðå äìåìññìÝì ðì ðççåßì óåð èðåéåä.

Ïçί óáΠρίòά óá deltas áί áβίáé äýóèτττí íá óá éάóääÜóáòá íáíÜ. òòòð èÝéάòá íá óá öòèÜíáòá áéά òçί ðáñβðòùóç ðïò èÜòé ðÜáé óòñááÜ. Áέùíá éáé áί òι íüñí ìÝóι ðïò Ý ÷ áòá áβίáé áéóéÝòáò, èÜíòá áίòβáñáóι ÷ ñçóèíñðιέπρίòáò òçί fdwrite.

A.5.5 Èñáòπρίòáò òéò ÕιðééÝò òáò ÁέéááÝò

Üò ðñíñáñííáíóéóòðò, èá èÝéάòá íá ðáéñáíáíóéóòáβòá éáé íá áéèÜíáòá áñ ÷ áβá óòι äÝíòñí òïò ðçááβιò èπáééá. Õι **CTM** ððιόóçñβáéé ðáñéíéóιÝíò òýðιò òιðééÝò áééááÝò: ðñéí áéÝáíáé áéά òçί ðáñιòóβá áíüò áñ ÷ áβιò foo, áéÝá ÷ áé ðñòá áéά òι foo.ctm. Áί òι áñ ÷ áβι áòòü òðÜñ ÷ áé, òι **CTM** èá ÷ ñçóèíñðιέπρίòáé áòòü áίòβ áéά òι foo.

Ç óòιðáñéóññÜ áòòð íáò ðáñÝ ÷ áé Ýíá áðèü ðñüðι íá áéáòçñβóιòíá òιðééÝò áééááÝò: áðèð áίòéáñÜòòá òá áñ ÷ áβá ðïò óéιðáýáòá íá áéèÜíáòá óá áίòβóðιé ÷ á áñ ÷ áβá ìá éáòÜèççç .ctm. Ìðñáβòá éáóüðéí íá èÜíáòá ùé áééááÝò èÝéάòá óòι èπáééá áñ òι **CTM** èá áéáòçñáβ áíáíáñíÝí òι áñ ÷ áβι .ctm.

A.5.6 ηèéáò ÁíáéáóÝññíòóáò ÁðééñāÝò òïò CTM

A.5.6.1 Άñβóèñíóáò òé Áéñéáρò èá ÁéèÜíáé óá íéá ÁíáíÝúóç

Ìðñáβòá íá ðñιόáéññβóáòá òéò áééááÝò ðïò èá ðñιéáéÝóáé òι **CTM** óòι repository òïò ðçááβιò óáò èπáééá, ÷ ñçóèíñðιέπρίòáò òçί áðééñāP -1.

Áòòü èá áβίáé ÷ ñβóèñí áί èÝéάòá íá èñáòβóáòá çìáñττèüáé òüí áééááπí, áί èÝéάòá íá áðáíáñáóóáβòá òá ðñιðιðιéçíÝí áñ ÷ áβá ðñéí P íáòÜ òçί ðñιðιðιβçóç òïòð, P áί áðèð áéóéèÜíáòá áéáòñð ðáñáñíüéüð.

A.5.6.2 Άçíéíññáπρίòáò Áίòβáñáóá Áóöáéáβáò ðñéí òçί ÁíáíÝúóç

ÌáñééÝò òññÝò èá èÝéάòá íá èñáòβóáòá áίòβáñáóι áóöáéáβáò üèüí òüí áñ ÷ áβüí ðïò ðñüéáéóáé íá áééá ÷ èìýí áðü íéá áíáíÝúóç ìÝòü **CTM**.

Áβñííóáò òçί áðééñāP -B backup-file òι **CTM** èá äçíéíññáβóáé áίòβáñáóι áóöáéáβáò üèüí òüí áñ ÷ áβüí ðïò ðñüéáéóáé íá áééá ÷ èìýí áðü èÜðιéí óóáéáñéñéÝíí delta óòι áñ ÷ áβι backup-file.

A.5.6.3 ðáñéññβáéñíóáò óá Áñ ÷ áβá ðïò èá Áééá ÷ èìýí áðü ÈÜðιéá ÁíáíÝúóç

ÌáñééÝò òññÝò βóùð íá áíáéáóÝññáòá íá ðáñéññβóáòá òçί ðáñéñ ÷ P áñÜóçð íéáò óóáéáñéñéÝíçð áíáíÝúóçð ìÝòü **CTM** P βóùð óáò áíáéáóÝññáé íá ðÜñáòá íüñí èβáá áñ ÷ áβá áðü èÜðιéá óáéñÜ áðü deltas.

Ìðñáβòá íá áéÝáíáòá òç èβóóá òüí áñ ÷ áβüí óóá ðιβá èá éáéóιòññáβóáé òι **CTM** ÷ ñçóèíñðιέπρίòáò ùð öβéòñá, regular expressions ìá òéò áðééñāÝò -e éáé -x.

Áéá ðáñÜááéáíá, áéá íá áíÜáòá Ýíá áíáíáñíÝíí áίòβáñáóι òïò áñ ÷ áβιò lib/libc/Makefile áðü òçί óðééñāP óáò òüí áðιèçéáòìÝíñí **CTM** deltas, áéòáéÝóáò òéò áίòιéÝò:

```
# cd /where/ever/you/want/to/extract/it/
# ctm -e '^lib/libc/Makefile' ~ctm/src-xxx.*
```

Áéá èÜèá áñ ÷ áβι ðïò éáéññβáéáòáé óá Ýíá **CTM** delta, íé áðééñāÝò -e éáé -x áòáññüáéñíóáé ìá òç óáéñÜ ðïò áìóáñβáéñíóáé óçç áñáñP áíòιéπí. Õòι áñ ÷ áβι áβíáóáé áðáíáñáóóá áðü òι **CTM**, íüñí áί ìáñéáñéóóáβ ùð Ýáéòñí ðñιò áíáíÝúóç ìáòÜ òçί áòáññāP üèüí òüí áðééñāπí -e éáé -x.

A.5.7 ΙάεëĩòéêÜ Ó÷ Ýäéá äéá òĩ CTM

Άβιάé δÜñά ðíεεÜ:

- ×ñΠόç êÜðιέιò áβιãòð ðéóòιðιβçóçò òðι óýóçιά CTM þóðå íá áíááññβæĩòáé òð÷üí ðåýóééåð áíááþóáéð.
- ΙάéáèÜñéóιά òüí áðéεĩäþí òĩò CTM, éåèþð ðññéáéεĩýí óýã÷òóç éáé äáí áβιάé ðññóáíáβð.

A.5.8 ÄéÜöĩñá

ÕðÜñ÷äé áðβóçð éáé íéá òáéñÜ áðü deltas äéá òçí òðéεĩäþ òüí ports, äééÜ äáí Ý÷äé äéäçèèðáβ áéüüá áñéäòü áíáéáóÝññí äéá áððþ.

A.5.9 CTM Mirrors

Õĩ CTM/FreeBSD äéáðβéäòáé ìÝóü áñþíòĩò FTP áðü òá áéüéĩòéá mirrors. Áí áðééÝíáðå íá éáðåáÜóáðå òĩ CTM ìÝóü áñþíòĩò FTP, óáð ðáñáéáéεĩýíå ðññóðáéþóðå íá áðééÝíáðå íéá òĩðĩèáóβá éĩòÜ óá óáð.

Õå ðáñβðòùòç ðññíäéçìÜòüí, ðáñáéáéεĩýíå áðééééíüíþóðå ìå òç èβóðá ctm-users (<http://lists.FreeBSD.org/mailman/listinfo/ctm-users>).

Éáééöüñíéá, Bay Area, áðβóçç ðçäþ

- <ftp://ftp.FreeBSD.org/pub/FreeBSD/development/CTM/>

Íüðéá Áðñéþþ, áíðβññáðå áóðáéäáβàð äéá ðäééÜ deltas

- <ftp://ftp.za.FreeBSD.org/pub/FreeBSD/CTM/>

ÕáúáÜí/R.O.C.

- <ftp://ctm.tw.FreeBSD.org/pub/FreeBSD/development/CTM/>
- <ftp://ctm2.tw.FreeBSD.org/pub/FreeBSD/development/CTM/>
- <ftp://ctm3.tw.FreeBSD.org/pub/FreeBSD/development/CTM/>

Áí äáí äñþéáðå êÜðιέĩ mirror óðçí ðáñéĩ÷þ óáð, þ áí òĩ mirror äáí áβιάé ðéþñåð, ðññóðáéþóðå íá ÷ñçóéññðĩéþóðå íéá ìç÷áñþ áíþ äíáæþðçóçò üðüð ç alltheweb (<http://www.alltheweb.com/>).

A.6 ×ñçóéιιðιέπιόάò òι CVSup

A.6.1 ΆέóáãũãÞ

Òι CVSup áβιáέ Υίá εϊάέóιέεũ áέá òçι áέáñíÞ éáέ áιáíΥùòç äÝíòñùι ðçãáβιò εÞáέέá áðu Υίá éáιòñέéũ (master) CVS repository òι ιðιβι áñβóέáðáέ óá εÙðιέι áðñáέñòòιΥι ððιέιáέóðÞ. Òι repository òιò FreeBSD áñβóέáðáέ óá Υίá éáιòñέéũ ιç÷: Ùίçιά óòçι Éáέéòũñιέá. Ìá òι CVSup, ιέ ÷ñÞóðáð òιò FreeBSD ιðιñιýι áγέιέá ιá áέáðçñÞóιòι áιáíáũΥιá óá áíðβáñáóá òιò ðçãáβιò òιòð εÞáέέá.

Òι CVSup ÷ñçóéιιðιέáβ Υίá ιιòÝει áιáíΥùòçð áíùóòũ ùð pull. Óòι ιιòÝει áòòũ, εÙεá ðáεÙòçð æçðÙ ðéð áιáíáÞóáέð áðu òιι áιòðçñáðòçðÞ, ùóáι éáέ áι ðéð áðέéðιáβ. Ì áιòðçñáðòçðð ðáñειΥιáέ, ðáεçðέéÙ, ðéð áðáέðÞóáέð áðu òιòð ðáεÙòçð. Ìá òιι ðñũðι áòòũ, εÙεá áιáíΥùòç ιáέειÙáέ éáðũðέι áðáβòççð òιò ðáεÙòç. Ì áιòðçñáðòçðð ðιòÝ ááι óóÝειáέ áιáíáÞóáέð ðιò ááι Ý÷ιòι æçðçéáβ. Ìέ ÷ñÞóðáð éá ðñÝðáέ áβòá ιá áέðáεÝóιòι òι CVSup ÷áέñιέβιçðá áέá ιá εÙáιòι ιέá áιáíΥùòç, áβòá éá ðñÝðáέ ιá ðñèιβóιòι éáðÙέεççéá òι cron þóðá ιá òι áέðáéáβ áðòũñιáóá éáðÙ óáέðÙ ÷ñιέéÙ áέáóðÞιáðá.

Ì ùñιò CVSup, áñáñιÝñιð Ìá éáðáέéáβá éáέ ιέéñÙ ùðòð óáβιáðáέ, áιáóÝñáðáέ óá ιεũéççñι òι ðáéÝòι εϊάέóιέéιγ. Óá ááóééÙ òιò òιÞιáðá áβιáέ ç áιòιεÞ ðáéÙòç cvsup ç ιðιβá áέðáéáβòáέ óòι ιç÷: Ùίçιά òιò εÙεá ÷ñÞóðç, éáέ òι ðñũáñáιá òιò áιòðçñáðòçðÞ cvsupd òι ιðιβι áέðáéáβòáέ óá εÙεá Υιá áðu óá mirror sites òιò FreeBSD.

ÉáεÞð áέááÙæáðá òçι ðáèιçñβùòç éáέ ðéð éβòðáð ðá÷-ðáññáβιò òιò FreeBSD, ιðιñáβ ιá áñáβðá áιáóιñÝð óòçι áðáñιñáÞ sup. Òι sup Þðáι ι ðñũáñιò òιò CVSup, éáέ áιòðçñáðòçγóá ðáñιñιέι óéιðu. Òι CVSup ÷ñçóéιιðιέáβðáέ Ìá áñéáðÙ ùñιέ ðñũðι Ìá òι sup, éáέ óòçι ðñááιáðééèùòçðá, ÷ñçóéιιðιέáβ áñ÷-áβá ðñèιβóáñι óá ιðιβá Ý÷ιòι ðβòũ óòιááðũòçðá Ìá áððÙ òιò sup. Òι sup ááι ÷ñçóéιιðιέáβðáέ ðεÝιí óòι FreeBSD Project, áðáέáÞ òι CVSup áβιáέ óá÷-γóáñι éáέ ðñιòðÝñáέ Ìááéγðáñç áðáέéιβá.

Óçιáβùòç: Òι ðñũáñáιá csup áβιáέ òι CVSup ιáιááñáιιÝιí óá áεÞóóá C. Òι Ìáááéγðáñι òιò ðεáιιÝéðçιά áβιáέ ùðé áβιáέ ðá÷-γóáñι, éáέ ááι áιáñðòÙðáέ áðu òçι áεÞóóá ðñιáñáιáðééòιγ Modula-3, òçι ιðιβá éáέ ááι ÷ñáéÙæáðáέ ðεÝιí ιá ááéáðáóðÞóáðá. Áðβòçð ìιòñáβòá Ìá òι ÷ñçóéιιðιέÞóáðá Ùιáóá, éáεÞð ðáñééáιáÙιáðáέ óòι ááóééũ óγóðçιά. Áι áðιòáóòáðá Ìá ÷ñçóéιιðιέÞóáðá òι csup, áðεÞð ðáñáéáβððá óá áÞιáðá áέá òçι ááéáðòÙðáóç òιò CVSup éáέ áιðééáðáóðÞóáðá εÙεá áιáóιñÙ óòι CVSup óá áðòũ òι Ùñéñι, Ìá csup.

A.6.2 ΆáέáðÙòðáóç

Ì áðéιεũðáñιð ðñũðιð áέá ιá ááéáðáóðÞóáðá òι CVSup áβιáέ ιÝòũ òιò Ýðιέñιò ðáéÝòιò net/cvsup áðu òçι óðéειáÞ ðáéÝòιò òιò FreeBSD. Áι ðñιðéιÙðá Ìá Ìáðááéèòðβòáðá òι CVSup áðu òιι ðçãáβι εÞáέέá, ιðιñáβòá Ìá ÷ñçóéιιðιέÞóáðá òι port net/cvsup. Óáð ðñιáέáιðιέιγÌá ùòòũòι ùðé òι port net/cvsup áιáñðòÙðáέ áðu òçι Modula-3, ç ιðιβá ÷ñáéÙæáðáέ áñéáðũ ÷ññιí éáέ ÷Þñι óòι áβòéι áέá ιá éáðÝááέ éáέ Ìá Ìáðááéèòðéóðáβ.

Óçιáβùòç: Áι ðñũéáéðáέ Ìá ÷ñçóéιιðιέÞóáðá òι CVSup óá Υιá ιç÷: Ùίçιά òι ιðιβι ááι éá áéáéÝðáέ áñáðééũ ðáñéáÙééιι ιÝòũ òιò Xorg, ùðòð ð.÷. óá Υιá áιòðçñáðòçðÞ, ááááéèéáβòá ùðé ááéáééóðòá òι áιðβòðιé÷ι port òι ιðιβι ááι ðáñééáιáÙιáέ áñáðééũ ðáñéáÙééιι, áçéááÞ òι net/cvsup-without-gui.

A.6.3 Νýèιέóç òιò CVSup

Ç èáèοιòñåáá òιò **CVSup** àèÝá÷-áðáé áðu Ýία áñ÷-åβι ñòèιβóáυι ðιò èáèåáβðáé `supfile`. ÒðÛñ÷-ιòι èÛðιέα òðιåáβåιáðá áðu `supfiles` òòιι èáðÛèιåι /usr/share/examples/cvsup/.

Ìé ðεçñιòιñβåð òòι `supfile` áðåιòιγί ðεð áευειòεðð åñυòððáéð åέα òι **CVSup**:

- Διέα áñ÷-åβå èÝèåðå íá èÛååðå;
- Διέåð àèåυιðáéð òυι áñ÷-åβυι èÝèåðå;
- Άðu ðιò èÝèåðå íá ðå èÛååðå;
- Διò èÝèåðå íá ðå áðιεçèåγóðåð òòι ιç÷-Ûιçιά ðáð;
- Διò èÝèåðå íá áðιεçèåγóðåð ðå áñ÷-åβå èáðÛððáçð;

Óáå áðuιáíá òιðιåðå, èå ççιειòñåððòιòιå Ýία ðððéευι `supfile` áðåιòιðιåð èÛèå íέα áðu ðεð åñυòððáéð áððÝð ιå ðç òåéñÛ. Δñððå, èå ðåñéåñÛðιòιå ðç òòñιέέèð åññð áñυð `supfile`.

Íá `supfile` åβιåé Ýία áñ÷-åβι èåéÝñιò. Óå ò÷-υέéå íåééíÛíå ιå # èåé áðåèðåáβñιðáé ùð òι ðÝèιð ðçð åñåñιðð. Ìé èåñÝð åñåñÝð, èåèðð èåé áððÝð ðιò ðåñéÝ÷-ιòι ιυñι ò÷-υέéå, ååññιγíðáé.

ÈÛèå åñåñιð áðu ðεð ððυειεððð ðåñéåñÛðáé Ýία òåð áñ÷-åβυι ðå ιðιβå áðèèòιåβ íá èÛååé ι÷-ñððçð. Ç åñåñιð ιåééíÛåé ιå òι υñíå ιέåð “òðèèιåðð”, áñυð ειåéεγυι åèñιðð áðu áñ÷-åβå ðιò ιñβæåðáé áðu òιι áñðççñåðçðð. Óι υñíå ðçð òðèèιåðð åçèðιåé òòιι áñðççñåðçðð ðιέα áñ÷-åβå áðèèòιåβðå. ÌåðÛ òι υñíå ðçð òðèèιåðð, ιðιñåβ íá òðÛñ÷-ιòι áðu ιçåÝι ùð èÛðιέα ðåååá, ðå ιðιβå ÷-υñβæιðáé ιåðåγυι òιòð ιå èåñÛ åéåððιåðå. Óå ðåååá áððÛ áðåιòιγί ðεð åñυòððáéð ðιò ðÝεçèåι ðåñåðÛι. ÒðÛñ÷-ιòι åγι òγðιε ðåååβυι: ðåååá òðιåιçð (flags) èåé ðåååá ðειðι. Íá ðåååβι òðιåιçðð áðιðåéåáβðáé áðu ιέå ιυñι èÝιç èèåéåβ ð÷. `delete P compress`. Íá ðåååβι ðειðð ιåééíÛåé áððçðð ιå ιέå èÝιç èèåéåβ, åèèÛ áððð áειειðεåáβðå ÷-υñβð ðçι ðåñåñιåèð èåñγυι åéåððιåðιð áðu = èåé ιέå ååγðåñç èÝιç. Άέα ðåñÛåéåιå òι `release=cvs` áðιðåéåβ Ýία ðåååβι ðειðð.

Íá `supfile` ðððéèÛ èåéιñβæåé ðñιð èðçç ðåñéòòυðåñåð áðu ιβå òðèèιåðð. Íá òñυðιð åέα íá åññððåðå Ýία `supfile` åβιåé íá èåéιñβðåðå υέå ðå ò÷-åðèèÛ ðåååá ÷-υñèððÛ åέα èÛèå òðèèιåðð. Ìå òιι òñυðιð áððυ ùððυòι òι `supfile` èå èáððåÛååé åñèåðÝð åñåñÝð èåé èå åβιåé Ûåιει, áðåéåð ðå ðåñéòòυðåñå ðåååá åβιåé βæåé åέα υέåð ðεð òðèèιåðð ðιò ðåñéÝ÷-ñιðáé òå áððυ. Óι **CVSup** ðåñÝ÷-åé Ýία ιç÷-åιέòιυ ÷-ñðçðð ðñιåðèéååñιγυι ðειðι, ðððå íá áðιòåγåñιðáé áððÛ ðå ðñιåðιåðå. Ìé åñåñÝð ðιò ιåééíÛíå ιå òι åéåéèυ υñíå ðåððυ-òðèèιåðð `*default` ιðιñιγί íá ÷-ñçðèιιðιεçèγι åέα íá èÝγιòι ðåååá òðιåιçðð èåé ðειðι ðå ιðιβå èå ÷-ñçðèιιðιεçèγι ùð ðñιåðèéåñÝð åέα ðεð òðèèιåðð òιò `supfile` ðιò åññðèιðáé ιåðÛ áðu áððÛ. Ìέα ðñιåðèéååñιγιç ðειð ιðιñåβ íá åèèÛιåé áι èåéιñèððåáβ ιåñÛ ιå Ýία ðειð ιÝðå òðçι βæåé ðç òðèèιåðð. Ìé ðñιåðèéåñÝð ιðιñιγι áððçðð íá åèèÛιòι, ð íá ðñιòðåιγι γÝåð, åÛæιððåð ðñυðèåðå `*default` òå ιðιειåððιðå ççιåβι ιÝðå òòι `supfile`.

Άññβæιððåð ðå ðåñåðÛι, èå ðñι÷-υñððòιòιå ððñå ðçç åυιççç áñυð `supfile` åέα èðçç èåé åίåñÝυòç òιò èðñβυð åÝιðñιò ðççååβιð èðåééå åέα òι FreeBSD-CURRENT.

- Διέα áñ÷-åβå èÝèåðå íá èÛååðå;
- Óå áñ÷-åβå ðιò åβιåé åéåéÝðéιå ιÝòυ ðçð **CVSup** åβιåé ιñååñιñÝία òå åèñιðð ðιò ιññÛæιðáé “òðèèιåðð”. Δåñéåñåðð òυι åéåéÝðéιυι òðèèιåðð èå åñåβðå òòι åευειòει òιðιå. Óòι ðåñÛåéåιå íåð, èÝειòιå íá èÛåñòιå òι ðèðñåð åÝιðñι ðççååβιð èðåééå ðιò FreeBSD òðððιåðιð. ÒðÛñ÷-åé ιέå ιååÛèç òðèèιåðð `src-all` ç ιðιβå èå íåð ðçι åððåé υέç. Óåι ðñðòι åðιå åéå ðçι åυιççç òιò `supfile`, áðèðð åñÛòιòιå ðεð òðèèιåðð, ιβå òå èÛèå åñåñιð (ðççι ðåññβððυçç íåð Ý÷-ιòιå ιυñι ιέå åñåñιð):
`src-all`
- Διέåð àèåυιðáéð òυι áñ÷-åβυι èÝèåðå íá èÛååðå;

Ìá òι **CVSup**, ìðñáβðà ìϑϑέáϑóέέÛ íá εÛάáðà ìðιέááβðιòá Ýέáιϑç òιϑ ðçááβιϑ òðññá ðιϑÝ. Άϑòυ áβιáέ áϑιáðυι áðáέáβ ì áìððçñáðçðβ ò **cvsupd** εάέϑιϑñááβ áðáðέáβáð áðυ òι CVS repository, òι ìðιβι ðáñέÝ ÷ áέ υέáð òέð áέáυóáέð. Άççðιáðá ðιέá áðυ áððÝð εÝέáðá ÷ ñçϑέιιðιέπιϑáð òá ðááβá òέιπι tag= éáέ date=.

Ðñιáέáιðιβçç: Έá ðñÝðáέ íá áðϑáðá εάέáβðáñç ðñιϑι÷β òιι εάέιñέϑιυ òυι ðááβυι tag= ðóðá íá áβιáέ òυóðÛ. ΈÛðιέá tags áβιáέ Ýáέϑñá ìυιí εάά òáέáέñέιÝιáð òϑέέιáÝð áñ÷áβυι. Áι εάέιñβϑáðá εáιέáϑιÝιí tag (β εÛιáðá ìñέιáñáðέέυ εÛέιϑ) òι **CVSup** εά òáβϑáέ áñ÷áβá òá ìðιβá ðέέáιβð ááι εÝέáðá íá òáçϑóιγι. Άέάέέυðáñá, áέá òçι òϑέέιáβ òυι ports=*, ÷ ñçϑέιιðιέβϑóðá ìυιí òι tag=.

Òι ðááβι tag= ááβ ÷ íáέ ðñιð Ýιá òιìáιέέέυ tag òιι repository. ÒðÛñ ÷ ìϑι áγι áβáç tags, òá tags áέáυóáυι (revision tags) éáέ òá tags ééÛáυι (branch tags). Íá revision tag áιáϑÝñáðáέ òá íέá òáέáέñέιÝιç Ýέáιϑç. Ç ϑçιáϑá òιϑ áέáðçñáβðáέ βáέá áðυ òç íέá ìÝñá òççι Ûέέç. Άðυ òççι Ûέέç, Ýιá branch tag, áιáϑÝñáðáέ òççι òáέáðϑáβá Ýέáιϑç íέá òáέáέñέιÝιçð áñáìβð áíÛððϑιçð, òá εÛέá ÷ ñιέέβ ϑέέáìβ. Άðáέáβ Ýιá branch tag ááι áιáϑÝñáðáέ òá εÛðιέá òáέáέñέιÝιç Ýέáιϑç, ìðñáβ áγñέι íá ϑçιáβιáέ εÛðέ áέáϑιñáðέέυ áðυ υðέ ϑçιáβιáέ òβιáñá.

Òοι Òιβιá A.7 éá áñáβðá branch tags òá ìðιβá ìðñáβ íá òáð áιáέáϑÝñιϑι. ¼ðáι εάέιñβæáðá Ýιá tag òοι áñ÷áβι ñϑέìβóáυι òιϑ **CVSup**, éá ðñÝðáέ ðñέι áðυ áððυ íá áÛæáðá òç εÝιç éέáέáβ tag= (áçç. òι RELENG_8 éá áβιáέ tag=RELENG_8). Íá Ý ÷ áðá òðυϑέι òáð υðέ áέá òççι òϑέέιáβ òυι Ports, òι tag= . áβιáέ òι ìυιí Ýáέðñι.

Ðñιáέáιðιβçç: Íá áβϑá εάέáβðáñá ðñιϑáέðέέέυð, ðóðá íá áñÛáðá òι tag áέñέáβð υðυð òáβιáðáέ. Òι **CVSup** ááι ìðιñáβ íá áέá ÷ υñβϑáέ ìáðáιγ Ýáέϑñυι éáέ ιç-Ýáέϑñυι tags. Áι áñÛáðá εÛέιϑ òι tag, òι **CVSup** éá òιðáñέϑáñέáβ òáι íá Ý ÷ áðá áðϑáέ Ýιá Ýáέϑñι tag òι ìðιβι ááι áιáϑÝñáðáέ òá éáιÝιá áñ÷áβι. Òççι ðáñβððυϑç áððβ éá áέááñÛáέ òá òðÛñ ÷ ìϑιá áñ÷áβá òáð ðçááβιϑ òðáέέá.

¼ðáι εάέιñβϑáðá εÛðιέι branch tag, òðϑέιϑιáέέÛ éá εÛάáðá òέð òáέáððáβáð áέáυóáέð òυι áñ÷áβυι ðιϑ òðÛñ ÷ ìϑι òá áððβ òç áñáìβ áíÛððϑιçð. Áι εÝέáðá íá εÛάáðá εÛðιέáð ðáέέυðáñáð áέáυóáέð, ìðñáβðá íá òι εÛιáðá éáέιñβæιϑáð íέá çιáñιçβιá ìÝϑυ òιϑ ðááβιϑ òέιπι date=. Ç òáέβáá manual csup(1) áιçááβ ðυð ìðñáβðá íá òι εÛιáðá.

Òοι ðáñÛáέέáιá íáð, áðέέϑιγιá íá εÛáιϑιá òι FreeBSD-CURRENT. ÐñιϑέÝϑιϑιá òç áñáìβ áððβ òççι áñ÷áβι òιϑ supfile áñ÷áβι íáð:

```
*default tag=.
```

ÒðÛñ ÷ áέ íέá ϑçιáιϑέέβ áέáέβ ðáñβððυϑç υðáι ááι εάέιñβϑáðá ìγðá ðááβι tag= ìγðá ðááβι date=. Òççι ðáñβððυϑç áððβ éá εÛάáðá òá εáñιέέÛ áñ÷áβá RCS áðáðέáβáð áðυ òι CVS repository òιϑ áìððçñáðçðβ, áιϑβ áέá íá εÛάáðá εÛðιέá òáέáέñέιÝιç Ýέáιϑç. Íé ðñιáñáìιáϑέϑóÝð ááιέέÛ ðñιϑέιγι áððυ òιι òñυðι éáέϑιϑñáβáð. Άέáðçñβιϑáð ðεβñáð áιϑβáñáϑι òιϑ CVS repository òðá òðððβιáðá òιϑð Ý ÷ ìϑι òççι éέáιυϑçðá íá áέÝðιϑι òι éϑðιñέέυ áέέáββι εÛέá Ýέáιϑçð éáέ íá áñáðÛæιϑι ðáέέυðáñáð áέáυóáέð òυι áñ÷áβυι. Òá ðáñáðÛιυ ðεáιñáέðβιáðá υϑóυι Ý ÷ ìϑι òι ευóϑιð òçð ìáááέγðáñçð ÷ ñβϑçð ÷ ðñιϑ òοι òέέçñυ áβϑέι.

- Άðυ ðιϑ εÝέáðá íá òá εÛάáðá;
 - × ñçϑέιιðιέιγιá òι ðááβι host= áέá íá ðιγιá òοι cvsup áðυ ðιϑ íá εÛάáέ òέð áιáιáβϑáέð òιϑ. Ìðιέιáβðιϑá áðυ òá **CVSup mirror sites** áβιáέ éáðÛέέççι, áι éáέ éá ðñÝðáέ íá ðñιððáεβϑáðá íá áðέéÝιáðá εÛðιέι òι ìðιβι íá áñβϑέáðáέ éñιðÛ òáð. Òòι ðáñÛáέέáιá íáð, éá ÷ ñçϑέιιðιέβϑιϑιá íέá òáιðáϑóέέβ òιðιέáϑá áέáñιβð òιϑ FreeBSD, òι cvsup99.FreeBSD.org:


```
*default host=cvsup99.FreeBSD.org
```

Εά ðñÝðáε ίά áεεΰíáòά òι host óά εΰðίεí ðιϑ ðñάíáíáóεεΰ òðΰñ÷áε ðñεí áεòáεΰóάòά òι **CVSup**. Εΰεά òíñΰ ðιϑ áεòáεáβòά òι cvsup, Ψ÷άòά òçí áðíáúòúòçòά ίά áíáíñÝðáòά áððP òç ñγέιέóç ιΨóú òçð ãñáíìPð áíòίεðí ίá òçí áðέεíãP -h *hostname*.

- Διϑ εΨεάòά ίά óά áðίεçεáγóάòά òòι ιç÷ΰίçιά óάò;

Όι ðááβι prefix= áçεðíáε òçí cvsup ðιϑ ίά áðίεçεáγóάε óά áñ÷áβá ðιϑ εáíáΰίáε. Όòι ðáñΰááεáíá ίáò, εά áΰεíòíá óά áñ÷áβá òιϑ ðçááβιϑ εðáεéá, áðáòεáβáò òòι εγñεí áΨίòñι ðçááβιϑ εðáεéá, /usr/src. Ί εáðΰεíáϑò src εáññáβóáε áááñΨíϑ áεá òεð òóεεíáΨò ðιϑ Ψ÷íòíá áðέεΨίáε ίά εΰáϑíá, εάε Ψóóε ι òúóòúð ðñιóáεíεóíúð áβίáε áðòúð ðιϑ óáβίáòáε ðáñáεΰòú:

```
*default prefix=/usr
```

- Διϑ εά áðίεçεáγóάε òι cvsup óά áñ÷áβá εáòΰóóáóçð òιϑ;

Ί ðáεΰòçð **CVSup** áεáòçñáβ εΰðίεά áñ÷áβá εáòΰóóáóçð (status files) óά áðòú ðιϑ áðίεáεáβóáε εáòΰεíáϑò “base”. Όá áñ÷áβá áðòΰ áιçεíγί òι **CVSup** ίά εáεòιϑñáβ ðεí áðίáϑóεεΰ εñáðíϑáò εíááñεáòíú òúι áíáíáðóáúι ðιϑ Ψ÷áòá ðáç εΰááε. Εά ÷ñçóεíϑίεðíóíá òιϑ ðñíáðέεáñΨí εáòΰεíáí base, /var/db:

```
*default base=/var/db
```

Άί ι base εáòΰεíáϑò óáò ááí òðΰñ÷áε ðáç, ðññá áβίáε ίεά εáεP òóεáìP ίά òιϑ áçίεíϑñáβóáòá. Ο ðáεΰòçð cvsup ááí εά áεòáεáβóáε áí ι base εáòΰεíáϑò ááí òðΰñ÷áε.

- Άεΰòιñáð ñðεíβóáεð áεά òι supfile:

Όðΰñ÷áε áεúíá ίεά είεíP áñáíìP ñðεíβóáúι, ç ιðίβá òððέεΰ òðΰñ÷áε òòι supfile:

```
*default release=cvs delete use-rel-suffix compress
```

Όι release=cvs ááβ÷ίáε úóε ι áíòðçñáòçðPð εά ðñÝðáε ίά εΰááε òεð ðεçñιϑιñβáò òιϑ ιΨóú òιϑ εγñεíò CVS repository òιϑ FreeBSD. Άðòú εó÷γáε ò÷ááúι ðΰίϑά, áεεΰ òðΰñ÷íòι εάε ΰεεáð ðεεáíúòçòáð ðιϑ ίáòáγáϑí ðú òι óεíðú áððPð òçð òóεPðççòçð.

Ç εΨίç delete áβίáε áεεáεðíáòά òòι **CVSup** ίά áεááñΰóáε áñ÷áβá. Εά ðñÝðáε ðΰίϑíòά ίά Ψ÷áòá òçí áðέεíãP áððP, ðóóά òι **CVSup** ίά ιðίñáβ ίά εñáðPóáε òι áΨίòñι òιϑ ðçááβιϑ óáò εðáεéá ðεðñúð áíáíáúιΨí. Όι **CVSup** áβίáε áñεáòΰ ðñιóáεòεéú ðóóά ίά óáβίáε ιúñι óά áñ÷áβá ðιϑ áñβóεíϑóáε òðú òçí áðεγίç òιϑ. Άί òð÷úι áΰεáòά Ψίòñá áñ÷áβá òòιβ βáεí εáòΰεíáí, ááí εά óά áááβίáε.

Ç áðέεíãP use-rel-suffix áβίáε... áñ÷áείεíáεεP. Άί ðñááíáóεεΰ εΨεáòά ίά ιΰεáòά ò÷áòεεΰ ίá áððPí, áεááΰóóά òç óáεβáá manual cvsup(1). Άέεεðð, áðεðð ÷ñçóεíϑίεðPóóá òçí, εάε ιçí áίçóó÷áβòá εáεáβòáñá áεά áððP.

Ç áðέεíãP compress áíáñáϑίεáβ òç ÷ñPóç òòιðβáóçð òγðιϑ gzip òòι εáíΰεε áðέείεíúíβáð. Άί Ψ÷áòά óγίááóç áεέòγíò òγðιϑ T1 P εάε ðεí áñPáιñç, ιΰεεíí ááí εά ðñÝðáε ίά ÷ñçóεíϑίεPóóá òòιðβáóç. Όá áεáòιñáðέεP ðáñβðòúóç, εά áιçεPóáε áíáεñáðέεΰ.

- Ψεáð ίε áðέεíáΨò ίάεβ:

Άáð áβίáε òι ðεðñáð supfile áεά òι ðáñΰááεáíá ίáò:

```
*default tag=.
*default host=cvsup99.FreeBSD.org
*default prefix=/usr
*default base=/var/db
*default release=cvs delete use-rel-suffix compress
```

```
src-all
```

A.6.3.1 Ὅτι ἂν ᾖ `refuse`

Ἡ αἰτία ἵνα ἡ ἀπάντησὶς τοῦ **CVSup** ἐπιπέσει εἰς τὴν `pull`. Ἀποτέλεσμα τοῦ σφάλματος τοῦ οὗτου τοῦ `CVSup` ἂν εἴη “Ἄσπαστο δὲ εἶναι τὸ ἡμεῖς τὸ ἀποθεμελίωσθαι τὴν ἀπάντησιν· ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν.” Ὁμοίως ἐπιπέσει τὸ `CVSup` ἐὰν εἴη ἡ ἀπάντησὶς τοῦ οὗτου τοῦ `CVSup` ἐπιπέσει εἰς τὴν `pull` ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν. Ὅμοίως ἐπιπέσει τὸ `CVSup` ἐὰν εἴη ἡ ἀπάντησὶς τοῦ οὗτου τοῦ `CVSup` ἐπιπέσει εἰς τὴν `pull` ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν.

Ὁ `CVSup` ἀρνεῖται τὴν ἀπάντησιν ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν. Ἡ ἀπάντησὶς ἐπιπέσει εἰς τὴν `pull` ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν. Ὁ `CVSup` ἀρνεῖται τὴν ἀπάντησιν ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν.

Ὁ `CVSup` ἀρνεῖται τὴν ἀπάντησιν ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν. Ἡ ἀπάντησὶς ἐπιπέσει εἰς τὴν `pull` ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν. Ὁ `CVSup` ἀρνεῖται τὴν ἀπάντησιν ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν.

- doc/bn_*
- doc/da_*
- doc/de_*
- doc/el_*
- doc/es_*
- doc/fr_*
- doc/it_*
- doc/ja_*
- doc/nl_*
- doc/no_*
- doc/pl_*
- doc/pt_*
- doc/ru_*
- doc/sr_*
- doc/tr_*
- doc/zh_*

Ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν. Ὁ `CVSup` ἀρνεῖται τὴν ἀπάντησιν ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν.

Ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν. Ὁ `CVSup` ἀρνεῖται τὴν ἀπάντησιν ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν.

A.6.4 Ἀποθεμελίωσθαι τὸν `CVSup`

Ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν. Ὁ `CVSup` ἀρνεῖται τὴν ἀπάντησιν ἐπεὶ δὲ οὐκ ἔστιν ἐπιτρεπτόν, ἡ ἀπάντησὶς ἀρνεῖται τὴν ἀπάντησιν.

```
# cvsup supfile
```

υðιϑ ðι supfile âβιάε öðóεéÛ ðι υññιά ðιϑ ãñ÷âβιϑ supfile ðιϑ ιυέεð ãçιέιϑñâβóáðâ. Õðιε Ýíϑιϑáð υðé ÷ñçóειϑιέâβðâ ðá X11, ç áφιϑεP cvsup εά óáð àìöáιβóáé Ýιά ãñáóéευι ðãñÛεðñι ιâ εÛðιέá ðεβέðñá óðιçέεöι Ýιυι εâέðιϑñâεβι. ΔεÝóðâ ðι ðεβέðñι go, εâé ðãñâέιϑιϑεβóðâ ðçι áεð Ýεâóç.

Έâεβð óðçι ðãñβððóυóç ιáð áιáιâβιáðáé ðι ðñãáιáðéευι äÝíϑñι /usr/src, εά ÷ñâέáóðâβ ιá áεðâéÝóáðâ ðι ðñυãñãιá υð root βóðâ ç cvsup ιá Ý÷âé ðá äέέâεβιáðá ðιϑ ÷ñâéÛæáðáé äéá ιá áιáιâβóáé ðá ãñ÷âβá óáð. Έâεβð ιυέεð Ý÷âðâ ãçιέιϑñâβóáé ðι ãñ÷âβι ãðεìβóáυι, εâé äã Ý÷âðâ ðιð Ý ðñéι ÷ñçóειϑιέβóáé ðι ðñυãñãιá, βóυð äέóèÛíáóðâ εβãÛ Ûãρεá. ÕðÛñ÷âé äýετεϑð ðñυðιϑ ιá εÛíáðâ äιέειáðóéεβ áεðÝεâóç ÷ññβð ιá ðãεñÛíáðâ ðá ðιεýðειá ãñ÷âβá óáð. Άðεβð ãçιέιϑñâβóáé Ýιά Ûãáει εáðÛειãι ðá Ýιά äιέέευι ιÝñιð, εâé äβóðâ ðι óáι Ýíðñá ðãñÛíáðñι óðçι ãñãìβ áφιϑεβι:

```
# mkdir /var/tmp/dest
# cvsup supfile /var/tmp/dest
```

Ï εáðÛειãιϑ ðιϑ εáειñβóáðâ εά ÷ñçóειϑιέçεâβ υð ðñññέóιυð äéá υεâð ðéð áιáιâβóáéð ãñ÷âβυι. Õι CVSUP εά äíáðÛóáé ðá εáñιέεÛ ãñ÷âβá óáð óðι /usr/src, äέεÛ äã εά ðñιðιðιέβóáé ιýðâ εá äéããñÛðáé εárÝιá áðυ áððÛ. ÈÛεã áιáιÝυóç ãñ÷âβιϑ εά ãβιáé óðιí εáðÛειãι /var/tmp/dest/usr/src. Õι CVSUP υðáι áεðâéâβðáé ιâ áððυ ðιí ðñυðι áðβιáé áðβóçð áιÝðáðâ ðá ãñ÷âβá εáðÛóðáóç ðιϑ óðιí εáðÛειãι base. Ïé ιÝáð äεäυóáéð ðυι ãñ÷âβυι áððβι εά ãñáðιγι óðιí εáειñεöιÝιí εáðÛειãι. Άι Ý÷âðâ áðεβð ðñυðááóç áíÛáιυóçð óðι /usr/src, äã ÷ñâéÛæáðáé ιá âβóðâ εáι root äéá ιá εÛíáðâ áððβ ðç äιέειáðóéεβ áεðÝεâóç.

Άι äã áεðâéâβðâ ðá X11 P áðεβð äã óáð ãñÝóιϑι ðá ãñáóéεÛ ðãñεáÛεειϑá, ιðιñâβðâ ιá äβóðâ εÛðιέáð áðέειãÝð óðçι ãñãìβ áφιϑεβι υðáι áεðâéâβðâ ðçι cvsup:

```
# cvsup -g -L 2 supfile
```

Ç áðέειãβ -g εÝáé óðι CVSUP ιá ιç ÷ñçóειϑιέβóáé ðι ãñáóéευι ðιϑ ðãñεáÛεειϑι. Άððυ ãβιáðáé áððυιáðá áι äã áεðâéιγιðáé ðá X11, äέεÛ äéáðιñáðéεÛ εά ðñÝðáé ιá ðι εáειñβóáðâ.

Ç áðέειãβ -L 2 εÝáé óðι CVSUP ιá àìöáιβóáé υεâð ðéð εäððñÝñáéáð äéá υεâð ðéð áιáιâβóáéð ãñ÷âβυι ðιϑ áεðâéâβ. ÕðÛñ÷âé ðñβá äðβðããã ðãñεãñáððð, áðυ ðι -L 0 υð ðι -L 2. Ç ðñιðáέεειãβ âβιáé ðι 0, ðιϑ óçιáβιáé áðυεððç óéυðβ áεðυð áðυ ιçιγιáðá εÛειϑð.

ÕðÛñ÷âé äéáéÝóειãð ãñεáðÝð áéυιá áðέειãÝð. Άέá ιεá ðãñέççððéεβ εββóá, ãñÛððâ cvsup -H. Άέá ðãñέóóυððãñι εäððñãñâβð ðãñεãñáðÝð, äãβðâ ðç óáεβãá ðιϑ manual.

¼ðáι ιâβιáðâ εéãñðιέçιÝñð áðυ ðιí ðñυðι ðιϑ ãβñιðáé ιé áιáιâβóáéð, ιðιñâβðâ ιá εáñιββóáðâ ðçι óá ðáéðÛ äéáððβιáðá áεðÝεâóç ðιϑ CVSUP ιâ ðçι ÷ñβóç ðιϑ cron(8). Δñιðáιβð äã εá ðñÝðáé ιá áðβóáðâ ðι CVSUP ιá ÷ñçóειϑιέâβ ðι ãñáóéευι ðιϑ ðãñεáÛεειϑι υðáι ðι áεðâéâβðâ ιÝóυ ðιϑ cron(8).

A.6.5 ÓðéειãÝð Άñ÷âβυι ðιϑCVSUP

Ïé óðéειãÝð ãñ÷âβυι ðιϑ äéáðβεáιðáé ιÝóυ ðιϑ CVSUP âβιáé ãñãáυιÝιáð εãñãñ÷έεÛ. ÕðÛñ÷âé εβããð ιããÛεáð óðéειãÝð, εâé áððÝð ÷ññβειϑιáé óá ιéεñυðãñãð ððι-ððéειãÝð. Ç εβθç ιεáð ιããÛεçð óðéειãβð, εóιãðíãñâβ ιâ ðçι εβθç εÛεã ιεáð áðυ ðéð ððι-ððéειãÝð ðéð. Ïé εãñãñ÷έεÝð ð÷Ýóáéð ιãðáιγ ðυι óðéειãβι, áφιέéáðιððñβειϑιáé ðãñáéÛðυ ιâ ðçι ÷ñβóç ðυι áðι÷βι.

Ïé ðει ðð÷íÛ ÷ñçóειϑιέιγιáíáð óðéειãÝð âβιáé ç src-all, εâé ç ports-all. Ïé Ûεéãð óðéειãÝð ÷ñçóειϑιέιγιðáé ιυιí áðυ ιéεñÝð ãñããð áιεñβðυι äéá äéáέειγð óειðιγð, εâé εÛðιέá mirror sites ιðιñâβ ιá ιçι ðéð Ý÷âé ðιϑ éáευειϑ.

cv^s-all release=cv^s

Ôι èýñéι CVS repository òιò FreeBSD, òιò ðáñééáιáÚííáé èáé òιí èπαέéá èñòðòιáñáòβáð.

distrib release=cv^s

Άñ÷áβá ðιò áíáòÝñιíòáé òçí äéáñιπ èáé òι mirroring òιò FreeBSD.

doc-all release=cv^s

Δçãáβιð èπαέéáð áéá òι FreeBSD Handbook èáé òçí òðüèιéðç òáèìçñβùç. Άáι ðáñééáιáÚííáé áñ÷áβá áéá òι web site òιò FreeBSD.

ports-all release=cv^s

Ç òðèèιã Ports òιò FreeBSD.

Óçιάíòééü: Áι ááι èÝéáðá íá áíáíáπóáðá üèι òι ports-all (òι ðèπñáð äÝíòñι òùι ports), áèèÜ íá ÷ñçòéιιðιèπóáðá íéá áðü òéð òðιòðèèιãÝò ðιò òáβιíιíòáé ðáñáèÜðü, ááááéüèáβðá üðé ðÚíðá áíáíáπíáðá òçí òðιòðèèιã ports-base! %ðáι èÜðé áèèÜæáé òòι òýòççιά íáðááèπóðéóçò òùι ports ðιò áíðéðñιòúðáγáðáé áðü òι ports-base, áβιáé ðñáèðééÜ äÝááéι üðé íé áèéááÝò áððÝò ðιèý òýíòιá èá ÷ñçòéιιðιèçéιýι áðü "ðñááιáðééÜ" ports. ρóé, áι áíáíáπíáðá íüιí òá "ðñááιáðééÜ" ports èáé áððÜ ÷ñçòéιιðιèçéιýι èÜðιéáð áðü òéð íÝáð áðιáðüççðáð, òðÜñ÷áé íááÜèç ðééáíüðçðá ç íáðááèπóðéóç òιòð íá áðιðý÷áé íá èÜðιéι ιðòòçñèπááð ιβιðιá èÜèιðð. Ôι ðñπòι ðñÜáιá ðιò ðñÝðáé íá èÜíáðá òá áððπ òçí ðáñβððùçç áβιáé íá ááááéüèáβðá üðé áβιáé áíçιáñüιÝιç ç òðèèιã òáð ports-base.

Óçιάíòééü: Áι òèιðáγáðá íá äçιéιòñãπóáðá òι áéèü òáð òιðéèü áíðβáñáòι òιò ports/INDEX, èá ðñÝðáé íá áá÷áβðá òç òðèèιã ports-all (íèüèèçñι òι äÝíòñι òùι ports). Η äçιéιòñãβá òιò ports/INDEX áðü ιç-ðèπñáð äÝíòñι ááι òðιòççñβæáðáé. Άáβðá òι FAQ (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/faq/applications.html#MAKE-INDEX).

ports-accessibility release=cv^s

Èιáéòιéèü áéá òçí áιðéáéá ÷ñçòòπι íá áíáðçñβáð.

ports-arabic release=cv^s

Ôðιòðπñéιç Άñááéèðð Æèπóáð.

ports-archivers release=cv^s

Άñááéáβá áðιèðéáððçð èáé òðιðβáðçð.

ports-astro release=cv^s

Ports ò÷áðééÜ íá áóòñιíñβá.

ports-audio release=cv^s

Ôðιòðπñéιç π÷ιð.

ports-base release=cvs

ΆάόέέÛ άñ ÷ άβá ðùι ports áέα ððιόððñείç ðιϑ óðóððιáðιϑ ìáðááεððóέóçð. ΆέÛöιñά άñ ÷ άβá ðιϑ άñβóέιíðάέ óðιϑð ððιέáðáέüüιϑð Mk/ έάέ Tools/ ðιϑ /usr/ports.

Όçιάβύóç: Δάñáέάέιγιά ááβðå ðçι ðçιáιðέέεð ðñιáέáιðιβçóç ðáñáðÛιú: έά ðñÝðáέ ðÛιðιðά ìá áιçìáñðιáðå áóðð ðçι ððιόðέέιäð, üðáι áιçìáñðιáðå ìðιέìäððιðå ðιðιá ðçð óðέέιäððò Ports ðιϑ FreeBSD.

ports-benchmarks release=cvs

ΔñιáñÛιáðά ìÝðñçóçð áðüüιóçð (Benchmarks).

ports-biology release=cvs

Άέιέìäβá.

ports-cad release=cvs

Άñáέéäβá ó ÷ ááβáóçð ìá ðç áìðéáέá ððιέìäέóðð.

ports-chinese release=cvs

Õðιόððñείç Έέìäæέéðð Άεðóáð.

ports-comms release=cvs

Ëìäέóìέéü áðέέιέíùíέíι.

ports-converters release=cvs

Ìáðáðñιðåβð ÷ άñáέððñùí.

ports-databases release=cvs

ΆÛóáέð ΆááñÝιúí.

ports-deskutils release=cvs

Άíóέéäβιáíá ðιϑ άñβóέιíðáι óðιðéùð óá Ýíá áñáðåβι ðñεί ðçι áðáγñáóç ðùι ððιέìäέóððι.

ports-devel release=cvs

ΆιçεçóέéÛ ðñιáñÛιáðά áέα ðçι áíÛððóιç έìäέóìέέιγ.

ports-dns release=cvs

Ëìäέóìέéü ó ÷ áðέéü ìá DNS.

ports-editors release=cvs

ÓðιόÛέðåð έáέιÝιϑ.

ports-emulators release=cvs
ΆññιέυδΎδ ΰέεϋι έάέοιñåέέβι όδóçιΰδϋι.

ports-finance release=cvs
×ñçιάóñíέέñíέέΰ δññññΰñιάόά.

ports-ftp release=cvs
Δññññΰñιάόά FTP (δåέΰδåð έάέ ãïðçñåðçôΎð).

ports-games release=cvs
Δάέ÷ίβåάά.

ports-german release=cvs
Õðïóðññέίç Άññιάίέέèð ãέβóóåð.

ports-graphics release=cvs
Άññåέåβå ãñåóέέβι.

ports-hebrew release=cvs
Õðïóðññέίç ååñåííέèð ãέβóóåð.

ports-hungarian release=cvs
Õðïóðññέίç ÌåããññΎæέέçð ãέβóóåð.

ports-irc release=cvs
Δññññΰñιάόά ãέά ðι IRC.

ports-japanese release=cvs
Õðïóðññέίç Έάδϋίέέèð ãέβóóåð.

ports-java release=cvs
Άññåέåβå ãέά ðçι Java.

ports-korean release=cvs
Õðïóðññέίç Έìñååóέέèð ãέβóóåð.

ports-lang release=cvs
Άέβóóåð δññññññιάóέóιϋι.

ports-mail release=cvs
Δññññΰñιάόά çååðññíέέίϋι ðå÷ðåñññåβιð.

ports-math release=cvs
Ëñåέóίέέϋι ìåççιάóέέέβι ððñññåέóιβι.

ports-misc release=cvs
ÄËÛöïñå äìçèçòééÛ ðñññÛññåóå.

ports-multimedia release=cvs
Ëìäéóìééü ðñèòìÝóóí.

ports-net release=cvs
Ëìäéóìééü äééðýúí.

ports-net-im release=cvs
Ëìäéóìééü Ûìåóóí ìçíðìÛòóí (instant messaging).

ports-net-mgmt release=cvs
Ëìäéóìééü äéå÷åβñéóçð äééðýúí.

ports-net-p2p release=cvs
Äééðýúòç peer-to-peer.

ports-news release=cvs
Ëìäéóìééü äéå ðì USENET.

ports-palm release=cvs
Ëìäéóìééü äéå ðçí ððñíóðññéíç ðóóèååðñí ðýðñò Palm™.

ports-polish release=cvs
Ïðñíóðññéíç Δñèüíééðð ãèðóóåð.

ports-ports-mgmt release=cvs
Åñååèååáå äéå ðç äéå÷åβñéóç ðåéÝòóí éåé ports.

ports-portuguese release=cvs
Ïðñíóðññéíç Δññòñìäééééðð ãèðóóåð.

ports-print release=cvs
Ëìäéóìééü äéððððóåúí.

ports-russian release=cvs
Ïðñíóðññéíç Ñùóééðð ãèðóóåð.

ports-science release=cvs
ÅðéóðçññéééÛ ðñññÛññåóå.

ports-security release=cvs
Åñååèååáå áóóåèååáðð.

ports-shells release=cvs

Shells àέα ôçí ãñáìÐ áíðïëþí.

ports-sysutils release=cvs

ΆίçèçòέέÛ ðññãñÛñιάόά óðóðÐιάðïð.

ports-textproc release=cvs

Άñãέέåßá áðãñãñãάóßáð èåείÝñï (ãáí ðãñέέãñãÛíãέé áðέóñáðÝæέα ôððñãñãóßá).

ports-ukrainian release=cvs

ÕðïóðÐñέίç Ïèññáíέέèðð ãëþóóáð.

ports-vietnamese release=cvs

ÕðïóðÐñέίç ΆέåðíáíÝæέèçð ãëþóóáð.

ports-www release=cvs

Ëñáέóíέèü ðïð ó÷-åðßæåðáέ íå ðñ ðáãèüóíέí éóóü (World Wide Web).

ports-x11 release=cvs

Ports àέα ððïóðÐñέίç ðïð óðóðÐιάðïð X Windows.

ports-x11-clocks release=cvs

Ññèüãέα àέα ðï X11.

ports-x11-drivers release=cvs

ÐññãñÛñιάόά ïãÐãçóçð àέα ðá X11.

ports-x11-fm release=cvs

Άέα÷áέñέóðÝð ãñ÷åßñí àέα ðá X11.

ports-x11-fonts release=cvs

ΆññáíáðïíóáέñÝð èάέ ãñãέέåßá ãññáíáðïíóáέñþí àέα X11.

ports-x11-toolkits release=cvs

Άñãåéåέíèèèåð X11.

ports-x11-servers release=cvs

ΆíððçñåðçðÝð X11.

ports-x11-themes release=cvs

ÈÝíáόά àέα X11.

ports-x11-wm release=cvs

Άέα÷áέñέóðÝð ðãñáέýññí (window managers) àέα X11.

projects-all release=cvs

Δçãáβιð èρãέέά ãέά ðι projects repository ðιð FreeBSD.

src-all release=cvs

Ï ááóέέυð ðçãáβιð èρãέέά ðιð FreeBSD, óðιðãñέέáíáááñíÝñò ðιð èρãέέά èñðððιãñáððáð.

src-base release=cvs

ΆέÛöιñá áñ÷áβá óççί èιñòðP ðιð /usr/src.

src-bin release=cvs

Άñãáèãá ðιð ðεέáíιí íá áðáέóιγίðάέ óá èáóÛóðáóç èáέðιðñãáð áíυð ÷ñPóçç (single-user) (/usr/src/bin).

src-cddl release=cvs

Άñãáèãá èáέ áέáέειèPεáð ðιð èáέγððιγίðάέ áðυ ççί Ûááέá ÷ñPóçç CDDL (/usr/src/cddl).

src-contrib release=cvs

Άñãáèãá èáέ áέáέειèPεáð ðιð ááí áιPειðι óðι FreeBSD Project, èáέ óá ιðιβá ÷ñçóέιιðιέιγίðάέ ιðóέáóóέέÛ áíáέειβùðá (/usr/src/contrib).

src-crypto release=cvs

Άñãáèãá èáέ áέáέειèPεáð èñðððιãñÛóçóçð ðιð ááí áιPειðι óðι FreeBSD project èáέ óá ιðιβá ÷ñçóέιιðιέιγίðάέ ιðóέáóóέέÛ áíáέειβùðá (/usr/src/crypto).

src-eBones release=cvs

Kerberos èáέ DES (/usr/src/eBones). Άáí ÷ñçóέιιðιέιγίðάέ óðέð ðñÝ÷ιðóáð áέáυúóáέð ðιð FreeBSD.

src-etc release=cvs

Άñ÷áβá ñðèιβóáυι ðιð óðóðPιáðιð (/usr/src/etc).

src-games release=cvs

Δάέ÷ιβáέá (/usr/src/games).

src-gnu release=cvs

Άñãáèãá ðιð èáέγððιγίðάέ áðυ ççί Ûááέá ÷ñPóçç GNU Public License (/usr/src/gnu).

src-include release=cvs

Άñ÷áβá áðέέáðáέβáυι (/usr/src/include).

src-kerberos5 release=cvs

ΔάέÝðι áóóáέãáðð Kerberos5 (/usr/src/kerberos5).

src-kerberosIV release=cvs

ΔάέÝðι áóóáέãáðð KerberosIV (/usr/src/kerberosIV).

src-lib release=cvs

ΆέέέιèÐéåð (/usr/src/lib).

src-libexec release=cvs

ÐñññÛññάά όόόðΠιάðì ðά ιðιβά όόόέιτᾶέέÛ ἄέðᾶειγίόάέ áðu Ûεεά ðñññÛññάά (/usr/src/libexec).

src-release release=cvs

Άñ ÷-άβå ðιϑ ᾰðᾶέοιγίόάέ ᾶέά ðçí ðᾰñᾰᾰᾰᾰΠ ιέάð Ýέᾰιόçð ðιϑ FreeBSD (/usr/src/release).

src-rescue release=cvs

ÐñññÛññάά ιᾰ όόᾰðéèÐ ιᾰόᾰᾰεððóέóç ᾶέά ÷-ñΠόç óᾰ Ýέðᾰéðᾰð ðᾰñέðððᾰéð ᾰðᾰίᾰοιñÛð ðιϑ όόόðΠιάðì. ᾰᾰβðå ðι rescue(8) (/usr/src/rescue).

src-sbin release=cvs

Άñᾰᾰᾰᾰᾰβå όόόðΠιάðì ᾰέᾰ éᾰéοιτᾰñᾰβå óᾰ éᾰóÛóðᾰóç ᾰíτᾰð ÷-ñΠόç (single user mode) (/usr/src/sbin).

src-secure release=cvs

ΆέέέιèÐéåð éᾰé ᾰίοιτᾰÝð êñðððιᾰñÛöçóçð (/usr/src/secure).

src-share release=cvs

Άñ ÷-άβå ðά ιðιβά ιðιñᾰᾰβ ίᾰ ᾰβίᾰέ έιέíÛ ᾰίÛññάά óᾰ ðιᾰᾰᾰᾰðᾰÛ όόόðΠιάðᾰ (/usr/src/share).

src-sys release=cvs

Ï ðññΠιάð (/usr/src/sys).

src-sys-crypto release=cvs

Éᾰᾰᾰᾰᾰ éñðððιᾰñᾰóβᾰð ðιϑ ðññΠιά (/usr/src/sys/crypto).

src-tools release=cvs

ᾰᾰÛοιñᾰ ᾰñᾰᾰᾰᾰβå ᾰέᾰ ðç όóιðΠñçóç ðιϑ FreeBSD (/usr/src/tools).

src-usrbin release=cvs

Άñᾰᾰᾰᾰᾰβå ÷-ñΠόç (/usr/src/usr.bin).

src-usrsbin release=cvs

Άñᾰᾰᾰᾰᾰβå όόόðΠιάðì (/usr/src/usr.sbin).

www release=cvs

Ï ðçᾰᾰβìð éᾰᾰᾰᾰᾰ ᾰέᾰ ðçí ðιðιᾰᾰᾰβå WWW ðιϑ FreeBSD.

distrib release=self

Όά άñ÷-άβá ñòèìβóáùì òῑò βáèῑò òῑò áῑòδçñáòçòð **CVSup**. ×ñçóèῑδῑéâβòáé áδῑ **CVSup** mirror sites.

gnats release=current

Η άŨòç áááñŸíùì òῑò òòòòðῑáòῑò δάñáèῑèγèçòçò δñῑáèçìŨòùì GNATS.

mail-archive release=current

Όά άñ÷-άβá òçò èβòòáò òá÷-òáññíâβῑò òῑò FreeBSD.

www release=current

Δñῑ-áδâíáñááòìŸíá άñ÷-άβá òçò äééòòáèð òῑδῑèáòβáò (WWW) òῑò FreeBSD (ù÷-é ì δçááβῑò èðáééáò). ×ñçóèῑδῑéâβòáé áδῑ WWW mirror sites.

A.6.6 Άέá Δάñéóòüòáñâò Δèçñῑòῑñβâò

Άέá òῑ FAQ òῑò **CVSup** éáé Ũèèâò δèçñῑòῑñβâò ó÷-áòééŨ ìá áòòü, áâβòâ òç Óáèβáá òῑò CVSup (<http://www.cvsup.org>).

Όðæçòðóáèð ó÷-áòééŨ ìá òç ÷ñðòç òῑò **CVSup** óòῑ FreeBSD éáíáŨíñòì ÷-ðñá òòçì çèáèòñῑéèð èβòòá òá÷-ῑéèðì òðæçòðóáùì òῑò FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-hackers>). Όðç èβòòá áòðð, éáèð ò èáé òòçì çèáèòñῑéèð èβòòá áíáèῑíðóáùì òῑò FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-announce>) áíáèῑíðñῑóáé éáé ῑé ιŸâð áèäüóáèð òῑò δñῑáñŨìáòῑò.

Άέá áñùòðóáèð ð áíáòῑñŸò òòáèìŨòùì ó÷-áòééŨ ìá òῑ **CVSup** ñβῑòâ ῑéá ιáòéŨ òòῑ CVSup FAQ (<http://www.cvsup.org/faq.html#bugreports>).

A.6.7 Όῑδῑèáóβâò CVSup

Ũðñâβòâ íá áñâβòâ áῑòδçñáòçòŸò CVSup áéá òῑ FreeBSD óòéð áèüèῑòèâò òῑδῑèáóβâò:

Central Servers, Primary Mirror Sites, Argentina, Armenia, Australia, Austria, Brazil, Bulgaria, Canada, China, Costa Rica, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Kuwait, Kyrgyzstan, Latvia, Lithuania, Netherlands, New Zealand, Norway, Philippines, Poland, Portugal, Romania, Russia, San Marino, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, Ukraine, United Kingdom, USA.

(as of 2011/09/11 11:28:10 UTC)

Central Servers

- cvsup.FreeBSD.org

Primary Mirror Sites

- cvsup1.FreeBSD.org

- cvsup2.FreeBSD.org
- cvsup3.FreeBSD.org
- cvsup4.FreeBSD.org
- cvsup5.FreeBSD.org
- cvsup6.FreeBSD.org
- cvsup7.FreeBSD.org
- cvsup8.FreeBSD.org
- cvsup9.FreeBSD.org
- cvsup10.FreeBSD.org
- cvsup11.FreeBSD.org
- cvsup12.FreeBSD.org
- cvsup13.FreeBSD.org
- cvsup14.FreeBSD.org
- cvsup15.FreeBSD.org
- cvsup16.FreeBSD.org
- cvsup18.FreeBSD.org

Argentina

- cvsup.ar.FreeBSD.org

Armenia

- cvsup1.am.FreeBSD.org

Australia

- cvsup.au.FreeBSD.org

Austria

- cvsup.at.FreeBSD.org

Brazil

- cvsup.br.FreeBSD.org
- cvsup2.br.FreeBSD.org
- cvsup3.br.FreeBSD.org
- cvsup4.br.FreeBSD.org
- cvsup5.br.FreeBSD.org

Bulgaria

- cvsup.bg.FreeBSD.org

Canada

- cvsup1.ca.FreeBSD.org

China

- cvsup.cn.FreeBSD.org
- cvsup2.cn.FreeBSD.org

Costa Rica

- cvsup1.cr.FreeBSD.org

Czech Republic

- cvsup.cz.FreeBSD.org

Denmark

- cvsup.dk.FreeBSD.org
- cvsup2.dk.FreeBSD.org

Estonia

- cvsup.ee.FreeBSD.org

Finland

- cvsup.fi.FreeBSD.org
- cvsup2.fi.FreeBSD.org

France

- cvsup.fr.FreeBSD.org
- cvsup1.fr.FreeBSD.org
- cvsup2.fr.FreeBSD.org
- cvsup3.fr.FreeBSD.org
- cvsup4.fr.FreeBSD.org
- cvsup5.fr.FreeBSD.org
- cvsup8.fr.FreeBSD.org

Germany

- cvsup.de.FreeBSD.org
- cvsup2.de.FreeBSD.org
- cvsup3.de.FreeBSD.org
- cvsup4.de.FreeBSD.org
- cvsup5.de.FreeBSD.org
- cvsup6.de.FreeBSD.org
- cvsup7.de.FreeBSD.org
- cvsup8.de.FreeBSD.org

Greece

- cvsup.gr.FreeBSD.org
- cvsup2.gr.FreeBSD.org

Hungary

- cvsup.hu.FreeBSD.org

Iceland

- cvsup.is.FreeBSD.org

Ireland

- cvsup.ie.FreeBSD.org
- cvsup2.ie.FreeBSD.org

Israel

- cvsup.il.FreeBSD.org

Italy

- cvsup.it.FreeBSD.org

Japan

- cvsup.jp.FreeBSD.org
- cvsup2.jp.FreeBSD.org
- cvsup3.jp.FreeBSD.org
- cvsup4.jp.FreeBSD.org
- cvsup5.jp.FreeBSD.org

- cvsup6.jp.FreeBSD.org

Korea

- cvsup.kr.FreeBSD.org
- cvsup2.kr.FreeBSD.org
- cvsup3.kr.FreeBSD.org

Kuwait

- cvsup1.kw.FreeBSD.org

Kyrgyzstan

- cvsup.kg.FreeBSD.org

Latvia

- cvsup.lv.FreeBSD.org
- cvsup2.lv.FreeBSD.org

Lithuania

- cvsup.lt.FreeBSD.org
- cvsup2.lt.FreeBSD.org
- cvsup3.lt.FreeBSD.org

Netherlands

- cvsup.nl.FreeBSD.org
- cvsup2.nl.FreeBSD.org
- cvsup3.nl.FreeBSD.org

New Zealand

- cvsup.nz.FreeBSD.org

Norway

- cvsup.no.FreeBSD.org

Philippines

- cvsup1.ph.FreeBSD.org

Poland

- cvsup.pl.FreeBSD.org
- cvsup2.pl.FreeBSD.org
- cvsup3.pl.FreeBSD.org

Portugal

- cvsup.pt.FreeBSD.org
- cvsup2.pt.FreeBSD.org
- cvsup3.pt.FreeBSD.org

Romania

- cvsup.ro.FreeBSD.org
- cvsup1.ro.FreeBSD.org
- cvsup2.ro.FreeBSD.org
- cvsup3.ro.FreeBSD.org

Russia

- cvsup.ru.FreeBSD.org
- cvsup2.ru.FreeBSD.org
- cvsup3.ru.FreeBSD.org
- cvsup4.ru.FreeBSD.org
- cvsup5.ru.FreeBSD.org
- cvsup6.ru.FreeBSD.org
- cvsup7.ru.FreeBSD.org

San Marino

- cvsup.sm.FreeBSD.org

Singapore

- cvsup.sg.FreeBSD.org

Slovak Republic

- cvsup.sk.FreeBSD.org

Slovenia

- cvsup.si.FreeBSD.org
- cvsup2.si.FreeBSD.org

South Africa

- cvsup.za.FreeBSD.org
- cvsup2.za.FreeBSD.org

Spain

- cvsup.es.FreeBSD.org
- cvsup2.es.FreeBSD.org
- cvsup3.es.FreeBSD.org

Sweden

- cvsup.se.FreeBSD.org
- cvsup2.se.FreeBSD.org

Switzerland

- cvsup.ch.FreeBSD.org

Taiwan

- cvsup.tw.FreeBSD.org
- cvsup3.tw.FreeBSD.org
- cvsup4.tw.FreeBSD.org
- cvsup5.tw.FreeBSD.org
- cvsup6.tw.FreeBSD.org
- cvsup7.tw.FreeBSD.org
- cvsup8.tw.FreeBSD.org
- cvsup9.tw.FreeBSD.org
- cvsup10.tw.FreeBSD.org
- cvsup11.tw.FreeBSD.org
- cvsup12.tw.FreeBSD.org
- cvsup13.tw.FreeBSD.org
- cvsup14.tw.FreeBSD.org

Thailand

- cvsup.th.FreeBSD.org

Turkey

- cvsup.tr.FreeBSD.org
- cvsup2.tr.FreeBSD.org

Ukraine

- cvsup2.ua.FreeBSD.org
- cvsup3.ua.FreeBSD.org
- cvsup5.ua.FreeBSD.org
- cvsup6.ua.FreeBSD.org
- cvsup7.ua.FreeBSD.org

United Kingdom

- cvsup.uk.FreeBSD.org
- cvsup2.uk.FreeBSD.org
- cvsup3.uk.FreeBSD.org
- cvsup4.uk.FreeBSD.org

USA

- cvsup1.us.FreeBSD.org
- cvsup2.us.FreeBSD.org
- cvsup3.us.FreeBSD.org
- cvsup4.us.FreeBSD.org
- cvsup5.us.FreeBSD.org
- cvsup6.us.FreeBSD.org
- cvsup7.us.FreeBSD.org
- cvsup8.us.FreeBSD.org

RELENG_8_2

Ç ãñáìÞ Ýêäïçò òϊò FreeBSD-8.2, ÷ñçóεϊιðïéάβδάé ìüíí áéά ářçìáñÞðáéò áóöάéάβáð èάé Ûεéáð èñβóεϊáð äéìñèÞðáéò.

RELENG_8_1

Ç ãñáìÞ Ýêäïçò òϊò FreeBSD-8.1, ÷ñçóεϊιðïéάβδάé ìüíí áéά ářçìáñÞðáéò áóöάéάβáð èάé Ûεéáð èñβóεϊáð äéìñèÞðáéò.

RELENG_8_0

Ç ãñáìÞ Ýêäïçò òϊò FreeBSD-8.0, ÷ñçóεϊιðïéάβδάé ìüíí áéά ářçìáñÞðáéò áóöάéάβáð èάé Ûεéáð èñβóεϊáð äéìñèÞðáéò.

RELENG_7

Ç ãñáìÞ ářÛððïçò áéά òϊ FreeBSD-7.X, ářüóðÞ áðβóçò èάé ùð FreeBSD 7-STABLE

RELENG_7_4

Ç ãñáìÞ Ýêäïçò òϊò FreeBSD-7.4, ÷ñçóεϊιðïéάβδάé ìüíí áéά ářçìáñÞðáéò áóöάéάβáð èάé Ûεéáð èñβóεϊáð äéìñèÞðáéò.

RELENG_7_3

Ç ãñáìÞ Ýêäïçò òϊò FreeBSD-7.3, ÷ñçóεϊιðïéάβδάé ìüíí áéά ářçìáñÞðáéò áóöάéάβáð èάé Ûεéáð èñβóεϊáð äéìñèÞðáéò.

RELENG_7_2

Ç ãñáìÞ Ýêäïçò òϊò FreeBSD-7.2, ÷ñçóεϊιðïéάβδάé ìüíí áéά ářçìáñÞðáéò áóöάéάβáð èάé Ûεéáð èñβóεϊáð äéìñèÞðáéò.

RELENG_7_1

Ç ãñáìÞ Ýêäïçò òϊò FreeBSD-7.1, ÷ñçóεϊιðïéάβδάé ìüíí áéά ářçìáñÞðáéò áóöάéάβáð èάé Ûεéáð èñβóεϊáð äéìñèÞðáéò.

RELENG_7_0

Ç ãñáìÞ Ýêäïçò òϊò FreeBSD-7.0, ÷ñçóεϊιðïéάβδάé ìüíí áéά ářçìáñÞðáéò áóöάéάβáð èάé Ûεéáð èñβóεϊáð äéìñèÞðáéò.

RELENG_6

Ç ãñáìÞ ářÛððïçò áéά òϊ FreeBSD-6.X, ářüóðÞ áðβóçò èάé ùð FreeBSD 6-STABLE

RELENG_6_4

Ç ãñáìÞ Ýêäïçò òϊò FreeBSD-6.4, ÷ñçóεϊιðïéάβδάé ìüíí áéά ářçìáñÞðáéò áóöάéάβáð èάé Ûεéáð èñβóεϊáð äéìñèÞðáéò.

RELENG_6_3

Ç ãñáìÞ Ýêäïçò òϊò FreeBSD-6.3, ÷ñçóεϊιðïéάβδάé ìüíí áéά ářçìáñÞðáéò áóöάéάβáð èάé Ûεéáð èñβóεϊáð äéìñèÞðáéò.

RELENG_6_2

Ç ãñåìÞ Ýêäïçð ðïϝ FreeBSD-6.2, ÷ñçóèïðïéåβðåέ ìïíí ãέá áçìåñþåðåð áóðåéåβåð èέέ Üèèåð èñβóéìåð äéìñèþåðåð.

RELENG_6_1

Ç ãñåìÞ Ýêäïçð ðïϝ FreeBSD-6.1, ÷ñçóèïðïéåβðåέ ìïíí ãέá áçìåñþåðåð áóðåéåβåð èέέ Üèèåð èñβóéìåð äéìñèþåðåð.

RELENG_6_0

Ç ãñåìÞ Ýêäïçð ðïϝ FreeBSD-6.0, ÷ñçóèïðïéåβðåέ ìïíí ãέá áçìåñþåðåð áóðåéåβåð èέέ Üèèåð èñβóéìåð äéìñèþåðåð.

RELENG_5

Ç ãñåìÞ áíÜðððίçð ãέá ðϊ FreeBSD-5.X, ãìòóðÞ åðβóçð ùð FreeBSD 5-STABLE.

RELENG_5_5

Ç ãñåìÞ Ýêäïçð ðïϝ FreeBSD-5.5, ÷ñçóèïðïéåβðåέ ìïíí ãέá áçìåñþåðåð áóðåéåβåð èέέ Üèèåð èñβóéìåð äéìñèþåðåð.

RELENG_5_4

Ç ãñåìÞ Ýêäïçð ðïϝ FreeBSD-5.4, ÷ñçóèïðïéåβðåέ ìïíí ãέá áçìåñþåðåð áóðåéåβåð èέέ Üèèåð èñβóéìåð äéìñèþåðåð.

RELENG_5_3

Ç ãñåìÞ Ýêäïçð ðïϝ FreeBSD-5.3, ÷ñçóèïðïéåβðåέ ìïíí ãέá áçìåñþåðåð áóðåéåβåð èέέ Üèèåð èñβóéìåð äéìñèþåðåð.

RELENG_5_2

Ç ãñåìÞ Ýêäïçð FreeBSD-5.2 èέέ FreeBSD-5.2.1, ÷ñçóèïðïéåβðåέ ìïíí ãέá áçìåñþåðåð áóðåéåβåð èέέ Üèèåð èñβóéìåð äéìñèþåðåð.

RELENG_5_1

Ç ãñåìÞ Ýêäïçð ãέá ðϊ FreeBSD-5.1, ÷ñçóèïðïéåβðåέ ìïíí ãέá ãέá áçìåñþåðåð áóðåéåβåð èέέ Üèèåð èñβóéìåð äéìñèþåðåð.

RELENG_5_0

Ç ãñåìÞ Ýêäïçð ãέá ðϊ FreeBSD-5.0, ÷ñçóèïðïéåβðåέ ìïíí ãέá áçìåñþåðåð áóðåéåβåð èέέ Üèèåð èñβóéìåð äéìñèþåðåð.

RELENG_4

Ç ãñåìÞ áíÜðððίçð ãέá ðϊ FreeBSD-4.X, ãìòóðÞ åðβóçð èέέ ùð FreeBSD 4-STABLE.

RELENG_4_11

Ç ãñåìÞ Ýêäïçð ãέá ðϊ FreeBSD-4.11, ÷ñçóèïðïéåβðåέ ìïíí ãέá áçìåñþåðåð áóðåéåβåð èέέ Üèèåð èñβóéìåð äéìñèþåðåð.

RELENG_4_10

Ç ãñáñìÞ Ýèäïðçð ãέά õϊ FreeBSD-4.10, ÷ ñçóέïððϊέάβðάέ ìüñ ãέά áιçìáñþðάέð áóðάέάβáð èάέ Ûέέáð èñβóέïáð äέïñèþðάέð.

RELENG_4_9

Ç ãñáñìÞ Ýèäïðçð ãέά õϊ FreeBSD-4.9, ÷ ñçóέïððϊέάβðάέ ìüñ ãέά áιçìáñþðάέð áóðάέάβáð èάέ Ûέέáð èñβóέïáð äέïñèþðάέð.

RELENG_4_8

Ç ãñáñìÞ Ýèäïðçð ãέά õϊ FreeBSD-4.8, ÷ ñçóέïððϊέάβðάέ ìüñ ãέά áιçìáñþðάέð áóðάέάβáð èάέ Ûέέáð èñβóέïáð äέïñèþðάέð.

RELENG_4_7

Ç ãñáñìÞ Ýèäïðçð ãέά õϊ FreeBSD-4.7, ÷ ñçóέïððϊέάβðάέ ìüñ ãέά áιçìáñþðάέð áóðάέάβáð èάέ Ûέέáð èñβóέïáð äέïñèþðάέð.

RELENG_4_6

Ç ãñáñìÞ Ýèäïðçð ãέά óá FreeBSD-4.6 èάέ FreeBSD-4.6.2, ÷ ñçóέïððϊέάβðάέ ìüñ ãέά áιçìáñþðάέð áóðάέάβáð èάέ Ûέέáð èñβóέïáð äέïñèþðάέð.

RELENG_4_5

Ç ãñáñìÞ Ýèäïðçð ãέά õϊ FreeBSD-4.5, ÷ ñçóέïððϊέάβðάέ ìüñ ãέά áιçìáñþðάέð áóðάέάβáð èάέ Ûέέáð èñβóέïáð äέïñèþðάέð.

RELENG_4_4

Ç ãñáñìÞ Ýèäïðçð ãέά õϊ FreeBSD-4.4, ÷ ñçóέïððϊέάβðάέ ìüñ ãέά áιçìáñþðάέð áóðάέάβáð èάέ Ûέέáð èñβóέïáð äέïñèþðάέð.

RELENG_4_3

Ç ãñáñìÞ Ýèäïðçð ãέά õϊ FreeBSD-4.3, ÷ ñçóέïððϊέάβðάέ ìüñ ãέά áιçìáñþðάέð áóðάέάβáð èάέ Ûέέáð èñβóέïáð äέïñèþðάέð.

RELENG_3

Ç ãñáñìÞ áíÛðððίçð ãέά õϊ FreeBSD-3.X, áíùóðÞ áðβóçð èάέ ùð 3.X-STABLE.

RELENG_2_2

Ç ãñáñìÞ áíÛðððίçð ãέά õϊ FreeBSD-2.2.X, áíùóðÞ áðβóçð èάέ ùð 2.2-STABLE. Ç ãñáñìÞ áððÞ èáùñάβðάέ ìðóέάóðέέÛ ðáñù ÷ çìÝίç.

A.7.2 ΆðέéÝðáð Άέäüóáùí (Release Tags)

Íé áðέéÝðáð áðÝð áíáóÝñïðάέ óá ìέά óðáέáèñέíÝίç ÷ ñïíέèÞ óðέáìÞ èáðÛ ðçí ìðñá Ýáέíá ìέά èáñíέέÞ Ýèäïðçð (release) õïð FreeBSD. Ç áέάáέέάóβá ðçð Ýèäïðçð ðáèìçñèþíáðάέ ìá ðáñέóóüðáñáð èáððñÝñáέáð óðά Ýáñáðάá ðççñïðñβáð Άέάáέέάóβáð èäïðçð (<http://www.FreeBSD.org/releng/>) èάέ Άέάáέέάóβá èäïðçð (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/releng/release-proc.html). Õï äÝíðñïñ src ÷ ñçóέïððϊέάβ

ííííáòá àòééàòþí ðiõ íâééííí íà òç èÝíç RELENG_. Óá äÝíòñá ports éáé doc ÷ ñçóéííðíéííí áòééÝòáð ðiõ íâééííí íà òç èÝíç RELEASE. ÓÝèò, óòí äÝíòñí www äáí äβíáòáé èÜðíéá äéäéèP áòééÝòá ðiõ íá Ý ÷ áé ó ÷ Ýóç íà ðéð äèäüóáéð.

RELENG_8_2_0_RELEASE

FreeBSD 8.2

RELENG_8_1_0_RELEASE

FreeBSD 8.1

RELENG_8_0_0_RELEASE

FreeBSD 8.0

RELENG_7_4_0_RELEASE

FreeBSD 7.4

RELENG_7_3_0_RELEASE

FreeBSD 7.3

RELENG_7_2_0_RELEASE

FreeBSD 7.2

RELENG_7_1_0_RELEASE

FreeBSD 7.1

RELENG_7_0_0_RELEASE

FreeBSD 7.0

RELENG_6_4_0_RELEASE

FreeBSD 6.4

RELENG_6_3_0_RELEASE

FreeBSD 6.3

RELENG_6_2_0_RELEASE

FreeBSD 6.2

RELENG_6_1_0_RELEASE

FreeBSD 6.1

RELENG_6_0_0_RELEASE

FreeBSD 6.0

RELENG_5_5_0_RELEASE

FreeBSD 5.5

RELENG_5_4_0_RELEASE

FreeBSD 5.4

RELENG_4_11_0_RELEASE

FreeBSD 4.11

RELENG_5_3_0_RELEASE

FreeBSD 5.3

RELENG_4_10_0_RELEASE

FreeBSD 4.10

RELENG_5_2_1_RELEASE

FreeBSD 5.2.1

RELENG_5_2_0_RELEASE

FreeBSD 5.2

RELENG_4_9_0_RELEASE

FreeBSD 4.9

RELENG_5_1_0_RELEASE

FreeBSD 5.1

RELENG_4_8_0_RELEASE

FreeBSD 4.8

RELENG_5_0_0_RELEASE

FreeBSD 5.0

RELENG_4_7_0_RELEASE

FreeBSD 4.7

RELENG_4_6_2_RELEASE

FreeBSD 4.6.2

RELENG_4_6_1_RELEASE

FreeBSD 4.6.1

RELENG_4_6_0_RELEASE

FreeBSD 4.6

RELENG_4_5_0_RELEASE

FreeBSD 4.5

RELENG_4_4_0_RELEASE

FreeBSD 4.4

RELENG_4_3_0_RELEASE

FreeBSD 4.3

RELENG_4_2_0_RELEASE

FreeBSD 4.2

RELENG_4_1_1_RELEASE

FreeBSD 4.1.1

RELENG_4_1_0_RELEASE

FreeBSD 4.1

RELENG_4_0_0_RELEASE

FreeBSD 4.0

RELENG_3_5_0_RELEASE

FreeBSD-3.5

RELENG_3_4_0_RELEASE

FreeBSD-3.4

RELENG_3_3_0_RELEASE

FreeBSD-3.3

RELENG_3_2_0_RELEASE

FreeBSD-3.2

RELENG_3_1_0_RELEASE

FreeBSD-3.1

RELENG_3_0_0_RELEASE

FreeBSD-3.0

RELENG_2_2_8_RELEASE

FreeBSD-2.2.8

RELENG_2_2_7_RELEASE

FreeBSD-2.2.7

RELENG_2_2_6_RELEASE

FreeBSD-2.2.6

RELENG_2_2_5_RELEASE

FreeBSD-2.2.5

RELENG_2_2_2_RELEASE

FreeBSD-2.2.2

RELENG_2_2_1_RELEASE

FreeBSD-2.2.1

RELENG_2_2_0_RELEASE

FreeBSD-2.2.0

A.8 Õïðïèåóßåò AFS

ΆïðçñåòçðÝò AFS æέα ðϊ FreeBSD èά åñåßðå óðéð æéüèïðéåð ðïðïèåóßåò:

Õïðçåßá

Ç æέαåññïß æέα óá åñ÷åßá åßιάέ: /afs/stacken.kth.se/ftp/pub/FreeBSD/

```
stacken.kth.se      # Stacken Computer Club, KTH, Sweden
130.237.234.43     #hot.stacken.kth.se
130.237.237.230   #fishburger.stacken.kth.se
130.237.234.3     #milko.stacken.kth.se
```

Õðåýèðñò Õóίðßñçðò: <ftp@stacken.kth.se>

A.9 Õïðïèåóßåò rsync

Õï FreeBSD åßιάέ æέαéÝóèï ìÝóó ðïð ðñòïðïèüèèèò rsync óðéð æéüèïðéåð ðïðïèåóßåò. Õï åñççðéèü ðñüåñåíüå **rsync** èåóóïðñååß ìå ðåñßðïò ðïß ßæéí ðñüðï ìå ççí åíðïèß rcp(1), æèèÛ Ý÷æ ðåñéóóüðåñåð åðéèåÝò èάé ÷ñçóèïðïèååß ðï ðñüðüèèèèè åðñåèñóóíÝíçð åíåíÝóçð ðï ððïß ìåóåóÝñåé ìüñ óéð æέαóïñÝð ìåóåóý åýí óåð åñ÷åßá, åðéóå÷ñíóåð Ýðé èάéåßðåñå ðï óðå÷ñíéóüü ìÝóó ðïð æéèðýïð. Αóðü åßιάέ ðåñéóóüðåñå ÷ñçóèï ãí æέαóçñååßðå mirror ðïð æέαéèñéóðß FTP ß ðïð CVS Repository ðïð FreeBSD. Ç óçèèñåß åóåññïßßí **rsync** æέαóßèååðæέ æέα ðïèèÛ èåóóïðñåéÛ óðóððιαóå, óïð FreeBSD ååßðå ðï port net/rsync ß ÷ñçóèïðïèèèèåðóå ðï åíóßóóïèé÷í ðåéÝò.

Άçïèñååßá ççð Õóå÷ßåð

rsync://ftp.cz.FreeBSD.org/

ΆέάéÝóèïð ÕðèèñåÝò:

- ftp: ìåñéèü mirror ðïð æέαéèñéóðß FTP ðïð FreeBSD.
- FreeBSD: Δèßñåð mirror ðïð æέαéèñéóðß FTP ðïð FreeBSD.

Ïëëáíäá

rsync://ftp.nl.FreeBSD.org/

ÄéáèÝóéíåð ÓðëëĩäÝð:

- FreeBSD: ΔëÞñåð mirror ðϊõ äéáêñéóðÞ FTP ðϊõ FreeBSD.

Ñùóá

rsync://ftp.mtu.ru/

ÄéáèÝóéíåð ÓðëëĩäÝð:

- FreeBSD: ΔëÞñåð mirror ðϊõ äéáêñéóðÞ FTP ðϊõ FreeBSD.
- FreeBSD-gnats: Ç åÜóç äåññÝíñí ðϊõ óðóðÞíåðïð ðåñåêñëĩýçóçð óðåëĩÜðñí GNATS.
- FreeBSD-Archive: Mirror ðϊõ äéáêñéóðÞ FTP ðåäééüðåññí äêäüóåñí (archive) ðϊõ FreeBSD.

Óïòçåäá

rsync://ftp4.se.freebsd.org/

ÄéáèÝóéíåð ÓðëëĩäÝð:

- FreeBSD: ΔëÞñåð mirror ðϊõ äéáêñéóðÞ FTP ðϊõ FreeBSD

ÔåÄåÛí

rsync://ftp.tw.FreeBSD.org/

rsync://ftp2.tw.FreeBSD.org/

rsync://ftp6.tw.FreeBSD.org/

ÄéáèÝóéíåð ÓðëëĩäÝð:

- FreeBSD: ΔëÞñåð mirror ðϊõ äéáêñéóðÞ FTP ðϊõ FreeBSD.

ÇíñíÝñí Äåóβåéí

rsync://rsync.mirror-service.org/

ÄéáèÝóéíåð ÓðëëĩäÝð:

- sites/ftp.freebsd.org: ΔëÞñåð mirror ðϊõ äéáêñéóðÞ FTP ðϊõ FreeBSD.

ÇíñíÝíåð Δñéóåβåð ÄíåñéÞð

rsync://ftp-master.FreeBSD.org/

Ï äéáêñéóðÞð áððüð ïðñåβ íå ðñóéñðñéçåβ ïñí áðñí êýñéå mirror sites ðϊõ FreeBSD.

ÄéáèÝóéíåð ÓðëëĩäÝð:

- FreeBSD: Το êýñêĩ (master) óýóôçιά áñ÷âβùĩ ôĩô äéáêñéóôÞ FTP ôĩô FreeBSD.
- acl: Ç êýñéá èβóôά ACL ôĩô FreeBSD.

rsync://ftp13.FreeBSD.org/

ĂéáèÝóéĩàò ÓðëĩãÝò:

- FreeBSD: ΔèÞñâò mirror ôĩô äéáêñéóôÞ FTP ôĩô FreeBSD.

Δαῖνῦῆçíá B.

Áéâëéíãñáößá

Áí éáé óá manual pages δᾶνῦῆçíá ÷ ðíí ðíá ᾰḍβóçìç ᾰíáíῶῖῆῦ ᾰéá íá ÷ ῦῆéóóῦ ὀῖḍíáóá ὀῖḍ FreeBSD ῆáéὀῖḗῆééῖῖ ὀóóóḍíáóῖḍ, ῦῆçíá éáéḍ ὀḍìç ᾰéá ὀῖ ῦὀé ᾰáí ᾰḍáíçᾰῖῖ ḍῦḍ ῖá ᾰῖḍᾰéḍ ὀá ὀῖḍíáóá íáæß ᾰéá íá ῆῦῖáéḍ ῦῆῖ ὀῖ ῆáéὀῖḗῆééῖῖ ὀῖḗὀçíá íá ῆáéὀῖḗῆáß ῖᾰéῦ. ᾰéá ᾰὀḍῖ, ᾰáí ὀḍῦῆ ÷ ᾰé ὀḍῖéáὀῦóḍáὀῖ ᾰḍῦ ῦῖá éáéῦ ᾰéáῆḍῖ ὀḍçí ᾰéá ÷ ᾰḍῆéóç ὀóóóçíῦḍῖ UNIX éáé ῦῖá éáéῦ ᾰᾰ ÷ ᾰῆῆḄáῆῖ ÷ ῆḍóç.

B.1 ᾰéâëßá & Δᾰῆῖᾰééῦ ὀ ÷ ᾰὀééῦ ῖá ὀῖ FreeBSD

ᾰéâḍῖḍ ᾰéâëßá & δᾰῆῖᾰééῦ:

- Using FreeBSD (<http://jdli.tw.FreeBSD.org/publication/book/freebsd2/index.htm>) (ὀá Δᾰῆᾰᾰῖᾰὀéáéῦ ῆῆῖῖᾰééá).
- FreeBSD Unleashed (ῖᾰὀῦḗᾰὀç ὀá ᾰḍῆῖḍῖéçíῦῖá ῆῆῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí China Machine Press (<http://www.hzbook.com/>). ISBN 7-111-10201-0.
- FreeBSD From Scratch First Edition (ὀá ᾰḍῆῖḍῖéçíῦῖá ῆῆῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí China Machine Press. ISBN 7-111-07482-3.
- FreeBSD From Scratch Second Edition (ὀá ᾰḍῆῖḍῖéçíῦῖá ῆῆῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí China Machine Press. ISBN 7-111-10286-X.
- FreeBSD Handbook Second Edition (ῖᾰὀῦḗᾰὀç ὀá ᾰḍῆῖḍῖéçíῦῖá ῆῆῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí Posts & Telecom Press (<http://www.ptpress.com.cn/>). ISBN 7-115-10541-3.
- FreeBSD 3.x Internet (ὀá ᾰḍῆῖḍῖéçíῦῖá ῆῆῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí Tsinghua University Press (<http://www.tup.tsinghua.edu.cn/>). ISBN 7-900625-66-6.
- FreeBSD & Windows (ὀá ᾰḍῆῖḍῖéçíῦῖá ῆῆῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí China Railway Publishing House (<http://www.tdpress.com/>). ISBN 7-113-03845-X
- FreeBSD Internet Services HOWTO (ὀá ᾰḍῆῖḍῖéçíῦῖá ῆῆῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí China Railway Publishing House. ISBN 7-113-03423-3
- FreeBSD for PC 98'ers (ὀá ᾰḗáḍῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí SHUWA System Co, LTD. ISBN 4-87966-468-5 C3055 P2900E.
- FreeBSD (ὀá ᾰḗáḍῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí CUTT. ISBN 4-906391-22-2 C3055 P2400E.
- Complete Introduction to FreeBSD (<http://www.shoeisha.com/book/Detail.asp?bid=650>) (ὀá ᾰḗáḍῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí Shoeisha Co., Ltd (<http://www.shoeisha.co.jp/>). ISBN 4-88135-473-6 P3600E.
- Personal UNIX Starter Kit FreeBSD (<http://www.ascii.co.jp/pb/book1/shinkan/detail/1322785.html>) (ὀá ᾰḗáḍῖῖᾰééá), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí ASCII (<http://www.ascii.co.jp/>). ISBN 4-7561-1733-3 P3000E.
- FreeBSD Handbook (ᾰḗáḍῖῖᾰééç ῖᾰὀῦḗᾰὀç), ᾰéâῦῆçéᾰ ᾰḍῦ ὀçí ASCII (<http://www.ascii.co.jp/>). ISBN 4-7561-1580-2 P3800E.

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- FreeBSD 4 - Installieren, Konfigurieren, Administrieren (<http://www.cul.de/freebsd.html>) (óðá Ἄññíáíééῴ), âêäüèçêá áðü òçí Computer und Literatur Verlag (<http://www.cul.de/>), 2001. ISBN 3-932311-88-4.
- FreeBSD 5 - Installieren, Konfigurieren, Administrieren (<http://www.cul.de/freebsd.html>) (óðá Ἄññíáíééῴ), âêäüèçêá áðü òçí Computer und Literatur Verlag (<http://www.cul.de/>), 2003. ISBN 3-936546-06-1.
- FreeBSD de Luxe (<http://www.mitp.de/vmi/mitp/detail/pWert/1343/>) (óðá Ἄññíáíééῴ), âêäüèçêá áðü òçí Verlag Modere Industrie (<http://www.mitp.de/>), 2003. ISBN 3-8266-1343-0.
- FreeBSD Install and Utilization Manual (<http://www.pc.mycom.co.jp/FreeBSD/install-manual.html>) (óðá Ἄέáðüíῴæééá), âêäüèçêá áðü òçí Mainichi Communications Inc. (<http://www.pc.mycom.co.jp/>).
- Onno W Purbo, Dodi Maryanto, Syahrial Hubbany, Widjil Widodo *Building Internet Server with FreeBSD* (<http://maxwell.itb.ac.id/>) (óðçí Ἐíäüçóéáêῴ ãêῴóá), âêäüèçêá áðü òçí Elex Media Komputindo (<http://www.elexmedia.co.id/>).
- Absolute BSD: The Ultimate Guide to FreeBSD (Ἰâῴöñáóç óá Δáñáäüóéáéῴ Ἐέíῴæééá), âêäüèçêá áðü òçí GrandTech Press (<http://www.grandtech.com.tw/>), 2003. ISBN 986-7944-92-5.
- The FreeBSD 6.0 Book (<http://www.twbsd.org/cht/book/>) (óá Δáñáäüóéáéῴ Ἐέíῴæééá), âêäüèçêá áðü òçí Drmaster, 2006. ISBN 9-575-27878-X.

Ἄέäüèçêá & ðáñéüèèῴ óðçí Ἄññíáíééῴ ãêῴóá:

- Absolute FreeBSD, 2nd Edition: The Complete Guide to FreeBSD (<http://www.absoluteFreeBSD.com/>), âêäüèçêá áðü òçí No Starch Press (<http://www.nostarch.com/>), 2007. ISBN: 978-1-59327-151-0
- The Complete FreeBSD (<http://www.freebsdmail.com/cgi-bin/fm/bsdcomp>), âêäüèçêá áðü òçí O'Reilly (<http://www.oreilly.com/>), 2003. ISBN: 0596005164
- The FreeBSD Corporate Networker's Guide (<http://www.freebsd-corp-net-guide.com/>), âêäüèçêá áðü òçí Addison-Wesley (<http://www.awl.com/awl/>), 2000. ISBN: 0201704811
- FreeBSD: An Open-Source Operating System for Your Personal Computer (<http://andrsn.stanford.edu/FreeBSD/introbook/>), âêäüèçêá áðü òçí The Bit Tree Press, 2001. ISBN: 0971204500
- Teach Yourself FreeBSD in 24 Hours, âêäüèçêá áðü òçí Sams (<http://www.sampublishing.com/>), 2002. ISBN: 0672324245
- FreeBSD 6 Unleashed, âêäüèçêá áðü òçí Sams (<http://www.sampublishing.com/>), 2006. ISBN: 0672328755
- FreeBSD: The Complete Reference, âêäüèçêá áðü òçí McGrawHill (<http://books.mcgraw-hill.com>), 2003. ISBN: 0072224096
- BSD Magazine (<http://www.bsdmag.org>), âêäüèçêá áðü òçí Software Press Sp. z o.o. SK. ISSN 1898-9144

B.2 Ἰäçäü ÷ñῴóç

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- Computer Systems Research Group, UC Berkeley. *4.BSD User's Supplementary Documents*. O'Reilly & Associates, Inc., 1994. ISBN 1-56592-076-7
- *UNIX in a Nutshell*. O'Reilly & Associates, Inc., 1990. ISBN 093717520X
- Mui, Linda. *What You Need To Know When You Can't Find Your UNIX System Administrator*. O'Reilly & Associates, Inc., 1995. ISBN 1-56592-104-6
- Ôï Ohio State University (<http://www.osu.edu/>) Ýñáφά όά ΆέόάãùãéêÛ íáèÏíáόά UNIX (http://8help.osu.edu/wks/unix_course/unix.html) ðĩò áέάóβèáíôáέ óá HTML éáέ óá ïñòÏ PostScript. Ìéá ÉόáέέéÏ íãðÛñáόç (http://www.FreeBSD.org/doc/it_IT.ISO8859-15/books/unix-introduction/index.html) áðöíý ôĩò éáéíÝñĩò áέάóβèáíôáέ ùð íÝñĩò ôĩò FreeBSD Italian Documentation Project.
- Jpman Project, Japan FreeBSD Users Group (<http://www.jp.FreeBSD.org/>). FreeBSD User's Reference Manual (<http://www.pc.mycom.co.jp/FreeBSD/urm.html>) (Japanese translation). Mainichi Communications Inc. (<http://www.pc.mycom.co.jp/>), 1998. ISBN4-8399-0088-4 P3800E.
- Ôï Edinburgh University (<http://www.ed.ac.uk/>) Ýñáφά Ýíá Online ïäçãü (<http://unixhelp.ed.ac.uk/>) ãéá íÝĩòð óôï ðãñéáÛééí ôĩò UNIX.

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- Computer Systems Research Group, UC Berkeley. *4.BSD System Manager's Manual*. O'Reilly & Associates, Inc., 1994. ISBN 1-56592-080-5
- Costales, Brian, et al. *Sendmail*, 2nd Ed. O'Reilly & Associates, Inc., 1997. ISBN 1-56592-222-0
- Frisch, Æleen. *Essential System Administration*, 2nd Ed. O'Reilly & Associates, Inc., 1995. ISBN 1-56592-127-5
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- *The BSD family tree*. <http://www.FreeBSD.org/cgi/cvsweb.cgi/src/share/misc/bsd-family-tree> ç ðï /usr/share/misc/bsd-family-tree óå Ýíá FreeBSD ìç÷ Ûíçιά.
- *Networked Computer Science Technical Reports Library*. <http://www.ncstrl.org/>
- *ΔάääéÝð BSD áêüüóáéð áðü ðï Computer Systems Research group (CSRG)*. <http://www.mckusick.com/csrg/>: Õï 4CD set Ý÷áé üëâð ðéð BSD áêüüóáéð áðü ðçí 1BSD ìÝ÷ñé ðçí 4.4BSD êáé ðçí 4.4BSD-Lite2 (áëÛ ü÷é ðçí 2.11BSD, äððð÷ðð). Õï ðäääððáβï äéóéÛéé ðñéÝ÷áé äðβçð ðï ðääéü ðçääβï êpäéá ðóí ðá áñ÷áβá SCCS.

B.9 ΔάνéíäéÛ êáé äöçìñβääð

- *The C/C++ Users Journal*. R&D Publications Inc. ISSN 1075-2838
- *Sys Admin — The Journal for UNIX System Administrators* Miller Freeman, Inc., ISSN 1061-2688
- *freeX — Das Magazin für Linux - BSD - UNIX* (óðá ΆññíáíéÛ) Computer- und Literaturverlag GmbH, ISSN 1436-7033

ΔαήŨñôçιά C.

ἘçãŸò Ἐḗçñïïöüñçόçò óôï Äéáäβêôõï

Ç ñáääáβá áïŸééιç òïò FreeBSD éáèéóóŨ òá Ÿíòòðá ιŸóá áίβεáιά íá áεῖῖòèΠóιòί òéò òáèáòðáβáð áíáεβίáèò. Ìé çèáèòñíééŸò ḗçãŸò áβίáé ι éáέŸòáññò (άί ù ÷ é ι ïüñò) òññòðìò áéá íá ḗñáíáíáβίáòá áίΠíáññò áéá òéò òáèáòðáβáð áíáεβίáèò. Éáεῖðò òι FreeBSD áβίáé íéá áεáεῖῖòéèΠ ḗññòðŸèáéá, ç éῖῖíüòçòá òüí ÷ ñçóðῖí éáéòíòñááβ éáé ùò “òìΠíá òá ÷ íéèΠò òðíòðΠñéιçò”, ìá òι çèáèòñíééü òá ÷ òáññáβι, òá web forums, éáé òá USENET news íá áβίáé íé ḗŸŸí áðìòáèáòíáòééιβ òññòῖῖé áéá íá Ÿéèáòá òá áðáòΠ ìá áòðΠ òçí éῖῖíüòçòá.

Óðéò ḗñáéŸò òá áíüòçòáð, éá áñáβòá òá òçíáíòééüòáñá òçíáβá áðééῖῖíüíáð ìá òçí éῖῖíüòçòá ÷ ñçóðῖí òïò FreeBSD. Áí áíñβáèáòá éáé Ÿéèáð ḗçãŸò, íé ïðíβáð ááí áíáòŸññíòáé ááῖ, ḗñáéáéῖῖíá íá òéò òðáβèáðá òóçí çèáèòñíééèΠ éβòðá ñŸŸáð òáèéçñβùòçò òïò FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-doc>) ῖòðá íá áíòá ÷ éῖῖí éáé áòðŸò.

C.1 Éβóðáò ÇèáèòñíééῖŸ Óá ÷ òáññáβìò

Ìé éβòðáð çèáèòñíééῖŸ òá ÷ òáññáβìò áβίáé ι ḗῖí Ÿíáòòð òññòðìò áéá íá áðáòéŸíáðá òéò áññòðóáéò òáð Π íá áíβίáðá íéá òá ÷ íéèΠ òðáèðçòç òïò íá áðáòéŸíáðáé òá éῖῖíü áéáéèáòíŸíí òóï FreeBSD. ÓðŸñ ÷ áé ìááŸèç ḗῖῖéééβá áðü éβòðáð, íé ïðíβáð éáέŸòðòῖòí áðñŸ òŸŸíá èáñŸòüí òïò FreeBSD. ÉáðáòéŸíííòáð òéò áññòðóáéò òáð òóç òüòðΠ éβòðá, éá áíáòáèèòáðá òá ÷ ḗòáñç éáé áéñéáŸòðáñç áðüèñéóç.

Óòí òŸŸèò áðòíŸ òïò éáεῖŸíñò éá áñáβòá Ÿíá ḗβίáéá ìá òç èáìáòῖῖῖíáβá òçò èŸèá éβòðáð. ḗñáéáéῖῖíá íá òïí áéááŸòðáðá ḗñéí áñ ÷ βòðáðá íá òðíáòŸ ÷ áðá Π íá òðŸŸíáðá ìçῖῖíáðá òá ïðíéááΠðìòá éβòðá. Ìé ḗñéòóüðáññé áðü òïòð òóíáñññòŸò íáð áŸ ÷ ñíòáé éáèçíáñéŸŸ áèáòñíòŸŸáð ìçῖῖíáðá òá ÷ áðééŸŸ ìá òï FreeBSD. Ìé éáíüíáð òïò Ÿ ÷ ïðíá éáèéáñῖòáé, áιçèŸíá íá áβíáðáé òüòðΠ ÷ ñΠóç éáé íá áéáðçñáβòáé òá òðçèü áðβðááí ç áíáéῖῖíáβá òΠíáòìò ḗññò èññòáí òçò èŸèá éβòðáð. ÁŸí Πíáðáí ḗῖí ÷ áéáñíβ, íé éβòðáð ìáð éá Ÿ ÷ áíáí òçí áðìòáèáòíáòééüòçòá òïòð ùò ìŸŸí áðééῖῖíüíáð áéá òï Project.

Óçíáβùòç: Áí èŸèáðá íá áñééíŸòðáðá òçí ééáíüòçòá òáð íá òðŸŸíáðá ìçῖῖíáðá òéòð éβòðáð òïò FreeBSD, òðáβèðá Ÿíá áñééíáòóééèü ìβíðíá òóçí éβòðá *freebsd-test* (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-test>). ḗñáéáéῖῖíá ìç òðŸŸíáðá áñééíáòóééèü ìçῖῖíáðá òá ïðíéááΠðìòá Ÿèèç éβòðá.

Áí áñβòéáòðá òá áβèçñíá òá ÷ áðééŸŸ ìá òï ḗῖéá éβòðá íá òðáβèáðá íéá áñῖòçòç, ááβòá òï ḗñò ìá ÷ ñçóéῖῖḗῖéáβòá ìá áðéòð ÷ βá òçí éβòðá çèáèòñíééῖŸ òá ÷ òáññáβìò FreeBSD-questions (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/freebsd-questions).

ḗñéí òðáβèáðá èŸòé òá ïðíéááΠðìòá éβòðá, ìŸèáðá ḗñò ìá ÷ ñçóéῖῖḗῖéáβòá éáέŸòáñá òéò éβòðáð çèáèòñíééῖŸ òá ÷ òáññáβìò. Áéá ḗñáŸŸáèáíá, ááβòá ḗñò ìðñáβòá íá áιçèΠóáðá ῖòðá íá áðìòáŸññíòáé òð ÷ ìŸŸ áðáíáéáíááíüíáíáð

ΕΒΡΟΔΑ

frebsd-policy
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-policy>)

frebsd-questions
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-questions>)

frebsd-security-notifications
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-security-notifications>)

frebsd-stable
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-stable>)

frebsd-test
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-test>)

ΟΔΑ ÷ ΙΕΕΥΟ ΕΒΡΟΔΑ: Ιε αειβιωσάδ εβροδάδ άβιάε αέα οα ÷ ΙεΕΥΟ οδαχόπράεδ. Δñεί άñ ÷ βροδά ίά οδίαόΥ ÷ άόά έάέ ίά οδΥείάδά ιγίγιάδά οά άδδΥ, έά δñΥθάέ ίά αέαάΥόάδά δñιόάεέεΥ όγί δñέάñάόπ όιόδ. ΌδΥñ ÷ ιόι άδδδçñΥδ ιάçãβáδ αέα όç ÷ ñπόç έάέ όι δñέά ÷ ιιáñ όιόδ.

Όεϊδύο

Έάόάδεδιόπñέάδ άδιόΥόάέδ (policy) όçδ ñΥάάδ FreeBSD Core. Έβρόδά ίά Ιεέñπ έβίçόç, έάέ ιύñí αέα άíΥáñύόç

Άδññβáδ ÷ ñçόδπí έάέ οá ÷ Ιεέπ όδιόδπñείç

Άέáñδιέπράέδ άόόάέάβáδ

Όόαχόπράέδ δñό ό ÷ άδβáñίόάέ ίά όçί ÷ ñπόç όιό FreeBSD-STABLE

Όόάβέδά άáπ οά áñέείάόέέΥ όάδ ιçγίγιάδά άίôβ αέα ίέα áδñ όέδ δñáñιáόέέΥδ εβροδάδ

ΕΒΡΟΔΑ

frebsd-acpi
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-acpi>)

frebsd-afs
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-afs>)

frebsd-aic7xxx
(<http://lists.FreeBSD.org/mailman/listinfo/aic7xxx>)

frebsd-amd64
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-amd64>)

frebsd-apache
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-apache>)

frebsd-arm
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-arm>)

frebsd-atm
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-atm>)

frebsd-audit
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-audit>)

Όεϊδύο

ΆíΥδδδδίç όçδ αέα ÷ άβñέόçδ άíΥñάάέάδ έάέ όιό ACPI

ΊάόάöñΥ όιό AFS όόñ FreeBSD

ΆíΥδδδδίç ιάçãπí αέα έΥñδάδ Adaptec AIC 7xxx

ΊάόάöñΥ όιό FreeBSD όά όδδδπíάόά AMD64

Όόáπόçόç αέα ports ό ÷ άδέέΥ ίά όñí Apache

ΊάόάöñΥ όιό FreeBSD όά άδáñáñáάόόΥδ ARM®

× ñπόç áέέδύύόçδ ATM όόñ FreeBSD

Project áεΥá ÷ ιό δçãáβιό έπαέέα

Ἐξόδα

freebsd-binup
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-binup>)

freebsd-bluetooth
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-bluetooth>)

freebsd-cluster
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-cluster>)

freebsd-cvsweb
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-cvsweb>)

freebsd-database
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-database>)

freebsd-doc
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-doc>)
freebsd-drivers
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-drivers>)

freebsd-eclipse
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-eclipse>)

freebsd-embedded
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-embedded>)

freebsd-eol
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-eol>)
freebsd-emulation
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-emulation>)

freebsd-firewire
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-firewire>)

Ὁεἶδη

Ὁ εἰσαγωγή ἐπέ ἀντιθέσεως οἷο ὁδοδριαδὸ Ἰοίεῖν ἀντιπροσώπῳ (binary updates)

× ἡ Πρός ὁδὸ δᾶ εἰσαγωγή Bluetooth οἷο FreeBSD

× ἡ Πρός οἷο FreeBSD ὁ δᾶ δᾶν Ἰεεεεᾶ ὁδοδριαδᾶ

Ὁ οἷο Πρός οἷο CVSweb

Ὁ ὁδοδριαδᾶ ἐπέ ὁδὸ εἰσαγωγή ἀντιπροσώπῳ ἀντιπροσώπῳ οἷο FreeBSD

Ἰοίεῖν ἐπέ ὁδοδριαδᾶ ἐπέ οἷο FreeBSD

Ἰοίεῖν ἐπέ ἰαααῖ ὁδοδριαδᾶ ἐπέ οἷο FreeBSD

Ὁ ὁδοδριαδᾶ ἐπέ ὁδὸ εἰσαγωγή οἷο Eclipse IDE, οἷο ἀντιπροσώπῳ οἷο, ἐπέ ὁδοδριαδᾶ rich client ἀντιπροσώπῳ ἐπέ ports οἷο FreeBSD.

× ἡ Πρός οἷο FreeBSD ὁ δᾶ embedded ἀντιπροσώπῳ

Ἰοίεῖν ὁδοδριαδᾶ ἐπέ εἰσαγωγή οἷο εἰσαγωγή ἰα FreeBSD, οἷο ἀντιπροσώπῳ ὁδοδριαδᾶ ἐπέ εἰσαγωγή οἷο FreeBSD Project. Ἰοίεῖν ὁδοδριαδᾶ ἰαααῖ, ἰαααῖ ἰαααῖ ὁδοδριαδᾶ Linux/MS-DOS/Windows

Ὁ εἰσαγωγή ὁδοδριαδᾶ ἐπέ FreeBSD FireWire (iLink, IEEE 1394)

Ἐββέδωϊ

freebsd-fs
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-fs)
freebsd-gecko
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-gecko)

freebsd-geom
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-geom)

freebsd-gnome
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-gnome)

freebsd-hackers
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-hackers)

freebsd-hardware
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-hardware)

freebsd-i18n
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-i18n)

freebsd-ia32
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-ia32)

freebsd-ia64
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-ia64)

freebsd-ipfw
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-ipfw)

freebsd-isdn
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-isdn)

freebsd-jail
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-jail)

freebsd-java
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-java)

freebsd-kde
(http://freebsd.kde.org/mailman/listinfo/kde-freebsd)

freebsd-lfs
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-lfs)

freebsd-mips
(http://lists.FreeBSD.org/mailman/listinfo/freebsd-mips)

Ὀββέδωϊ

Ὀδὸδὸββέδωϊ ἀνδρῶν

Ὀδὸδὸββέδωϊ ὁδὸδὸββέδωϊ ἰὰ ὁδὸν **Gecko Rendering Engine**

Ὀδὸδὸββέδωϊ ὁδὸδὸββέδωϊ ἰὰ ὁδὸν **GEOM** ἐὰν ὁδὸν ὁββέδωϊββέδωϊ ὁββέδωϊ

Ἰὰ ὁδὸν ὁββέδωϊ **GNOME** ἐὰν ὁδὸν ἀοἀνῆββέδωϊ ὁββέδωϊ

Ἀἀῖββέδωϊ ὁδὸδὸββέδωϊ ὁδὸδὸββέδωϊ

Ἀἀῖββέδωϊ ὁδὸδὸββέδωϊ ἀεὶ ὁδὸν ἰὰ ὁδὸν ὁββέδωϊ
FreeBSD

Ἀεὶββέδωϊββέδωϊ ὁββέδωϊ FreeBSD

Ὀββέδωϊ FreeBSD ὁδὸν ἀνδρῶν ὁδὸν ὁββέδωϊββέδωϊ IA-32 (Intel x86)

Ἰὰ ὁδὸν ὁββέδωϊ FreeBSD ὁδὸν ἰὰ ὁδὸν ὁδὸδὸββέδωϊ IA64 ὁδὸν Intel

Ὀδὸδὸββέδωϊ ὁδὸδὸββέδωϊ ὁββέδωϊ ἀδὸδὸββέδωϊββέδωϊ ὁδὸν ἀδὸδὸββέδωϊββέδωϊ IP ὁββέδωϊ firewall

Ἰββέδωϊ ἀνδρῶν ὁββέδωϊ ISDN

Ὀδὸδὸββέδωϊ ὁδὸδὸββέδωϊ ἰὰ ὁδὸν ὁδὸν ὁδὸν ὁββέδωϊββέδωϊ ὁββέδωϊ jail(8)

Ἰββέδωϊ ἀνδρῶν Java ἐὰν ὁββέδωϊ ὁββέδωϊ ἰὰ ὁδὸν ὁββέδωϊββέδωϊ ὁδὸν JDKs ὁββέδωϊ FreeBSD

Ἰὰ ὁδὸν ὁββέδωϊ **KDE** ἐὰν ὁδὸν ἀοἀνῆββέδωϊ ὁββέδωϊ

Ἰὰ ὁδὸν ὁββέδωϊ LFS ὁββέδωϊ FreeBSD

Ἰὰ ὁδὸν ὁββέδωϊ FreeBSD ὁδὸν ἀδὸδὸββέδωϊββέδωϊ MIPS®

Ἐξόδα

frebsd-mobile
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-mobile>)

frebsd-mono
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-mono>)

frebsd-mozilla
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-mozilla>)

frebsd-multimedia
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-multimedia>)

frebsd-new-bus
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-new-bus>)

frebsd-net
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-net>)
frebsd-office
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-office>)

frebsd-performance
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-performance>)

frebsd-perl
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-perl>)

frebsd-pf
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-pf>)
frebsd-platforms
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-platforms>)

frebsd-ports
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-ports>)

frebsd-ports-bugs
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-ports-bugs>)

Ὀμιλῶν

Ὀμαζὸβόαδὸ ὁδὸ Ἀεὶβὸδὸ ἰα ὀμῖνὸ ὀδὸβὸδὸδὸδὸ
ὀδὸδὸβὸδὸ

Ἀοάνη Ἰωάννη Mono ἐαέ C# ὀδὸ FreeBSD

Ἰαδὸβὸδὸ ὀδὸ **Mozilla** ὀδὸ FreeBSD

Ἀοάνη Ἰωάννη ὀδὸδὸ Ἰωάννη

Ὀαδὸβὸδὸ ὀδὸ ὀμαζὸβόαδὸ ὁδὸ Ἀεὶβὸδὸ ἰα ὀμῖν
ἰαδὸβὸδὸδὸδὸδὸ ἰαδὸβὸδὸ

Ὀμαζὸβόαδὸ ἰαδὸβὸδὸδὸ ἐαέ δὸβὸδὸδὸ ἐβὸδὸδὸ TCP/IP

Ἀοάνη Ἰωάννη ἰαδὸβὸδὸδὸ ὀδὸ FreeBSD

Ἀνὸδὸβόαδὸ ὁδὸ Ἀεὶβὸδὸ ἰα ἰαδὸβὸδὸδὸδὸδὸδὸδὸδὸ ἰαδὸβὸδὸδὸ
ἰαδὸβὸδὸδὸδὸδὸδὸδὸ ὀδὸβὸδὸδὸ ἰαδὸβὸδὸδὸδὸ ἰαδὸβὸδὸδὸ

Ὀδὸβὸδὸδὸδὸ ἰαδὸβὸδὸ ἰαδὸβὸδὸδὸ ἰα Perl

Ὀμαζὸβόαδὸ ἰαδὸβὸδὸδὸ ὁδὸ Ἀεὶβὸδὸ ἰα ὀδὸ ὀμῖν ὀμῖν
packet filter firewall

Ὀμαζὸβόαδὸ ἰαδὸβὸδὸδὸ ὀδὸ ἰα Intel ἰαδὸβὸδὸδὸδὸδὸ

Ὀμαζὸβόαδὸ ἰαδὸβὸδὸ ὀδὸ ὀμῖν ὀμῖν Ports

Ὀμαζὸβόαδὸ ἰαδὸβὸδὸδὸ ἰαδὸβὸδὸδὸ ἰαδὸβὸδὸδὸ ὀδὸβὸδὸδὸ
ὀδὸβὸδὸδὸ ὀμῖν ὀμῖν ports

Ἐβόδα

frebsd-threads
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-threads>)

frebsd-testing
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-testing>)

frebsd-tilera
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-tilera>)

frebsd-tokenring
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-tokenring>)

frebsd-toolchain
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-toolchain>)

frebsd-usb
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-usb>)

frebsd-virtualization
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-virtualization>)

frebsd-vuxml
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-vuxml>)

frebsd-x11
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-x11>)

frebsd-xen
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-xen>)

frebsd-xfce
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-xfce>)

Δανάη Ὀνήσια Ἐβόδα: Ἡ ἀεὺ ἐβόδα ἀβία ἀεὺ δέι ἀεάεϋ (ἀεὺ ἀδεδόδεϋ) ἐιέϋ ἀεὺ δέεαίϋ ἀί ἀίεάϋ Ἰνίϋ ὀι ἀίεέϋ ἐιέϋ. Δñέι ἀñ ÷ βόαα ἰά ὀϊηάϋ ÷ ἀά ὀά εϋδία ἀϋ ἀόδϋ, ἀεϋ ἀ ἀβία ἰά Ἰ ÷ ἀά δαηάεϋ ἐβόαε ὀέ ὀα ÷ ἰέϋ Ἐβόα, ὀά ἰά ἀίεέα Ἰά ἰά ὀι ἐπᾶέα ἀδέεϋ ἰβᾶδ ἀεὺ ὀϊδᾶεϋ Ἰδ Ἰδ ἰό ÷ ἰά ὀά ἀόδϋ.

Ὀεἶδϋ

Δἰεὺ ἰά ἀεἶϋ ἀδᾶἰᾶ ἰά ὀι FreeBSD

Ἀἰεἶ Ἰδ ἀδᾶἰᾶ ἰά ὀι ἀεἶ ἰά ὀι FreeBSD

Ἰά ὀι ἰά ὀι FreeBSD ὀδᾶ ἰεἶ ἰά CPU Tlera

Ὀδἰ ὀδᾶ ὀι Token Ring ὀι FreeBSD

Ὀδἰ ὀδᾶ ὀι ἰά ἰά ὀι FreeBSD

Ὀδᾶ ὀδᾶ ὀδἰ ὀδᾶ ὀι USB ὀι FreeBSD

Ὀδᾶ ὀδᾶ ὀ ÷ ἀδεδϋ ἰά ἀεϋ ἰά ὀ ὀ ÷ ἰέϋ Ἰδ ἀεἶ ἰεἶ ἰδᾶ ὀδἰ ὀδἰ ὀδᾶ ἰά ἰά ὀι FreeBSD

Ὀδᾶ ὀδᾶ ἰά ὀδᾶ ὀδᾶ VuXML

Ὀδἰ ὀδᾶ ἰά ὀδἰ ὀδᾶ ὀι X11 ὀι FreeBSD

Ὀδᾶ ὀδᾶ ἰά ὀ ἰά ὀ ὀι FreeBSD ὀι Xen™ — ὀεἶ ὀδᾶ ἰά ÷ ἰδᾶ

XFCE ὀι FreeBSD — Ἰά ὀ ἰά ἰά ὀδᾶ ὀδᾶ

Ἐβόδα

frebsd-hubs
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-hubs>)

Ὀεἶδϋ

¶ ὀἰ ἰά ἰά ἰά mirror sites (ὀδἰ ὀδᾶ ὀδᾶ ὀδᾶ)

ΕΒΟΔΑ

freebsd-user-groups
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-user-groups>)

freebsd-vendors
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-vendors>)

freebsd-wip-status
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-wip-status>)

freebsd-wireless
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-wireless>)

freebsd-www
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-www>)

ΟΕΙΘΟΥ

Γνωστοποίηση του ελεύθερου λογισμικού

Γνωστοποίηση για το ελεύθερο λογισμικό που είναι άδικο να χρησιμοποιηθεί

Εάν θέλετε να βοηθήσετε το FreeBSD να γίνει καλύτερο, τότε μπορείτε να βοηθήσετε με το **Work-in-Progress**.

Ο καθένας από εμάς μπορεί να έχει το δικό του 802.11, αλλά αν θέλουμε να έχουμε ένα καλύτερο, τότε πρέπει να βοηθήσουμε το **FreeBSD Wireless**.

Οι πληροφορίες για το www.FreeBSD.org
(<http://www.FreeBSD.org/index.html>)

Εβδόμη digest: ¼είδο ίε δανάη C. Δημόσιος Διευθυντής του Αλλάβου είναι ο πρώτος digest (δανάη C. Δημόσιος Διευθυντής του Αλλάβου). Ίσως να μην είναι ο καλύτερος, αλλά είναι ο καλύτερος, ίσως να μην είναι ο καλύτερος, αλλά είναι ο καλύτερος.

Εβδόμη CVS & SVN: Ίε ελεύθερο λογισμικό είναι ο καλύτερος, αλλά είναι ο καλύτερος, ίσως να μην είναι ο καλύτερος, αλλά είναι ο καλύτερος. Είναι ο καλύτερος, ίσως να μην είναι ο καλύτερος, αλλά είναι ο καλύτερος.

ΕΒΟΔΑ

Δανάη C. Δημόσιος Διευθυντής του Αλλάβου

Δανάη C. Δημόσιος Διευθυντής του Αλλάβου (ελεύθερο λογισμικό)

cvcs-all
(<http://lists.FreeBSD.org/mailman/listinfo/cvcs-all>)

/usr/(CVSROOT|doc|ports)

¼είδο ίε ελεύθερο λογισμικό ού είναι ο καλύτερος, αλλά είναι ο καλύτερος, ίσως να μην είναι ο καλύτερος, αλλά είναι ο καλύτερος.

cvcs-doc
(<http://lists.FreeBSD.org/mailman/listinfo/cvcs-doc>)

/usr/(doc|www)

¼είδο ίε ελεύθερο λογισμικό ού είναι ο καλύτερος, αλλά είναι ο καλύτερος, ίσως να μην είναι ο καλύτερος, αλλά είναι ο καλύτερος.

cvcs-ports
(<http://lists.FreeBSD.org/mailman/listinfo/cvcs-ports>)

/usr/ports

¼είδο ίε ελεύθερο λογισμικό ού είναι ο καλύτερος, αλλά είναι ο καλύτερος, ίσως να μην είναι ο καλύτερος, αλλά είναι ο καλύτερος.

cvcs-projects
(<http://lists.FreeBSD.org/mailman/listinfo/cvcs-projects>)

/usr/projects

¼είδο ίε ελεύθερο λογισμικό ού είναι ο καλύτερος, αλλά είναι ο καλύτερος, ίσως να μην είναι ο καλύτερος, αλλά είναι ο καλύτερος.

Ἐῖσὸς	Δαῖνι ÷ ἁ δῆλῶν ἐπαέε	Δαῖνι ÷ ἁ δῆλῶν ἐπαέε (ἁέε)
<p>cvsrc (http://lists.FreeBSD.org/mailman/listinfo/cvs-src)</p>	<p>/usr/src</p>	<p>¼εἶν ἁέεἶν ὁδὸν ἁέεἶν src (ἁέεἶν ἁέεἶν ἁέεἶν ἁέεἶν commit ὁδὸν ἁέεἶν ἁέεἶν ἁέεἶν svn-to-cvs)</p>
<p>svn-src-all (http://lists.FreeBSD.org/mailman/listinfo/svn-src-all)</p>	<p>/usr/src</p>	<p>¼εἶν ἁέεἶν ὁδὸν Subversion repository (ἁέεἶν ἁέεἶν ὁδὸν ἁέεἶν ÷ ὁδὸν user ἁέεἶν projects)</p>
<p>svn-src-head (http://lists.FreeBSD.org/mailman/listinfo/svn-src-head)</p>	<p>/usr/src</p>	<p>¼εἶν ἁέεἶν ὁδὸν ἁέεἶν "head" ὁδὸν Subversion repository (ἁέεἶν ἁέεἶν ἁέεἶν ἁέεἶν FreeBSD-CURRENT)</p>
<p>svn-src-projects (http://lists.FreeBSD.org/mailman/listinfo/svn-src-projects)</p>	<p>/usr/projects</p>	<p>¼εἶν ἁέεἶν ὁδὸν ἁέεἶν ÷ ἁέεἶν δῆλῶν ἐπαέε projects ὁδὸν Subversion repository</p>
<p>svn-src-release (http://lists.FreeBSD.org/mailman/listinfo/svn-src-release)</p>	<p>/usr/src</p>	<p>¼εἶν ἁέεἶν ὁδὸν ἁέεἶν ÷ ἁέεἶν δῆλῶν ἐπαέε releases ὁδὸν Subversion repository</p>
<p>svn-src-releng (http://lists.FreeBSD.org/mailman/listinfo/svn-src-releng)</p>	<p>/usr/src</p>	<p>¼εἶν ἁέεἶν ὁδὸν ἁέεἶν ὁδὸν ἁέεἶν ὁδὸν δῆλῶν ἐπαέε releng ὁδὸν Subversion repository (ἁέεἶν ἁέεἶν ἁέεἶν ἁέεἶν security / release engineering)</p>
<p>svn-src-stable (http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable)</p>	<p>/usr/src</p>	<p>¼εἶν ἁέεἶν ὁδὸν ἁέεἶν ὁδὸν ἁέεἶν ὁδὸν δῆλῶν ἐπαέε stable ὁδὸν Subversion repository</p>
<p>svn-src-stable-6 (http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-6)</p>	<p>/usr/src</p>	<p>¼εἶν ἁέεἶν ὁδὸν ἁέεἶν δῆλῶν δῆλῶν ἐπαέε stable/6 ὁδὸν Subversion repository</p>
<p>svn-src-stable-7 (http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-7)</p>	<p>/usr/src</p>	<p>¼εἶν ἁέεἶν ὁδὸν ἁέεἶν δῆλῶν δῆλῶν ἐπαέε stable/7 ὁδὸν Subversion repository</p>
<p>svn-src-stable-8 (http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-8)</p>	<p>/usr/src</p>	<p>¼εἶν ἁέεἶν ὁδὸν ἁέεἶν δῆλῶν δῆλῶν ἐπαέε stable/8 ὁδὸν Subversion repository</p>

ΕΒΘΟΑ	ΔΑΝΕΙ: P ΔΕΧΑΑΒΙΘ ΕΡΑΕΕΑ	ΔΑΝΕΑΝΑΘΡ ΔΑΝΕΙ: ΡΘ (ΕΡΑΕΕΑΘ ΑΕΑ)
svn-src-stable-9 (http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-9)	/usr/src	¼εάθ ιέ άεεάάΥθ όθι έεÜäi δεχάάβιθ έρπέεά stable/9 θιθ Subversion repository
svn-src-stable-other (http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-other)	/usr/src	¼εάθ ιέ άεεάάΥθ όθιθδ θάεείΥθ stable έεÜäiθδ δεχάάβιθ έρπέεά θιθ Subversion repository
svn-src-svnadmin (http://lists.FreeBSD.org/mailman/listinfo/svn-src-svnadmin)	/usr/src	¼εάθ ιέ άεεάάΥθ όθά scripts άεά: άβñέόçð, θά hooks, έάέ Üέέά ääñi Ýiά θιθ άóññiÝi όέθ ñθèiβóáέθ θιθ Subversion repository
svn-src-user (http://lists.FreeBSD.org/mailman/listinfo/svn-src-user)	/usr/src	¼εάθ ιέ άεεάάΥθ όθçí θάέñáiáóέέP θάñéi: P δεχάάβιθ έρπέεά user θιθ Subversion repository
svn-src-vendor (http://lists.FreeBSD.org/mailman/listinfo/svn-src-vendor)	/usr/src	¼εάθ ιέ άεεάάΥθ όθçí θάñéi: P άñάάóβάθ δεχάάβιθ έρπέεά vendor θιθ Subversion repository

C.1.2 Θυθ ιά Άάñάóáβóá

Άέά ιά άάñάóáβóá όά iβά έβóθά, άθέέÝiθά θi úññá όçð áθü θiθδ θάñάθÜñü äáóñiÝð P δεχάάβiθά όθi <http://lists.FreeBSD.org/mailman/listinfo> έάέ άθέέÝiθά όçí έβóθά άέά όçí iθiβά áíάέάóÝñáóá. Ç óάέβάá όçð έβóθάθ δñÝθάέ ιά θάñéÝ: áέ üέáθ όέθ áθάñάβóçóáθδ δεçñiθiñβáθ άάñάóPð.

Άέά ιά äñÜφáθά όά iέά έβóθά, áθέPð óθáβέθá θi iPíθiά óáθ όθi <úíiñá-έβóθáθ@FreeBSD.org>. Öi iPíθiά óáθ έá áέάiáιçέáβ όá üέá όá iÝέç όçð έβóθάθ, όá iθiέiáPθiθά όçiáβi θiθ έüóññi έάέ áí άñβóέiθiάέ.

Άέά ιά áέáñáóáβóá áθü iέá έβóθά, άθέέÝiθά θi URL θiθ άñβóέáóáέ όθi óÝέiθ έÜèá içýiáθiθδ θiθ έáiáÜiáθá áθü όçí έβóθά. Iθiñáβóá áθβóçð ιά óθáβέáθá Ýiá iPíθiά όθi <úíiñá-έβóθáθ-unsubscribe@FreeBSD.org> άέά ιά áέáñáóáβóá iüñiθ óáθ.

Άέά áέüñi iέá öñÜ, έá έÝέáiá ιá óáθ æçðPóñiθiá ιá áέáóçñPóáθá όç óθæPóççç ðñi ðá: iέέPí έέóθPí óθá áíθβóθiέ: á óá: iέέÜ έÝiáθá. Áí áíáέáóÝñáóáθá iüñi áέá óçiáíóέέÝð áíáέiέiPóáέθ, ðñiθá θñiθáβñiθiá ιá άάñάóáβóá óóçí çéáέθññiέέP έβóθά áíáέiέiPóáñi θiθ FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-announce>), ç iθiβá Ý: áέ iέέñP έβiççç.

C.1.3 Θβiάέáθ ΈέóθPí

¼εάθ ιέ FreeBSD έβóθáθ Ý: iθi óθáέáñέñéÝñiθδ ááóέéiÝð έáíñiáθ iέ iθiβiέ δñÝθάέ ιá áέiέiθéiÝiθáέ áθü iθiέiáPθiθá όέθ ðñçóέññiέέáβ. ¼θiέiθ áθiθý: áέ ιá áέiέiθéPóáέ áθóñiÝð θiθδ έáíñiáθ έá eÜááέ äýi (2) áñáθðÝð θññiáέáññiέPóáέθ áθü θiθ FreeBSD Postmaster <postmaster@FreeBSD.org>. Óá θáñβððüçθ όñβóçð θáñááβáóçð, θi Üóññi áóðü έá áθñiáέññiέáβ áθü üέáθ όέθ έβóθáθ θiθ FreeBSD έάέ óá içýiáθáθ θiθ θñiθ áθðÝð έá óέéθñÜññiθáέ. Έðθñiáóáθ θiθ

- Δεν είναι απαραίτητο να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος.
- Οι δίσκοι είναι διαθέσιμοι από το VFS που είναι ελαστικοί από τη Heidemann layers.
- Δεν είναι απαραίτητο να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος (interface) που είναι ελαστικοί από τη Heidemann layers που είναι ελαστικοί από τη Heidemann layers.
- Δεν είναι απαραίτητο να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος.

freebsd-audit (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-audit>)

Project αεΨα-ιθ δεξαμενή ερωτήσεων

Ο σκοπός είναι να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος. Η ερώτηση είναι: Είναι απαραίτητο να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος?

Ο σκοπός είναι να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος. Οι ενημερωμένες εκδόσεις του συστήματος είναι διαθέσιμες από το FreeBSD. Η ερώτηση είναι: Είναι απαραίτητο να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος?

freebsd-binup (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-binup>)

Project ατάαΨεϊεός οίω FreeBSD ιΨού Ψοϊεϊνί (αδάαεβί) αν-βνί

Ο σκοπός είναι να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος. Η ερώτηση είναι: Είναι απαραίτητο να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος?

freebsd-bluetooth (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-bluetooth>)

× nΠός ός οδ-νίεϊαβδ Bluetooth οίω FreeBSD

Ο σκοπός είναι να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος. Η ερώτηση είναι: Είναι απαραίτητο να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος?

freebsd-bugbusters (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-bugbusters>)

ΔνιόδΨεάα νάΨιούός οίω -αενηοϊνί ονί ατάοϊνί δνιεϊνί

Ο σκοπός είναι να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος. Η ερώτηση είναι: Είναι απαραίτητο να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος?

freebsd-bugs (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-bugs>)

Ατάοϊνί οοαεϊνί

Ο σκοπός είναι να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος. Η ερώτηση είναι: Είναι απαραίτητο να ενημερωθεί ο κάτοχος της συσκευής με τη βοήθεια των ενημερωμένων εκδόσεων του συστήματος?

freebsd-chat (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-chat>)

Ìç òá÷-ιέέÛ èÝιάòά ðιò ó÷-άòβαεííóáέ ιά òçι εíεíιúòçòά òιò FreeBSD

Άòð Ç εβóðά ðñéÝ÷-áé εíεíιúέέÝò òðæçðρóáέð, έάé ááίεέιúòáñά υíéé ááι ó÷-άòβαεííóáέ ιά òá÷-ιέέÝò ðεçñιòιñβáð ιά ðéð ιðιβáð áó÷-ιέéγíóáέ ιέ òðυέιέðð ðéβóðáð. ΔñéÝ÷-áé òðæçðρóáέð áέά òι áι í Jordan ιιέÛæáé ιά ιέéñυ εíοιÛáé ρ ù÷-έ, áέά òι áι ðñÝðáé ρ ù÷-έ ιά áñÛοιðιá ιά έááéáéáβά, ðιεíð ðβίáé ðιεγύ έáöÝ, ðιò òðéÛ÷-ιáðáέ ç έάέγðáñç ιðγñά, ðιεíð òðéÛ÷-ιáé ιðγñά òòι òðυάáéι òιò, έáέ Ûééά. ΔñéóóáóéάέÝò áíáéιéιρóáέð óçιáíðέéπι áááιιúòι (ιúòð ðÛñòð, áÛιέ, ááιιρóáέð, έάéίγñάέáð áιòéάéÝò έéð) ιðιιιγί ιá áβιòι óðéð òá÷-ιέέÝò έβóðáð, áééÛ ιέ áðáιðρóáέð òιòð ðñÝðáé ιá óðÝéιιíóáέ òòçι έβóðά -chat.

freebsd-chromium (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-chromium>)

ÈÝιάòά ó÷-áðééÛ ιά òι Chromium òιò FreeBSD

Έβóðά òðæçðρóáéι áéά òçι òðιòðρñéιç òιò Chromium òιò FreeBSD. Δñυέáéóáé áέά òá÷-ιέέρ έβóðά ó÷-áðééρ ιά òçι áíÛððòιç έάέ ááéáðÛóóáóç òιò Chromium.

freebsd-core

ÌÛáá core òιò FreeBSD

Άòðρ ç áβιáé ιβά áóυòáñééρ έβóðά áέά ÷ñρóç áðu òά ιÝέç òιò core. Óá áòðρ òç έβóðά ιðιñáβóá ιá óóáβéáðá ιçιγίáðά, υðáι ðñιεγύðáé èÛðιεí èÝιá ò÷-áðééÛ ιά òι FreeBSD òι ιðιβι áðáέðáβ áέάέòçòβά ρ έáððñáñρ áιÝðáóç.

freebsd-current (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-current>)

Óðæçðρóáέð ò÷-áðééÛ ιά òçι ÷ñρóç òιò FreeBSD-CURRENT

Άòðρ Ç έβóðά áβιáé áέά ÷ñρóðáð òιò FreeBSD-CURRENT. ΔñéÝ÷-áé ðñιáέáιðιερóáέð áέά ιÝά ÷-áñáéòçñéóééÛ ðιò ðñυέáéóáé ιά ðñιóáéιγί òòι -CURRENT έáέ òά ιðιβά έá áðçñáÛóιòι òιòð ÷ñρóðáð, έáέ ιãçáβáð áέά ðéð έéιρóáέð ðιò ðñÝðáé ιá áβιòι ðρóðá ιá ðáñáιáβιáðá òòι -CURRENT. Ξðιεíð áέðáéáβ òι “CURRENT” ðñÝðáé ιá áááñáðáβ óά áòðρι òçι έβóðά. Άβιáé ιέá òá÷-ιέέρ έβóðά έáέ òðæçðιγίíóáé ιιιι áòóòçñÛ òá÷-ιέέÛ èÝιáðά.

freebsd-cvsweb (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-cvsweb>)

FreeBSD CVSweb Project

Óá÷-ιέέÝò òðæçðρóáέð áέά òçι ÷ñρóç, òçι áíÛððòιç έáέ òçι óðιòðρñçóç òιò FreeBSD-CVSweb.

freebsd-doc (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-doc>)

Project ðáéιçñβùòçò òιò FreeBSD

Άòðρ ç έβóðά áβιáé áέά òðæρòçóç éáιÛðυι έáέ projects ðιò ó÷-áðβαεííóáé ιά òçι áçιεíòñáβά ðáéιçñβùòçò áέά òι FreeBSD. Óá ιÝέç áòðρð òçò έβóðáð áðιεáéγίíóáé òðιέέéÛ ùð “The FreeBSD Documentation Project”. Άβιáé ιέá áñιέéðρ έβóðά έáέ áβóðά áéáγéáñιð ιá óòιìáðÝ÷-áðá έáέ ιá óðιáéóóÝñáðá!

freebsd-drivers (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-drivers>)

Άçιεíòñáβά ιãçáβι óðóéáðρι áέά òι FreeBSD

Άòðρ ç έβóðά ðñιιñβæáðáé áέά òá÷-ιέέÝò òðæçðρóáέð ó÷-áðééÝò ιá ιãçáιγð òðóéáðρι òòι FreeBSD. ×ñçóéιιðιεáβóáé έòñβùð áðu òιòð áçιεíòñáιγð ιãçáβι óðóéáðρι áέá áñυòρóáέð ó÷-áðééÝò ιá òç óðááñáðρ ιãçáβι, ÷ñçóéιιðιερíðáð òά APIs ðιò ðáñÝ÷-áé ι ððñρíáð òιò FreeBSD.

freebsd-eclipse (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-eclipse>)

FreeBSD ÷ ñΠόδò δiò Eclipse IDE, òùì àñāáéâβùì òiò, rich client àòāñiāβí, éáé ports.

Δñùèàóζ òζò èβóδàδ àδòΠò àβiάé iά δñiòóÝñāé àñiéāāβā òδiòδΠñéιζ áéá uóé Ý ÷ áé iά èÚiáé iά òζi áδéēiāΠ, àāéáδÚóδàóζ, ÷ ñΠóζ, áíÚδòδiζ éáé óδiòδΠñéζ òiò Eclipse IDE, òùì àñāáéâβùì òiò, àòāñiāβí rich client óδζi δéáδóüñiā òiò FreeBSD éáé áéá àiΠèáéá ó ÷ àδééÚ iά òζi iáδàóñiÚ òiò Eclipse IDE éáé òùì δñiòéâδòùì òiò óδi δāñéáÚéēií òiò FreeBSD.

Δñùèàóζ òζò àβiάé àδβóζò iά áéáòēiēyíáé òζi áíóáēēāāΠ δέζñiòiñēβí áíÚiáóá óδζi éiēiúòζóá òiò Eclipse éáé óδζi éiēiúòζóá òiò FreeBSD, δñiò uòāēiò éáé òùì àyì.

Ái éáé ζ èβóδà áδéēáiòñβiáóáé èδñβùδ óδòé áíÚāēàδ òùì ÷ ñζóδβí òiò Eclipse, δñiòóÝñāé àδβóζò Ýiá ÷ βñi óδæΠóζóζò áéá uóiòδ èÝēiò iά áíáδóyñiò iáòāñiāÝò ó ÷ àδééÝò iá òi FreeBSD ÷ ñζóéiñδiēβiáóá òi Eclipse.

freebsd-embedded (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-embedded>)

× ñΠóζ òiò FreeBSD óā embedded àòāñiāÝò

Ç èβóδà óδæçòÚ èÝiáóá ó ÷ àδééÚ iά òζi ÷ ñΠóζ òiò FreeBSD óā embedded óδóδΠiáóá. Άβiάé iéá òā ÷ iéèΠ èβóδà éáé óδæçòiýiáé iñií áδóδçñÚ òā ÷ iééÚ èÝiáóá. Άéá òií óēiòü òζò èβóδàδ àδòΠò, iñβæiòiā uò embedded óδóδΠiáóá óéò òδiēiāéóδééÝò óδóéâóÝò ðiò āáí δñiññβæiíóáé áéá desktop àòāñiāÝò, éáé ðiò óóìΠèùδ éáéýδòiò iéá iñií áíÚāéç, áíòβèáòá iá òá āáíééÚ òδiēiāéóδééÚ δāñéáÚéēiíóá. ÓòìδāñééāiāÚñiíóáé, àéòuò òùì Úéēùí, uēá òá òçèÝòùíá, áéèδòāéuò àñiðééóiuò uðùò routers, switches éáé PBXs, àñiðééóiuò iáòñΠóáùí áδù áδüòδàóζ, PDAs, óδóδΠiáóá Point Of Sale, éáé δÚāé èÝñiíóáδ.

freebsd-emulation (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-emulation>)

Áñiñβùóζ Úéēùì óδóδçiÚòùì uðùò àβiάé óá Linux/MS-DOS/Windows

Άβiάé iéá èβóδà áéá òā ÷ iééÝò óδæçòΠóáéò, ó ÷ àδééÝò iά òζi àèòÝéáóζ óòì FreeBSD δñiñāñiñÚòùì ðiò àçiēiòñāΠèçéáí áéá Úééá èāéδiòñāééÚ.

freebsd-eol (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-eol>)

Îñùðéιζ òδiòδΠñéιζ áéá èñāéóíééù ò ÷ àδééù iá òi FreeBSD ðiò āáí òδiòδçñβæāðáé δèÝií áδù òi FreeBSD Project.

ÁðòΠ ç èβóδà àβiάé áéá uóiòδ áíāéáöÝñiíóáé iá δāñÝ ÷ iòì Π iá ÷ ñζóéiñδiēβiáóá òζi ññùðéιζ òδiòδΠñéιζ áéá èñāéóíééù ò ÷ àδééù iá òi FreeBSD ðiò āáí òδiòδçñβæāðáé δèÝií áδù òi FreeBSD Project (ð. ÷., iá òζi iññòΠ “patches” éáé áíāēiēβiáóáùí áóóāéâáò).

freebsd-firewire (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-firewire>)

FireWire (iLink, IEEE 1394)

ÁðòΠ ç èβóδà àβiάé áéá òζi óδæΠóζóζ òζò ò ÷ àāβáóζò éáé òēiðiβçóζò áñiúò òδiòδóδΠiáòiò FireWire (áñiúòù éáé uò IEEE 1394 Π iLink) áéá òi FreeBSD. Ó ÷ àδééÚ èÝiáóá àβiάé òá δñiòòδá, ié óδóéâóÝò áéáýēiò éáé òá δñiòùēiēéÚ òiòδ, èÚñòàδ, δñiòāñiñāâò éáé chipsets, éáé ç àñ ÷ éðāéòiēéΠ éáé ç òēiðiβçóζ òiò èβāééá áéá òζi òúòδΠ òδiòδΠñéιζ òiòδ.

freebsd-fs (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-fs>)

ÓδóδΠiáóá àñ ÷ àβiúí

ÓδæçòΠóáéò ó ÷ àδééÝò iá òá óδóδΠiáóá àñ ÷ àβiúí òiò FreeBSD. Άβiάé iéá òā ÷ iéèΠ èβóδà éáé óδæçòiýiáé iñií áδóδçñÚ òā ÷ iééÚ èÝiáóá.

freebsd-gecko (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-gecko>)

Gecko Rendering Engine

ΌοαζοΠοάεο ο÷άοέέΪο ιά αοάνιιαΪο θιο ÷ηζοείηθιείιγί οζι ιζ÷άιΠ Gecko οδι FreeBSD.

Ç οοαζοΠοζός άδεάιόνηπιάοάε οά αοάνιιαΪο οζο ΌοείιαΠο ούι Ports θιο ÷ηζοείηθιείιγί οζι ιζ÷άιΠ Gecko, έαέ άεάέεüοάνά οζι άάέάοÜοοάοζ, άίÜθδοιζ έαέ οθιόοΠηείζ οιτοδ οδι FreeBSD.

freebsd-geom (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-geom>)

GEOM

ΌοαζοΠοάεο ο÷άοέέΪο ιά οι GEOM έαέ θάνιιιέάο οείθιέΠοάεο. Άβιάέ ιέα οά÷ιέέΠ έβόοά έαέ οοαζοιγίόάε ιιιι άοόοζηÜ οά÷ιέέÜ εΪιιάόά.

freebsd-gnome (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-gnome>)

GNOME

ΌοαζοΠοάεο ο÷άοέέΪο ιά οι θάνέαÜεείη **GNOME** άέα οοόοΠιάόά FreeBSD. Άβιάέ ιέα οά÷ιέέΠ έβόοά έαέ οοαζοιγίόάε ιιιι άοόοζηÜ οά÷ιέέÜ εΪιιάόά.

freebsd-ipfw (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ipfw>)

IP Firewall

ΆοδΠ ζ έβόοά άβιάέ άέα οά÷ιέέΪο οοαζοΠοάεο θιο αοιιιγί οιι άθαίαο÷άαέαοιι οιο έπαέέα IP firewall οδι FreeBSD. Άβιάέ ιέα οά÷ιέέΠ έβόοά έαέ οοαζοιγίόάε ιιιι άοόοζηÜ οά÷ιέέÜ εΪιιάόά.

freebsd-ia64 (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ia64>)

ΙάοάοιηÜ οιο FreeBSD οοζι άη÷έοάέοιιέέΠ IA64

Δηιιέάεοάε άέα ιέα οά÷ιέέΠ έβόοά, άέα Üοιιά θιο αιοέαιγιοι άιάνηÜ οοζι ιάοάοιηÜ οιο FreeBSD οοζι θεάοοιιιιά IA-64 οζο Intel, άέα ιά άιάοΪηιοι θηιιέΠιάόά Π ιά οοαζοΠοιοι άιάέάέοέέΪο εγύάεο. ¶οιιά θιο άιάέάοΪηιοι έαέ ιά θάνάειιέοθιοι οζι οά÷ιέέΠ οοαζοΠοζός άβιάέ άθβόζο άοθηιιόάάέοά.

freebsd-isdn (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-isdn>)

ΆίÜθδοιζ οιο ISDN

ΆοδΠ ζ έβόοά άβιάέ άέα Üοιιά θιο οοαζοιγί οζι άίÜθδοιζ οζο οθιόοΠηείζο ISDN οδι FreeBSD.

freebsd-java (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-java>)

ΆίÜθδοιζ οζο Java

ΆοδΠ ζ έβόοά άβιάέ άέα Üοιιά θιο οοαζοιγί οζι άίÜθδοιζ οζιάιόέέπι αοάνιιιπi Java άέα οι FreeBSD έαέ οζι ιάοάοιηÜ έαέ οοιθΠηζός ούι JDKs.

freebsd-jobs (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-jobs>)

ΑΠοζός έαέ θηιιόοιηÜ άηάάόβάο

Άοδου άβιάέ Ϊιάο ÷ηηιό άέα αζιιόβάοζ άιάειιέπιαοιι άέα θηιιόοιηÜ έαέ αΠοζός άηάάόβάο θιο ο÷άοβαέοάε ιά οι FreeBSD, έαεθ έαέ άειιιιόέέπι ο÷άοέέπι ιά οι FreeBSD. Άι άέα θάνÜάαέαιά άιάαζοÜοά άηάάόβά ο÷άοέέΠ ιά οι FreeBSD, Π θηιιόΪηιόά ιέα εΪοζ άηάάόβάο ο÷άοέέΠ ιά οι FreeBSD, αοου άβιάέ οι οουοου ιΪηιό άέα ιά οζ άεάοζιβόάοά. Ç έβόοά αοδΠ *aii* άβιάέ άέα άαιέέÜ εΪιιάόά άηάάόβάο, άέα οά ιθιβά οθÜη÷άε θεζεπηά αδου Üεεάο έβόοάο οδι Άεάαβέδοι.

Άοδρ ρ έβόόά, ιιδύο έάέ ιέ οδύιέόδδ όβόόάδ όιό FreeBSD.org, άέάιΥιιόάέ δάάετιόιέά. ρόέ, δñÝδάέ ιά άβόόά όάόδδ άέά όζι όιδύιέάόβά έάέ όζι άοιάόυόζόά όζέάñάόβάδ ϐ άιϐέάέάδ όόζι ιάόιβέζόζ.

Όι ιϐιόιά όάδ έά δñÝδάέ ιά ϐñζόέιιδύιέάβ ιιιι άιιέϐ-δΥ δñüοδδά — έάόΥ δñιόβιζόζ άδέυ έάβιάιι, άι έάέ άάόέέϐδ ιιñόϐδ Portable Document Format (PDF), HTML, έάέ ιάñέέΥ Üέέά άβιáέ άδύιáέδΥ άδύ δύιέιγύδ ϐñϐόόάδ. ΈέάέόόΥ δñüοδδά ιιδύο όι Microsoft Word (.doc) έά άδύιñέόέιγί άδύ όιι άέάέιιέόδϐ όζο έβόόάδ.

freebsd-kde (<http://freebsd.kde.org/mailman/listinfo/kde-freebsd>)

KDE

Όζαζόϐόάέδ δύο άόιñιγί όι **KDE** όά όδóδϐιáόά FreeBSD. Άβιáέ ιέά όάϐ-ιέέϐ έβόόά έάέ όδαζόιγίόάέ ιιιι άόόόζñΥ όάϐ-ιέέΥ έΥιáόά.

freebsd-hackers (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-hackers>)

Όάϐ-ιέέΥδ όδαζόϐόάέδ

Άβιáέ Υιáδ ϐñιü άέά όάϐ-ιέέΥδ όδαζόϐόάέδ όϐ-άόέέΥδ ιά όι FreeBSD. Άδδϐ άβιáέ ρ έγñέά όάϐ-ιέέϐ έβόόά. Άβιáέ άέά Üόñά δύο άιáδόγόοιόι άιáñáΥ όι FreeBSD, άέά ιά άιáóΥñιόι δñιáέϐιáόά ϐ ιά όδαζόϐοιόι άιáέέάέδóέΥδ έγóáέδ. ¶όñά δύο άιáέάóΥñιόáέ ιά δάñáέιιέιρδέϐοιόι όζι όάϐ-ιέέϐ όδαϐόζόζ άβιáέ άδδñüόááέόά. Άβιáέ ιέά όάϐ-ιέέϐ έβόόά έάέ όδαζόιγίόáέ ιιιι άόόόζñΥ όάϐ-ιέέΥ έΥιáόά.

freebsd-hardware (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-hardware>)

ΆάιέέΥδ όδαϐόζόζ άέά δέέέυ έέ άιáñδϐιáόά δδύιέιáέόόϐι όόι FreeBSD

ΆάιέέΥδ όδαζόϐόάέδ άέά όγδύδδ δέέέιγύ δύο έάέόιρñιγί όόι FreeBSD, άέÜοιñά δñιáέϐιáόά έάέ δñιüÜόáέδ όϐ-άόέέΥδ ιά όι όέ ιά άññÜόáόά ϐ ιά άδύγááόά.

freebsd-hubs (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-hubs>)

Mirror sites

Άιáέιιέιρόáέδ έάέ όδαζόϐόáέδ άέά Üόñά δύο όόιόζñιγί mirror sites όιό FreeBSD.

freebsd-isp (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-isp>)

ΈΥιáόά άέά Δάñιϐ-άβδ Όδζñάόέϐι Άέάάέέδóγύδ

Άοδρ ρ έβόόά άβιáέ άέά όδαϐόζόζ έάñÜδύι όϐ-άόέέϐι ιά Δάñιϐ-άβδ Όδζñάόέϐι Άέάάέέδóγύδ (ISPs) δύο ϐñζόέιιδύιέιγί FreeBSD. Άβιáέ ιέά όάϐ-ιέέϐ έβόόά έάέ όδαζόιγίόáέ ιιιι άόόόζñΥ όάϐ-ιέέΥ έΥιáόά.

freebsd-mono (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-mono>)

ΆόάñüáΥδ Mono έάέ C# όόι FreeBSD

Άοδρ ρ έβόόά άβιáέ άέά όδαϐόζόζ έάñÜδύι όϐ-άόέέϐι ιά όι όγóόζιá άíÜδóδóζδ άόάñüáϐι Mono όόι FreeBSD. Δñüέάέόáέ άέά ιέá όάϐ-ιέέϐ έβόόά. Δñüññβαάόáέ άέά ιδύιέιιáϐδύιόά άόϐ-ιέάβόáέ άιáñáΥ ιά όζι άíÜδóδóζ ϐ όζ ιάόάóññÜ άόάñüáϐι Mono ϐ C# όόι FreeBSD. ζ όδαϐόζόζ άóññÜ όζι άδβέδóζ δñιáέζιÜδύι ρ όζι άγñáόζ άιáέέάέδóέϐι έγóáúι. ¶όñά δύο άιáέάóΥñιόáέ ιά δάñáέιιέιρδέϐοιόι όζι όάϐ-ιέέϐ όδαϐόζόζ άβιáέ άδβόζόζ άδδñüόááέόά.

freebsd-office (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-office>)

ΆόάñüáΥδ άñáóáϐιü όόι FreeBSD

Όζαζόϐόáέδ όϐ-άόέέΥδ ιά όζι άáέάóÜόόáόζ, άíÜδóδóζ έάέ δδύιόδϐñέιζ άόάñüáϐι άñáóáϐιü όόι FreeBSD.

[freebsd-performance](http://lists.FreeBSD.org/mailman/listinfo/freebsd-performance)

ÓðæçðPóáêð áέα ôçí ñýðèέόç έάέ ôçí ââëðéóððïðïβççð ôïð FreeBSD

ΆòðP ç ìβòðá ððŸñ÷áε áέα íá ðñŸŸ÷áε Ÿíá ðŸñïð ùðïð íε hackers, íε áέα÷áέñέóðŸð, έάέ ùóíε Ÿéëíε áíáέáoŸñïðáέ, íá óðæçðïüíý òŸíáðá ó÷áðéέŸ ðá ôçí áðüüáíóç ðïð FreeBSD. ΆðñááέðŸ èŸíáðá áβíáέ íε óðæçðPóáêð ðïð áíáóŸñïðáέ óá ááέáðáóðŸóáέð FreeBSD ðïð ððüèáέíóáέ óá ðááŸèí òüñòï, Ÿ÷íóí ðñïäεÞíáðá áðüüáíóçð, Þ òðŸñïð ðïð FreeBSD óðá ùñéá ðïð. Óðíέóðïüíý ðá áíáðéçýέάέðá íá ðñáóïüíý óðç ìβòðá ùóíε áíáέáoŸñïðáέ íá ááέðéÞóíóí ôçí áðüüáíóç ðïð FreeBSD. Άβíáέ ðá ðá÷íέêÞ ìβòðá ðïð áðáðéçýíáðáέ óá Ÿíðáέñïðð ÷ñÞóðáð ðïð FreeBSD, hackers, Þ áέα÷áέñέóðŸð ðïð áíáέáoŸñïðáέ íá èŸñïð ðïð FreeBSD ðñÞññï éáέ áíέüðéóðï. Άáí ðñüèáέóáέ áέα íέα ìβòðá ðñüðPóáüí éáέ áðáíðPóáüí ðïð ðññáβ íá áíóέέáðáóðPóáέ ôçí ðáéŸðç ôçð ðáèìçñβüóçð, áéèŸ Ÿíá ðŸñïð áέα óðíáέóðïñŸð Þ áέα áðáíðPóáêð óá áíáðŸíóçðá èŸíáðá ó÷áðéέŸ ðá ôçí áðüüáíóç.

[freebsd-pf](http://lists.FreeBSD.org/mailman/listinfo/freebsd-pf)

ÓðæçðPóáêð έάέ ðñüðPóáêð áέα ôï ðýóðçιά packet filter firewall

ÓðæçðPóáêð ó÷áðéέŸð ðá ðïð packet filter (pf) firewall system óðï FreeBSD. Óá÷íέέŸð óðæçðPóáêð έάέ ðñüðPóáêð ÷ñçóðÞí áβíáέ áððñüóááéðáð. Ç ìβòðá áβíáέ áðβóçð Ÿíá ðŸñïð áέα óðæÞðççð ðïð ALTQ QoS framework.

[freebsd-platforms](http://lists.FreeBSD.org/mailman/listinfo/freebsd-platforms)

ðáðáóñŸŸ ðïð FreeBSD óá ðç-Intel ðéáðòüññáð

ðñïäεÞíáðá ðïð FreeBSD ðïð áíòáíβæíðáέ óá ðñéóóüðáññáð áðü ðá ðéáðòüññáð, éáèð éáέ ááíέέŸð óðæçðPóáêð éáέ ðñïðŸóáêð áέα ðáðáóñŸŸ ðïð FreeBSD óá ðç-Intel ðéáðòüññáð. Άβíáέ íέα ðá÷íέêÞ ìβòðá éáέ óðæçðïüíýðáέ ðññ áðóðçñŸ ðá÷íέέŸ èŸíáðá.

[freebsd-policy](http://lists.FreeBSD.org/mailman/listinfo/freebsd-policy)

ÉáðáððèðíðÞñéáð áðïðŸóáêð (policy) ôçð ðŸŸááð Core ðïð FreeBSD

ΆòðP áβíáέ ðá ìβòðá ðá ðéññÞ êÞççç, ðñññ áέα áíŸáñùç, áέα ðéð áðïðŸóáêð ôçð Core ðŸŸááð ðïð FreeBSD ó÷áðéέŸ ðá èŸñéíá èŸíáðá éáðáyèðíóçð ðïð Project (policies).

[freebsd-ports](http://lists.FreeBSD.org/mailman/listinfo/freebsd-ports)

ÓðæÞðççç áέα ðá “ports”

ÓðæçðPóáêð ó÷áðéέŸð ðá ôçí “ÓðéëíäÞ ðññ Þòñ” ðïð FreeBSD (/usr/ports), ôçí ððñññÞ ðññ Þòñ, éάέ ááíέέŸ ðéð ðññððŸèáέð óðíðñέóðñý ðññ Þòñ. Άβíáέ íέα ðá÷íέêÞ ìβòðá éáέ óðæçðïüíýðáέ ðñññ áðóðçñŸ ðá÷íέέŸ èŸíáðá.

[freebsd-ports-bugs](http://lists.FreeBSD.org/mailman/listinfo/freebsd-ports-bugs)

ÓðæÞðççç áέα ðá óðŸèíáðá ðññ “ports”

ÓðæçðPóáêð ðïð ó÷áðβæíðáέ ðá ðéð áíáóñŸŸð ðñññæçñŸðññ ôçð “ÓðéëíäÞ ðññ Þòñ” (/usr/ports) ðïð FreeBSD, ðññðŸóáêð áέα íŸá ports Þ áέα áééááŸð óá ððŸñ÷ññá ports. Άβíáέ íέα ðá÷íέêÞ ìβòðá éάέ óðæçðïüíýðáέ ðñññ áðóðçñŸ ðá÷íέέŸ èŸíáðá.

[freebsd-proliant](http://lists.FreeBSD.org/mailman/listinfo/freebsd-proliant)

Óá÷íέέêÞ óðæÞðççç áέα ðïð FreeBSD óá üéáéñééóðŸð HP ProLiant

Άοδρ ϑ εβόδδ οδδεοδÜ εΐιόδδ ό÷άδεεÜ ιά άοδύδεέοδδ άεñýð έάε embedded äääóáóóÜóáέδ όü FreeBSD.
Άβιάε ιέα όá÷ιεέP εβόδδ έάε οδδεοδύιγίόδδ üüü άοδδöñÜ όá÷ιεεÜ εΐιόδδ.

Όχιάβύοε: ϑ εβόδδ άοδρ ý÷άε άιδέέαδδάόδδάεάβ άδö όγι freebsd-embedded
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-embedded>).

freebsd-stable (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-stable>)

ΌδδεοδPóáέδ ό÷άδεέΰð ιά όγι ÷ñPóε όü FreeBSD-STABLE

Άοδρ ϑ εβόδδ άβιάε áέα όüð ÷ñPóóä όü FreeBSD-STABLE. ΔάñéÝ÷άε δñüéáñδíεPóáέδ áέα íΎά ÷άñáεοεέεÜ δü δñüéάέάέ ίά άίούιόδδúέíύ όü -STABLE έάε όά üñüá άíáá÷ñÝüð ίά άδöñüóüí όüð ÷ñPóóä όü. Άδβόε δάñéÝ÷άε íααβαò áέα όά άPíάόά δü δñÝðáé ίά áεüéüεPóáóá Póóá ίά δάñáíάβιάóá όü -STABLE. Èά δñÝðáé ίά äáñáóáβóä όá άοδP όε εβόδδ, άί áεüéüεáβóá όü “STABLE”. Άβιάε ιέα όá÷ιεέP εβόδδ έάε οδδεοδύιγίόδδ üüü άοδδöñÜ όá÷ιεεÜ εΐιόδδ.

freebsd-standards (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-standards>)

Όδñüñóε ιά όá δñüðδδά C99 & POSIX

Άοδρ ϑ εβόδδ άβιάε áέα όá÷ιεεΰð οδδεοδPóáέδ ό÷άδεεÜ ιά όγι όδñüñóε όü FreeBSD ιά όá δñüðδδά C99 έάε POSIX.

freebsd-toolchain (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-toolchain>)

ΌδδPñεόε όü άíóüüóüíΎüü äñáéáβüü όü FreeBSD

Άοδρ ϑ εβόδδ άβιάε áέα οδδεοδPóáέδ δü ό÷άδβáíúάέ ιά όγι óáéñÜ äñáéáβüü (toolchain) δü Ύñ÷ííόάε ιά όü FreeBSD. ϑ οδδPδεόε üññáβ ίά δάñééáíáΎíáé εΐιόδδ ό÷άδεεÜ ιά όγι éádÜóóóε όü Clang έάε όü GCC, áéÜ έάε εΐιόδδ ό÷άδεεÜ ιά δñüñÜñáóá üδðð ιάόάáüεóóéóΰð, assemblers, linkers έάε debuggers.

freebsd-usb (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-usb>)

ΌδδPδεόε áέα όγι όδδúðPñéíε όü áéáyüö USB όü FreeBSD

Άοδρ ϑ εβόδδ άβιάε áέα όá÷ιεεΰð οδδεοδPóáέδ ό÷άδεεÜ ιά όγι όδδúðPñéíε όü áéáyüö USB όü FreeBSD.

freebsd-user-groups (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-user-groups>)

İñäÜüóε όü όδεüüüüü ÷ñόóPí

Άοδρ ϑ εβόδδ άβιάε áέα όüð όδδúíéóóΰð όü áδéíΎñüð όüδéPí όδεüüüüü ÷ñόóPí áέα οδδPδεόε éäÜüüüü íáóáíý όüð έάε ιá éÜδúéí üΎéüð όε ñÜááð Core. Άοδρ ϑ εβόδδ έά δñÝðáé ίά άíáóΎñáé üüü όεð óóíáíðPóáέδ έάε όγι ññäÜüóε projects δü áíáóΎñüüάέ óá δάñéóóüðüñüð áδü Ύíá όδεüüüüð ÷ñόóPí.

freebsd-vendors (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-vendors>)

Δüεεóΰð

İñäÜüóε οδδεοδPóáüüü íáóáíý όü FreeBSD Project έάε όü δüεεóPí éüéóíééíý έάε óéééíý ό÷άδεéíý ιá όü FreeBSD.

Óðέò ìβóòáð àðέòñÝðñíðáέ ìüñí óðáέâèñéíÝñé òýðíé óðíçìíÝíúí àñ÷àβùí. ¼éá óá óðíçìíÝíá àñ÷àβá ìà òýðì MIME ðñò àáí àñβóέâáέέ óðçì ðáñáéÜòü ìβóðá, äéáñÜòñíðáέ ðñéí äéáíàìçèáβ òì ìÞñíá óðέò ìβóòáð.

- application/octet-stream
- application/pdf
- application/pgp-signature
- application/x-pkcs7-signature
- message/rfc822
- multipart/alternative
- multipart/related
- multipart/signed
- text/html
- text/plain
- text/x-diff
- text/x-patch

Óçìáβüòç: ìáñééÝò ìβóòáð ìðñíáβ ìá àðέòñÝðñíðáέ òðíçìíÝíá àñ÷àβá éáέ Üèèüí òýðùí MIME, áéèÜ ìé ðáñáðÜíü òýðìé éó÷ýíðí óðέò ðáñéóóüðáñáð ìβóòáð.

ÀÜí òì èáβìáñí áíüð ìçíýíáðñò ðáñéÝ÷àðáέ òüñí óá ìñòÞ HTML üñí éáέ áðéíý èáéíÝñò, òì òìÞñíá HTML èá áðáέñáèáβ. ÀÜí Ýíá ìÞñíá ðáñéÝ÷àé ìñíí HTML, èá ìáðáðñáðáβ óá áðèü èáβìáñí.

C.2 Usenet Newsgroups

Áéòüð áðü äýí newsgroups ðñò áó÷ñèíýíðáέ ìà òì FreeBSD, ððÜñ÷ìñí ðñèèÜ áéüìá óóá ìðñíá àβíáðáέ óðáÞòçòç áéá òì FreeBSD Þ Üèèá èÝíáðá ðñò áíáá÷ñÝíüð áíáéáóÝñíñí òñò ðñóòáð ðñò. Áéá èÜðñéá áðü áððÜ òá newsgroups, ìðñíáβðá ìá èÜíáðá áíááÞòçòç ìá èÝíáèð-èèáééÜ óðέð ðáééÝò äçñíóéáýóáéð (http://minnie.tuhs.org/BSD-info/bsdnews_search.html), ðÜñç òðçì òðçñáðá ðñò ðñññóÝñáé ì Warren Toomey <wkt@cs.adfa.edu.au>.

C.2.1 Newsgroups Ó÷àðéèÜ ìà òì BSD

- comp.unix.bsd.freebsd.announce (news:comp.unix.bsd.freebsd.announce)
- comp.unix.bsd.freebsd.misc (news:comp.unix.bsd.freebsd.misc)
- de.comp.os.unix.bsd (news:de.comp.os.unix.bsd) (Óðá ÁññíáíéèÜ)
- fr.comp.os.bsd (news:fr.comp.os.bsd) (Óðá ÁáèèèèÜ)
- it.comp.os.freebsd (news:it.comp.os.freebsd) (Óðá ÉðáéèèÜ)
- tw.bbs.comp.386bsd (news:tw.bbs.comp.386bsd) (Óá ΔáñááññóééÜ ÈéíÝæééá)

C.2.2 Ηλεκτρονικά Νέα UNIX Newsgroups

- comp.unix (news:comp.unix)
- comp.unix.questions (news:comp.unix.questions)
- comp.unix.admin (news:comp.unix.admin)
- comp.unix.programmer (news:comp.unix.programmer)
- comp.unix.shell (news:comp.unix.shell)
- comp.unix.user-friendly (news:comp.unix.user-friendly)
- comp.security.unix (news:comp.security.unix)
- comp.sources.unix (news:comp.sources.unix)
- comp.unix.advocacy (news:comp.unix.advocacy)
- comp.unix.misc (news:comp.unix.misc)
- comp.bugs.4bsd (news:comp.bugs.4bsd)
- comp.bugs.4bsd.ucb-fixes (news:comp.bugs.4bsd.ucb-fixes)
- comp.unix.bsd (news:comp.unix.bsd)

C.2.3 Ηλεκτρονικά X Window

- comp.windows.x.i386unix (news:comp.windows.x.i386unix)
- comp.windows.x (news:comp.windows.x)
- comp.windows.x.apps (news:comp.windows.x.apps)
- comp.windows.x.announce (news:comp.windows.x.announce)
- comp.windows.x.intrinsics (news:comp.windows.x.intrinsics)
- comp.windows.x.motif (news:comp.windows.x.motif)
- comp.windows.x.pex (news:comp.windows.x.pex)
- comp.emulators.ms-windows.wine (news:comp.emulators.ms-windows.wine)

C.3 Ηλεκτρονικά Επικοινωνία

C.3.1 Forums, Blogs, και Ειδικά Άρθρα

- Τα Forums του FreeBSD (<http://forums.freebsd.org/>) είναι ένα web site με άρθρα σχετικά με το FreeBSD.
- Οι Planet FreeBSD (<http://planet.freebsd.org/>) είναι ένα site με άρθρα σχετικά με το FreeBSD. Είναι ένα site με άρθρα σχετικά με το FreeBSD.

ãñüóðìðìéΠóììí ðçí ãñãááóβá ðìò èÜñìí ðç äããñÝíç óðéãñΠ, ðð÷üí íÝãò äéññèðóáéò, ééèðò éáé óá ìäèèíðééÜ ðìòð ð÷Ýáéá.

- Õì éáíÜéé BSDConferences óðì Youtube (<http://www.youtube.com/bsdconferences>) ðãñÝ÷áé ìéá óðèèñãΠ áβíðãñ ðççèΠð ðìéüðçóáð, áðü äéÜöñãá BSD óðíÝãñéá óá üèí ðñí èüóñ. Δññüèäéðáé äéá Ýíá èáðìÜóéí ðñüðì íá ðãñãéñèðéΠóáðá óçíáíðééÜ ìÝèç ðçò ñÜááð áíÜðððíçð ìá ðãññìóéÜæìí ðç íÝá ðìòð äñðéäéÜ óðì FreeBSD.

C.3.2 Άðβóçìá Mirrors

Central Servers, Argentina, Armenia, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, China, Costa Rica, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Italy, Japan, Korea, Kuwait, Kyrgyzstan, Latvia, Lithuania, Netherlands, Norway, Philippines, Portugal, Romania, Russia, San Marino, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, Ukraine, United Kingdom, USA.

(as of 2011/09/11 11:28:10 UTC)

- Central Servers
 - <http://www.FreeBSD.org/>
- Argentina
 - <http://www.ar.FreeBSD.org/>
- Armenia
 - <http://www1.am.FreeBSD.org/> (IPv6)
- Australia
 - <http://www.au.FreeBSD.org/>
 - <http://www2.au.FreeBSD.org/>
- Austria
 - <http://www.at.FreeBSD.org/> (IPv6)
- Belgium

- <http://freebsd.unixtech.be/>

•
Brazil

- <http://www.br.FreeBSD.org/> (IPv6)
- <http://www2.br.FreeBSD.org/www.freebsd.org/>
- <http://www3.br.FreeBSD.org/>

•
Bulgaria

- <http://www.bg.FreeBSD.org/>
- <http://www2.bg.FreeBSD.org/>

•
Canada

- <http://www.ca.FreeBSD.org/>
- <http://www2.ca.FreeBSD.org/>

•
China

- <http://www.cn.FreeBSD.org/>

•
Costa Rica

- <http://www1.cr.FreeBSD.org/>

•
Czech Republic

- <http://www.cz.FreeBSD.org/> (IPv6)

•
Denmark

- <http://www.dk.FreeBSD.org/> (IPv6)
-

Estonia

- <http://www.ee.FreeBSD.org/>

•

Finland

- <http://www.fi.FreeBSD.org/>
- <http://www2.fi.FreeBSD.org/>

•

France

- <http://www.fr.FreeBSD.org/>
- <http://www1.fr.FreeBSD.org/>

•

Germany

- <http://www.de.FreeBSD.org/>

•

Greece

- <http://www.gr.FreeBSD.org/>

•

Hong Kong

- <http://www.hk.FreeBSD.org/>

•

Hungary

- <http://www.hu.FreeBSD.org/>
- <http://www2.hu.FreeBSD.org/>

•

Iceland

- <http://www.is.FreeBSD.org/>

•

Italy

- <http://www.it.FreeBSD.org/>
- <http://www.gufi.org/mirrors/www.freebsd.org/data/>

•

Japan

- <http://www.jp.FreeBSD.org/www.FreeBSD.org/> (IPv6)

•

Korea

- <http://www.kr.FreeBSD.org/>
- <http://www2.kr.FreeBSD.org/>

•

Kuwait

- <http://www.kw.FreeBSD.org/>

•

Kyrgyzstan

- <http://www.kg.FreeBSD.org/>

•

Latvia

- <http://www.lv.FreeBSD.org/>
- <http://www2.lv.FreeBSD.org/>

•

Lithuania

- <http://www.lt.FreeBSD.org/>

•

Netherlands

- <http://www.nl.FreeBSD.org/>
- <http://www2.nl.FreeBSD.org/>

- Norway
 - <http://www.no.FreeBSD.org/>

- Philippines
 - <http://www.FreeBSD.org.ph/>

- Portugal
 - <http://www.pt.FreeBSD.org/>
 - <http://www1.pt.FreeBSD.org/>
 - <http://www4.pt.FreeBSD.org/>
 - <http://www5.pt.FreeBSD.org/>

- Romania
 - <http://www.ro.FreeBSD.org/>
 - <http://www1.ro.FreeBSD.org/>
 - <http://www2.ro.FreeBSD.org/>
 - <http://www3.ro.FreeBSD.org/>

- Russia
 - <http://www.ru.FreeBSD.org/>
 - <http://www2.ru.FreeBSD.org/>
 - <http://www3.ru.FreeBSD.org/>
 - <http://www4.ru.FreeBSD.org/>
 - <http://www5.ru.FreeBSD.org/>

- San Marino
 - <http://www.sm.FreeBSD.org/>

-

Singapore

- <http://www2.sg.FreeBSD.org/>

•

Slovak Republic

- <http://www.sk.FreeBSD.org/>

•

Slovenia

- <http://www.si.FreeBSD.org/>
- <http://www2.si.FreeBSD.org/>

•

South Africa

- <http://www.za.FreeBSD.org/>
- <http://www2.za.FreeBSD.org/>

•

Spain

- <http://www.es.FreeBSD.org/>
- <http://www2.es.FreeBSD.org/>
- <http://www3.es.FreeBSD.org/>

•

Sweden

- <http://www.se.FreeBSD.org/>
- <http://www2.se.FreeBSD.org/>

•

Switzerland

- <http://www.ch.FreeBSD.org/>
- <http://www2.ch.FreeBSD.org/>

•

Taiwan

- <http://www.tw.FreeBSD.org/> (IPv6)
- <http://www2.tw.FreeBSD.org/>
- <http://www3.tw.FreeBSD.org/>
- <http://www4.tw.FreeBSD.org/>
- <http://www5.tw.FreeBSD.org/> (IPv6)
- <http://www6.tw.FreeBSD.org/>
- <http://www7.tw.FreeBSD.org/>

•

Thailand

- <http://www.th.FreeBSD.org/>

•

Turkey

- <http://www.tr.FreeBSD.org/>
- <http://www2.tr.FreeBSD.org/>
- <http://www3.tr.FreeBSD.org/> (IPv6)

•

Ukraine

- <http://www.ua.FreeBSD.org/>
- <http://www2.ua.FreeBSD.org/>
- <http://www5.ua.FreeBSD.org/>
- <http://www4.ua.FreeBSD.org/>

•

United Kingdom

- <http://www1.uk.FreeBSD.org/>
- <http://www3.uk.FreeBSD.org/>

•

USA

- <http://www2.us.FreeBSD.org/>
- <http://www5.us.FreeBSD.org/> (IPv6)

C.4 Άέαòèýíóáέò Çäêônñíéêíý Óá ÷ òäññãáβìò

Íé áέüèüòèäò áñρóáέò ÷ ñçόðí δάνÝ ÷ ðìí óðá ìÝέç òìòð áέαòèýíóáέò çäêônñíéêíý Óá ÷ òäññãáβìò ðìò ó ÷ áðβæííóáέ ìá òì FreeBSD. Í áέα ÷ áέñέóðò ðò ðìò áíáòÝññáóáέ δάνάέÜòù, áέαòçñãá òì áέαáβìüíá íá áíáέáèÝóáέ òçí áέαýèðìόç, áí äβíáέ έáóÜ ÷ ñçόç òçò ìá ðìèíäððìä òñüðì.

ÓñÝáò	Óðçñáóáò	λúóç × ñçόðí	Άέα ÷ áέñέóðò
ukug.uk.FreeBSD.org	Ìüñ ðñìρèçόç	<ukfreebsd@uk.FreeBSD.org>	Lee Johnston <lee@uk.FreeBSD.org>

Óçìáέρπόáέò

1. <http://www.freebsd.org/news/status/>

Ἐἰσαγωγή D. Ἐἰσαγωγή PGP

Ὁἱ ἰδιοκτήτες αὐτοῦ, ἐὰν ἀναβῶν ἡ ἀπὸ τοῦ PGP ἰσοπέδισμα οὐκ ἔστιν ἰσοπέδισμα τοῦ
FreeBSD. Ἰδιοκτήτες ἡ ἀπὸ τοῦ ἰσοπέδισμα ἀπὸ τοῦ ἰσοπέδισμα ἰσοπέδισμα ἰσοπέδισμα
email ἡ ἰσοπέδισμα ἰσοπέδισμα ἰσοπέδισμα. Ἰδιοκτήτες ἡ ἀπὸ τοῦ ἰσοπέδισμα ἰσοπέδισμα
FreeBSD.org, ἀπὸ τοῦ ἰσοπέδισμα <http://www.FreeBSD.org/doc/pgpkeyring.txt>.

D.1 Officers

D.1.1 ἰδιοκτήτης ἰσοπέδισμα <security-officer@FreeBSD.org>

```
pub 1024D/CA6CDFB2 2002-08-27 FreeBSD Security Officer <security-officer@FreeBSD.org>
   Key fingerprint = C374 0FC5 69A6 FBB1 4AED B131 15D6 8804 CA6C DFB2
sub 2048g/A3071809 2002-08-27
```

D.1.2 ἰδιοκτήτης ἰσοπέδισμα Core <core-secretary@FreeBSD.org>

```
pub 1024R/FF8AE305 2002-01-08 core-secretary@FreeBSD.org
   Key fingerprint = CE EF 8A 48 70 00 B5 A9 55 69 DE 87 E3 9A E1 CD
```

D.1.3 ἰδιοκτήτης ἰσοπέδισμα ἰσοπέδισμα ἰσοπέδισμα ἰσοπέδισμα <portmgr-secretary@FreeBSD.org>

```
pub 1024D/7414629C 2005-11-30
   Key fingerprint = D50C BA61 8DC6 C42E 4C05 BF9A 79F6 E071 7414 629C
uid FreeBSD portmgr secretary <portmgr-secretary@FreeBSD.org>
sub 2048g/80B696E6 2005-11-30
```

D.2 ἰσοπέδισμα ἰσοπέδισμα Core

D.2.1 John Baldwin <jhb@FreeBSD.org>

```
pub 1024R/C10A874D 1999-01-13 John Baldwin <jbaldwin@weather.com>
   Key fingerprint = 43 33 1D 37 72 B1 EF 5B 9B 5F 39 F8 BD C1 7C B5
uid John Baldwin <john@baldwin.cx>
```

uid John Baldwin <jhb@FreeBSD.org>
uid John Baldwin <jobaldwi@vt.edu>

D.2.2 Konstantin Belousov <kib@FreeBSD.org>

pub 1024D/DD4C6F88 2004-07-29
Key fingerprint = 39DA E615 A45C 111D 777B 3AD0 0B7F 8C04 DD4C 6F88
uid Konstantin Belousov <kib@freebsd.org>
uid Konstantin Belousov <konstantin.belousov@zoral.com.ua>
uid Kostik Belousov <kostikbel@ukr.net>
uid Kostik Belousov <kostikbel@gmail.com>
sub 2048g/18488597 2004-07-29

D.2.3 Wilko Bulte <wilko@FreeBSD.org>

pub 1024D/186B8DBD 2006-07-29
Key fingerprint = 07C2 6CB3 9C18 D290 6C5F 8879 CF83 EC86 186B 8DBD
uid Wilko Bulte (wilko@FreeBSD.org) <wilko@FreeBSD.org>
sub 2048g/1C4683F1 2006-07-29

D.2.4 Brooks Davis <brooks@FreeBSD.org>

pub 1024D/F2381AD4 2001-02-10
Key fingerprint = 655D 519C 26A7 82E7 2529 9BF0 5D8E 8BE9 F238 1AD4
uid Brooks Davis (The Aerospace Corporation) <brooks@aero.org>
uid Brooks Davis <brooks@one-eyed-alien.net>
uid Brooks Davis <brooks@FreeBSD.org>
uid Brooks Davis <brooks@aero.org>
sub 2048g/CFDACA7A 2003-01-25 [expires: 2016-04-30]
sub 1024g/42921194 2001-02-10 [expires: 2016-04-30]

D.2.5 Warner Losh <imp@FreeBSD.org>

pub 1024D/1EF6D8A7 2006-08-15
Key fingerprint = AEC9 99C1 3212 1A86 93A6 A96B DB9F 6F12 1EF6 D8A7
uid M. Warner Losh <imp@bsdimp.com>
sub 4096g/34FC5B17 2006-08-15

D.2.6 Pav Lucistnik <pav@FreeBSD.org>

pub 1024D/C14EB282 2003-08-25 Pav Lucistnik <pav@FreeBSD.org>
Key fingerprint = 2622 B7E3 7DA5 5C53 2079 855B 9ED7 583F C14E B282
uid Pav Lucistnik <pav@oook.cz>
sub 1024g/7287A947 2003-08-25

D.2.7 Colin Percival <cperciva@FreeBSD.org>

```
pub 1024D/0C6A6A6E 2009-01-12
   Key fingerprint = EAF4 8BBA 7CC7 7A30 FEFC 0DA9 38CE CA69 0C6A 6A6E
uid Colin Percival <cperciva@tarsnap.com>
uid Colin Percival <cperciva@FreeBSD.org>
uid Colin Percival <cperciva@alumni.sfu.ca>
sub 2048g/DC606691 2009-01-12
```

D.2.8 Hiroki Sato <hrs@FreeBSD.org>

```
pub 1024D/2793CF2D 2001-06-12
   Key fingerprint = BDB3 443F A5DD B3D0 A530 FFD7 4F2C D3D8 2793 CF2D
uid Hiroki Sato <hrs@allbsd.org>
uid Hiroki Sato <hrs@eos.ocn.ne.jp>
uid Hiroki Sato <hrs@ring.gr.jp>
uid Hiroki Sato <hrs@FreeBSD.org>
uid Hiroki Sato <hrs@jp.FreeBSD.org>
uid Hiroki Sato <hrs@vlsi.ee.noda.tus.ac.jp>
uid Hiroki Sato <hrs@jp.NetBSD.org>
uid Hiroki Sato <hrs@NetBSD.org>
sub 1024g/8CD251FF 2001-06-12
```

D.3 ÌÝèç ôçò ìiÛääò ÁíÛðôôîçò

D.3.1 Ariff Abdullah <ariff@FreeBSD.org>

```
pub 1024D/C5304CDA 2005-10-01
   Key fingerprint = 5C7C 6BF4 8293 DE76 27D9 FD57 96BF 9D78 C530 4CDA
uid Ariff Abdullah <skywizard@MyBSD.org.my>
uid Ariff Abdullah <ariff@MyBSD.org.my>
uid Ariff Abdullah <ariff@FreeBSD.org>
sub 2048g/8958C1D3 2005-10-01
```

D.3.2 Thomas Abthorpe <tabthorpe@FreeBSD.org>

```
pub 2048R/A473C990 2010-05-28
   Key fingerprint = D883 2D7C EB78 944A 69FC 36A6 D937 1097 A473 C990
uid Thomas Abthorpe (FreeBSD Committer) <tabthorpe@FreeBSD.org>
uid Thomas Abthorpe <thomas@goodking.ca>
uid Thomas Abthorpe <tabthorpe@goodking.org>
sub 2048R/8CA60EE0 2010-05-28
```

D.3.3 Eitan Adler <eadler@FreeBSD.org>

```
pub 4096R/8FC8196C 2011-02-11
    Key fingerprint = 49C7 29DF E09C 0FC7 A1C4 6ECB A338 A6FC 8FC8 196C
uid          Eitan Adler <lists@eitanadler.com>
sub 4096R/18763D51 2011-02-11
sub 4096R/DAB9CF9B 2011-02-11
```

D.3.4 Shaun Amott <shaun@FreeBSD.org>

```
pub 1024D/6B387A9A 2001-03-19
    Key fingerprint = B506 E6C7 74A1 CC11 9A23 5C13 9268 5D08 6B38 7A9A
uid          Shaun Amott <shaun@inerd.com>
uid          Shaun Amott <shaun@FreeBSD.org>
sub 2048g/26FA8703 2001-03-19
sub 2048R/7FFF5151 2005-11-06
sub 2048R/27C54137 2005-11-06
```

D.3.5 Henrik Brix Andersen <brix@FreeBSD.org>

```
pub 1024D/54E278F8 2003-04-09
    Key fingerprint = 7B63 EF32 7831 A704 220D 7E61 BFE4 387E 54E2 78F8
uid          Henrik Brix Andersen <henrik@brixandersen.dk>
uid          Henrik Brix Andersen <brix@FreeBSD.org>
uid          Henrik Brix Andersen <hbn@terma.com>
uid          Henrik Brix Andersen <brix@osaa.dk>
sub 1024g/3B13C209 2003-04-09
```

D.3.6 Matthias Andree <mandree@FreeBSD.org>

```
pub 1024D/052E7D95 2003-08-28
    Key fingerprint = FDD0 0C43 6E33 07E1 0758 C6A8 BE61 8339 052E 7D95
uid          Matthias Andree <mandree@freebsd.org>
uid          Matthias Andree <matthias.andree@gmx.de>
sub 1536g/E65A83DA 2003-08-28
```

D.3.7 Will Andrews <will@FreeBSD.org>

```
pub 1024D/F81672C5 2000-05-22 Will Andrews (Key for official matters) <will@FreeBSD.org>
    Key fingerprint = 661F BBF7 9F5D 3D02 C862 5F6C 178E E274 F816 72C5
uid          Will Andrews <will@physics.purdue.edu>
uid          Will Andrews <will@puck.firepipe.net>
uid          Will Andrews <will@c-60.org>
uid          Will Andrews <will@csociety.org>
uid          Will Andrews <will@csociety.ecn.purdue.edu>
uid          Will Andrews <will@telperion.openpackages.org>
```

sub 1024g/55472804 2000-05-22

D.3.8 Dimitry Andric <dim@FreeBSD.org>

```
pub 1024D/2E2096A3 1997-11-17
Key fingerprint = 7AB4 62D2 CE35 FC6D 4239 4FCD B05E A30A 2E20 96A3
uid Dimitry Andric <dimitry@andric.com>
uid Dimitry Andric <dim@xs4all.nl>
uid Dimitry Andric <dimitry.andric@tomtom.com>
uid [jpeg image of size 5132]
uid Dimitry Andric <dim@nah6.com>
uid Dimitry Andric <dim@FreeBSD.org>
sub 4096g/6852A5C5 1997-11-17
```

D.3.9 Eric Anholt <anholt@FreeBSD.org>

```
pub 1024D/6CF0EAF7 2003-09-08
Key fingerprint = 76FE 2475 820B B75F DCA4 0F3E 1D47 6F60 6CF0 EAF7
uid Eric Anholt <eta@lclark.edu>
uid Eric Anholt <anholt@FreeBSD.org>
sub 1024g/80B404C1 2003-09-08
```

D.3.10 Marcus von Appen <mva@FreeBSD.org>

```
pub 1024D/B267A647 2009-02-14
Key fingerprint = C7CC 1853 D8C5 E580 7795 B654 8BAF 3F12 B267 A647
uid Marcus von Appen <freebsd@sysfault.org>
uid Marcus von Appen <mva@freebsd.org>
sub 2048g/D34A3BAF 2009-02-14
```

D.3.11 Marcelo Araujo <araujo@FreeBSD.org>

```
pub 1024D/53E4CFA8 2007-04-27
Key fingerprint = 9D6A 2339 925C 4F61 ED88 ED8B A2FC 4977 53E4 CFA8
uid Marcelo Araujo (Ports Committer) <araujo@FreeBSD.org>
sub 2048g/63CC012D 2007-04-27
```

D.3.12 Mathieu Arnold <mat@FreeBSD.org>

```
pub 1024D/FE6D850F 2005-04-25
Key fingerprint = 2771 11F4 0A7E 73F9 ADDD A542 26A4 7C6A FE6D 850F
uid Mathieu Arnold <mat@FreeBSD.org>
uid Mathieu Arnold <mat@mat.cc>
uid Mathieu Arnold <mat@cpan.org>
```

```
uid          Mathieu Arnold <m@absolight.fr>
uid          Mathieu Arnold <m@absolight.net>
uid          Mathieu Arnold <mat@club-internet.fr>
uid          Mathieu Arnold <marnold@april.org>
uid          Mathieu Arnold <paypal@mat.cc>
sub 2048g/EAD18BD9 2005-04-25
```

D.3.13 Satoshi Asami <asami@FreeBSD.org>

```
pub 1024R/1E08D889 1997-07-23 Satoshi Asami <asami@cs.berkeley.edu>
Key fingerprint = EB 3C 68 9E FB 6C EB 3F DB 2E 0F 10 8F CE 79 CA
uid          Satoshi Asami <asami@FreeBSD.ORG>
```

D.3.14 Gavin Atkinson <gavin@FreeBSD.org>

```
pub 1024D/A093262B 2005-02-18
Key fingerprint = 313A A79F 697D 3A5C 216A EDF5 935D EF44 A093 262B
uid          Gavin Atkinson <gavin@16squared.co.uk>
uid          Gavin Atkinson (FreeBSD key) <gavin@FreeBSD.org>
uid          Gavin Atkinson (Work e-mail) <ga9@york.ac.uk>
uid          Gavin Atkinson <gavin.atkinson@ury.york.ac.uk>
sub 2048g/58F40B3D 2005-02-18
```

D.3.15 Joseph S. Atkinson <jsa@FreeBSD.org>

```
pub 2048R/21AA7B06 2010-07-14
Key fingerprint = 5B38 63B0 9CCA 12BE 3919 9412 CC9D FC84 21AA 7B06
uid          Joseph S. Atkinson <jsa@FreeBSD.org>
uid          Joseph S. Atkinson <jsa.bsd@gmail.com>
uid          Joseph S. Atkinson <jsa@wickedmachine.net>
sub 2048R/5601C3E3 2010-07-14
```

D.3.16 Philippe Audeoud <jadawin@FreeBSD.org>

```
pub 1024D/C835D40E 2005-04-13
Key fingerprint = D090 8C96 3612 15C9 4E3E 7A4A E498 FC2B C835 D40E
uid          Philippe Audeoud <jadawin@tuxaco.net>
uid          Philippe Audeoud <philippe@tuxaco.net>
uid          Philippe Audeoud <philippe.audeoud@sitadelle.com>
uid          Philippe Audeoud <jadawin@freebsd.org>
sub 2048g/EF8EA329 2005-04-13
```

D.3.17 Timur I. Bakeyev <timur@FreeBSD.org>

```
pub 1024D/60BA1F47 2002-04-27
   Key fingerprint = 84BF EAD1 607D 362F 210E 69B3 0BF0 6412 60BA 1F47
uid          Timur I. Bakeyev (BaT) <timur@bat.ru>
uid          Timur I. Bakeyev <timur@gnu.org>
uid          Timur I. Bakeyev (BaT) <bat@cpan.org>
uid          Timur I. Bakeyev (BaT) <timur@FreeBSD.org>
uid          Timur I. Bakeyev (BaT) <timur@gnome.org>
uid          Timur I. Bakeyev <timur@gnome.org>
sub 2048g/8A5B0042 2002-04-27
```

D.3.18 Glen Barber <gjb@FreeBSD.org>

```
pub 2048R/A0B946A3 2010-08-03
   Key fingerprint = 78B3 42BA 26C7 B2AC 681E A7BE 524F 0C37 A0B9 46A3
uid          Glen Barber <glen.j.barber@gmail.com>
uid          Glen Barber <gjb35@drexel.edu>
uid          Glen Barber <gjb@glenbarber.us>
uid          Glen Barber <gjb@FreeBSD.org>
sub 2048R/6C0527E5 2010-08-03
```

D.3.19 Nick Barkas <snb@FreeBSD.org>

```
pub 2048R/DDADB9DC 2010-07-27
   Key fingerprint = B678 6ECB 303D F580 A050 098F BDFE 4F3D DDAD B9DC
uid          S. Nicholas Barkas <snb@freebsd.org>
sub 2048R/36E181FB 2010-07-27
sub 2048R/BDA4BED3 2010-07-29
sub 2048R/782A8737 2010-07-29
```

D.3.20 Simon Barner <barner@FreeBSD.org>

```
pub 1024D/EBADA82A 2000-11-10
   Key fingerprint = 67D1 3562 9A2F 3177 E46A 35ED 0A49 FEFD EBAD A82A
uid          Simon Barner <barner@FreeBSD.org>
uid          Simon Barner <barner@in.tum.de>
uid          Simon Barner <barner@informatik.tu-muenchen.de>
uid          Simon Barner <barner@gmx.de>
sub 2048g/F63052DE 2000-11-10
```

D.3.21 Doug Barton <dougb@FreeBSD.org>

```
pub 2048R/1A1ABC84 2010-03-23
   Key fingerprint = E352 0E14 9D05 3533 C33A 67DB 5CC6 86F1 1A1A BC84
uid          Douglas Barton <dougb@dougbarton.us>
```

```
uid          Douglas Barton <dougb@FreeBSD.org>
uid          [jpeg image of size 6140]
sub 3072R/498795B4 2010-03-23
Key fingerprint = C0BE C1E3 8DC8 D7F4 8E6C 732B 0C14 D9CF 4987 95B4
```

D.3.22 Artem Belevich <art@FreeBSD.org>

```
pub 2048R/9ED4C836 2011-03-28
Key fingerprint = 7400 D541 07ED 3DF3 3E97 F2D5 8BDF 101C 9ED4 C836
uid          Artem Belevich <artemb@gmail.com>
uid          Artem Belevich <art@freebsd.org>
sub 2048R/55B0E4EB 2011-03-28
```

D.3.23 Anton Berezin <tobez@FreeBSD.org>

```
pub 1024D/7A7BA3C0 2000-05-25 Anton Berezin <tobez@catpipe.net>
Key fingerprint = CDD8 560C 174B D8E5 0323 83CE 22CA 584C 7A7B A3C0
uid          Anton Berezin <tobez@tobez.org>
uid          Anton Berezin <tobez@FreeBSD.org>
sub 1024g/ADC71E87 2000-05-25
```

D.3.24 Damien Bergamini <damien@FreeBSD.org>

```
pub 2048R/D129F093 2005-03-02
Key fingerprint = D3AB 28C3 1A4A E219 3145 54FE 220A 7486 D129 F093
uid          Damien Bergamini <damien.bergamini@free.fr>
uid          Damien Bergamini <damien@FreeBSD.org>
sub 2048R/9FBA73A4 2005-03-02
```

D.3.25 Tim Bishop <tdb@FreeBSD.org>

```
pub 1024D/5AE7D984 2000-10-07
Key fingerprint = 1453 086E 9376 1A50 ECF6 AE05 7DCE D659 5AE7 D984
uid          Tim Bishop <tim@bishnet.net>
uid          Tim Bishop <T.D.Bishop@kent.ac.uk>
uid          Tim Bishop <tdb@i-scream.org>
uid          Tim Bishop <tdb@FreeBSD.org>
sub 4096g/7F886031 2000-10-07
```

D.3.26 Martin Blapp <mbr@FreeBSD.org>

```
pub 1024D/D300551E 2001-12-20 Martin Blapp <mb@imp.ch>
Key fingerprint = B434 53FC C87C FE7B 0A18 B84C 8686 EF22 D300 551E
sub 1024g/998281C8 2001-12-20
```

D.3.27 Warren Block <wblock@FreeBSD.org>

```
pub 2048R/A1F360A3 2011-09-14
    Key fingerprint = 3A44 4DEC B304 5191 8A41 C317 5117 4BB6 A1F3 60A3
uid          Warren Block <wblock@FreeBSD.org>
uid          Warren Block <wblock@wonkity.com>
sub 2048R/51F483F3 2011-09-14
```

D.3.28 Vitaly Bogdanov <bvs@FreeBSD.org>

```
pub 1024D/B32017F7 2005-10-02 Vitaly Bogdanov <gad@gad.glazov.net>
    Key fingerprint = 402E B8E4 53CB 22FF BE62 AE35 A0BF B077 B320 17F7
uid          Vitaly Bogdanov <bvs@freebsd.org>
sub 1024g/0E88C62E 2005-10-02
```

D.3.29 Roman Bogorodskiy <novel@FreeBSD.org>

```
pub 2048R/08C2226A 2010-12-03
    Key fingerprint = 8BA4 DF2A D14F 99B6 37E0 0070 C96D 5FFE 08C2 226A
uid          Roman Bogorodskiy <bogorodskiy@gmail.com>
uid          Roman Bogorodskiy <novel@FreeBSD.org>
uid          Roman Bogorodskiy <rbogorodskiy@apache.org>
uid          Roman Bogorodskiy <rbogorodskiy@gridynamics.com>
sub 2048R/EC4ED237 2010-12-03
```

D.3.30 Renato Botelho <garga@FreeBSD.org>

```
pub 1024D/2244EDA9 2003-12-16 [expires: 2015-10-18]
    Key fingerprint = 4006 C844 BC51 AD75 CE60 6E24 E824 5B89 2244 EDA9
uid          Renato Botelho <garga@FreeBSD.org>
uid          Renato Botelho <rbgarga@gmail.com>
uid          Renato Botelho <garga@freebsdbrasil.com.br>
uid          Renato Botelho <renato@galle.com.br>
uid          Renato Botelho <freebsd@galle.com.br>
uid          Renato Botelho <garga@brainsoft.com.br>
uid          Renato Botelho <garga.bsd@gmail.com>
sub 1024g/7B295760 2003-12-16
```

D.3.31 Alexander Botero-Lowry <alexbl@FreeBSD.org>

```
pub 1024D/12A95A7B 2006-09-13
    Key fingerprint = D0C3 47F8 AE87 C829 0613 3586 24DF F52B 12A9 5A7B
uid          Alexander Botero-Lowry <alexbl@FreeBSD.org>
sub 2048g/CA287923 2006-09-13
```

D.3.32 Sofian Brabez <sbz@FreeBSD.org>

```
pub 1024D/2487E57E 2011-03-15 [expires: 2012-03-14]
    Key fingerprint = 05BA DC7E F628 DE3F B241 BFBB 7363 51F4 2487 E57E
uid          Sofian Brabez <sbrabez@gmail.com>
uid          Sofian Brabez <sbz@FreeBSD.org>
uid          Sofian Brabez <sbz@6dev.net>
sub 1024g/06D39CF7 2011-03-15 [expires: 2012-03-14]
```

D.3.33 Hartmut Brandt <harti@FreeBSD.org>

```
pub 1024D/5920099F 2003-01-29 Hartmut Brandt <brandt@fokus.fraunhofer.de>
    Key fingerprint = F60D 09A0 76B7 31EE 794B BB91 082F 291D 5920 099F
uid          Hartmut Brandt <harti@freebsd.org>
sub 1024g/21D30205 2003-01-29
```

D.3.34 Oliver Braun <obraun@FreeBSD.org>

```
pub 1024D/EF25E1BA 2001-05-06 Oliver Braun <obraun@unsane.org>
    Key fingerprint = 6A3B 042A 732E 17E4 B6E7 3EAF C0B1 6B7D EF25 E1BA
uid          Oliver Braun <obraun@obraun.net>
uid          Oliver Braun <obraun@freebsd.org>
uid          Oliver Braun <obraun@haskell.org>
sub 1024g/09D28582 2001-05-06
```

D.3.35 Max Brazhnikov <makc@FreeBSD.org>

```
pub 1024D/ACB3CD12 2008-08-18
    Key fingerprint = 4BAA 200E 720A 0BD1 7BB0 9DFD FBD9 08C2 ACB3 CD12
uid          Max Brazhnikov <makc@FreeBSD.org>
uid          Max Brazhnikov <makc@issp.ac.ru>
sub 1024g/5FAA4088 2008-08-18
```

D.3.36 Jonathan M. Bresler <jmb@FreeBSD.org>

```
pub 1024R/97E638DD 1996-06-05 Jonathan M. Bresler <jmb@Bresler.org>
    Key fingerprint = 31 57 41 56 06 C1 40 13 C5 1C E3 E5 DC 62 0E FB
uid          Jonathan M. Bresler <jmb@FreeBSD.ORG>
uid          Jonathan M. Bresler
uid          Jonathan M. Bresler <Jonathan.Bresler@USi.net>
uid          Jonathan M. Bresler <jmb@Frb.GOV>
```

D.3.37 Antoine Brodin <antoine@FreeBSD.org>

```
pub 1024D/50CC2671 2008-02-03
   Key fingerprint = F3F7 72F0 9C4C 9E56 4BE9 44EA 1B80 31F3 50CC 2671
uid      Antoine Brodin <antoine@FreeBSD.org>
sub 2048g/6F4AFBE5 2008-02-03
```

D.3.38 Diane Bruce <db@FreeBSD.org>

```
pub 1024D/E08F5B15 2007-01-18
   Key fingerprint = A5FB 296B 5771 C1CD 6183 0FAB 77FF DCBE E08F 5B15
uid      Diane Bruce <db@db.net>
uid      Diane Bruce <db@FreeBSD.org>
sub 2048g/73281702 2007-01-18
```

D.3.39 Christian Brueffer <brueffer@FreeBSD.org>

```
pub 1024D/A0ED982D 2002-10-14 Christian Brueffer <chris@unixpages.org>
   Key fingerprint = A5C8 2099 19FF AAC A F41B B29B 6C76 178C A0ED 982D
uid      Christian Brueffer <brueffer@hitnet.rwth-aachen.de>
uid      Christian Brueffer <brueffer@FreeBSD.org>
sub 4096g/1DCC100F 2002-10-14
```

D.3.40 Markus Brueffer <markus@FreeBSD.org>

```
pub 1024D/78F8A8D4 2002-10-21
   Key fingerprint = 3F9B EBE8 F290 E5CC 1447 8760 D48D 1072 78F8 A8D4
uid      Markus Brueffer <markus@brueffer.de>
uid      Markus Brueffer <buff@hitnet.rwth-aachen.de>
uid      Markus Brueffer <mbrueffer@mi.rwth-aachen.de>
uid      Markus Brueffer <markus@FreeBSD.org>
sub 4096g/B7E5C7B6 2002-10-21
```

D.3.41 Oleg Bulyzhin <oleg@FreeBSD.org>

```
pub 1024D/78CE105F 2004-02-06
   Key fingerprint = 98CC 3E66 26DE 50A8 DBC4 EB27 AF22 DCEF 78CE 105F
uid      Oleg Bulyzhin <oleg@FreeBSD.org>
uid      Oleg Bulyzhin <oleg@rinet.ru>
sub 1024g/F747C159 2004-02-06
```

D.3.42 Michael Bushkov <bushman@FreeBSD.org>

```
pub 1024D/F694C6E4 2007-03-11 [expires: 2008-03-10]
    Key fingerprint = 4278 4392 BF6B 2864 C48E 0FA9 7216 C73C F694 C6E4
uid      Michael Bushkov <bushman@rsu.ru>
uid      Michael Bushkov <bushman@freebsd.org>
sub 2048g/5A783997 2007-03-11 [expires: 2008-03-10]
```

D.3.43 Jayachandran C. <jchandra@FreeBSD.org>

```
pub 1024D/3316E465 2010-05-19
    Key fingerprint = 320B DB08 4FE3 BCFD 60AF E4DB F486 015F 3316 E465
uid      Jayachandran C. <jchandra@freebsd.org>
sub 2048g/1F7755F9 2010-05-19
```

D.3.44 Jesus R. Camou <jcamou@FreeBSD.org>

```
pub 1024D/C2161947 2005-03-01
    Key fingerprint = 274C B265 48EC 42AE A2CA 47D9 7D98 588A C216 1947
uid      Jesus R. Camou <jcamou@FreeBSD.org>
sub 2048g/F8D2A8DF 2005-03-01
```

D.3.45 José Alonso Cárdenas Márquez <acm@FreeBSD.org>

```
pub 1024D/9B21BC19 2006-07-18
    Key fingerprint = 4156 2EAC A11C 9651 713B 3FC1 195F D4A8 9B21 BC19
uid      Jose Alonso Cardenas Marquez <acm@FreeBSD.org>
sub 2048g/ADA16C52 2006-07-18
```

D.3.46 Pietro Cerutti <gahr@FreeBSD.org>

```
pub 1024D/9571F78E 2006-05-17
    Key fingerprint = 1203 92B5 3919 AF84 9B97 28D6 C0C2 6A98 9571 F78E
uid      Pietro Cerutti <gahr@gahr.ch>
uid      Pietro Cerutti (The FreeBSD Project) <gahr@FreeBSD.org>
sub 2048g/F24227D5 2006-05-17 [expires: 2011-05-16]
```

D.3.47 Dmitry Chagin <dchagin@FreeBSD.org>

```
pub 1024D/738EFCED 2009-02-27
    Key fingerprint = 3F3F 8B87 CE09 9E10 3606 6ACA D2DD 936F 738E FCED
uid      Dmitry Chagin <dchagin@freebsd.org>
uid      Dmitry Chagin (dchagin key) <chagin.dmitry@gmail.com>
sub 2048g/6A3FDF9 2009-02-27
```

D.3.48 Hye-Shik Chang <perky@FreeBSD.org>

```
pub 1024D/CFDB4BA4 1999-04-23 Hye-Shik Chang <perky@FreeBSD.org>
    Key fingerprint = 09D9 57D6 58BA 44DD CAEC 71CD 0D65 2C59 CFDB 4BA4
uid                                     Hye-Shik Chang <hyeshik@gmail.com>
sub 1024g/A94A8ED1 1999-04-23
```

D.3.49 Jonathan Chen <jon@FreeBSD.org>

```
pub 1024D/2539468B 1999-10-11 Jonathan Chen <jon@spock.org>
    Key fingerprint = EE31 CDA1 A105 C8C9 5365 3DB5 C2FC 86AA 2539 468B
uid                                     Jonathan Chen <jon@freebsd.org>
uid                                     Jonathan Chen <chenj@rpi.edu>
uid                                     Jonathan Chen <spock@acm.rpi.edu>
uid                                     Jonathan Chen <jon@cs.rpi.edu>
sub 3072g/B81EF1DB 1999-10-11
```

D.3.50 Jonathan Anderson <jonathan@FreeBSD.org>

```
pub 1024D/E3BBCA48 2006-06-17
    Key fingerprint = D7C6 9096 874F 707E 48F8 FAB7 22A6 6E53 E3BB CA48
uid                                     Jonathan Anderson <jonathan@FreeBSD.org>
uid                                     Jonathan Anderson <jonathan.anderson@ieee.org>
uid                                     Jonathan Anderson <anderson@engr.mun.ca>
uid                                     Jonathan Anderson <jonathan.anderson@mun.ca>
sub 2048g/A703650D 2006-06-17
```

D.3.51 Fukang Chen <loader@FreeBSD.org>

```
pub 1024D/40AB1752 2007-08-01 [expires: 2010-07-31]
    Key fingerprint = 98C4 6E6B 1C21 15E4 5042 01FC C7B7 E152 40AB 1752
uid                                     loader <loader@FreeBSD.org>
sub 4096g/9E53A5C7 2007-08-01 [expires: 2010-07-31]
```

D.3.52 Luoqi Chen <luoqi@FreeBSD.org>

```
pub 1024D/2926F3BE 2002-02-22 Luoqi Chen <luoqi@FreeBSD.org>
    Key fingerprint = B470 A815 5917 D9F4 37F3 CE2A 4D75 3BD1 2926 F3BE
uid                                     Luoqi Chen <luoqi@bricore.com>
uid                                     Luoqi Chen <lchen@onetta.com>
sub 1024g/5446EB72 2002-02-22
```

D.3.53 Andrey A. Chernov <ache@FreeBSD.org>

```
pub 1024D/964474DD 2006-12-26
   Key fingerprint = 0F63 1B61 D76D AA23 1591 EA09 560E 582B 9644 74DD
uid      Andrey Chernov <ache@freebsd.org>
uid      [jpeg image of size 4092]
sub 2048g/08331894 2006-12-26
```

D.3.54 Alexander V. Chernikov <melifaro@FreeBSD.org>

```
pub 1024D/2675AB69 2008-02-17
   Key fingerprint = 00D2 E063 2FB0 2990 C602 50FD C1C2 7889 2675 AB69
uid      Alexander V. Chernikov <melifaro@yandex-team.ru>
uid      Alexander V. Chernikov <melifaro@ipfw.ru>
uid      Alexander V. Chernikov <melifaro@freebsd.org>
sub 4096g/BC64F40C 2008-02-17
```

D.3.55 Sean Chittenden <seanc@FreeBSD.org>

```
pub 1024D/EE278A28 2004-02-08 Sean Chittenden <sean@chittenden.org>
   Key fingerprint = E41F F441 7E91 6CBA 1844 65CF B939 3C78 EE27 8A28
sub 2048g/55321853 2004-02-08
```

D.3.56 Junho CHOI <cjh@FreeBSD.org>

```
pub 1024D/E60260F5 2002-10-14 CHOI Junho (Work) <cjh@wdb.co.kr>
   Key fingerprint = 1369 7374 A45F F41A F3C0 07E3 4A01 C020 E602 60F5
uid      CHOI Junho (Personal) <cjh@kr.FreeBSD.org>
uid      CHOI Junho (FreeBSD) <cjh@FreeBSD.org>
sub 1024g/04A4FDD8 2002-10-14
```

D.3.57 Crist J. Clark <cjc@FreeBSD.org>

```
pub 1024D/FE886AD3 2002-01-25 Crist J. Clark <cjclark@jhu.edu>
   Key fingerprint = F04E CCD7 3834 72C2 707F 0A8F 259F 8F4B FE88 6AD3
uid      Crist J. Clark <cjclark@alum.mit.edu>
uid      Crist J. Clark <cjc@freebsd.org>
sub 1024g/9B6BAB99 2002-01-25
```

D.3.58 Joe Marcus Clarke <marcus@FreeBSD.org>

```
pub 1024D/FE14CF87 2002-03-04 Joe Marcus Clarke (FreeBSD committer address) <marcus@FreeBSD.org>
   Key fingerprint = CC89 6407 73CC 0286 28E4 AFB9 6F68 8F8A FE14 CF87
uid      Joe Marcus Clarke <marcus@marcuscom.com>
```

sub 1024g/B9ACE4D2 2002-03-04

D.3.59 Nik Clayton <nik@FreeBSD.org>

```
pub 1024D/2C37E375 2000-11-09 Nik Clayton <nik@freebsd.org>
   Key fingerprint = 15B8 3FFC DDB4 34B0 AA5F 94B7 93A8 0764 2C37 E375
uid                               Nik Clayton <nik@slashdot.org>
uid                               Nik Clayton <nik@crf-consulting.co.uk>
uid                               Nik Clayton <nik@ngo.org.uk>
uid                               Nik Clayton <nik@bsd.i.com>
sub 1024g/769E298A 2000-11-09
```

D.3.60 Benjamin Close <benjsc@FreeBSD.org>

```
pub 1024D/4842B5B4 2002-04-10
   Key fingerprint = F00D C83D 5F7E 5561 DF91 B74D E602 CAA3 4842 B5B4
uid                               Benjamin Simon Close <Benjamin.Close@clearchain.com>
uid                               Benjamin Simon Close <benjsc@FreeBSD.org>
uid                               Benjamin Simon Close <benjsc@clearchain.com>
sub 2048g/3FA8A57E 2002-04-10
```

D.3.61 Tijl Coosemans <tijl@FreeBSD.org>

```
pub 2048D/20A0B62B 2010-07-13
   Key fingerprint = 39AA F580 6B44 5161 9F86 ED49 7E80 92D8 20A0 B62B
uid                               Tijl Coosemans <tijl@coosemans.org>
uid                               Tijl Coosemans <tijl@freebsd.org>
sub 2048g/7D71BA74 2010-07-13
```

D.3.62 Raphael Kubo da Costa <rakuco@FreeBSD.org>

```
pub 4096R/18DCEED6 2011-10-03
   Key fingerprint = 6911 54FE BA6E 6106 5789 7099 8DD0 7D21 18DC EED6
uid                               Raphael Kubo da Costa (Personal key) <rakuco@FreeBSD.org>
```

D.3.63 Bruce Cran <brucec@FreeBSD.org>

```
pub 2048R/6AF6F99E 2010-01-29
   Key fingerprint = 9A3C AE57 2706 B0E3 4B8A 8374 5787 A72B 6AF6 F99E
uid                               Bruce Cran <brucec@FreeBSD.org>
uid                               Bruce Cran <bruce@cran.org.uk>
sub 2048R/1D665CEE 2010-01-29
```

D.3.64 Frederic Culot <culot@FreeBSD.org>

```
pub 1024D/34876C5B 2006-08-26
   Key fingerprint = 50EE CE94 E43E BA85 CB67 262B B739 1A26 3487 6C5B
uid Frederic Culot <culot@FreeBSD.org>
uid Frederic Culot <frederic@culot.org>
sub 2048g/F1EF901F 2006-08-26
```

D.3.65 Aaron Dalton <aaron@FreeBSD.org>

```
pub 1024D/8811D2A4 2006-06-21 [expires: 2011-06-20]
   Key fingerprint = 8DE0 3CBB 3692 992F 53EF ACC7 BE56 0A4D 8811 D2A4
uid Aaron Dalton <aaron@freebsd.org>
sub 2048g/304EE8E5 2006-06-21 [expires: 2011-06-20]
```

D.3.66 Baptiste Daroussin <bapt@FreeBSD.org>

```
pub 1024D/49A4E84C 2008-11-19
   Key fingerprint = A14B A5FC B860 86DE 73E2 B24C F244 ED31 49A4 E84C
uid Baptiste Daroussin <bapt@etoilebsd.net>
uid Baptiste Daroussin <baptiste.daroussin@gmail.com>
uid Baptiste Daroussin <bapt@FreeBSD.org>
sub 2048g/54AB46B4 2008-11-19
```

D.3.67 Ceri Davies <ceri@FreeBSD.org>

```
pub 1024D/34B7245F 2002-03-08
   Key fingerprint = 9C88 EB05 A908 1058 A4AE 9959 A1C7 DCC1 34B7 245F
uid Ceri Davies <ceri@submonkey.net>
uid Ceri Davies <ceri@FreeBSD.org>
uid Ceri Davies <ceri@opensolaris.org>
sub 1024g/0C482CBC 2002-03-08
```

D.3.68 Brad Davis <brd@FreeBSD.org>

```
pub 1024D/ED0A754D 2005-05-14 [expires: 2014-02-21]
   Key fingerprint = 5DFD D1A6 BEEE A6D4 B3F5 4236 D362 3291 ED0A 754D
uid Brad Davis <sol4k@sol4k.com>
uid Brad Davis <brd@FreeBSD.org>
sub 2048g/1F29D404 2005-05-14 [expires: 2014-02-21]
```

D.3.69 Pawel Jakub Dawidek <pjd@FreeBSD.org>

```
pub 1024D/B1293F34 2004-02-02 Pawel Jakub Dawidek <Pawel@Dawidek.net>
   Key fingerprint = A3A3 5B4D 9CF9 2312 0783 1B1D 168A EF5D B129 3F34
uid                               Pawel Jakub Dawidek <pjd@FreeBSD.org>
uid                               Pawel Jakub Dawidek <pjd@FreeBSD.pl>
sub 2048g/3EEC50A7 2004-02-02 [expires: 2006-02-01]
```

D.3.70 Brian S. Dean <bsd@FreeBSD.org>

```
pub 1024D/723BDEE9 2002-01-23 Brian S. Dean <bsd@FreeBSD.org>
   Key fingerprint = EF49 7ABE 47ED 91B3 FC3D 7EA5 4D90 2FF7 723B DEE9
sub 1024g/4B02F876 2002-01-23
```

D.3.71 Vasil Dimov <vd@FreeBSD.org>

```
pub 1024D/F6C1A420 2004-12-08
   Key fingerprint = B1D5 04C6 26CC 0D20 9525 14B8 170E 923F F6C1 A420
uid                               Vasil Dimov <vd@FreeBSD.org>
uid                               Vasil Dimov <vd@datamax.bg>
sub 4096g/A0148C94 2004-12-08
```

D.3.72 Roman Divacky <rdivacky@FreeBSD.org>

```
pub 1024D/3DC2044C 2006-11-15
   Key fingerprint = 6B61 25CA 49BC AAC5 21A9 FA7A 2D51 23E8 3DC2 044C
uid                               Roman Divacky <rdivacky@freebsd.org>
sub 2048g/39BDCE16 2006-11-15
```

D.3.73 Alexey Dokuchaev <danfe@FreeBSD.org>

```
pub 1024D/3C060B44 2004-08-23 Alexey Dokuchaev <danfe@FreeBSD.org>
   Key fingerprint = D970 08A4 922C 8D63 0C19 8D27 F421 76EE 3C06 0B44
sub 1024g/70BAE967 2004-08-23
```

D.3.74 Dima Dorfman <dd@FreeBSD.org>

```
pub 1024D/69FAE582 2001-09-04
   Key fingerprint = B340 8338 7DA3 4D61 7632 098E 0730 055B 69FA E582
uid                               Dima Dorfman <dima@trit.org>
uid                               Dima Dorfman <dima@unixfreak.org>
uid                               Dima Dorfman <dd@freebsd.org>
sub 2048g/65AF3B89 2003-08-19 [expires: 2005-08-18]
sub 2048g/8DB0CF2C 2005-05-29 [expires: 2007-05-29]
```

D.3.75 Bruno Ducrot <bruno@FreeBSD.org>

```
pub 1024D/7F463187 2000-12-29
    Key fingerprint = 7B79 E1D6 F5A1 6614 792F D906 899B 4D28 7F46 3187
uid          Ducrot Bruno (Poup Master) <ducrot@poupinou.org>
sub 1024g/40282874 2000-12-29
```

D.3.76 Alex Dupre <ale@FreeBSD.org>

```
pub 1024D/CE5F554D 1999-06-27 Alex Dupre <sysadmin@alexdupre.com>
    Key fingerprint = DE23 02EA 5927 D5A9 D793 2BA2 8115 E9D8 CE5F 554D
uid          Alex Dupre <ale@FreeBSD.org>
uid          [jpeg image of size 5544]
uid          Alex Dupre <ICQ:5431856>
sub 2048g/FD5E2D21 1999-06-27
```

D.3.77 Peter Edwards <peadar@FreeBSD.org>

```
pub 1024D/D80B4B3F 2004-03-01 Peter Edwards <peadar@FreeBSD.org>
    Key fingerprint = 7A8A 9756 903E BEF2 4D9E 3C94 EE52 52F7 D80B 4B3F
uid          Peter Edwards <pmedwards@eircom.net>
```

D.3.78 Josef El-Rayes <josef@FreeBSD.org>

```
pub 2048R/A79DB53C 2004-01-04 Josef El-Rayes <josef@FreeBSD.org>
    Key fingerprint = 58EB F5B7 2AB9 37FE 33C8 716B 59C5 22D9 A79D B53C
uid          Josef El-Rayes <josef@daemon.li>
```

D.3.79 Lars Engels <lme@FreeBSD.org>

```
pub 1024D/C0F769F8 2004-08-27
    Key fingerprint = 17FC 08E1 5E09 BD21 489E 2050 29CE 75DA C0F7 69F8
uid          Lars Engels <lars.engels@0x20.net>
sub 1024g/8AD5BF9D 2004-08-27
```

D.3.80 Udo Erdelhoff <ue@FreeBSD.org>

```
pub 1024R/E74FA871 1994-07-19 Udo Erdelhoff <uer@de.uu.net>
    Key fingerprint = 8C B1 80 CA 2C 52 73 81 FB A7 B4 03 C5 32 C8 67
uid          Udo Erdelhoff <ue@nathan.ruhr.de>
uid          Udo Erdelhoff <ue@freebsd.org>
uid          Udo Erdelhoff <uerdelho@eu.uu.net>
uid          Udo Erdelhoff <uerdelho@uu.net>
```

D.3.81 Ruslan Ermilov <ru@FreeBSD.org>

```
pub 1024D/996E145E 2004-06-02 Ruslan Ermilov (FreeBSD) <ru@FreeBSD.org>
    Key fingerprint = 274E D201 71ED 11F6 9CCB 0194 A917 E9CC 996E 145E
uid                                     Ruslan Ermilov (FreeBSD Ukraine) <ru@FreeBSD.org.ua>
uid                                     Ruslan Ermilov (IPNet) <ru@ip.net.ua>
sub 1024g/557E3390 2004-06-02 [expires: 2007-06-02]
```

D.3.82 Lukas Ertl <le@FreeBSD.org>

```
pub 1024D/F10D06CB 2000-11-23 Lukas Ertl <le@FreeBSD.org>
    Key fingerprint = 20CD C5B3 3A1D 974E 065A B524 5588 79A9 F10D 06CB
uid                                     Lukas Ertl <a9404849@unet.univie.ac.at>
uid                                     Lukas Ertl <l.ertl@univie.ac.at>
uid                                     Lukas Ertl <le@univie.ac.at>
sub 1024g/5960CE8E 2000-11-23
```

D.3.83 Brendan Fabeny <bf@FreeBSD.org>

```
pub 2048R/9806EBC1 2010-06-08 [expires: 2012-06-07]
    Key fingerprint = 2075 ADD3 7634 A4F9 5357 D934 08E7 06D9 9806 EBC1
uid                                     b. f. <bf@freebsd.org>
sub 2048R/1CD0AD79 2010-06-08 [expires: 2012-06-07]
```

D.3.84 Rong-En Fan <rafan@FreeBSD.org>

```
pub 1024D/86FD8C68 2004-06-04
    Key fingerprint = DC9E 5B4D 2DDA D5C7 B6F8 6E69 D78E 1091 86FD 8C68
uid                                     Rong-En Fan <rafan@infor.org>
uid                                     Rong-En Fan <rafan@csie.org>
uid                                     Rong-En Fan <rafan@FreeBSD.org>
sub 2048g/42A8637E 2009-01-25 [expires: 2012-07-08]
```

D.3.85 Stefan Farfeleder <stefanf@FreeBSD.org>

```
pub 1024D/8BEFD15F 2004-03-14 Stefan Farfeleder <stefan@fafoe.narf.at>
    Key fingerprint = 4220 FE60 A4A1 A490 5213 27A6 319F 8B28 8BEF D15F
uid                                     Stefan Farfeleder <stefanf@complang.tuwien.ac.at>
uid                                     Stefan Farfeleder <stefanf@FreeBSD.org>
uid                                     Stefan Farfeleder <stefanf@ten15.org>
sub 2048g/418753E9 2004-03-14 [expires: 2007-03-14]
```

D.3.86 Babak Farrokhi <farrokhi@FreeBSD.org>

```
pub 1024D/7C810476 2005-12-22
   Key fingerprint = AABD 388F A207 58B4 2EE3 5DFD 4FC1 32C3 7C81 0476
uid          Babak Farrokhi <farrokhi@FreeBSD.org>
uid          Babak Farrokhi <babak@farrokhi.net>
sub 2048g/2A5F93C7 2005-12-22
```

D.3.87 Chris D. Faulhaber <jedgar@FreeBSD.org>

```
pub 1024D/FE817A50 2000-12-20 Chris D. Faulhaber <jedgar@FreeBSD.org>
   Key fingerprint = A47D A838 9216 F921 A456 54FF 39B6 86E0 FE81 7A50
uid          Chris D. Faulhaber <jedgar@fxp.org>
sub 2048g/93452698 2000-12-20
```

D.3.88 Brian F. Feldman <green@FreeBSD.org>

```
pub 1024D/41C13DE3 2000-01-11 Brian Fundakowski Feldman <green@FreeBSD.org>
   Key fingerprint = 6A32 733A 1BF6 E07B 5B8D AE14 CC9D DCA2 41C1 3DE3
sub 1024g/A98B9FCC 2000-01-11 [expires: 2001-01-10]

pub 1024D/773905D6 2000-09-02 Brian Fundakowski Feldman <green@FreeBSD.org>
   Key fingerprint = FE23 7481 91EA 5E58 45EA 6A01 B552 B043 7739 05D6
sub 2048g/D2009B98 2000-09-02
```

D.3.89 Mário Sérgio Fujikawa Ferreira <lioux@FreeBSD.org>

```
pub 1024D/75A63712 2006-02-23 [expires: 2007-02-23]
   Key fingerprint = 42F2 2F74 8EF9 5296 898F C981 E9CF 463B 75A6 3712
uid          Mario Sergio Fujikawa Ferreira (lioux) <lioux@FreeBSD.org>
uid          Mario Sergio Fujikawa Ferreira <lioux@uol.com.br>
sub 4096g/BB7D80F2 2006-02-23 [expires: 2007-02-23]
```

D.3.90 Tony Finch <fanf@FreeBSD.org>

```
pub 1024D/84C71B6E 2002-05-03 Tony Finch <dot@dotat.at>
   Key fingerprint = 199C F25B 2679 6D04 63C5 2159 FFC0 F14C 84C7 1B6E
uid          Tony Finch <fanf@FreeBSD.org>
uid          Tony Finch <fanf@apache.org>
uid          Tony Finch <fanf2@cam.ac.uk>
sub 2048g/FD101E8B 2002-05-03
```

D.3.91 Marc Fonvieille <blackend@FreeBSD.org>

```
pub 1024D/4F8E74E8 2004-12-25 Marc Fonvieille <blackend@FreeBSD.org>
    Key fingerprint = 55D3 4883 4A04 828A A139 A5CF CD0F 51C0 4F8E 74E8
uid                                     Marc Fonvieille <marc@blackend.org>
uid                                     Marc Fonvieille <marc@freebsd-fr.org>
sub 1024g/37AD4E7D 2004-12-25
```

D.3.92 Pete Fritchman <petef@FreeBSD.org>

```
pub 1024D/74B91CFD 2001-01-30 Pete Fritchman <petef@FreeBSD.org>
    Key fingerprint = 9A9F 8A13 DB0D 7777 8D8E 1CB2 C5C9 A08F 74B9 1CFD
uid                                     Pete Fritchman <petef@databits.net>
uid                                     Pete Fritchman <petef@csh.rit.edu>
sub 1024g/0C02AF0C 2001-01-30
```

D.3.93 Bernhard Fröhlich <decke@FreeBSD.org>

```
pub 1024D/CF5840D4 2008-01-07 [expires: 2015-05-05]
    Key fingerprint = 47F6 BDF1 DF9E 81E2 2C54 8A06 E796 7A5A CF58 40D4
uid                                     Bernhard Fröhlich <decke@FreeBSD.org>
uid                                     Bernhard Fröhlich <decke@bluelife.at>
sub 2048g/4E51CE79 2008-01-07
```

D.3.94 Bill Fumerola <billf@FreeBSD.org>

```
pub 1024D/7F868268 2000-12-07 Bill Fumerola (FreeBSD Developer) <billf@FreeBSD.org>
    Key fingerprint = 5B2D 908E 4C2B F253 DAEB FC01 8436 B70B 7F86 8268
uid                                     Bill Fumerola (Security Yahoo) <fumerola@yahoo-inc.com>
sub 1024g/43980DA9 2000-12-07
```

D.3.95 Andriy Gapon <avg@FreeBSD.org>

```
pub 2048R/A651FE2F 2009-02-16
    Key fingerprint = F234 4D58 DEFF 5E3A 4E0F 13BC 74A5 2D27 A651 FE2F
uid                                     Andriy Gapon (FreeBSD) <avg@FreeBSD.org>
uid                                     Andriy Gapon (FreeBSD) <avg@freebsd.org>
uid                                     Andriy Gapon (FreeBSD) <avg@icyb.net.ua>
sub 4096R/F9A4D312 2009-02-16
```

D.3.96 Beat Gätzi <beat@FreeBSD.org>

```
pub 1024D/774249DB 2009-01-28 [expires: 2014-01-27]
    Key fingerprint = C410 3187 5B29 DD02 745F 0890 40C5 BCF7 7742 49DB
uid      Beat Gaetzi <beat@FreeBSD.org>
sub 2048g/173CFFCA 2009-01-28 [expires: 2014-01-27]
```

D.3.97 Daniel Geržo <danger@FreeBSD.org>

```
pub 1024D/DA913352 2007-08-30 [expires: 2008-08-29]
    Key fingerprint = 7372 3F15 F839 AFF5 4052 CAC7 1ADA C204 DA91 3352
uid      Daniel Gerzo <gerzo@rulez.sk>
uid      Daniel Gerzo <danger@rulez.sk>
uid      Daniel Gerzo (The FreeBSD Project) <danger@FreeBSD.org>
uid      Daniel Gerzo (Micronet, a.s.) <gerzo@micronet.sk>
sub 2048g/C5D57BDC 2007-08-30 [expires: 2008-08-29]
```

D.3.98 Philip M. Gollucci <pgollucci@FreeBSD.org>

```
pub 1024D/DB9B8C1C 2008-04-15
    Key fingerprint = B90B FBC3 A3A1 C71A 8E70 3F8C 75B8 8FFB DB9B 8C1C
uid      Philip M. Gollucci (FreeBSD Foundation) <pgollucci@freebsd.org>
uid      Philip M. Gollucci (Riderway Inc.) <pgollucci@riderway.com>
uid      Philip M. Gollucci <pgollucci@p6m7g8.com>
uid      Philip M. Gollucci (ASF) <pgollucci@apache.org>
sub 2048g/73943732 2008-04-15
```

D.3.99 Daichi GOTO <daichi@FreeBSD.org>

```
pub 1024D/09EBADD6 2002-09-25 Daichi GOTO <daichi@freebsd.org>
    Key fingerprint = 620A 9A34 57FB 5E93 0828 28C7 C360 C6ED 09EB ADD6
sub 1024g/F0B1F1CA 2002-09-25
```

D.3.100 Marcus Alves Grando <mnag@FreeBSD.org>

```
pub 1024D/CDCC273F 2005-09-15 [expires: 2010-09-14]
    Key fingerprint = 57F9 DEC1 5BBF 06DE 44A5 9A4A 8BEE 5F3A CDCC 273F
uid      Marcus Alves Grando <marcus@sbh.eng.br>
uid      Marcus Alves Grando <marcus@corp.grupos.com.br>
uid      Marcus Alves Grando <mnag@FreeBSD.org>
sub 2048g/698AC00C 2005-09-15 [expires: 2010-09-14]
```

D.3.101 Peter Grehan <grehan@FreeBSD.org>

```
pub 1024D/EA45EA7D 2004-07-13 Peter Grehan <grehan@freebsd.org>
   Key fingerprint = 84AD 73DC 370E 15CA 7556 43C8 F5C8 4450 EA45 EA7D
sub 2048g/0E122D70 2004-07-13
```

D.3.102 Jamie Gritton <jamie@FreeBSD.org>

```
pub 1024D/8832CB7F 2009-01-29
   Key fingerprint = 34F8 1E62 C7A5 7CB9 A91F 7864 8C5A F85E 8832 CB7F
uid                               James Gritton <jamie@FreeBSD.org>
sub 2048g/94E3594D 2009-01-29
```

D.3.103 John-Mark Gurney <jmg@FreeBSD.org>

```
pub 1024R/3F9951F5 1997-02-11 John-Mark Gurney <johnmark@gladstone.uoregon.edu>
   Key fingerprint = B7 EC EF F8 AE ED A7 31 96 7A 22 B3 D8 56 36 F4
uid                               John-Mark Gurney <gurney_j@efn.org>
uid                               John-Mark Gurney <jmg@cs.uoregon.edu>
uid                               John-Mark Gurney <gurney_j@resnet.uoregon.edu>
```

D.3.104 Daniel Harris <dannyboy@FreeBSD.org>

```
pub 1024D/84D0D7E7 2001-01-15 Daniel Harris <dannyboy@worksforfood.com>
   Key fingerprint = 3C61 B8A1 3F09 D194 3259 7173 6C63 DA04 84D0 D7E7
uid                               Daniel Harris <dannyboy@freebsd.org>
uid                               Daniel Harris <dh@askdh.com>
uid                               Daniel Harris <dh@wordassault.com>
sub 1024g/9DF0231A 2001-01-15
```

D.3.105 Daniel Hartmeier <dhartmei@FreeBSD.org>

```
pub 1024R/6A3A7409 1994-08-15 Daniel Hartmeier <dhartmei@freebsd.org>
   Key fingerprint = 13 7E 9A F3 36 82 09 FE FD 57 B8 5C 2B 81 7E 1F
```

D.3.106 Olli Hauer <ohauer@FreeBSD.org>

```
pub 2048R/5D008F1A 2010-07-26
   Key fingerprint = E9EE C9A5 EB4C BD29 74D7 9178 E56E 06B3 5D00 8F1A
uid                               olli hauer <ohauer@FreeBSD.org>
uid                               olli hauer <ohauer@gmx.de>
sub 2048R/5E25776E 2010-07-26
```

D.3.107 Emanuel Haupt <ehaupt@FreeBSD.org>

```
pub 2048R/C06D09BE 2010-09-24 [expires: 2011-09-24]
    Key fingerprint = CC88 5081 78D1 39C3 B467 865A 348E F6CC C06D 09BE
uid Emanuel Haupt <ehaupt@FreeBSD.org>
sub 2048R/F658659F 2010-09-24 [expires: 2011-09-24]
```

D.3.108 John Hay <jhay@FreeBSD.org>

```
pub 2048R/A9275B93 2000-05-10 John Hay <jhay@icomtek.csir.co.za>
    Key fingerprint = E7 95 F4 B9 D4 A7 49 6A 83 B9 77 49 28 9E 37 70
uid John Hay <jhay@mikom.csir.co.za>
uid Thawte Freemail Member <jhay@mikom.csir.co.za>
uid John Hay <jhay@csir.co.za>
uid John Hay <jhay@FreeBSD.ORG>
```

D.3.109 Sheldon Hearn <sheldonh@FreeBSD.org>

```
pub 1024D/74A06ACD 2002-06-20 Sheldon Hearn <sheldonh@starjuice.net>
    Key fingerprint = 01A3 EF91 9C5A 3633 4E01 8085 A462 57F1 74A0 6ACD
sub 1536g/C42F8AC8 2002-06-20
```

D.3.110 Mike Heffner <mikeh@FreeBSD.org>

```
pub 1024D/CDECBF99 2001-02-02 Michael Heffner <mheffner@novacoxmail.com>
    Key fingerprint = AFAB CCEB 68C7 573F 5110 9285 1689 1942 CDEC BF99
uid Michael Heffner <mheffner@vt.edu>
uid Michael Heffner <mikeh@FreeBSD.org>
uid Michael Heffner <spock@techfour.net>
uid Michael Heffner (ACM sysadmin) <mheffner@acm.vt.edu>
sub 1024g/3FE83FB5 2001-02-02
```

D.3.111 Martin Heinen <mheinen@FreeBSD.org>

```
pub 1024D/116C5C85 2002-06-17 Martin Heinen <mheinen@freebsd.org>
    Key fingerprint = C898 3FCD EEA0 17ED BEA9 564D E5A6 AFF2 116C 5C85
uid Martin Heinen <martin@sumuk.de>
sub 1024g/EA67506B 2002-06-17
```

D.3.112 Niels Heinen <niels@FreeBSD.org>

```
pub 1024D/5FE39B80 2004-12-06 Niels Heinen <niels.heinen@ubizen.com>
    Key fingerprint = 75D8 4100 CF5B 3280 543F 930C 613E 71AA 5FE3 9B80
uid Niels Heinen <niels@defaced.be>
```

```
uid          Niels Heinen <niels@heinen.ws>
uid          Niels Heinen <niels@FreeBSD.org>
sub 2048g/057F4DA7 2004-12-06
```

D.3.113 Jaakko Heinonen <jh@FreeBSD.org>

```
pub 1024D/53CCB781 2009-10-01 [expires: 2014-09-30]
   Key fingerprint = 3AED A2B6 B63D D771 1AFD 25FA DFDF 5B89 53CC B781
uid          Jaakko Heinonen (FreeBSD) <jh@FreeBSD.org>
sub 4096g/BB97397E 2009-10-01 [expires: 2014-09-30]
```

D.3.114 Guy Helmer <ghelmer@FreeBSD.org>

```
pub 1024R/35F4ED2D 1997-01-26 Guy G. Helmer <ghelmer@freebsd.org>
   Key fingerprint = A2 59 4B 92 02 5B 9E B1 B9 4E 2E 03 29 D5 DC 3A
uid          Guy G. Helmer <ghelmer@cs.iastate.edu>
uid          Guy G. Helmer <ghelmer@palisadesys.com>
```

D.3.115 Maxime Henrion <mux@FreeBSD.org>

```
pub 1024D/881D4806 2003-01-09 Maxime Henrion <mux@FreeBSD.org>
   Key fingerprint = 81F1 BE2D 12F1 184A 77E4 ACD0 5563 7614 881D 4806
sub 2048g/D0B510C0 2003-01-09
```

D.3.116 Dennis Herrmann <dhn@FreeBSD.org>

```
pub 1024D/65181EA0 2008-09-07 [expires: 2009-03-06]
   Key fingerprint = D4DB A438 EB5E 1B26 C782 F969 820B 66B3 6518 1EA0
uid          Dennis Herrmann (Vi veri universum vivus vici) <adox@mcx2.org>
sub 4096g/C003C5DD 2008-09-07 [expires: 2009-03-06]
```

D.3.117 Peter Holm <pho@FreeBSD.org>

```
pub 1024D/CF244E81 2008-11-17
   Key fingerprint = BE9B 32D8 89F1 F285 00E4 E4C5 EF3F B4B5 CF24 4E81
uid          Peter Holm <pho@FreeBSD.org>
sub 2048g/E20A409F 2008-11-17
```

D.3.118 Michael L. Hostbaek <mich@FreeBSD.org>

```
pub 1024D/0F55F6BE 2001-08-07 Michael L. Hostbaek <mich@freebsdcluster.org>
   Key fingerprint = 4D62 9396 B19F 38D3 5C99 1663 7B0A 5212 0F55 F6BE
uid                               Michael L. Hostbaek <mich@freebsdcluster.dk>
uid                               Michael L. Hostbaek <mich@icommerce-france.com>
uid                               Micahel L. Hostbaek <mich@freebsd.dk>
uid                               Michael L. Hostbaek <mich@the-lab.org>
uid                               Michael L. Hostbaek <mich@freebsd.org>
sub 1024g/8BE4E30F 2001-08-07
```

D.3.119 Po-Chuan Hsieh <sunpoet@FreeBSD.org>

```
pub 4096R/CC57E36B 2010-09-21
   Key fingerprint = 8AD8 68F2 7D2B 0A10 7E9B 8CC0 DC44 247E CC57 E36B
uid                               Po-Chuan Hsieh (FreeBSD) <sunpoet@FreeBSD.org>
uid                               Po-Chuan Hsieh (sunpoet) <sunpoet@sunpoet.net>
sub 4096R/ADE9E203 2010-09-21
```

D.3.120 Li-Wen Hsu <lwhsu@FreeBSD.org>

```
pub 1024D/2897B228 2005-01-16
   Key fingerprint = B6F7 170A 6DC6 5D1A BD4B D86A 416B 0E39 2897 B228
uid                               Li-wen Hsu <lwhsu@lwhsu.org>
uid                               Li-wen Hsu <lwhsu@lwhsu.ckefgisc.org>
uid                               Li-wen Hsu <lwhsu@lwhsu.csie.net>
uid                               Li-wen Hsu <lwhsu@ckefgisc.org>
uid                               Li-wen Hsu <lwhsu@csie.nctu.edu.tw>
uid                               Li-wen Hsu <lwhsu@ccca.nctu.edu.tw>
uid                               Li-wen Hsu <lwhsu@iis.sinica.edu.tw>
uid                               Li-wen Hsu <lwhsu@cs.nctu.edu.tw>
uid                               Li-Wen Hsu <lwhsu@FreeBSD.org>
sub 2048g/16F82238 2005-01-16
```

D.3.121 Howard F. Hu <foxfair@FreeBSD.org>

```
pub 1024D/4E9BCA59 2003-09-01 Foxfair Hu <foxfair@FreeBSD.org>
   Key fingerprint = 280C A846 CA1B CAC9 DDCF F4CB D553 4BD5 4E9B CA59
uid                               Foxfair Hu <foxfair@drago.fomokka.net>
uid                               Howard Hu <howardhu@yahoo-inc.com>
sub 1024g/3356D8C1 2003-09-01
```

D.3.122 Chin-San Huang <chinsan@FreeBSD.org>

```
pub 1024D/350EECF8 2006-10-04
   Key fingerprint = 1C4D 0C9E 0E68 DB74 0688 CE43 D2A5 3F82 350E ECFA
uid Chin-San Huang (lab) <chinsan@chinsan2.twbbs.org>
uid Chin-San Huang (FreeBSD committer) <chinsan@FreeBSD.org>
uid Chin-San Huang (Gmail) <chinsan.tw@gmail.com>
sub 2048g/35F75A30 2006-10-04
```

D.3.123 Jordan K. Hubbard <jkh@FreeBSD.org>

```
pub 1024R/8E542D5D 1996-04-04 Jordan K. Hubbard <jkh@FreeBSD.org>
   Key fingerprint = 3C F2 27 7E 4A 6C 09 0A 4B C9 47 CD 4F 4D 0B 20
```

D.3.124 Konrad Jankowski <versus@FreeBSD.org>

```
pub 1024D/A01C218A 2008-10-28
   Key fingerprint = A805 21DC 859F E941 D2EA 9986 2264 8E5D A01C 218A
uid Konrad Jankowski <versus@freebsd.org>
sub 2048g/56AE1959 2008-10-28
```

D.3.125 Weongyo Jeong <weongyo@FreeBSD.org>

```
pub 1024D/22354D7A 2007-12-28
   Key fingerprint = 138E 7115 A86F AA40 B509 5883 B387 DCE9 2235 4D7A
uid Weongyo Jeong <weongyo.jeong@gmail.com>
uid Weongyo Jeong <weongyo@freebsd.org>
sub 2048g/9AE6DAEE 2007-12-28
```

D.3.126 Tatuya JINMEI <jinmei@FreeBSD.org>

```
pub 1024D/ABA82228 2002-08-15
   Key fingerprint = BB70 3050 EE39 BE00 48BB A5F3 5892 F203 ABA8 2228
uid JINMEI Tatuya <jinmei@FreeBSD.org>
uid JINMEI Tatuya <jinmei@jinmei.org>
uid JINMEI Tatuya (the KAME project) <jinmei@isl.rdc.toshiba.co.jp>
sub 1024g/8B43CF66 2002-08-15
```

D.3.127 Michael Johnson <ahze@FreeBSD.org>

```
pub 1024D/3C046FD6 2004-10-29 Michael Johnson (FreeBSD key) <ahze@FreeBSD.org>
   Key fingerprint = 363C 6ABA ED24 C23B 5F0C 3AB4 9F8B AA7D 3C04 6FD6
uid Michael Johnson (pgp key) <ahze@ahze.net>
sub 2048g/FA334AE3 2004-10-29
```

D.3.128 Trevor Johnson <trevor@FreeBSD.org>

```
pub 1024D/3A3EA137 2000-04-20 Trevor Johnson <trevor@jppj.net>
   Key fingerprint = 7ED1 5A92 76C1 FFCB E5E3 A998 F037 5A0B 3A3E A137
sub 1024g/46C24F1E 2000-04-20
```

D.3.129 Poul-Henning Kamp <phk@FreeBSD.org>

```
pub 1024R/0358FCBD 1995-08-01 Poul-Henning Kamp <phk@FreeBSD.org>
   Key fingerprint = A3 F3 88 28 2F 9B 99 A2 49 F4 E2 FA 5A 78 8B 3E
```

D.3.130 Sergey Kandaurov <pluknet@FreeBSD.org>

```
pub 2048R/10607419 2010-10-04
   Key fingerprint = 020B EC25 7E1F 8BC5 C42C 513B 3F4E 97BA 1060 7419
uid          Sergey Kandaurov (freebsd) <pluknet@freebsd.org>
uid          Sergey Kandaurov <pluknet@gmail.com>
sub 2048R/5711F73B 2010-10-04
```

D.3.131 Coleman Kane <cokane@FreeBSD.org>

```
pub 1024D/C5DAB797 2007-07-22
   Key fingerprint = FC09 F326 4318 E714 DE45 6CB0 70C4 B141 C5DA B797
uid          Coleman Kane (Personal PGP Key) <cokane@cokane.org>
uid          Coleman Kane (Personal PGP Key) <cokane@FreeBSD.org>
sub 2048g/5C680129 2007-07-22
```

D.3.132 Josef Karthausser <joe@FreeBSD.org>

```
pub 1024D/E6B15016 2000-10-19 Josef Karthausser <joe@FreeBSD.org>
   Key fingerprint = 7266 8EAF 82C2 D439 5642 AC26 5D52 1C8C E6B1 5016
uid          Josef Karthausser <joe@tao.org.uk>
uid          Josef Karthausser <joe@uk.FreeBSD.org>
uid          [revoked] Josef Karthausser <josef@bsd.i.com>
uid          [revoked] Josef Karthausser <joe@pavilion.net>
sub 2048g/1178B692 2000-10-19
```

D.3.133 Vinod Kashyap <vkashyap@FreeBSD.org>

```
pub 1024R/04FCCDD3 2004-02-19 Vinod Kashyap (gnupg key) <vkashyap@freebsd.org>
   Key fingerprint = 9B83 0B55 604F E491 B7D2 759D DF92 DAA0 04FC CDD3
```

D.3.134 Kris Kennaway <kris@FreeBSD.org>

```
pub 1024D/68E840A5 2000-01-14 Kris Kennaway <kris@citusc.usc.edu>
    Key fingerprint = E65D 0E7D 7E16 B212 1BD6 39EE 5ABC B405 68E8 40A5
uid                               Kris Kennaway <kris@FreeBSD.org>
uid                               Kris Kennaway <kris@obsecrity.org>
sub 2048g/03A41C45 2000-01-14 [expires: 2006-01-14]
```

D.3.135 Giorgos Keramidas <keramida@FreeBSD.org>

```
pub 1024D/318603B6 2001-09-21
    Key fingerprint = C1EB 0653 DB8B A557 3829 00F9 D60F 941A 3186 03B6
uid                               Giorgos Keramidas <keramida@FreeBSD.org>
uid                               Giorgos Keramidas <keramida@ceid.upatras.gr>
uid                               Giorgos Keramidas <keramida@hellug.gr>
uid                               Giorgos Keramidas <keramida@linux.gr>
uid                               Giorgos Keramidas <gkeramidas@gmail.com>
sub 1024g/50FDBAD1 2001-09-21
```

D.3.136 Max Khon <fjoe@FreeBSD.org>

```
pub 1024D/6B87E212 2009-02-17
    Key fingerprint = 124D EC6C 6365 D41A 497A 9C3E FCF3 8708 6B87 E212
uid                               Max Khon <fjoe@FreeBSD.org>
uid                               Max Khon <fjoe@samodelkin.net>
sub 2048g/CB71491D 2009-02-17
```

D.3.137 Manolis Kiagias <manolis@FreeBSD.org>

```
pub 1024D/6E0FB494 2006-08-22
    Key fingerprint = F820 5AAF 7112 2CDD 23D8 3BDF 67F3 311A 6E0F B494
uid                               Manolis Kiagias <manolis@FreeBSD.org>
uid                               Manolis Kiagias <sonicy@otenet.gr>
uid                               Manolis Kiagias (A.K.A. sonic, sonicy, sonic2000gr) <sonic@diktia.dyndns.org>
sub 2048g/EB94B411 2006-08-22
```

D.3.138 Jung-uk Kim <jkim@FreeBSD.org>

```
pub 1024D/BF6A9D53 2004-04-07
    Key fingerprint = F841 0339 93EF D27D 32AD 3261 9A56 B2D5 BF6A 9D53
uid                               Jung-uk Kim <jkim@FreeBSD.org>
uid                               Jung-uk Kim <jkim@niksun.com>
sub 4096g/B01CA5A0 2004-04-07
```

D.3.139 Zack Kirsch <zack@FreeBSD.org>

```
pub 1024D/1A725562 2010-11-05 Zack Kirsch <zack@freebsd.org>
   Key fingerprint = A8CC AA5E FB47 A386 E757 A2B8 BDD2 0684 1A72 5562
sub 1024g/6BFE2C06 2010-11-05
```

D.3.140 Jakub Klama <jceel@FreeBSD.org>

```
pub 2048R/2AAEA67D 2011-09-27
   Key fingerprint = 40D6 097A 174F 511B 80EB F3A3 0946 4193 2AAE A67D
uid                               Jakub Klama <jceel@FreeBSD.org>
sub 2048R/5291BC4D 2011-09-27
```

D.3.141 Andreas Klemm <andreas@FreeBSD.org>

```
pub 1024D/6C6F6CBA 2001-01-06 Andreas Klemm <andreas.klemm@eu.didata.com>
   Key fingerprint = F028 D51A 0D42 DD67 4109 19A3 777A 3E94 6C6F 6CBA
uid                               Andreas Klemm <andreas@klemm.gtn.com>
uid                               Andreas Klemm <andreas@FreeBSD.org>
uid                               Andreas Klemm <andreas@apsfilter.org>
sub 2048g/FE23F866 2001-01-06
```

D.3.142 Johann Kois <jkois@FreeBSD.org>

```
pub 1024D/DD61C2D8 2004-06-27 Johann Kois <J.Kois@web.de>
   Key fingerprint = 8B70 03DB 3C45 E71D 0ED4 4825 FEB0 EBEF DD61 C2D8
uid                               Johann Kois <jkois@freebsd.org>
sub 1024g/568307CB 2004-06-27
```

D.3.143 Sergei Kolobov <sergei@FreeBSD.org>

```
pub 1024D/3BA53401 2003-10-10 Sergei Kolobov <sergei@FreeBSD.org>
   Key fingerprint = A2F4 5F34 0586 CC9C 493A 347C 14EC 6E69 3BA5 3401
uid                               Sergei Kolobov <sergei@kolobov.com>
sub 2048g/F8243671 2003-10-10
```

D.3.144 Maxim Konovalov <maxim@FreeBSD.org>

```
pub 1024D/2C172083 2002-05-21 Maxim Konovalov <maxim@FreeBSD.org>
   Key fingerprint = 6550 6C02 EFC2 50F1 B7A3 D694 ECF0 E90B 2C17 2083
uid                               Maxim Konovalov <maxim@macomnet.ru>
sub 1024g/F305DDCA 2002-05-21
```

D.3.145 Taras Korenko <taras@FreeBSD.org>

```
pub 1024D/8ACCC68B 2010-03-30
   Key fingerprint = 5128 2A8B 9BC1 A664 21E0 1E61 D838 54D3 8ACC C68B
uid          Taras Korenko <taras@freebsd.org>
uid          Taras Korenko <ds@ukrhub.net>
uid          Taras Korenko <tarasishche@gmail.com>
sub 2048g/8D7CC0FA 2010-03-30 [expires: 2015-03-29]
```

D.3.146 Joseph Koshy <jkoshy@FreeBSD.org>

```
pub 1024D/D93798B6 2001-12-21 Joseph Koshy (FreeBSD) <jkoshy@freebsd.org>
   Key fingerprint = 0DE3 62F3 EF24 939F 62AA 2E3D ABB8 6ED3 D937 98B6
sub 1024g/43FD68E9 2001-12-21
```

D.3.147 Wojciech A. Koszek <wkoszek@FreeBSD.org>

```
pub 1024D/C9F25145 2006-02-15
   Key fingerprint = 6E56 C571 9D33 D23E 9A61 8E50 623C AD62 C9F2 5145
uid          Wojciech A. Koszek <dunstan@FreeBSD.czyst.pl>
uid          Wojciech A. Koszek <wkoszek@FreeBSD.org>
sub 4096g/3BBD20A5 2006-02-15
```

D.3.148 Steven Kreuzer <skreuzer@FreeBSD.org>

```
pub 1024D/E0D6F907 2009-03-16 [expires: 2013-04-25]
   Key fingerprint = 8D8F 14D6 ED9F 6BD0 7756 7A46 66BA B4B6 E0D6 F907
uid          Steven Kreuzer <skreuzer@exit2shell.com>
uid          Steven Kreuzer <skreuzer@freebsd.org>
```

D.3.149 Gábor Kövesdán <gabor@FreeBSD.org>

```
pub 1024D/2373A6B1 2006-12-05
   Key fingerprint = A42A 10D6 834B BEC0 26F0 29B1 902D D04F 2373 A6B1
uid          Gabor Kovesdan <gabor@FreeBSD.org>
sub 2048g/92B0A104 2006-12-05
```

D.3.150 Ana Kukec <anchie@FreeBSD.org>

```
pub 2048R/510D23BB 2010-04-18
   Key fingerprint = 0A9B 0ABB 0E1C B5A4 3408 398F 778A C3B4 510D 23BB
uid          Ana Kukec <anchie@FreeBSD.org>
sub 2048R/699E4DDA 2010-04-18
```

D.3.151 Roman Kurakin <rik@FreeBSD.org>

```
pub 1024D/C8550F4C 2005-12-16 [expires: 2008-12-15]
    Key fingerprint = 25BB 789A 6E07 E654 8E59 0FA9 42B1 937C C855 0F4C
uid          Roman Kurakin <rik@FreeBSD.org>
sub 2048g/D15F2AB6 2005-12-16 [expires: 2008-12-15]
```

D.3.152 Hideyuki KURASHINA <rushani@FreeBSD.org>

```
pub 1024D/439ADC57 2002-03-22 Hideyuki KURASHINA <rushani@bl.mmtr.or.jp>
    Key fingerprint = A052 6F98 6146 6FE3 91E2 DA6B F2FA 2088 439A DC57
uid          Hideyuki KURASHINA <rushani@FreeBSD.org>
uid          Hideyuki KURASHINA <rushani@jp.FreeBSD.org>
sub 1024g/64764D16 2002-03-22
```

D.3.153 Jun Kuriyama <kuriyama@FreeBSD.org>

```
pub 1024D/FE3B59CD 1998-11-23 Jun Kuriyama <kuriyama@imgsrc.co.jp>
    Key fingerprint = 5219 55CE AC84 C296 3A3B B076 EE3C 4DBB FE3B 59CD
uid          Jun Kuriyama <kuriyama@FreeBSD.org>
uid          Jun Kuriyama <kuriyama@jp.FreeBSD.org>
sub 2048g/1CF20D27 1998-11-23
```

D.3.154 René Ladan <rene@FreeBSD.org>

```
pub 1024D/E5642BFC 2008-11-03
    Key fingerprint = AD5C ECCD EB5F A6B4 549F 600D 8C9E 647A E564 2BFC
uid          René Ladan <rene@freebsd.org>
sub 2048g/C54EA560 2008-11-03
```

D.3.155 Julien Laffaye <jlaffaye@FreeBSD.org>

```
pub 2048R/6AEBE420 2011-06-06
    Key fingerprint = 031A B449 B383 5C3B B618 E2F4 BAD0 0F0E 6AEB E420
uid          Julien Laffaye <jlaffaye@FreeBSD.org>
sub 2048R/538B8D5B 2011-06-06
```

D.3.156 Clement Laforet <clement@FreeBSD.org>

```
pub 1024D/0723BA1D 2003-12-13 Clement Laforet (FreeBSD committer address) <clement@FreeBSD.org>
    Key fingerprint = 3638 4B14 8463 A67B DC7E 641C B118 5F8F 0723 BA1D
uid          Clement Laforet <sheepkiller@cultdeadsheep.org>
uid          Clement Laforet <clement.laforet@cotds.org>
sub 2048g/23D57658 2003-12-13
```

D.3.157 Max Laier <mlaier@FreeBSD.org>

```
pub 1024D/3EB6046D 2004-02-09
   Key fingerprint = 917E 7F25 E90F 77A4 F746 2E8D 5F2C 84A1 3EB6 046D
uid      Max Laier <max@love2party.net>
uid      Max Laier <max.laier@ira.uka.de>
uid      Max Laier <mlaier@freebsd.org>
uid      Max Laier <max.laier@tm.uka.de>
sub 4096g/EDD08B9B 2005-06-28
```

D.3.158 Erwin Lansing <erwin@FreeBSD.org>

```
pub 1024D/15256990 1998-07-03
   Key fingerprint = FB58 9797 299A F18E 2D3E 73D6 AB2F 5A5B 1525 6990
uid      Erwin Lansing <erwin@lansing.dk>
uid      Erwin Lansing <erwin@FreeBSD.org>
uid      Erwin Lansing <erwin@droso.dk>
uid      Erwin Lansing <erwin@droso.org>
uid      Erwin Lansing <erwin@aaaug.dk>
sub 2048g/7C64013D 1998-07-03
```

D.3.159 Ganael Laplanche <martymac@FreeBSD.org>

```
pub 1024D/10B87391 2006-01-13
   Key fingerprint = D59D 984D 8988 7BB9 DA37 BA77 757E D5F0 10B8 7391
uid      Ganael LAPLANCHE <ganael.laplanche@martymac.org>
uid      Ganael LAPLANCHE <martymac@martymac.com>
uid      Ganael LAPLANCHE <ganael.laplanche@martymac.com>
uid      Ganael LAPLANCHE <martymac@martymac.org>
uid      Ganael LAPLANCHE <martymac@pasteur.fr>
uid      Ganael LAPLANCHE <ganael.laplanche@pasteur.fr>
uid      Ganael LAPLANCHE <martymac@FreeBSD.org>
sub 2048g/D65069D5 2006-01-13
```

D.3.160 Greg Larkin <glarkin@FreeBSD.org>

```
pub 1024D/1C940290 2003-10-09
   Key fingerprint = 8A4A 80AA F26C 8C2C D01B 94C6 D2C4 68B8 1C94 0290
uid      Greg Larkin (The FreeBSD Project) <glarkin@FreeBSD.org>
uid      Gregory C. Larkin (SourceHosting.Net, LLC) <glarkin@sourcehosting.net>
uid      [jpeg image of size 6695]
sub 2048g/47674316 2003-10-09
```

D.3.161 Frank J. Laszlo <laszlof@FreeBSD.org>

```
pub 4096R/012360EC 2006-11-06 [expires: 2011-11-05]
Key fingerprint = 3D93 21DB B5CC 1339 E4B4 1BC4 AD50 C17C 0123 60EC
uid Frank J. Laszlo <laszlof@FreeBSD.org>
```

D.3.162 Sam Lawrance <lawrance@FreeBSD.org>

```
pub 1024D/32708C59 2003-08-14
Key fingerprint = 1056 2A02 5247 64D4 538D 6975 8851 7134 3270 8C59
uid Sam Lawrance <lawrance@FreeBSD.org>
uid Sam Lawrance <boris@brooknet.com.au>
sub 2048g/0F9CCF92 2003-08-14
```

D.3.163 Nate Lawson <njl@FreeBSD.org>

```
pub 1024D/60E5AC11 2007-02-07
Key fingerprint = 18E2 7E5A FD6A 199B B08B E9FB 73C8 DB67 60E5 AC11
uid Nate Lawson <nate@root.org>
sub 2048g/CDBC7E1B 2007-02-07
```

D.3.164 Yen-Ming Lee <leeym@FreeBSD.org>

```
pub 1024D/93FA8BD6 2007-05-21
Key fingerprint = DEC4 6E7F 69C0 4AC3 21ED EE65 6C0E 9257 93FA 8BD6
uid Yen-Ming Lee <leeym@leeym.com>
sub 2048g/899A3931 2007-05-21
```

D.3.165 Sam Leffler <sam@FreeBSD.org>

```
pub 1024D/BD147743 2005-03-28
Key fingerprint = F618 F2FC 176B D201 D91C 67C6 2E33 A957 BD14 7743
uid Samuel J. Leffler <sam@freebsd.org>
sub 2048g/8BA91D05 2005-03-28
```

D.3.166 Jean-Yves Lefort <jylefort@FreeBSD.org>

```
pub 1024D/A3B8006A 2002-09-07
Key fingerprint = CC99 D1B0 8E44 293D 32F7 D92E CB30 FB51 A3B8 006A
uid Jean-Yves Lefort <jylefort@FreeBSD.org>
uid Jean-Yves Lefort <jylefort@brutele.be>
sub 4096g/C9271AFC 2002-09-07
```

D.3.167 Alexander Leidinger <netchild@FreeBSD.org>

```
pub 1024D/72077137 2002-01-31
   Key fingerprint = AA3A 8F69 B214 6BBD 5E73 C9A0 C604 3C56 7207 7137
uid      Alexander Leidinger <netchild@FreeBSD.org>
uid      [jpeg image of size 19667]
sub 2048g/8C9828D3 2002-01-31
```

D.3.168 Andrey V. Elsukov <ae@FreeBSD.org>

```
pub 2048R/10C8A17A 2010-05-29
   Key fingerprint = E659 1E1B 41DA 1516 F0C9 BC00 01C5 EA04 10C8 A17A
uid      Andrey V. Elsukov <ae@freebsd.org>
uid      Andrey V. Elsukov <bu7cher@yandex.ru>
sub 2048R/0F6D64C5 2010-05-29
```

D.3.169 Dejan Lesjak <lesi@FreeBSD.org>

```
pub 1024D/96C5221F 2004-08-18 Dejan Lesjak <lesi@FreeBSD.org>
   Key fingerprint = 2C5C 02EA 1060 1D6D 9982 38C0 1DA7 DBC4 96C5 221F
uid      Dejan Lesjak <dejan.lesjak@ijs.si>
sub 1024g/E0A69278 2004-08-18
```

D.3.170 Chuck Lever <cel@FreeBSD.org>

```
pub 1024D/8FFC2B87 2006-02-13
   Key fingerprint = 6872 923F 5012 F88B 394C 2F69 37B4 8171 8FFC 2B87
uid      Charles E. Lever <cel@freebsd.org>
sub 2048g/9BCE0459 2006-02-13
```

D.3.171 Greg Lewis <glewis@FreeBSD.org>

```
pub 1024D/1BB6D9E0 2002-03-05 Greg Lewis (FreeBSD) <glewis@FreeBSD.org>
   Key fingerprint = 2410 DA6D 5A3C D801 65FE C8DB DEEA 9923 1BB6 D9E0
uid      Greg Lewis <glewis@eyesbeyond.com>
sub 2048g/45E67D60 2002-03-05
```

D.3.172 Xin Li <delphij@FreeBSD.org>

```
pub 1024D/CAEEB8C0 2004-01-28
   Key fingerprint = 43B8 B703 B8DD 0231 B333 DC28 39FB 93A0 CAEE B8C0
uid      Xin LI <delphij@FreeBSD.org>
uid      Xin LI <delphij@frontfree.net>
uid      Xin LI <delphij@delphij.net>
```

```

uid          Xin LI <delphij@geekcn.org>

pub 1024D/42EA8A4B 2006-01-27 [expired: 2008-01-01]
Key fingerprint = F19C 2616 FA97 9C13 2581 C6F3 85C5 1CCE 42EA 8A4B
uid          Xin LI <delphij@geekcn.org>
uid          Xin LI <delphij@FreeBSD.org>
uid          Xin LI <delphij@delphij.net>

pub 1024D/18EDEBA0 2008-01-02 [expired: 2010-01-02]
Key fingerprint = 79A6 CF42 F917 DDCA F1C2 C926 8BEB DB04 18ED EBA0
uid          Xin LI <delphij@geekcn.org>
uid          Xin LI <delphij@FreeBSD.org>
uid          Xin LI <delphij@delphij.net>

pub 2048R/3FCA37C1 2010-01-10 [expires: 2012-01-10]
Key fingerprint = 27EA 5D6C 9398 BA7F B205 8F70 04CE F812 3FCA 37C1
uid          Xin LI <delphij@geekcn.org>
uid          Xin LI <delphij@delphij.net>
uid          Xin LI <delphij@FreeBSD.org>
sub 2048R/F956339F 2010-01-10 [expires: 2012-01-10]

```

D.3.173 Tai-hwa Liang <avatar@FreeBSD.org>

```

pub 1024R/F4013AB1 1998-05-13 Tai-hwa Liang <avatar@FreeBSD.org>
Key fingerprint = 5B 05 1D 37 7F 35 31 4E 5D 38 BD 07 10 32 B9 D0
uid          Tai-hwa Liang <avatar@mmlab.cse.yzu.edu.tw>

```

D.3.174 Ying-Chieh Liao <ijliao@FreeBSD.org>

```

pub 1024D/11C02382 2001-01-09 Ying-Chieh Liao <ijliao@CCCA.NCTU.edu.tw>
Key fingerprint = 4E98 55CC 2866 7A90 EFD7 9DA5 ACC6 0165 11C0 2382
uid          Ying-Chieh Liao <ijliao@FreeBSD.org>
uid          Ying-Chieh Liao <ijliao@csie.nctu.edu.tw>
uid          Ying-Chieh Liao <ijliao@dragon2.net>
uid          Ying-Chieh Liao <ijliao@tw.FreeBSD.org>
sub 4096g/C1E16E89 2001-01-09

```

D.3.175 Ulf Lilleengen <lulf@FreeBSD.org>

```

pub 1024D/ADE1B837 2009-08-19 [expires: 2014-08-18]
Key fingerprint = 3822 B4E6 6D1C 6F71 4AA8 7A27 ADDF C400 ADE1 B837
uid          Ulf Lilleengen <lulf.lilleengen@gmail.com>
uid          Ulf Lilleengen <lulf@pvv.ntnu.no>
uid          Ulf Lilleengen <lulf@stud.ntnu.no>
uid          Ulf Lilleengen <lulf@FreeBSD.org>
uid          Ulf Lilleengen <lulf@idi.ntnu.no>
sub 2048g/B5409122 2009-08-19 [expires: 2014-08-18]

```

D.3.176 Clive Lin <clive@FreeBSD.org>

```
pub 1024D/A008C03E 2001-07-30 Clive Lin <clive@tongi.org>
    Key fingerprint = FA3F 20B6 A77A 6CEC 1856 09B0 7455 2805 A008 C03E
uid                               Clive Lin <clive@CirX.ORG>
uid                               Clive Lin <clive@FreeBSD.org>
sub 1024g/03C2DC87 2001-07-30 [expires: 2005-08-25]
```

D.3.177 Yi-Jheng Lin <yzlin@FreeBSD.org>

```
pub 2048R/A34C6A8A 2009-07-20
    Key fingerprint = 7E3A E981 BB7C 5D73 9534 ED39 0222 04D3 A34C 6A8A
uid                               Yi-Jheng Lin (FreeBSD) <yzlin@FreeBSD.org>
sub 2048R/B4D776FE 2009-07-20
```

D.3.178 Mark Linimon <linimon@FreeBSD.org>

```
pub 1024D/84C83473 2003-10-09
    Key fingerprint = 8D43 1B55 D127 0BFC 842E 1C96 803C 5A34 84C8 3473
uid                               Mark Linimon <linimon@FreeBSD.org>
uid                               Mark Linimon <linimon@lonesome.com>
sub 1024g/24BFF840 2003-10-09
```

D.3.179 Tilman Keskinöz <arved@FreeBSD.org>

```
pub 1024D/807AC53A 2002-06-03 [expires: 2013-09-07]
    Key fingerprint = A92F 344F 31A8 B8DE DDFA 7FB4 7C22 C39F 807A C53A
uid                               Tilman Keskinöz <arved@arved.at>
uid                               Tilman Keskinöz <arved@FreeBSD.org>
sub 1024g/FA351986 2002-06-03 [expires: 2013-09-07]
```

D.3.180 Dryice Liu <dryice@FreeBSD.org>

```
pub 1024D/77B67874 2005-01-28
    Key fingerprint = 8D7C F82D D28D 07E5 EF7F CD25 6B5B 78A8 77B6 7874
uid                               Dryice Dong Liu (Dryice) <dryice@FreeBSD.org>
uid                               Dryice Dong Liu (Dryice) <dryice@liu.com.cn>
uid                               Dryice Dong Liu (Dryice) <dryice@hotpop.com>
uid                               Dryice Dong Liu (Dryice) <dryiceliu@gmail.com>
uid                               Dryice Dong Liu (Dryice) <dryice@dryice.name>
sub 2048g/ECFA49E4 2005-01-28
```

D.3.181 Tong Liu <nemoliu@FreeBSD.org>

```
pub 1024D/ECC7C907 2007-07-10
   Key fingerprint = B62E 3109 896B B283 E2FA 60FE A1BA F92E ECC7 C907
uid          Tong LIU <nemoliu@FreeBSD.org>
sub 4096g/B6D7B15D 2007-07-10
```

D.3.182 Zachary Loafman <zml@FreeBSD.org>

```
pub 1024D/4D65492D 2009-05-26
   Key fingerprint = E513 4AE9 5D6D 8BF9 1CD3 4389 4860 D79B 4D65 492D
uid          Zachary Loafman <zml@FreeBSD.org>
sub 2048g/1AD659F0 2009-05-26
```

D.3.183 Juergen Lock <nox@FreeBSD.org>

```
pub 1024D/1B6BFbfd 2006-12-22
   Key fingerprint = 33A7 7FAE 51AF 00BC F0D3 ECCE FAFD 34C1 1B6B FBFD
uid          Juergen Lock <nox@FreeBSD.org>
sub 2048g/251229D1 2006-12-22
```

D.3.184 Remko Lodder <remko@FreeBSD.org>

```
pub 2048R/6EB8C8C8 2010-05-28 [expires: 2012-05-27]
   Key fingerprint = D692 91F9 F4EF D363 7F3F 4D17 9C75 DF7B 6EB8 C8C8
uid          Remko Lodder (Remko Lodder's Key) <remko@FreeBSD.org>
sub 2048R/011C6AA0 2010-05-28 [expires: 2012-05-27]
```

D.3.185 Alexander Logvinov <avl@FreeBSD.org>

```
pub 1024D/1C47D5C0 2009-05-28
   Key fingerprint = 8B5F 880A 382B 075E E707 9DB2 E135 4176 1C47 D5C0
uid          Alexander Logvinov <alexander@logvinov.com>
uid          Alexander Logvinov (FreeBSD Ports Committer) <avl@FreeBSD.org>
uid          Alexander Logvinov <ports@logvinov.com>
uid          Alexander Logvinov <logvinov@gmail.com>
uid          Alexander Logvinov <logvinov@yandex.ru>
sub 2048g/60BDD4BB 2009-05-28
```

D.3.186 Scott Long <scottl@FreeBSD.org>

```
pub 1024D/017C5EBF 2003-01-18 Scott A. Long (This is my official FreeBSD key) <scottl@freebsd.org>
   Key fingerprint = 34EA BD06 44F7 F8C3 22BC B52C 1D3A F6D1 017C 5EBF
sub 1024g/F61C8F91 2003-01-18
```

D.3.187 Rick Macklem <rmacklem@FreeBSD.org>

```
pub 1024D/7FB9C5F1 2009-04-05
   Key fingerprint = B9EA 767A F6F3 3786 E0C7 434A 05C6 70D6 7FB9 C5F1
uid                               Rick Macklem <rmacklem@freebsd.org>
sub 1024g/D0B20E8A 2009-04-05
```

D.3.188 Bruce A. Mah <bmah@FreeBSD.org>

```
pub 1024D/5BA052C3 1997-12-08
   Key fingerprint = F829 B805 207D 14C7 7197 7832 D8CA 3171 5BA0 52C3
uid                               Bruce A. Mah <bmah@acm.org>
uid                               Bruce A. Mah <bmah@ca.sandia.gov>
uid                               Bruce A. Mah <bmah@ieee.org>
uid                               Bruce A. Mah <bmah@cisco.com>
uid                               Bruce A. Mah <bmah@employees.org>
uid                               Bruce A. Mah <bmah@freebsd.org>
uid                               Bruce A. Mah <bmah@packetdesign.com>
uid                               Bruce A. Mah <bmah@kitchenlab.org>
sub 2048g/B4E60EA1 1997-12-08
```

D.3.189 Mike Makonnen <mtm@FreeBSD.org>

```
pub 1024D/7CD41F55 2004-02-06 Michael Telahun Makonnen <mtm@FreeBSD.Org>
   Key fingerprint = AC7B 5672 2D11 F4D0 EBF8 5279 5359 2B82 7CD4 1F55
uid                               Michael Telahun Makonnen <mtm@tmsa-inc.com>
uid                               Mike Makonnen <mtm@identd.net>
uid                               Michael Telahun Makonnen <mtm@acs-et.com>
sub 2048g/E7DC936B 2004-02-06
```

D.3.190 David Malone <dwmalone@FreeBSD.org>

```
pub 512/40378991 1994/04/21 David Malone <dwmalone@maths.tcd.ie>
   Key fingerprint = 86 A7 F4 86 39 2C 47 2C C1 C2 35 78 8E 2F B8 F5
```

D.3.191 Dmitry Marakasov <amdmi3@FreeBSD.org>

```
pub 1024D/F9D2F77D 2008-06-15 [expires: 2010-06-15]
   Key fingerprint = 55B5 0596 FF1E 8D84 5F56 9510 D35A 80DD F9D2 F77D
uid                               Dmitry Marakasov <amdmi3@amdmi3.ru>
uid                               Dmitry Marakasov <amdmi3@FreeBSD.org>
sub 2048g/2042CDD8 2008-06-15
```

D.3.192 Koop Mast <kwm@FreeBSD.org>

```
pub 1024D/F95426DA 2004-09-10 Koop Mast <kwm@rainbow-runner.nl>
    Key fingerprint = C66F 1835 0548 3440 8576 0FFE 6879 B7CD F954 26DA
uid                               Koop Mast <kwm@FreeBSD.org>
sub 1024g/A782EEDD 2004-09-10
```

D.3.193 Makoto Matsushita <matusita@FreeBSD.org>

```
pub 1024D/20544576 1999-04-18
    Key fingerprint = 71B6 13BF B262 2DD8 2B7C 6CD0 EB2D 4147 2054 4576
uid                               Makoto Matsushita <matusita@matatabi.or.jp>
uid                               Makoto Matsushita <matusita@FreeBSD.org>
uid                               Makoto Matsushita <matusita@jp.FreeBSD.ORG>
uid                               Makoto Matsushita <matusita@ist.osaka-u.ac.jp>
sub 1024g/F1F3C94D 1999-04-18
```

D.3.194 Martin Matuska <mm@FreeBSD.org>

```
pub 1024D/4261B0D1 2007-02-05
    Key fingerprint = 17C4 3F32 B3DE 3ED7 E84E 5592 A76B 8B03 4261 B0D1
uid                               Martin Matuska <martin@matuska.org>
uid                               Martin Matuska <mm@FreeBSD.org>
uid                               Martin Matuska <martin.matuska@wu-wien.ac.at>
sub 2048g/3AC9A5A6 2007-02-05
```

D.3.195 Sergey Matveychuk <sem@FreeBSD.org>

```
pub 1024D/B71F605D 1999-10-13
    Key fingerprint = 4704 F374 DB28 BEC6 51C8 1322 4DC9 4BD8 B71F 605D
uid                               Sergey Matveychuk <sem@FreeBSD.org>
uid                               Sergey Matveychuk <sem@ciam.ru>
uid                               Sergey Matveychuk <sem@core.inec.ru>
sub 2048g/DEAF9D91 1999-10-13
```

D.3.196 Tom McLaughlin <tmclaugh@FreeBSD.org>

```
pub 1024D/E2F7B3D8 2005-05-24
    Key fingerprint = 7692 B222 8D23 CF94 1993 0138 E339 E225 E2F7 B3D8
uid                               Tom McLaughlin (Personal email address) <tmclaugh@sdf.lonestar.org>
uid                               Tom McLaughlin (Work email address) <tmclaughlin@meditech.com>
uid                               Tom McLaughlin (FreeBSD email address) <tmclaugh@FreeBSD.org>
sub 2048g/16838F62 2005-05-24
```

D.3.197 Jean Milanez Melo <jmelo@FreeBSD.org>

```
pub 1024D/AA5114BF 2006-03-03
   Key fingerprint = 826D C2AA 6CF2 E29A EBE7 4776 D38A AB83 AA51 14BF
uid          Jean Milanez Melo <jmelo@FreeBSD.org>
uid          Jean Milanez Melo <jmelo@freebsdbrasil.com.br>
sub 4096g/E9E1CBD9 2006-03-03
```

D.3.198 Kenneth D. Merry <ken@FreeBSD.org>

```
pub 1024D/54C745B5 2000-05-15 Kenneth D. Merry <ken@FreeBSD.org>
   Key fingerprint = D25E EBC5 F17A 9E52 84B4 BF14 9248 F0DA 54C7 45B5
uid          Kenneth D. Merry <ken@kdm.org>
sub 2048g/89D0F797 2000-05-15

pub 1024R/2FA0A505 1995-10-30 Kenneth D. Merry <ken@plutotech.com>
   Key fingerprint = FD FA 85 85 95 C4 8E E8 98 1A CA 18 56 F0 00 1F
```

D.3.199 Dirk Meyer <dinoex@FreeBSD.org>

```
pub 1024R/331CDA5D 1995-06-04 Dirk Meyer <dinoex@FreeBSD.org>
   Key fingerprint = 44 16 EC 0A D3 3A 4F 28 8A 8A 47 93 F1 CF 2F 12
uid          Dirk Meyer <dirk.meyer@dinoex.sub.org>
uid          Dirk Meyer <dirk.meyer@guug.de>
```

D.3.200 Yoshiro Sanpei MIHIRA <sanpei@FreeBSD.org>

```
pub 1024R/391C5D69 1996-11-21 sanpei@SEAPLE.ICC.NE.JP
   Key fingerprint = EC 04 30 24 B0 6C 1E 63 5F 5D 25 59 3E 83 64 51
uid          MIHIRA Yoshiro <sanpei@sanpei.org>
uid          Yoshiro MIHIRA <sanpei@FreeBSD.org>
uid          MIHIRA Yoshiro <sanpei@yy.cs.keio.ac.jp>
uid          MIHIRA Yoshiro <sanpei@cc.keio.ac.jp>
uid          MIHIRA Yoshiro <sanpei@educ.cc.keio.ac.jp>
uid          MIHIRA Yoshiro <sanpei@st.keio.ac.jp>
```

D.3.201 Robert Millan <rmh@FreeBSD.org>

```
pub 4096R/DEA2C38E 2009-08-14
   Key fingerprint = A537 F029 AAAE 0E9C 39A7 C22C BB9D 98D9 DEA2 C38E
uid          Robert Millan <rmh@debian.org>
uid          Robert Millan <rmh@freebsd.org>
uid          Robert Millan <rmh@gnu.org>
sub 4096R/65A0A9CE 2009-08-14
sub 4096R/41F37946 2009-08-14
```

D.3.202 Stephen Montgomery-Smith <stephen@FreeBSD.org>

```
pub 2048R/9A92D807 2011-06-14
   Key fingerprint = 2B61 D82E 168E F08B 6E08 712E 2DF1 2BD1 9A92 D807
uid          Stephen Montgomery-Smith <stephen@freebsd.org>
sub 2048R/A4BA6560 2011-06-14
```

D.3.203 Marcel Moolenaar <marcel@FreeBSD.org>

```
pub 1024D/61EE89F6 2002-02-09 Marcel Moolenaar <marcel@xcllnt.net>
   Key fingerprint = 68BB E2B7 49AA FF69 CA3A DF71 A605 A52D 61EE 89F6
sub 1024g/6EAAB456 2002-02-09
```

D.3.204 Kris Moore <kmoore@FreeBSD.org>

```
pub 1024D/6294612C 2009-05-26
   Key fingerprint = 8B70 9876 346F 1F97 5687 6950 4C92 D789 6294 612C
uid          Kris Moore <kmoore@freebsd.org>
sub 2048g/A7FFE8FB 2009-05-26
```

D.3.205 Dmitry Morozovsky <marck@FreeBSD.org>

```
pub 1024D/6B691B03 2001-07-20
   Key fingerprint = 39AC E336 F03D C0F8 5305 B725 85D4 5045 6B69 1B03
uid          Dmitry Morozovsky <marck@rinet.ru>
uid          Dmitry Morozovsky <marck@FreeBSD.org>
sub 2048g/44D656F8 2001-07-20
```

D.3.206 Alexander Motin <mav@FreeBSD.org>

```
pub 1024D/0577BACA 2007-04-20 [expires: 2012-04-18]
   Key fingerprint = 0E84 B263 E97D 3E48 161B 98A2 D240 A09E 0577 BACA
uid          Alexander Motin <mav@freebsd.org>
uid          Alexander Motin <mav@mavhome.dp.ua>
uid          Alexander Motin <mav@alkar.net>
sub 2048g/4D59D1C2 2007-04-20 [expires: 2012-04-18]
```

D.3.207 Felipe de Meirelles Motta <lippe@FreeBSD.org>

```
pub 1024D/F2CF7DAE 2008-09-02 [expires: 2010-09-02]
   Key fingerprint = 0532 A900 286D DAFD 099D 394D 231B AF20 F2CF 7DAE
uid          Felipe de Meirelles Motta (FreeBSD Ports Committer) <lippe@FreeBSD.org>
sub 2048g/38E8EEF3 2008-09-02 [expires: 2010-09-02]
```

D.3.208 Rich Murphey <rich@FreeBSD.org>

pub 1024R/583443A9 1995-03-31 Rich Murphey <rich@lamprey.utmb.edu>
 Key fingerprint = AF A0 60 C4 84 D6 0C 73 D1 EF C0 E9 9D 21 DB E4

D.3.209 Akinori MUSHHA <knu@FreeBSD.org>

pub 1024D/9FD9E1EE 2000-03-21 Akinori MUSHHA <knu@and.or.jp>
 Key fingerprint = 081D 099C 1705 861D 4B70 B04A 920B EFC7 9FD9 E1EE
 uid Akinori MUSHHA <knu@FreeBSD.org>
 uid Akinori MUSHHA <knu@idaemons.org>
 uid Akinori MUSHHA <knu@ruby-lang.org>
 sub 1024g/71BA9D45 2000-03-21

D.3.210 Thomas Möstl <tmml@FreeBSD.org>

pub 1024D/419C776C 2000-11-28 Thomas Moestl <tmml@FreeBSD.org>
 Key fingerprint = 1C97 A604 2BD0 E492 51D0 9C0F 1FE6 4F1D 419C 776C
 uid Thomas Moestl <tmoestl@gmx.net>
 uid Thomas Moestl <t.moestl@tu-bs.de>
 sub 2048g/ECE63CE6 2000-11-28

D.3.211 Masafumi NAKANE <max@FreeBSD.org>

pub 1024D/CE356B59 2000-02-19 Masafumi NAKANE <max@wide.ad.jp>
 Key fingerprint = EB40 BCAB 4CE5 0764 9942 378C 9596 159E CE35 6B59
 uid Masafumi NAKANE <max@FreeBSD.org>
 uid Masafumi NAKANE <max@accessibility.org>
 uid Masafumi NAKANE <kd5pdi@qsl.net>
 sub 1024g/FA9BD48B 2000-02-19

D.3.212 Maho Nakata <maho@FreeBSD.org>

pub 1024D/F28B4069 2009-02-09
 Key fingerprint = 3FE4 99A9 6F41 8161 4F5F 240C 8615 A60C F28B 4069
 uid Maho NAKATA (NAKATA's FreeBSD.org alias) <maho@FreeBSD.org>
 sub 2048g/6B49098E 2009-02-09

D.3.213 Yoichi NAKAYAMA <yoichi@FreeBSD.org>

pub 1024D/E0788E46 2000-12-28 Yoichi NAKAYAMA <yoichi@assist.media.nagoya-u.ac.jp>
 Key fingerprint = 1550 2662 46B3 096C 0460 BC03 800D 0C8A E078 8E46
 uid Yoichi NAKAYAMA <yoichi@eken.phys.nagoya-u.ac.jp>
 uid Yoichi NAKAYAMA <yoichi@FreeBSD.org>

sub 1024g/B987A394 2000-12-28

D.3.214 Edward Tomasz Napierala <trasz@FreeBSD.org>

pub 1024D/8E53F00E 2007-04-13
Key fingerprint = DD8F 91B0 12D9 6237 42D9 DBE1 AFC8 CDE9 8E53 F00E
uid Edward Tomasz Napierala <trasz@FreeBSD.org>
sub 2048g/7C1F5D67 2007-04-13

D.3.215 Alexander Nedotsukov <bland@FreeBSD.org>

pub 1024D/D004116C 2003-08-14 Alexander Nedotsukov <bland@FreeBSD.org>
Key fingerprint = 35E2 5020 55FC 2071 4ADD 1A4A 86B6 8A5D D004 116C
sub 1024g/1CCA8D46 2003-08-14

D.3.216 George V. Neville-Neil <gnn@FreeBSD.org>

pub 1024D/440A33D2 2002-09-17
Key fingerprint = AF66 410F CC8D 1FC9 17DB 6225 61D8 76C1 440A 33D2
uid George V. Neville-Neil <gnn@freebsd.org>
uid George V. Neville-Neil <gnn@neville-neil.com>
sub 2048g/95A74F6E 2002-09-17

D.3.217 Simon L. Nielsen <simon@FreeBSD.org>

pub 1024D/FF7490AB 2007-01-14
Key fingerprint = 4E92 BA8D E45E 85E2 0380 B264 049C 7480 FF74 90AB
uid Simon L. Nielsen <simon@FreeBSD.org>
uid Simon L. Nielsen <simon@nitro.dk>
sub 2048g/E3F5A76E 2007-01-14

D.3.218 Robert Noland <rnoland@FreeBSD.org>

pub 1024D/8A9F44E3 2007-07-24
Key fingerprint = 107A 0C87 E9D0 E581 677B 2A28 3384 EB43 8A9F 44E3
uid Robert C. Noland III <rnoland@FreeBSD.org>
uid Robert C. Noland III (Personal Key) <rnoland@2hip.net>
sub 2048g/76C3CF00 2007-07-24

D.3.219 Anders Nordby <anders@FreeBSD.org>

```
pub 1024D/00835956 2000-08-13 Anders Nordby <anders@fix.no>
    Key fingerprint = 1E0F C53C D8DF 6A8F EAAD 19C5 D12A BC9F 0083 5956
uid                                Anders Nordby <anders@FreeBSD.org>
sub 2048g/4B160901 2000-08-13
```

D.3.220 Michael Nottebrock <lofi@FreeBSD.org>

```
pub 1024D/6B2974B0 2002-06-06 Michael Nottebrock <michaelnottebrock@gmx.net>
    Key fingerprint = 1079 3C72 0726 F300 B8EC 60F9 5E17 3AF1 6B29 74B0
uid                                Michael Nottebrock <lofi@freebsd.org>
uid                                Michael Nottebrock <lofi@tigress.com>
uid                                Michael Nottebrock <lofi@lofi.dyndns.org>
uid                                Michael Nottebrock <michaelnottebrock@web.de>
uid                                Michael Nottebrock <michaelnottebrock@meitner.wh.uni-dortmund.de>
sub 1024g/EF652E04 2002-06-06 [expires: 2004-06-15]
```

D.3.221 David O'Brien <obrien@FreeBSD.org>

```
pub 1024R/34F9F9D5 1995-04-23 David E. O'Brien <defunct - obrien@Sea.Legent.com>
    Key fingerprint = B7 4D 3E E9 11 39 5F A3 90 76 5D 69 58 D9 98 7A
uid                                David E. O'Brien <obrien@NUXI.com>
uid                                deobrien@ucdavis.edu
uid                                David E. O'Brien <whois Do38>
uid                                David E. O'Brien <obrien@FreeBSD.org>
uid                                David E. O'Brien <dobrien@seas.gwu.edu>
uid                                David E. O'Brien <obrien@cs.ucdavis.edu>
uid                                David E. O'Brien <defunct - obrien@media.sra.com>
uid                                David E. O'Brien <obrien@elsewhere.roanoke.va.us>
uid                                David E. O'Brien <obrien@Nuxi.com>

pub 1024D/7F9A9BA2 1998-06-10 "David E. O'Brien" <obrien@cs.ucdavis.edu>
    Key fingerprint = 02FD 495F D03C 9AF2 5DB7 F496 6FC8 DABD 7F9A 9BA2
uid                                "David E. O'Brien" <obrien@NUXI.com>
uid                                "David E. O'Brien" <obrien@FreeBSD.org>
sub 3072g/BA32C20D 1998-06-10
```

D.3.222 Philip Paeps <philip@FreeBSD.org>

```
pub 4096R/C5D34D05 2006-10-22
    Key fingerprint = 356B AE02 4763 F739 2FA2 E438 2649 E628 C5D3 4D05
uid                                Philip Paeps <philip@paeps.cx>
uid                                Philip Paeps <philip@nixsys.be>
uid                                Philip Paeps <philip@fosdem.org>
uid                                Philip Paeps <philip@freebsd.org>
uid                                Philip Paeps <philip@pub.telenet.be>
sub 1024D/035EFC58 2006-10-22 [expires: 2010-10-13]
```

sub 2048g/6E5FD7D6 2006-10-22 [expires: 2010-10-14]

D.3.223 Josh Paetzel <jpaetzel@FreeBSD.org>

```
pub 1024D/27AFAECB 2007-05-11
   Key fingerprint = 8A48 EF36 5E9F 4EDA 5A8C 11B4 26F9 01F1 27AF AECB
uid      Josh Paetzel (BSD UNIX) <josh@tcbug.org>
uid      Josh Paetzel <josh@rephunter.net>
uid      Josh Paetzel <josh@pcbsd.org>
uid      Josh Paetzel <jpaetzel@FreeBSD.org>
sub 2048g/E0F5996B 2007-05-11
```

D.3.224 Gábor Páli <pgj@FreeBSD.org>

```
pub 1024D/9E3F9BE6 2008-04-17 [expires: 2013-04-16]
   Key fingerprint = DA0B 2143 0FC8 EE5F E211 D329 7D4B 6E18 9E3F 9BE6
uid      Gabor PALI <pgj@FreeBSD.org>
uid      PÁLI Gábor János <pali.gabor@gmail.com>
sub 2048g/A780C60B 2008-04-17 [expires: 2013-04-16]
```

D.3.225 Hiten Pandya <hmp@FreeBSD.org>

```
pub 1024D/938CACA8 2004-02-13 Hiten Pandya (FreeBSD) <hmp@FreeBSD.org>
   Key fingerprint = 84EB C75E C75A 50ED 304E E446 D974 7842 938C ACA8
uid      Hiten Pandya <hmp@backplane.com>
sub 2048g/783874B5 2004-02-13
```

D.3.226 Dima Panov <fluffy@FreeBSD.org>

```
pub 1024D/93E3B018 2006-11-08
   Key fingerprint = C73E 2B72 1FFD 61BD E206 1234 A626 76ED 93E3 B018
uid      Dima Panov (FreeBSD.ORG Committer) <fluffy@FreeBSD.ORG>
uid      Dima Panov (at home) <Fluffy@Fluffy.Khv.RU>
uid      Dima Panov (at home) <fluffy.khv@gmail.com>
sub 2048g/89047419 2006-11-08

pub 4096R/D5398F29 2009-08-09
   Key fingerprint = 2D30 2CCB 9984 130C 6F87 BAFC FB8B A09D D539 8F29
uid      Dima Panov (FreeBSD.ORG Committer) <fluffy@FreeBSD.ORG>
uid      Dima Panov (at Home) <fluffy@Fluffy.Khv.RU>
uid      Dima Panov (at GMail) <fluffy.khv@gmail.com>
sub 4096R/915A7785 2009-08-09
```

D.3.227 Andrew Pantyukhin <sat@FreeBSD.org>

```
pub 1024D/6F38A569 2006-05-06
   Key fingerprint = 4E94 994A C2EF CB86 C144 3B04 3381 67C0 6F38 A569
uid      Andrew Pantyukhin <infofarmer@gubkin.ru>
uid      Andrew Pantyukhin <sat@FreeBSD.org>
uid      Andrew Pantyukhin <infofarmer@gmail.com>
uid      Andrew Pantyukhin <infofarmer@mail.ru>
sub 2048g/5BD4D469 2006-05-06
```

D.3.228 Navdeep Parhar <np@FreeBSD.org>

```
pub 1024D/ACAB8812 2009-06-08
   Key fingerprint = C897 7AFB AFC0 4DA9 7B76 D991 CAB2 2B93 ACAB 8812
uid      Navdeep Parhar <np@FreeBSD.org>
sub 2048g/AB61D2DC 2009-06-08
```

D.3.229 Rui Paulo <rpaulo@FreeBSD.org>

```
pub 4096R/39CB4153 2010-02-03
   Key fingerprint = ABE8 8465 DE8F F04D E9C8 3FF6 AF89 B2E6 39CB 4153
uid      Rui Paulo <rpaulo@FreeBSD.org>
uid      Rui Paulo <rpaulo@gmail.com>
sub 4096R/F87D2F34 2010-02-03
```

D.3.230 Mark Peek <mp@FreeBSD.org>

```
pub 1024D/330D4D01 2002-01-27 Mark Peek <mp@FreeBSD.org>
   Key fingerprint = 510C 96EE B4FB 1B0A 2CF8 A0AF 74B0 0B0E 330D 4D01
sub 1024g/9C6CAC09 2002-01-27
```

D.3.231 Peter Pentchev <roam@FreeBSD.org>

```
pub 1024D/16194553 2002-02-01
   Key fingerprint = FDDB FD79 C26F 3C51 C95E DF9E ED18 B68D 1619 4553
uid      Peter Pentchev <roam@ringlet.net>
uid      Peter Pentchev <roam@cnsys.bg>
uid      Peter Pentchev <roam@sbnd.net>
uid      Peter Pentchev <roam@online.bg>
uid      Peter Pentchev <roam@orbitel.bg>
uid      Peter Pentchev <roam@FreeBSD.org>
uid      Peter Pentchev <roam@techlab.officel.bg>
uid      Peter Pentchev <roam@hoster.bg>
uid      Peter Pentchev <roam@space.bg>
sub 1024g/7074473C 2002-02-01
```

```
pub 4096R/2527DF13 2009-10-16
Key fingerprint = 2EE7 A7A5 17FC 124C F115 C354 651E EFB0 2527 DF13
uid Peter Pentchev <roam@ringlet.net>
uid Peter Pentchev <roamer@users.sourceforge.net>
uid Peter Pentchev <roam@cpan.org>
uid Peter Pentchev <roam@cnsys.bg>
uid Peter Pentchev <roam@sbnd.net>
uid Peter Pentchev <roam@online.bg>
uid Peter Pentchev <roam@orbite1.bg>
uid Peter Pentchev <roam@FreeBSD.org>
uid Peter Pentchev <roam@techlab.officel.bg>
uid Peter Pentchev <roam@hoster.bg>
uid Peter Pentchev <roam@space.bg>
uid Peter Pentchev <roam-guest@alioth.debian.org>
uid Peter Pentchev <ppentchev@alumni.princeton.edu>
sub 4096R/D0B337AA 2009-10-16
```

D.3.232 Denis Peplin <den@FreeBSD.org>

```
pub 1024D/485DDDF5 2003-09-11 Denis Peplin <den@FreeBSD.org>
Key fingerprint = 495D 158C 8EC9 C2C1 80F5 EA96 6F72 7C1C 485D DDF5
sub 1024g/E70BA158 2003-09-11
```

D.3.233 Christian S.J. Peron <csjp@FreeBSD.org>

```
pub 1024D/033FA33C 2009-05-16
Key fingerprint = 74AA 6040 89A7 936E D970 DDC0 CC71 6954 033F A33C
uid Christian S.J. Peron <csjp@FreeBSD.ORG>
sub 2048g/856B194A 2009-05-16
```

D.3.234 Gerald Pfeifer <gerald@FreeBSD.org>

```
pub 1024D/745C015A 1999-11-09 Gerald Pfeifer <gerald@pfeifer.com>
Key fingerprint = B215 C163 3BCA 0477 615F 1B35 A5B3 A004 745C 015A
uid Gerald Pfeifer <Gerald.Pfeifer@vibe.at>
uid Gerald Pfeifer <pfeifer@dbai.tuwien.ac.at>
uid Gerald Pfeifer <gerald@pfeifer.at>
uid Gerald Pfeifer <gerald@FreeBSD.org>
sub 1536g/F0156927 1999-11-09
```

D.3.235 Giuseppe Pilichi <jacula@FreeBSD.org>

```
pub 4096R/8B9F4B8B 2006-03-08
Key fingerprint = 31AD 73AE 0EC0 16E5 4108 8391 D942 5F20 8B9F 4B8B
uid Giuseppe Pilichi (Jacula Modyun) <jacula@FreeBSD.org>
uid Giuseppe Pilichi (Jacula Modyun) <jaculamodyun@gmail.com>
```

```
uid      Giuseppe Pilichi (Jacula Modyun) <gpilch@gmail.com>
uid      Giuseppe Pilichi (Jacula Modyun) <jacula@gmail.com>
sub      4096R/FB4D05A3 2006-03-08
```

D.3.236 John Polstra <jdp@FreeBSD.org>

```
pub      1024R/BFBCF449 1997-02-14 John D. Polstra <jdp@polstra.com>
Key fingerprint = 54 3A 90 59 6B A4 9D 61 BF 1D 03 09 35 8D F6 0D
```

D.3.237 Kirill Ponomarew <krion@FreeBSD.org>

```
pub      1024D/AEB426E5 2002-04-07
Key fingerprint = 58E7 B953 57A2 D9DD 4960 2A2D 402D 46E9 AEB4 26E5
uid      Kirill Ponomarew <krion@voodoo.bawue.com>
uid      Kirill Ponomarew <krion@guug.de>
uid      Kirill Ponomarew <krion@FreeBSD.org>
sub      1024D/05AC7CA0 2006-01-30 [expires: 2008-01-30]
sub      2048g/C3EE5537 2006-01-30 [expires: 2008-01-30]
```

D.3.238 Stephane E. Potvin <sepotvin@FreeBSD.org>

```
pub      1024D/3097FE7B 2002-08-06
Key fingerprint = 6B56 62FA ADE1 6F46 BB62 8B1C 99D3 97B5 3097 FE7B
uid      Stephane E. Potvin <sepotvin@videotron.ca>
uid      Stephane E. Potvin <stephane.potvin@telcobridges.com>
uid      Stephane E. Potvin <stephane_potvin@telcobridges.com>
uid      Stephane E. Potvin <sepotvin@FreeBSD.org>
sub      2048g/0C427BC9 2002-08-06
```

D.3.239 Mark Pulford <markp@FreeBSD.org>

```
pub      1024D/182C368F 2000-05-10 Mark Pulford <markp@FreeBSD.org>
Key fingerprint = 58C9 C9BF C758 D8D4 7022 8EF5 559F 7F7B 182C 368F
uid      Mark Pulford <mark@kyne.com.au>
sub      2048g/380573E8 2000-05-10
```

D.3.240 Alejandro Pulver <alepulver@FreeBSD.org>

```
pub      1024D/945C3F61 2005-11-13
Key fingerprint = 085F E8A2 4896 4B19 42A4 4179 895D 3912 945C 3F61
uid      Alejandro Pulver (Ale's GPG key pair) <alepulver@FreeBSD.org>
uid      Alejandro Pulver (Ale's GPG key pair) <alejandro@varnet.biz>
sub      2048g/6890C6CA 2005-11-13
```

D.3.241 Thomas Quinot <thomas@FreeBSD.org>

```
pub 1024D/393D2469 1999-09-23 Thomas Quinot <thomas@cuivre.fr.eu.org>
  Empreinte de la clé = 4737 A0AD E596 6D30 4356 29B8 004D 54B8 393D 2469
uid                               Thomas Quinot <thomas@debian.org>
uid                               Thomas Quinot <thomas@FreeBSD.org>
sub 1024g/8DE13BB2 1999-09-23
```

D.3.242 Herve Quiroz <hq@FreeBSD.org>

```
pub 1024D/85AC8A80 2004-07-22 Herve Quiroz <hq@FreeBSD.org>
  Key fingerprint = 14F5 BC56 D736 102D 41AF A07B 1D97 CE6C 85AC 8A80
uid                               Herve Quiroz <herve.quiroz@esil.univ-mrs.fr>
sub 1024g/8ECCAFED 2004-07-22
```

D.3.243 Doug Rabson <dfr@FreeBSD.org>

```
pub 1024D/59F57821 2004-02-07
  Key fingerprint = 9451 C4FE 1A7E 117B B95F 1F8F B123 456E 59F5 7821
uid                               Doug Rabson <dfr@nlsystems.com>
sub 1024g/6207AA32 2004-02-07
```

D.3.244 Lars Balker Rasmussen <lbr@FreeBSD.org>

```
pub 1024D/9EF6F27F 2006-04-30
  Key fingerprint = F251 28B7 897C 293E 04F8 71EE 4697 F477 9EF6 F27F
uid                               Lars Balker Rasmussen <lbr@FreeBSD.org>
sub 2048g/A8C1CFD4 2006-04-30
```

D.3.245 Chris Rees <crees@FreeBSD.org>

```
pub 2048R/E1EBCAC4 2011-06-11 [expires: 2012-06-10]
  Key fingerprint = 2066 B855 E4B1 226A 8B4C B6E6 B084 92D1 E1EB CAC4
uid                               Chris Rees <crees@freebsd.org>
sub 2048R/FA45D5D6 2011-06-11 [expires: 2012-06-10]
```

D.3.246 Jim Rees <rees@FreeBSD.org>

```
pub 512/B623C791 1995/02/21 Jim Rees <rees@umich.edu>
  Key fingerprint = 02 5F 1B 15 B4 6E F1 3E F1 C5 E0 1D EA CC 17 88
```

D.3.247 Benedict Reuschling <bcr@FreeBSD.org>

```
pub 1024D/4A819348 2009-05-24
   Key fingerprint = 2D8C BDF9 30FA 75A5 A0DF D724 4D26 502E 4A81 9348
uid          Benedict Reuschling <bcr@FreeBSD.org>
sub 2048g/8DA16EDD 2009-05-24
```

D.3.248 Tom Rhodes <trhodes@FreeBSD.org>

```
pub 1024D/FB7D88E1 2008-05-07
   Key fingerprint = 8279 3100 2DF2 F00E 7FDD AC2C 5776 23AB FB7D 88E1
uid          Tom Rhodes (trhodes) <trhodes@FreeBSD.org>
sub 4096g/7B0CD79F 2008-05-07
```

D.3.249 Benno Rice <benno@FreeBSD.org>

```
pub 1024D/87C59909 2002-01-16 Benno Rice <benno@FreeBSD.org>
   Key fingerprint = CE27 DADA 08E3 FAA3 88F1 5B31 5E34 705A 87C5 9909
uid          Benno Rice <benno@jeamland.net>
sub 1024g/4F7C2BAD 2002-01-16 [expires: 2007-01-15]
```

D.3.250 Beech Rintoul <beech@FreeBSD.org>

```
pub 1024D/ECBFDC44 2011-08-29
   Key fingerprint = 6921 47CC 8B61 7C02 70EF 4D00 16B4 EAB7 ECBF DC44
uid          Beech Rintoul <beech@freebsd.org>
sub 1024g/F1FD1C3D 2011-08-29
```

D.3.251 Matteo Riondato <matteo@FreeBSD.org>

```
pub 1024D/1EC56BEC 2003-01-05 [expires: 2009-09-07]
   Key fingerprint = F0F3 1B43 035D 65B1 08E9 4D66 D8CA 78A5 1EC5 6BEC
uid          Matteo Riondato (Rionda) <matteo@FreeBSD.ORG>
uid          Matteo Riondato (Rionda) <rionda@riondabsd.net>
uid          Matteo Riondato (Rionda) <rionda@gufi.org>
uid          Matteo Riondato (Rionda) <matteo@riondato.com>
uid          Matteo Riondato (Rionda) <rionda@riondato.com>
uid          Matteo Riondato (Rionda) <rionda@FreeSBIE.ORG>
uid          Matteo Riondato (Rionda) <rionda@autistici.org>
sub 2048g/87C44A55 2008-09-23 [expires: 2009-09-23]
```

D.3.252 Ollivier Robert <roberto@FreeBSD.org>

```
pub 1024D/7DCAE9D3 1997-08-21
    Key fingerprint = 2945 61E7 D4E5 1D32 C100 DBEC A04F FB1B 7DCA E9D3
uid      Ollivier Robert <roberto@keltia.freenix.fr>
uid      Ollivier Robert <roberto@FreeBSD.org>
sub 2048g/C267084D 1997-08-21
```

D.3.253 Craig Rodrigues <rodrigc@FreeBSD.org>

```
pub 1024D/3998479D 2005-05-20
    Key fingerprint = F01F EBE6 F5C8 6DC2 954F 098F D20A 8A2A 3998 479D
uid      Craig Rodrigues <rodrigc@freebsd.org>
uid      Craig Rodrigues <rodrigc@crodrigues.org>
sub 2048g/AA77E09B 2005-05-20
```

D.3.254 Guido van Rooij <guido@FreeBSD.org>

```
pub 1024R/599F323D 1996-05-18 Guido van Rooij <guido@gvr.org>
    Key fingerprint = 16 79 09 F3 C0 E4 28 A7 32 62 FA F6 60 31 C0 ED
uid      Guido van Rooij <guido@gvr.win.tue.nl>

pub 1024D/A95102C1 2000-10-25 Guido van Rooij <guido@madison-gurkha.nl>
    Key fingerprint = 5B3E 51B7 0E7A D170 0574 1E51 2471 117F A951 02C1
uid      Guido van Rooij <guido@madison-gurkha.com>
sub 1024g/A5F20553 2000-10-25
```

D.3.255 Eygene Ryabinkin <rea@FreeBSD.org>

```
pub 3072D/8152ECFB 2010-10-27
    Key fingerprint = 82FE 06BC D497 C0DE 49EC 4FF0 16AF 9EAE 8152 ECFB
uid      Eygene Ryabinkin <rea-fbsd@codelabs.ru>
uid      Eygene Ryabinkin <rea@freebsd.org>
uid      Eygene Ryabinkin <rea@codelabs.ru>
sub 3072g/5FC03749 2010-10-27
```

D.3.256 Aleksandr Rybalko <ray@FreeBSD.org>

```
pub 2048R/4B7B7A4E 2011-05-24
    Key fingerprint = BB9F D01D 7327 0B33 B2F5 6C72 EC49 E6ED 4B7B 7A4E
uid      Aleksandr Rybalko (Aleksandr Rybalko FreeBSD project identification) <ray@fr
sub 2048R/99F9F9EF 2011-05-24
```

D.3.257 Niklas Saers <niklas@FreeBSD.org>

```
pub 1024D/C822A476 2004-03-09 Niklas Saers <niklas@saers.com>
   Key fingerprint = C41E F734 AF0E 3D21 7499 9EB1 9A31 2E7E C822 A476
sub 1024g/81E2FF36 2004-03-09
```

D.3.258 Boris Samorodov <bsam@FreeBSD.org>

```
pub 1024D/ADFD5C9A 2006-06-21
   Key fingerprint = 81AA FED0 6050 208C 0303 4007 6C03 7263 ADFD 5C9A
uid                               Boris Samorodov (FreeBSD) <bsam@freebsd.org>
sub 2048g/7753A3F1 2006-06-21
```

D.3.259 Mark Santcroos <marks@FreeBSD.org>

```
pub 1024D/DBE7EB8E 2005-03-08
   Key fingerprint = C0F0 44F3 3F15 520F 6E32 186B BE0A BA42 DBE7 EB8E
uid                               Mark Santcroos <marks@ripe.net>
uid                               Mark Santcroos <mark@santcroos.net>
uid                               Mark Santcroos <marks@freebsd.org>
sub 2048g/FFF80F85 2005-03-08
```

D.3.260 Bernhard Schmidt <bschmidt@FreeBSD.org>

```
pub 1024D/5F754FBC 2009-06-15
   Key fingerprint = 6B87 C8A9 6BA5 6B18 11CF 8C38 A1B7 0731 5F75 4FBC
uid                               Bernhard Schmidt <bschmidt@FreeBSD.org>
uid                               Bernhard Schmidt <bschmidt@techwires.net>
sub 1024g/1945DC1D 2009-06-15
```

D.3.261 Wolfram Schneider <wosch@FreeBSD.org>

```
Type Bits/KeyID   Date       User ID
pub 1024/2B7181AD 1997/08/09 Wolfram Schneider <wosch@FreeBSD.org>
   Key fingerprint = CA 16 91 D9 75 33 F1 07 1B F0 B4 9F 3E 95 B6 09
```

D.3.262 Ed Schouten <ed@FreeBSD.org>

```
pub 4096R/3491A2BB 2011-03-12 [expires: 2016-03-10]
   Key fingerprint = A110 5982 A887 74A2 F4B1 D70A 6E5E D8FE 3491 A2BB
uid                               Ed Schouten (The FreeBSD Project) <ed@FreeBSD.org>
uid                               Ed Schouten <ed@80386.nl>
sub 4096R/81BB41E6 2011-03-12 [expires: 2016-03-10]
```

D.3.263 David Schultz <das@FreeBSD.org>

```
pub 1024D/BE848B57 2001-07-19 David Schultz <das@FreeBSD.ORG>
    Key fingerprint = 0C12 797B A9CB 19D9 FDAF 2A39 2D76 A2DB BE84 8B57
uid David Schultz <dschultz@uclink.Berkeley.EDU>
uid David Schultz <das@FreeBSD.ORG>
sub 2048g/69206E8E 2001-07-19
```

D.3.264 Jens Schweikhardt <schweikh@FreeBSD.org>

```
pub 1024D/0FF231FD 2002-01-27 Jens Schweikhardt <schweikh@FreeBSD.org>
    Key fingerprint = 3F35 E705 F02F 35A1 A23E 330E 16FE EA33 0FF2 31FD
uid Jens Schweikhardt <schweikh@schweikhardt.net>
sub 1024g/6E93CACC 2002-01-27 [expires: 2005-01-26]
```

D.3.265 Stanislav Sedov <stas@FreeBSD.org>

```
pub 4096R/092FD9F0 2009-05-23
    Key fingerprint = B83A B15D 929A 364A D8BC B3F9 BF25 A231 092F D9F0
uid Stanislav Sedov <stas@FreeBSD.org>
uid Stanislav Sedov <stas@SpringDaemons.com>
uid Stanislav Sedov (Corporate email) <stas@deglitch.com>
uid Stanislav Sedov (Corporate email) <stas@ht-systems.ru>
uid Stanislav Sedov (Corporate email) <ssedov@3playnet.com>
uid Stanislav Sedov <ssedov@mbsd.msk.ru>
uid Stanislav Sedov (Corporate email) <ssedov@swifttest.com>
sub 4096R/6FD2025F 2009-05-23
```

D.3.266 Johan van Selst <johans@FreeBSD.org>

```
pub 4096R/D3AE8D3A 2009-09-01
    Key fingerprint = 31C8 D089 DDB6 96C6 F3C1 29C0 A9C8 6C8D D3AE 8D3A
uid Johan van Selst
uid Johan van Selst <johans@gletsjer.net>
uid Johan van Selst <johans@stack.nl>
uid Johan van Selst <johans@FreeBSD.org>
uid Johan van Selst (GSWoT:NL50) <johans@gswot.org>
sub 2048R/B002E38C 2009-09-01
sub 2048R/1EBCAECB 2009-09-01
sub 2048R/639A1446 2009-09-01
sub 3072D/6F2708F4 2009-09-01
sub 4096g/D6F89E83 2009-09-01
```

D.3.267 Bakul Shah <bakul@FreeBSD.org>

```
pub 1024D/86AEE4CB 2006-04-20
   Key fingerprint = 0389 26E8 381C 6980 AEC0 10A5 E540 A157 86AE E4CB
uid                               Bakul Shah <bakul@freebsd.org>
sub 2048g/5C3DCC24 2006-04-20
```

D.3.268 Gregory Neil Shapiro <gshapiro@FreeBSD.org>

```
pub 1024R/4FBE2ADD 2000-10-13 Gregory Neil Shapiro <gshapiro@gshapiro.net>
   Key fingerprint = 56 D5 FF A7 A6 54 A6 B5 59 10 00 B9 5F 5F 20 09
uid                               Gregory Neil Shapiro <gshapiro@FreeBSD.org>

pub 1024D/F76A9BF5 2001-11-14 Gregory Neil Shapiro <gshapiro@FreeBSD.org>
   Key fingerprint = 3B5E DAF1 4B04 97BA EE20 F841 21F9 C5BC F76A 9BF5
uid                               Gregory Neil Shapiro <gshapiro@gshapiro.net>
sub 2048g/935657DC 2001-11-14

pub 1024D/FCE56561 2000-10-14 Gregory Neil Shapiro <gshapiro@FreeBSD.org>
   Key fingerprint = 42C4 A87A FD85 C34F E77F 5EA1 88E1 7B1D FCE5 6561
uid                               Gregory Neil Shapiro <gshapiro@gshapiro.net>
sub 1024g/285DC8A0 2000-10-14 [expires: 2001-10-14]
```

D.3.269 Arun Sharma <arun@FreeBSD.org>

```
pub 1024D/7D112181 2003-03-06 Arun Sharma <arun@sharma-home.net>
   Key fingerprint = A074 41D6 8537 C7D5 070E 0F78 0247 1AE2 7D11 2181
uid                               Arun Sharma <arun@freebsd.org>
uid                               Arun Sharma <arun.sharma@intel.com>
sub 1024g/ACAD98DA 2003-03-06 [expires: 2005-03-05]
```

D.3.270 Wesley Shields <wxs@FreeBSD.org>

```
pub 1024D/17F0AA37 2007-12-27
   Key fingerprint = 96D1 2E6B F61C 2F3D 83EF 8F0B BE54 310C 17F0 AA37
uid                               Wesley Shields <wxs@FreeBSD.org>
uid                               Wesley Shields <wxs@atarininja.org>
sub 2048g/2EDA1BB8 2007-12-27
```

D.3.271 Norikatsu Shigemura <nork@FreeBSD.org>

```
pub 1024D/7104EA4E 2005-02-14
   Key fingerprint = 9580 60A3 B58A 0864 79CB 779A 6FAE 229B 7104 EA4E
uid                               Norikatsu Shigemura <nork@cityfujisawa.ne.jp>
uid                               Norikatsu Shigemura <nork@ninth-nine.com>
uid                               Norikatsu Shigemura <nork@FreeBSD.org>
```

sub 4096g/EF56997E 2005-02-14

D.3.272 Shteryana Shopova <syrinx@FreeBSD.org>

pub 1024D/1C139BC5 2006-10-07
Key fingerprint = B83D 2451 27AB B767 504F CB85 4FB1 C88B 1C13 9BC5
uid Shteryana Shopova (syrinx) <shteryana@FreeBSD.org>
sub 2048g/6D2E9C98 2006-10-07

D.3.273 Vanilla I. Shu <vanilla@FreeBSD.org>

pub 1024D/ACE75853 2001-11-20 Vanilla I. Shu <vanilla@FreeBSD.org>
Key fingerprint = 290F 9DB8 42A3 6257 5D9A 5585 B25A 909E ACE7 5853
sub 1024g/CE695D0E 2001-11-20

D.3.274 Ashish SHUKLA <ashish@FreeBSD.org>

pub 4096R/E74FA4B0 2010-04-13
Key fingerprint = F682 CDCC 39DC 0FEA E116 20B6 C746 CFA9 E74F A4B0
uid Ashish SHUKLA <wahjava@gmail.com>
uid Ashish SHUKLA <wahjava@googlegmail.com>
uid Ashish SHUKLA <wahjava.ml@gmail.com>
uid Ashish SHUKLA <wahjava@members.fsf.org>
uid Ashish SHUKLA <wahjava@perl.org.in>
uid Ashish SHUKLA <wahjava@users.sourceforge.net>
uid Ashish SHUKLA <wah.java@yahoo.com>
uid Ashish SHUKLA <wah_java@hotmail.com>
uid Ashish SHUKLA <ashish.shukla@airtelmail.in>
uid Ashish SHUKLA <wahjava@member.fsf.org>
uid [jpeg image of size 4655]
uid Ashish SHUKLA (FreeBSD Committer Address) <ashish@FreeBSD.ORG>
sub 4096R/F20D202D 2010-04-13

D.3.275 Bruce M. Simpson <bms@FreeBSD.org>

pub 1024D/860DB53B 2003-08-06 Bruce M Simpson <bms@freebsd.org>
Key fingerprint = 0D5F 1571 44DF 51B7 8B12 041E B9E5 2901 860D B53B
sub 2048g/A2A32D8B 2003-08-06 [expires: 2006-08-05]

D.3.276 Dmitry Sivachenko <demon@FreeBSD.org>

pub 1024D/13D5DF80 2002-03-18 Dmitry Sivachenko <mitya@cavia.pp.ru>
Key fingerprint = 72A9 12C9 BB02 46D4 4B13 E5FE 1194 9963 13D5 DF80
uid Dmitry S. Sivachenko <demon@FreeBSD.org>

sub 1024g/060F6DBD 2002-03-18

D.3.277 Jesper Skriver <jesper@FreeBSD.org>

pub 1024D/F9561C31 2001-03-09 Jesper Skriver <jesper@FreeBSD.org>
 Key fingerprint = 6B88 9CE8 66E9 E631 C9C5 5EB4 22AB F0EC F956 1C31
 uid Jesper Skriver <jesper@skriver.dk>
 uid Jesper Skriver <jesper@wheel.dk>
 sub 1024g/777C378C 2001-03-09

D.3.278 Ville Skyttä <scop@FreeBSD.org>

pub 1024D/BCD241CB 2002-04-07 Ville Skyttä <ville.skytta@iki.fi>
 Key fingerprint = 4E0D EBAB 3106 F1FA 3FA9 B875 D98C D635 BCD2 41CB
 uid Ville Skyttä <ville.skytta@xemacs.org>
 uid Ville Skyttä <scop@FreeBSD.org>
 sub 2048g/9426F4D1 2002-04-07

D.3.279 Andrey Slusar <anray@FreeBSD.org>

pub 1024D/AE7B5418 2005-12-12
 Key fingerprint = DE70 C24B 55A0 4A06 68A1 D425 3C59 9A9B AE7B 5418
 uid Andrey Slusar <anray@ext.by>
 uid Andrey Slusar <anrays@gmail.com>
 uid Andrey Slusar <anray@FreeBSD.org>
 sub 2048g/7D0EB77D 2005-12-12

D.3.280 Florian Smeets <flo@FreeBSD.org>

pub 1024D/C942BF09 2008-10-24
 Key fingerprint = 54BB 157B 8DB2 9E46 4A3C 69AB 6A9A 3C3F C942 BF09
 uid Florian Smeets <flo@smeets.im>
 uid Florian Smeets <flo@kasimir.com>
 uid Florian Smeets <flo@FreeBSD.org>
 sub 2048g/4AAF040E 2008-10-24

D.3.281 Gleb Smirnoff <glebius@FreeBSD.org>

pub 1024D/1949DC80 2003-08-25
 Key fingerprint = 872C E14A 2F03 A3E8 D882 026E 5DE4 D7FE 1949 DC80
 uid Gleb Smirnoff <glebius@FreeBSD.org>
 uid Gleb Smirnoff <glebius@cell.sick.ru>
 uid Gleb Smirnoff <glebius@bestcom.ru>
 uid Gleb Smirnoff <glebius@rambler-co.ru>

```
uid          Gleb Smirnoff <glebius@freebsd.org>
uid          Gleb Smirnoff <glebius@freebsd.int.ru>
sub 1024g/A05118BD 2003-08-25
```

D.3.282 Ken Smith <kensmith@FreeBSD.org>

```
pub 1024D/29AEA7F6 2003-12-02 Ken Smith <kensmith@cse.buffalo.edu>
   Key fingerprint = 4AB7 D302 0753 8215 31E7 F1AD FC6D 7855 29AE A7F6
uid          Ken Smith <kensmith@freebsd.org>
sub 1024g/0D509C6C 2003-12-02
```

D.3.283 Ben Smithurst <ben@FreeBSD.org>

```
pub 1024D/2CEF442C 2001-07-11 Ben Smithurst <ben@LSRfm.com>
   Key fingerprint = 355D 0FFF B83A 90A9 D648 E409 6CFC C9FB 2CEF 442C
uid          Ben Smithurst <ben@vinosystems.com>
uid          Ben Smithurst <ben@smithurst.org>
uid          Ben Smithurst <ben@FreeBSD.org>
uid          Ben Smithurst <csxbsc@comp.leeds.ac.uk>
uid          Ben Smithurst <ben@scientia.demon.co.uk>
sub 1024g/347071FF 2001-07-11
```

D.3.284 Dag-Erling C. Smørgrav <des@FreeBSD.org>

```
pub 1024D/64EBE220 2006-11-11 [expires: 2011-05-31]
   Key fingerprint = 3A1C 8E68 952C 3305 6984 6486 30D4 3A6E 64EB E220
uid          Dag-Erling Smørgrav <des@des.no>
uid          Dag-Erling Smørgrav <des@freebsd.org>
uid          [jpeg image of size 3315]
sub 2048g/920C3313 2006-11-11 [expires: 2011-05-31]
```

D.3.285 Maxim Sobolev <sobomax@FreeBSD.org>

```
pub 1024D/888205AF 2001-11-21 Maxim Sobolev <sobomax@FreeBSD.org>
   Key fingerprint = 85C9 DCB0 6828 087C C977 3034 A0DB B9B7 8882 05AF
uid          Maxim Sobolev <sobomax@mail.ru>
uid          Maxim Sobolev <sobomax@altavista.net>
uid          Maxim Sobolev <vegacap@i.com.ua>

pub 1024D/468EE6D8 2003-03-21 Maxim Sobolev <sobomax@portaone.com>
   Key fingerprint = 711B D315 3360 A58F 9A0E 89DB 6D40 2558 468E E6D8
uid          Maxim Sobolev <sobomax@FreeBSD.org>
uid          Maxim Sobolev <sobomax@mail.ru>
uid          Maxim Sobolev <vegacap@i.com.ua>

pub 1024D/6BEC980A 2004-02-13 Maxim Sobolev <sobomax@portaone.com>
```

```
Key fingerprint = 09D5 47B4 8D23 626F B643 76EB DFEE 3794 6BEC 980A
uid Maxim Sobolev <sobomax@FreeBSD.org>
uid Maksym Sobolyev (It's how they call me in official documents. Pret
uid Maksym Sobolyev (It's how they call me in official documents. Pret
sub 2048g/16D049AB 2004-02-13 [expires: 2005-02-12]
```

D.3.286 Brian Somers <brian@FreeBSD.org>

```
pub 1024R/666A7421 1997-04-30 Brian Somers <brian@freebsd-services.com>
Key fingerprint = 2D 91 BD C2 94 2C 46 8F 8F 09 C4 FC AD 12 3B 21
uid Brian Somers <brian@awfulhak.org>
uid Brian Somers <brian@FreeBSD.org>
uid Brian Somers <brian@OpenBSD.org>
uid Brian Somers <brian@uk.FreeBSD.org>
uid Brian Somers <brian@uk.OpenBSD.org>
```

D.3.287 Stacey Son <:sson@FreeBSD.org>

```
pub 1024D/CE8319F3 2008-07-08
Key fingerprint = 64C7 8D92 C1DF B940 1171 5ED3 186A 758A CE83 19F3
uid Stacey Son <:sson@FreeBSD.org>
uid Stacey Son <stacey@son.org>
uid Stacey Son <:sson@byu.net>
uid Stacey Son <:sson@secure.net>
uid Stacey Son <:sson@dev-random.com>
sub 2048g/0F724E52 2008-07-08
```

D.3.288 Nicolas Souchu <nsouch@FreeBSD.org>

```
pub 1024D/C744F18B 2002-02-13 Nicholas Souchu <nsouch@freebsd.org>
Key fingerprint = 992A 144F AC0F 40BA 55AE DE6D 752D 0A6C C744 F18B
sub 1024g/90BD3231 2002-02-13
```

D.3.289 Suleiman Souhlal <ssouhlal@FreeBSD.org>

```
pub 1024D/2EA50469 2004-07-24 Suleiman Souhlal <ssouhlal@FreeBSD.org>
Key fingerprint = DACF 89DB 54C7 DA1D 37AF 9A94 EB55 E272 2EA5 0469
sub 2048g/0CDCC535 2004-07-24
```

D.3.290 Ulrich Spörlein <uqs@FreeBSD.org>

```
pub 2048R/4AAF82CE 2010-01-27 [expires: 2015-01-26]
Key fingerprint = 08DF A6A0 B1EB 98A5 EDDA 9005 A3A6 9864 4AAF 82CE
uid Ulrich Spörlein <uqs@spoerlein.net>
```

```
uid          Ulrich Spoerlein <uspoerlein@gmail.com>
uid          Ulrich SpÄ¶rlein (The FreeBSD Project) <uqs@FreeBSD.org>
uid          Ulrich SpÄ¶rlein <ulrich.spoerlein@web.de>
sub 2048R/162E8BD2 2010-01-27 [expires: 2015-01-26]
```

D.3.291 Rink Springer <rink@FreeBSD.org>

```
pub 1024D/ECEDBFFF 2003-09-19
   Key fingerprint = A8BE 9C82 9B81 4289 A905 418D 6F73 BAD2 ECED BFFF
uid          Rink Springer <rink@il.fontys.nl>
uid          Rink Springer (FreeBSD Project) <rink@FreeBSD.org>
uid          Rink Springer <rink@stack.nl>
sub 2048g/3BC3E67E 2003-09-19
```

D.3.292 Vsevolod Stakhov <vsevolod@FreeBSD.org>

```
pub 1024D/213D0033 2005-03-14 [expires: 2008-03-13]
   Key fingerprint = B852 0010 761E 944A C76D D447 A25D C12C 213D 0033
uid          Vsevolod Stakhov <vsevolod@FreeBSD.org>
uid          Vsevolod Stakhov <cebka@jet.msk.su>
uid          Vsevolod Stakhov <vsevolod@highsecure.ru>
sub 2048g/786F2187 2005-03-14 [expires: 2008-03-13]
```

D.3.293 Ryan Steinmetz <zi@FreeBSD.org>

```
pub 1024D/7AD7FAF2 2004-01-21
   Key fingerprint = EF36 D45A 5CA9 28B1 A550 18CD A43C D111 7AD7 FAF2
uid          Ryan Steinmetz <zi@FreeBSD.org>
uid          Ryan Steinmetz <rpsfa@rit.edu>
uid          Ryan Steinmetz <zi@zi0r.com>
sub 1024g/058BC057 2004-01-21
sub 4096g/0EB108D2 2006-02-27
sub 1024D/FEF36DD7 2006-02-27
```

D.3.294 Randall R. Stewart <rrs@FreeBSD.org>

```
pub 1024D/0373B8B2 2006-09-01
   Key fingerprint = 74A6 810E 6DEA D69B 6496 5FA9 8AEF 4166 0373 B8B2
uid          Randall R Stewart <randall@lakerest.net>
uid          Randall R Stewart <rrs@cisco.com>
uid          Randall R Stewart <rrs@FreeBSD.org>
sub 2048g/88027C0B 2006-09-01
```

D.3.295 Murray Stokely <murray@FreeBSD.org>

```
pub 1024D/0E451F7D 2001-02-12 Murray Stokely <murray@freebsd.org>
   Key fingerprint = E2CA 411D DD44 53FD BB4B 3CB5 B4D7 10A2 0E45 1F7D
sub 1024g/965A770C 2001-02-12
```

D.3.296 Volker Stolz <vs@FreeBSD.org>

```
pub 1024R/3FD1B6B5 1998-06-16 Volker Stolz <vs@freebsd.org>
   Key fingerprint = 69 6F BD A0 2E FE 19 66 CF B9 68 6E 41 7D F9 B9
uid                               Volker Stolz <stolz@i2.informatik.rwth-aachen.de> (LSK)
uid                               Volker Stolz <vs@foldr.org>
```

D.3.297 Ryan Stone <rstone@FreeBSD.org>

```
pub 1024D/3141B73A 2010-04-13
   Key fingerprint = 4A6D DC04 DDC5 0822 2687 A086 FD3F 16CB 3141 B73A
uid                               Ryan Stone (FreeBSD) <rstone@freebsd.org>
sub 2048g/A8500B5F 2010-04-13
```

D.3.298 Søren Straarup <xride@FreeBSD.org>

```
pub 1024D/E683AD40 2006-09-28
   Key fingerprint = 8A0E 7E57 144B BC25 24A9 EC1A 0DBC 3408 E683 AD40
uid                               Soeren Straarup <xride@xride.dk>
uid                               Soeren Straarup <xride@FreeBSD.org>
uid                               Soeren Straarup <xride@x12.dk>
sub 2048g/2B18B3B8 2006-09-28
```

D.3.299 Marius Strobl <marius@FreeBSD.org>

```
pub 1024D/E0AC6F8D 2004-04-16
   Key fingerprint = 3A6C 4FB1 8BB9 4F2E BDDC 4AB6 D035 799C E0AC 6F8D
uid                               Marius Strobl <marius@FreeBSD.org>
uid                               Marius Strobl <marius@alchemy.franken.de>
sub 1024g/08BBD875 2004-04-16
```

D.3.300 Carlo Strub <cs@FreeBSD.org>

```
pub 4096R/1ACAF57A 2011-06-29 [expires: 2012-06-28]
   Key fingerprint = 3019 F948 5F92 E45B 5B33 6EA2 22A3 B308 1ACA F57A
uid                               Carlo Strub <cs@carlostrub.ch>
uid                               Carlo Strub <cs@freebsd.org>
sub 4096R/648E9F32 2011-06-29 [expires: 2012-06-28]
```

D.3.301 Cheng-Lung Sung <clsung@FreeBSD.org>

```
pub 1024D/956E8BC1 2003-09-12 Cheng-Lung Sung <clsung@FreeBSD.org>
    Key fingerprint = E0BC 57F9 F44B 46C6 DB53 8462 F807 89F3 956E 8BC1
uid                               Cheng-Lung Sung (Software Engineer) <clsung@dragon2.net>
uid                               Cheng-Lung Sung (Alumnus of CSIE, NCTU, Taiwan) <clsung@sungsung.c
uid                               Cheng-Lung Sung (AlanSung) <clsung@tiger2.net>
uid                               Cheng-Lung Sung (FreeBSD@Taiwan) <clsung@freebsd.csie.nctu.edu.tw>
uid                               Cheng-Lung Sung (Ph.D. Student of NTU.EECS) <d92921016@ntu.edu.tw>
uid                               Cheng-Lung Sung (FreeBSD Freshman) <clsung@tw.freebsd.org>
uid                               Cheng-Lung Sung (ports committer) <clsung@FreeBSD.org>
sub 1024g/1FB800C2 2003-09-12
```

D.3.302 Gregory Sutter <gsutter@FreeBSD.org>

```
pub 1024D/845DFEED 2000-10-10 Gregory S. Sutter <gsutter@zer0.org>
    Key fingerprint = D161 E4EA 4BFA 2427 F3F9 5B1F 2015 31D5 845D FEDD
uid                               Gregory S. Sutter <gsutter@freebsd.org>
uid                               Gregory S. Sutter <gsutter@daemonnews.org>
uid                               Gregory S. Sutter <gsutter@pobox.com>
sub 2048g/0A37BBCE 2000-10-10
```

D.3.303 Koichi Suzuki <metal@FreeBSD.org>

```
pub 1024D/AE562682 2004-05-23 SUZUKI Koichi <metal@FreeBSD.org>
    Key fingerprint = 92B9 A202 B5AB 8CB6 89FC 6DD1 5737 C702 AE56 2682
sub 4096g/730E604B 2004-05-23
```

D.3.304 Ryusuke SUZUKI <ryusuke@FreeBSD.org>

```
pub 1024D/63D29724 2009-12-18
    Key fingerprint = B108 7109 2E62 BECB 0F78 FE65 1B9A D1BE 63D2 9724
uid                               Ryusuke SUZUKI <ryusuke@FreeBSD.org>
uid                               Ryusuke SUZUKI <ryusuke@jp.FreeBSD.org>
sub 1024g/5E4DD044 2009-12-18
```

D.3.305 Gary W. Swearingen <garys@FreeBSD.org>

```
pub 1024D/FAA48AD5 2005-08-22 [expires: 2007-08-22]
    Key fingerprint = 8292 CC3E 81B5 E54F E3DD F987 FA52 E643 FAA4 8AD5
uid                               Gary W. Swearingen <garys@freebsd.org>
sub 2048g/E34C3CA0 2005-08-22 [expires: 2007-08-22]
```

D.3.306 Yoshihiro Takahashi <nyan@FreeBSD.org>

```
pub 1024D/8394B81F 2001-10-15 Yoshihiro TAKAHASHI <nyan@jp.FreeBSD.org>
    Key fingerprint = D4FA D8CA 2AED FCF4 90A3 3569 8666 0500 8394 B81F
uid                               Yoshihiro TAKAHASHI <nyan@furiru.org>
uid                               Yoshihiro TAKAHASHI <nyan@FreeBSD.org>
sub 1024g/B796F020 2001-10-15
```

D.3.307 Sahil Tandon <sahil@FreeBSD.org>

```
pub 2048R/C016D977 2010-04-08
    Key fingerprint = 6AD2 BA99 8E3A 8DA6 DFC1 53CF DBD0 6001 C016 D977
uid                               Sahil Tandon <sahil@tandon.net>
uid                               Sahil Tandon <sahil@FreeBSD.org>
sub 2048R/F7776FBC 2010-04-08
```

D.3.308 TAKATSU Tomonari <tota@FreeBSD.org>

```
pub 1024D/67F58F29 2009-05-17
    Key fingerprint = 6940 B575 FC4A FA26 C094 279A 4B9B 6326 67F5 8F29
uid                               TAKATSU Tomonari <tota@FreeBSD.org>
sub 2048g/18B112CD 2009-05-17
```

D.3.309 Romain Tartière <romain@FreeBSD.org>

```
pub 3072R/5112336F 2010-04-09
    Key fingerprint = 8234 9A78 E7C0 B807 0B59 80FF BA4D 1D95 5112 336F
uid                               Romain Tartière <romain@blogreen.org>
uid                               Romain Tartière (FreeBSD) <romain@FreeBSD.org>
sub 3072R/C1B2B656 2010-04-09
sub 3072R/8F8125F4 2010-04-09
```

D.3.310 Sylvio Cesar Teixeira <sylvio@FreeBSD.org>

```
pub 2048R/AA7395A1 2009-10-28
    Key fingerprint = B319 6AAF 0016 4308 6D93 E652 3C5F 21A2 AA73 95A1
uid                               Sylvio Cesar Teixeira (My key) <sylvio@FreeBSD.org>
sub 2048R/F758F556 2009-10-28
```

D.3.311 Ion-Mihai Tetcu <itetcu@FreeBSD.org>

```
pub 1024D/21FFA1E5 2008-05-08 [expires: 2010-05-08]
    Key fingerprint = A880 42DD BD71 BAA5 AED7 AEA2 27B1 88BA 21FF A1E5
uid                               Ion-Mihai "IOnut" Tetcu <itetcu@FreeBSD.org>
```

sub 2048g/0B30E680 2008-05-08 [expires: 2010-05-08]

D.3.312 Mikhail Teterin <mi@FreeBSD.org>

pub 1024R/3FC71479 1995-09-08 Mikhail Teterin <mi@aldan.star89.galstar.com>
Key fingerprint = 5F 15 EA 78 A5 40 6A 0F 14 D7 D9 EA 6E 2B DA A4

D.3.313 Gordon Tetlow <gordon@FreeBSD.org>

pub 1024D/357D65FB 2002-05-14 Gordon Tetlow <gordont@gnf.org>
Key fingerprint = 34EF AD12 10AF 560E C3AE CE55 46ED ADF4 357D 65FB
uid Gordon Tetlow <gordon@FreeBSD.org>
sub 1024g/243694AB 2002-05-14

D.3.314 Lars Thegler <lth@FreeBSD.org>

pub 1024D/56B0CA08 2004-05-31 Lars Thegler <lth@FreeBSD.org>
Key fingerprint = AB AE F98C EA78 1C8D 6FDD CB27 1CA9 5A63 56B0 CA08
uid Lars Thegler <lars@thegler.dk>
sub 1024g/E8C58EF3 2004-05-31

D.3.315 David Thiel <lth@FreeBSD.org>

pub 1024D/A887A9B4 2006-11-30 [expires: 2011-11-29]
Key fingerprint = F08F 6A12 738F C9DF 51AC 8C62 1E30 7CBE A887 A9B4
uid David Thiel <lth@FreeBSD.org>
sub 2048g/B9BD92C5 2006-11-30 [expires: 2011-11-29]

D.3.316 Fabien Thomas <fabient@FreeBSD.org>

pub 1024D/07745930 2009-03-16
Key fingerprint = D8AC EFA2 2FBD 7788 9628 4E8D 3F35 3B88 0774 5930
uid Fabien Thomas <fabient@FreeBSD.org>
sub 2048g/BC173395 2009-03-16

D.3.317 Thierry Thomas <thierry@FreeBSD.org>

pub 1024D/C71405A2 1997-10-11
Key fingerprint = 3BB8 F358 C2F1 776C 65C9 AE51 73DE 698C C714 05A2
uid Thierry Thomas <thierry@pompo.net>
uid Thierry Thomas <tthomas@mail.dotcom.fr>
uid Thierry Thomas (FreeBSD committer) <thierry@FreeBSD.org>

```
sub 1024R/C5529925 2003-11-26
sub 2048g/05CF3992 2008-02-05
```

D.3.318 Andrew Thompson <thompsa@FreeBSD.org>

```
pub 1024D/BC6B839B 2005-05-05
   Key fingerprint = DE74 3F49 B97C A170 C8F1 8423 CAB6 9D57 BC6B 839B
uid      Andrew Thompson <thompsa@freebsd.org>
uid      Andrew Thompson <andy@fud.org.nz>
sub 2048g/92E370FB 2005-05-05
```

D.3.319 Florent Thoumie <flz@FreeBSD.org>

```
pub 1024D/5147DCF4 2004-12-04
   Key fingerprint = D203 AF5F F31A 63E2 BFD5 742B 3311 246D 5147 DCF4
uid      Florent Thoumie (FreeBSD committer address) <flz@FreeBSD.org>
uid      Florent Thoumie (flz) <florent@thoumie.net>
uid      Florent Thoumie (flz) <flz@xbsd.org>
uid      [jpeg image of size 1796]
sub 2048g/15D930B9 2004-12-04
```

D.3.320 Yar Tikhyy <yar@FreeBSD.org>

```
pub 1024D/EA04CF5A 2008-08-31
   Key fingerprint = C063 6788 AFF2 A62F 06B7 516D 200F 06AF EA04 CF5A
uid      Yar Tikhyy <yar@freebsd.org>
sub 2048g/20443F06 2008-08-31
```

D.3.321 Jilles Tjoelker <jilles@FreeBSD.org>

```
pub 4096R/D5AE6220 2011-07-02
   Key fingerprint = 4AF5 F1CC BDD7 700B F005 79A4 A2C4 C4D4 D5AE 6220
uid      Jilles Tjoelker <jilles@stack.nl>
uid      Jilles Tjoelker <tjoelker@zonnet.nl>
uid      Jilles Tjoelker (FreeBSD) <jilles@FreeBSD.org>
sub 4096R/14CB5775 2011-07-02
```

D.3.322 Ganbold Tsagaankhuu <ganbold@FreeBSD.org>

```
pub 1024D/78F6425E 2008-02-26 [expires: 2013-02-24]
   Key fingerprint = 9B8E DC41 D3F4 F7FC D8EA 417C D4F7 2AEF 78F6 425E
uid      Ganbold <ganbold@freebsd.org>
sub 2048g/716FCBF9 2008-02-26 [expires: 2013-02-24]
```

D.3.323 Michael Tuexen <tuexen@FreeBSD.org>

```
pub 1024D/04EEDABE 2009-06-08
   Key fingerprint = 493A CCB8 60E6 5510 A01D 360E 8497 B854 04EE DABE
uid          Michael Tuexen <tuexen@FreeBSD.org>
sub 2048g/F653AA03 2009-06-08
```

D.3.324 Andrew Turner <andrew@FreeBSD.org>

```
pub 2048R/31B31614 2010-07-01
   Key fingerprint = 08AC 2C57 F14F FDD1 2232 B5CD AA16 EFB8 31B3 1614
uid          Andrew Turner <andrew@freebsd.org>
uid          Andrew Turner <andrew@fubar.geek.nz>
sub 2048R/9ACBF138 2010-07-01
```

D.3.325 Hajimu UMEMOTO <ume@FreeBSD.org>

```
pub 1024D/BF9071FE 2005-03-17
   Key fingerprint = 1F00 0B9E 2164 70FC 6DC5 BF5F 04E9 F086 BF90 71FE
uid          Hajimu UMEMOTO <ume@mahoroba.org>
uid          Hajimu UMEMOTO <ume@FreeBSD.org>
uid          Hajimu UMEMOTO <ume@jp.FreeBSD.org>
sub 2048g/748DB3B0 2005-03-17
```

D.3.326 Stephan Uphoff <ups@FreeBSD.org>

```
pub 2048R/D684B04A 2004-10-06 Stephan Uphoff <ups@freebsd.org>
   Key fingerprint = B5D2 04AE CA8F 7055 7474 3C85 F908 7F55 D684 B04A
uid          Stephan Uphoff <ups@tree.com>
sub 2048R/A15F921B 2004-10-06
```

D.3.327 Jacques Vidrine <nectar@FreeBSD.org>

```
pub 2048R/33C1627B 2001-07-05 Jacques A. Vidrine <nectar@celabo.org>
   Key fingerprint = CB CE 7D A0 6E 01 DC 61 E5 91 0A BE 79 17 D3 82
uid          Jacques A. Vidrine <jvidrine@verio.net>
uid          Jacques A. Vidrine <n@nectar.com>
uid          Jacques A. Vidrine <jacques@vidrine.cc>
uid          Jacques A. Vidrine <nectar@FreeBSD.org>
uid          Jacques A. Vidrine <n@nectar.cc>

pub 1024D/1606DB95 2001-07-05 Jacques A. Vidrine <nectar@celabo.org>
   Key fingerprint = 46BC EA5B F70A CC81 5332 0832 8C32 8CFF 1606 DB95
uid          Jacques A. Vidrine <jvidrine@verio.net>
uid          Jacques A. Vidrine <n@nectar.com>
uid          Jacques A. Vidrine <jacques@vidrine.cc>
```

```
uid                Jacques A. Vidrine <nectar@FreeBSD.org>
uid                Jacques A. Vidrine <n@nectar.cc>
sub 2048g/57EDEA6F 2001-07-05
```

D.3.328 Alberto Villa <avilla@FreeBSD.org>

```
pub 1024R/44350A8B 2010-01-24
   Key fingerprint = F740 CE4E EDDD DA9B 4A1B 1445 DF18 82EA 4435 0A8B
uid                Alberto Villa <avilla@FreeBSD.org>
sub 1024R/F7C8254C 2010-01-24
```

D.3.329 Nicola Vitale <nivit@FreeBSD.org>

```
pub 1024D/F11699E5 2006-12-05
   Key fingerprint = 2C17 C591 2C6D 82BD F3DB F1BF 8FC9 6763 F116 99E5
uid                Nicola Vitale (Public key for nivit@FreeBSD.org) <nivit@FreeBSD.org>
sub 2048g/4C90805D 2006-12-05
```

D.3.330 Ivan Voras <ivoras@FreeBSD.org>

```
pub 1024D/569C05C8 2000-05-24
   Key fingerprint = AB9A A555 C47C B61D BF83 154C 95D9 C041 569C 05C8
uid                Ivan Voras <ivoras@fer.hr>
uid                Ivan Voras <ivan.voras@fer.hr>
uid                Ivan Voras <ivoras@geri.cc.fer.hr>
uid                [jpeg image of size 4567]
uid                Ivan Voras <ivoras@sharanet.org>
uid                Ivan Voras <ivoras@gmail.com>
uid                Ivan Voras <ivoras@yahoo.com>
uid                Ivan Voras <ivoras@freebsd.org>
uid                Ivan Voras <ivan.voras@zg.t-com.hr>
sub 1536g/149FDD60 2000-05-24
```

D.3.331 Stefan Walter <stefan@FreeBSD.org>

```
pub 3072R/12B9E0B3 2003-03-06
   Key fingerprint = 85D8 6A49 22C7 6CD9 B011 5D6A 5691 111B 12B9 E0B3
uid                Stefan Walter <stefan@freebsd.org>
uid                Stefan Walter <sw@gegenunendlich.de>
sub 3072R/6D35457A 2003-03-06
```

D.3.332 Kai Wang <kaiw@FreeBSD.org>

```
pub 1024D/AEB910EB 2006-09-27
   Key fingerprint = 3534 10A3 F143 B760 EF3E BEDF 8509 6A06 AEB9 10EB
uid      Kai Wang <kaiw@FreeBSD.org>
uid      Kai Wang <kaiw@student.chalmers.se>
uid      Kai Wang <kaiwang27@gmail.com>
uid      Kai Wang <kaiw27@gmail.com>
sub 2048g/1D5AA4DD 2006-09-27
```

D.3.333 Adam Weinberger <adamw@FreeBSD.org>

```
pub 1024D/42C743FD 2002-10-12 Adam Weinberger <adam@vectors.cx>
   Key fingerprint = A980 3F2E 80A8 9619 9D1C 82E8 A3C2 8CD9 42C7 43FD
sub 1024g/15D67628 2002-10-12
```

D.3.334 Peter Wemm <peter@FreeBSD.org>

```
pub 1024D/7277717F 2003-12-14 Peter Wemm <peter@wemm.org>
   Key fingerprint = 622B 2282 E92B 3BAB 57D1 A417 1512 AE52 7277 717F
uid      Peter Wemm <peter@FreeBSD.ORG>
sub 1024g/8B40D9D1 2003-12-14
pub 1024R/D89CE319 1995-04-02 Peter Wemm <peter@netplex.com.au>
   Key fingerprint = 47 05 04 CA 4C EE F8 93 F6 DB 02 92 6D F5 58 8A
uid      Peter Wemm <peter@perth.dialix.oz.au>
uid      Peter Wemm <peter@haywire.dialix.com>
```

D.3.335 Nathan Whitehorn <nwhitehorn@FreeBSD.org>

```
pub 1024D/FC118258 2008-07-03
   Key fingerprint = A399 BEA0 8D2B 63B3 47B5 056D 8513 5B96 FC11 8258
uid      Nathan Whitehorn <nwhitehorn@freebsd.org>
uid      Nathan Whitehorn <nwhitehorn@icecube.wisc.edu>
uid      Nathan Whitehorn <nwhitehorn@physics.wisc.edu>
uid      Nathan Whitehorn <whitehorn@wisc.edu>
sub 2048g/EDB55363 2008-07-03
```

D.3.336 Martin Wilke <miwi@FreeBSD.org>

```
pub 1024D/B1E6FCE9 2009-01-31
   Key fingerprint = C022 7D60 F598 8188 2635 0F6E 74B2 4884 B1E6 FCE9
uid      Martin Wilke <miwi@FreeBSD.org>
sub 4096g/096DA69D 2009-01-31
```

D.3.337 Nate Williams <nate@FreeBSD.org>

```
pub 1024D/C2AC6BA4 2002-01-28 Nate Williams (FreeBSD) <nate@FreeBSD.org>
   Key fingerprint = 8EE8 5E72 8A94 51FA EA68 E001 FFF9 8AA9 C2AC 6BA4
sub 1024g/03EE46D2 2002-01-28
```

D.3.338 Steve Wills <swills@FreeBSD.org>

```
pub 2048R/207B1BA1 2010-09-02 [expires: 2011-09-02]
   Key fingerprint = 98FA 414A 5C2A 0EF9 CFD0 AD0D F5CF 62B3 207B 1BA1
uid                               Steve Wills <swills@freebsd.org>
uid                               Steve Wills <steve@mouf.net>
sub 2048R/E9B254FD 2010-09-02 [expires: 2011-09-02]
```

D.3.339 Thomas Wintergerst <twinterg@FreeBSD.org>

```
pub 1024D/C45CB978 2006-01-08
   Key fingerprint = 04EE 8114 7C6D 22CE CDC8 D7F8 112D 01DB C45C B978
uid                               Thomas Wintergerst <twinterg@gmx.de>
uid                               Thomas Wintergerst <twinterg@freebsd.org>
uid                               Thomas Wintergerst
uid                               Thomas Wintergerst <thomas.wintergerst@nord-com.net>
uid                               Thomas Wintergerst <thomas.wintergerst@materna.de>
sub 2048g/3BEBEF8A 2006-01-08
sub 1024D/8F631374 2006-01-08
sub 2048g/34F631DC 2006-01-08
```

D.3.340 Garrett Wollman <wollman@FreeBSD.org>

```
pub 1024D/0B92FAEA 2000-01-20 Garrett Wollman <wollman@FreeBSD.org>
   Key fingerprint = 4627 19AF 4649 31BF DE2E 3C66 3ECF 741B 0B92 FAEA
sub 1024g/90D5EBC2 2000-01-20
```

D.3.341 Jörg Wunsch <joerg@FreeBSD.org>

```
pub 1024D/69A85873 2001-12-11 Joerg Wunsch <j@uriah.heep.sax.de>
   Key fingerprint = 5E84 F980 C3CA FD4B B584 1070 F48C A81B 69A8 5873
pub 1024D/69A85873 2001-12-11 Joerg Wunsch <j@uriah.heep.sax.de>
uid                               Joerg Wunsch <joerg_wunsch@interface-systems.de>
uid                               Joerg Wunsch <joerg@FreeBSD.org>
uid                               Joerg Wunsch <j@ida.interface-business.de>
sub 1024g/21DC9924 2001-12-11
```

D.3.342 David Xu <davidxu@FreeBSD.org>

```
pub 1024D/48F2BDAB 2006-07-13 [expires: 2009-07-12]
    Key fingerprint = 7182 434F 8809 A4AF 9AE8 F1B5 12F6 3390 48F2 BDAB
uid          David Xu <davidxu@freebsd.org>
sub 4096g/ED7DB38A 2006-07-13 [expires: 2009-07-12]
```

D.3.343 Maksim Yevmenkin <emax@FreeBSD.org>

```
pub 1024D/F050D2DD 2003-10-01 Maksim Yevmenkin <m_evmenkin@yahoo.com>
    Key fingerprint = 8F3F D359 E318 5641 8C81 34AD 791D 53F5 F050 D2DD
```

D.3.344 Bjoern A. Zeeb <bz@FreeBSD.org>

```
pub 1024D/3CCF1842 2007-02-20
    Key fingerprint = 1400 3F19 8FEF A3E7 7207 EE8D 2B58 B8F8 3CCF 1842
uid          Bjoern A. Zeeb <bz@zabbadoz.net>
uid          Bjoern A. Zeeb <bzeeb@zabbadoz.net>
uid          Bjoern A. Zeeb <bz@FreeBSD.org>
uid          Bjoern A. Zeeb <bzeeb-lists@lists.zabbadoz.net>
sub 4096g/F36BDC5D 2007-02-20
```

D.3.345 Alexey Zelkin <phantom@FreeBSD.org>

```
pub 1024D/9196B7D9 2002-01-28 Alexey Zelkin <phantom@FreeBSD.org>
    Key fingerprint = 4465 F2A4 28C1 C2E4 BB95 1EA0 C70D 4964 9196 B7D9
sub 1024g/E590ABA4 2002-01-28
```

D.3.346 Sepherosa Ziehau <sephe@FreeBSD.org>

```
pub 2048R/3E51FB42 2005-10-21
    Key fingerprint = 5F47 3861 7ABA 8773 9E32 0474 5C33 841C 3E51 FB42
uid          Sepherosa Ziehau (freebsd) <sephe@freebsd.org>
uid          Sepherosa Ziehau (sephe) <sepherosa@gmail.com>
sub 2048R/7AA31321 2005-10-21
```

Ἐὰι ἐὺ οἷῶ FreeBSD

Ἄδου οἱ ἐαίεὺ δᾶνέΥ ÷ ἀέ ὑνῖοδ ἑάε ἀἐνῦίγῖέα δῖο ÷ ἢçóεἱδῖεἱγῖόαé ἀδῦ ὁçí εἱεἱῦοçόά ἑé ἀδῦ ὀά ἑἀβῖαῖά ὁçò ὀἀεἱçῖβῦοçò οἷῶ FreeBSD.

A

ACL

Ἀᾶβδῶᾶ: Access Control List

ACPI

Ἀᾶβδῶᾶ: Advanced Configuration and Power Interface

AMD

Ἀᾶβδῶᾶ: Automatic Mount Daemon

AML

Ἀᾶβδῶᾶ: ACPI Machine Language

API

Ἀᾶβδῶᾶ: Application Programming Interface

APIC

Ἀᾶβδῶᾶ: Advanced Programmable Interrupt Controller

APM

Ἀᾶβδῶᾶ: Advanced Power Management

APOP

Ἀᾶβδῶᾶ: Authenticated Post Office Protocol

ASL

Ἀᾶβδῶᾶ: ACPI Source Language

ATA

Ἀᾶβδῶᾶ: Advanced Technology Attachment

ATM

Ἀᾶβδῶᾶ: Asynchronous Transfer Mode

ACPI Machine Language

Øāōāēēāēāō, ðīō āēōāēāēāēāē āðū Ýía virtual machine óā ēŪēā ēāēōīōñāēēū óýóōçía óōīāāōū ĩā ðī ðñūōððī ACPI, ðāñŸ ÷ ĩīōāō Ýía ðñūðī āðēēīēīūīβāō ðīō ðēēēīŸ ĩā ðī ðāēīçñēūŸŸī interface ðī ĩðīβī ÷ ñçōēīŸðīēāē ðī βāēī ðī ēāēōīōñāēēū óýóōçía.

ACPI Source Language

Ç āēēōōā ðñīāñāīāāōēōīŸŸ ĩā ðçī ĩðīβā āñŪōāōāē ç AML.

Access Control List

Īēā ēβōōā āðū Ūāāēāō ēāē āēēāēīāōā ðñīōðŸēāōçōð, ç ĩðīβā Ÿ ÷ āē óōīāāēāē ĩā Ýía āíōēēāēīāñī, Ÿðūð ð. ÷. Ýía āñ ÷ āēī β ĩēā āēēōðāēēP óōōēāōP.

Advanced Configuration and Power Interface

Īā ðñūōððī ðī ĩðīβī ēāēñβāēē ðīī ðñūðī āðēēīēīūīβāō ðīō ðēēēīŸ ĩā ðī ēāēōīōñāēēū óýóōçía. Ī óēīðūð Ÿðāñīçð ðīō ACPI āēīāē ĩā ĩðñāē ðī ĒŌ ĩā āðēēīēīūīβāōē ĩā ðī ðēēēū āīūð ððīēīāēōðP ēāē ĩā āēīāōāēēāōðāē Ÿōī ðī āōīāōūī ēāēŸōāñā āōðū ðī ðēēēū, āēūīç ēē āī āāī ĩŸñāē óā ðŪīōā āēā āōðū. Ōī ACPI āðīōāēāē ĩāōāīŸēēīç ðūī APM, PNPBIOS ēāē āíōβōðīē ÷ Ÿī ðā ÷ ñīēīāēēī, ðēð ĩðīβāð ēāē āíōēēāēēōðŪ. Ōī ACPI ðāñŸ ÷ āē ðç āōīāōūðçōā ĩā āēŸāñīðā ðçī ēāðāīŪēūōç ēō ÷ Ÿīð, ðçī āíāōðīēP ēāēōīōñāēāð ðīō óōōðβīāðīð, ðçī āñāñāīðīβçōç ēāē āðāīāñāīðīβçōç óōōēāōēēī, ēēð.

Application Programming Interface

Īā óŸñēī āðū āēāñāāōβāð, ðñūðūēēēā ēāē āñāāēāēā ðīō ēāēñβāēēī ðīī āíāāññēōīŸŸī ðñūðī āðēēīēīūīβāō ĩāðāīŸ āŸī β ðāñēōōūðāñūī ðīçīŪðūī ēīāēōīēēīŸ. Ōā āōðŪ ðāñēēāīāŪñīōāē ðēçñīōññβāð āēā ðī ðūð, ðūðā, ēāē āēāōβ óā ðīβīāōā āōðŪ ēīāēōīēēīŸ ēā óōīāñāŪæīīðāē, ēāē ðē āēāīðōð āāāñŸŸīā ĩðñīŸŸī ĩā āíōāēēŪñīðī, ĩā ĩīēñāōðīŸŸī β ĩā āðāīāñāāōðīŸŸī.

Advanced Power Management

Īā API ðī ĩðīβī ðāñŸ ÷ āē óōī ēāēōīōñāēēū óýóōçía ðç āōīāōūðçōā ĩā óōīāñāāōōāē ĩā ðī BIOS āðēōðā ÷ Ūñīōāō ēāēŸōāñç āēā ÷ āēñēōç ðçð ēō ÷ Ÿīð ðīō óōōðβīāðīð. Ōī APM Ÿ ÷ āē āíōēēāōāōōāēāē āðū ðī ðñūōððī ACPI, ðī ĩðīβī āēīāē ðēī ēēēçññūīŸŸī ēāē ðēī āōŸēēēōī āðū ðī APM.

Advanced Programmable Interrupt Controller

Advanced Technology Attachment

Asynchronous Transfer Mode

Authenticated Post Office Protocol

Automatic Mount Daemon

Ήεα οδχναόβα οδδδΠιαότδ ο ιδνβα οειδνέαβ οοί αοδνιιάοο δνιόύπδδοο οοδδοοίύοδνι αν ÷ άβνι υοάι άβνάοάε δνιόδύέαά δνιόδύέάοο αίνδ αν ÷ άβνι ρ έάοάέυάιόο δνι δάñέύ ÷ άοάέ οά αοδύ.

B

BAR

Άάβδδâ: Base Address Register

BIND

Άάβδδâ: Berkeley Internet Name Domain

BIOS

Άάβδδâ: Basic Input/Output System

BSD

Άάβδδâ: Berkeley Software Distribution

Base Address Register

Ήε έάοά ÷ υñοδύδ δνι έάέιννβæιόί οοί αν ÷ έέϐ άέάύέδδδίοο ίνδνιόο οοοί ιδνβα άδνάίόύ ίέα οδδδδδϐ PCI.

Basic Input/Output System

Ή άέñέάϐδ ιñέοίυδ ονι BIOS άνάñόύοάέ έβάρ έάέ άδνι οά οδοιñάέυιάά. Έύδνέιέ άνάόύνιίόάέ οά αοδνι υδ ονι ROM chip δνι οειδνέαβ άάοέέύδ έάέοιñάβδδ άδέέιέιννβδδ ιάοάίύ οέέέίύ έάέ ειαέοίέέίύ. ¶έέιέ άνάόύνιίόάέ οά αοδνι υδ ύά άάοέέυ οάδ άδνι νιόδβνάδ άέά οοί άέέβνιόοο δνι οοδδΠιαότδ. ¶έέάδ οννύδ ι υννιό BIOS άνάόύνιίόάέ οοοί ρέυνι έάέ ον ιάνιύ ιά ον ιδνβνι νδδνβæάοάέ ο έέάάέέάοβά άέέβνιόοο δνι οοδδΠιαότδ. Ή υννιό BIOS άνάόύνιίόάέ οοί ϐέυδ άέά οοδδΠιαόά PC, άέέύ ο έέέοιñάέέυδοοά δνι οειδνέαβ οδύñ ÷ άέ ιά δάñυνιέι οñνδνι έάέ οά ο ÷ άάυνι υέά οά ύέέά οοδδΠιαόά.

Berkeley Internet Name Domain

Ἡ λέξη `bind` εἶναι τὸ ὄνομα τοῦ DNS.

Berkeley Software Distribution

Ἡ λέξη `BSD` εἶναι τὸ ὄνομα τοῦ Computer Systems Research Group (CSRG) ὁποῦ ἐπιβλέπει τὴν ἐξέλιξη τῆς Berkeley (<http://www.berkeley.edu>) ὁποῦ ἀπελευθεροῦνται ἐκείνη ἀπό τὴν A&T. Ἡ FreeBSD ἀναπτύσσεται ἀπὸ τὸ CSRG.

Bikeshed Building

Ἡ λέξη `bikeshed` εἶναι τὸ ὄνομα τοῦ κτιρίου τοῦ CSRG ἐν τῇ Berkeley, ἀπὸ τὴν λέξη `painting` (ἔργο τέχνης) ἐπειδὴ ἐκεῖ ἐκτελέσθη ἡ ἐξέλιξη τῆς FreeBSD ([./faq/misc.html#BIKESHED-PAINTING](http://faq/misc.html#BIKESHED-PAINTING)) ἀπὸ τὴν λέξη `painting`.

C

CD

Ἄλλα: Carrier Detect

CHAP

Ἄλλα: Challenge Handshake Authentication Protocol

CLIP

Ἄλλα: Classical IP over ATM

COFF

Ἄλλα: Common Object File Format

CPU

Ἄλλα: Central Processing Unit

CTS

Ἄλλα: Clear To Send

CVS

Ἄλλα: Concurrent Versions System

Carrier Detect

Ἡ λέξη `CD` εἶναι τὸ ὄνομα τοῦ ὀπίσθιου ἀποδέκτη (carrier) τῆς RS232C.

Central Processing Unit

Ο κεντρικός υπολογιστής είναι το “αδελφικό σύστημα”. Αποδοτικότητα είναι η αμετάβλητη αξία του οπτικού συστήματος, όπου η αξία είναι η αξία του οπτικού συστήματος. Ο δρομολόγηση είναι η αξία του οπτικού συστήματος, όπου η αξία είναι η αξία του οπτικού συστήματος. Η αξία του οπτικού συστήματος είναι η αξία του οπτικού συστήματος, όπου η αξία είναι η αξία του οπτικού συστήματος.

Challenge Handshake Authentication Protocol

Η αξία του οπτικού συστήματος είναι η αξία του οπτικού συστήματος, όπου η αξία είναι η αξία του οπτικού συστήματος. Η αξία του οπτικού συστήματος είναι η αξία του οπτικού συστήματος, όπου η αξία είναι η αξία του οπτικού συστήματος.

Classical IP over ATM

Clear To Send

Η αξία του οπτικού συστήματος είναι η αξία του οπτικού συστήματος, όπου η αξία είναι η αξία του οπτικού συστήματος. Η αξία του οπτικού συστήματος είναι η αξία του οπτικού συστήματος, όπου η αξία είναι η αξία του οπτικού συστήματος.

Αξία του οπτικού συστήματος: Request To Send.

Common Object File Format

Concurrent Versions System

Η αξία του οπτικού συστήματος είναι η αξία του οπτικού συστήματος, όπου η αξία είναι η αξία του οπτικού συστήματος. Η αξία του οπτικού συστήματος είναι η αξία του οπτικού συστήματος, όπου η αξία είναι η αξία του οπτικού συστήματος. Η αξία του οπτικού συστήματος είναι η αξία του οπτικού συστήματος, όπου η αξία είναι η αξία του οπτικού συστήματος.

D

DAC

Αξία του οπτικού συστήματος: Discretionary Access Control

DDB

Αξία του οπτικού συστήματος: Debugger

DES

Αξία του οπτικού συστήματος: Data Encryption Standard

DHCP

Āâβôâ: Dynamic Host Configuration Protocol

DNS

Āâβôâ: Domain Name System

DSDT

Āâβôâ: Differentiated System Description Table

DSR

Āâβôâ: Data Set Ready

DTR

Āâβôâ: Data Terminal Ready

DVMRP

Āâβôâ: Distance-Vector Multicast Routing Protocol

Discretionary Access Control

Data Encryption Standard

Īéá ĩÝèrārĭ òñðððĭrĭrĭĪŪòçòçð ðèçñĭŵĭñβāð, ç ĩðĭβĭ ðāééüðāñā āðĭŵāēĭγŵā ôç āāóéèĪ ĩÝèrārĭ òñðððĭrĭrĭĪŪòçòçð ðŵĭ èŵāééβĭ (passwords) ôĭĭ UNIX. ×ñçŵēĭĭðĭēĭγĭŵāĭ āðβŵçð éāé āðŵ ôç ôðĭŪñŵçççç crypt(3).

Data Set Ready

Īā ôĪĭā RS232C ôĭ ĩðĭβĭ ôðÝèĭāðāé āðŵ ôĭĭ modem ôĭĭ ððĭēĭrĭāéŵŵĪ Ī ôĭ ôāñĭāðééü, ùð Ýĭāāéĭç ôçð āðĭēĭŵŵççðāð āéā èĪøç Ī āðĭŵŵĭēĪ āāñÝĭŵĭ.

Āâβôâ Āðβŵçð: Data Terminal Ready.

Data Terminal Ready

Īā ôĪĭā RS232C ôĭ ĩðĭβĭ ôðÝèĭāðāé āðŵ ôĭĭ ððĭēĭrĭāéŵŵĪ Ī ôĭ ôāñĭāðééü ôĭĭ modem, ùð Ýĭāāéĭç ôçð āðĭēĭŵŵççðāð āéā èĪøç Ī āðĭŵŵĭēĪ āāñÝĭŵĭ.

Debugger

Īā äéāññāŵŵééü (interactive) ððĭŵŵŵççĭā ôĭŵ ððñĪĭā, ôĭ ĩðĭβĭ ðāñÝ÷āé āñāāéēāβā āéā āĭÝŵŵŵççç ôçð éāðŪŵŵŵŵçççð ôĭŵ ôðŵŵĪāðĭð. Óð÷ĭŪ ÷ñçŵēĭĭðĭēĭāβŵāé āçĭγ ôĭŵ ŵŵŵŵççĭā Ý÷āé ôðāĭāðĪŵāé ĭā èāéŵĭŵñāāβ éāĭĭééŪ, āéā ĭā éāŵāéŪāĭŵĭā ŵŵĭ ðāñēŵŵŵŵŵāñā ðñŪāĭāŵā ĭðĭñĭγĭā ô÷āðééŪ ĭā ôéð āéŵŵāð ôĭŵ ðñĭāèĪĪāðĭð.

Differentiated System Description Table

Το δίσταμα του ACPI είναι ένα πίνακα που περιγράφει τα χαρακτηριστικά του συστήματος.

Distance-Vector Multicast Routing Protocol

Domain Name System

Οι ονόματα του Διαδικτύου είναι οι αρίθμητοι, οι οποίοι είναι οι ονόματα (hostname), όπως ο `mail.example.net`, οι οποίοι αντιστοιχούν με τη διεύθυνση Internet του ονόματος ή είναι οι αρίθμητοι.

Dynamic Host Configuration Protocol

Το σύστημα διοίκησης των ονόματων IP είναι το πρωτόκολλο (host) που είναι ένα απλό μέσο IP που είναι το πρωτόκολλο DHCP. Το σύστημα ονόματων IP είναι "lease".

E

ECOFF

Επέκταση: Extended COFF

ELF

Επέκταση: Executable and Linking Format

ESP

Επέκταση: Encapsulated Security Payload

Encapsulated Security Payload

Executable and Linking Format

Extended COFF

F

FADT

Αβδδ: Fixed ACPI Description Table

FAT

Αβδδ: File Allocation Table

FAT16

Αβδδ: File Allocation Table (16-bit)

FTP

Αβδδ: File Transfer Protocol

File Allocation Table

File Allocation Table (16-bit)

File Transfer Protocol

Το `libnet` παρέχει την απαραίτητη δομή δεδομένων για την επικοινωνία με το TCP/IP stack του FreeBSD.

Fixed ACPI Description Table

G

GUI

Αβδδ: Graphical User Interface

Giant

Οι κριτές κλήσεων `sleep` και `mutex` (ή `sleep mutex`) είναι κριτές κλήσεων που χρησιμοποιούνται για τον έλεγχο πρόσβασης σε κοινά δεδομένα. Η χρήση τους είναι απαραίτητη για την επίτευξη της ασφάλειας των κλήσεων που μοιράζονται κριτές κλήσεων. Η χρήση τους είναι απαραίτητη για την επίτευξη της ασφάλειας των κλήσεων που μοιράζονται κριτές κλήσεων.

Graphical User Interface

ία αέαάναόόέετι όύόόçιά άδέείετίιβαò ιάόάίύ άíεñþðíò έάέ ìç÷-άίþò, άάόέοιÝíí óά άέέτιíáò (graphics).

H

HTML

Άάβδô: HyperText Markup Language

HUP

Άάβδô: HangUp

HangUp

HyperText Markup Language

Ç äëþóóá δãñέãñáöþò έάέίÝííò (markup language) ðíò ÷ñçόέίιðíέáβδóάέ áέα ôç äçìέíõñãßá έóòíóáëβäùí (web pages).

I

I/O

Άάβδô: Input/Output

IASL

Άάβδô: Intel's ASL compiler

IMAP

Άάβδô: Internet Message Access Protocol

IP

Άάβδô: Internet Protocol

IPFW

Άάβδô: IP Firewall

IPP

Άάβδô: Internet Printing Protocol

IPv4

Άάβδô: IP Version 4

IPv6

Άλλα: IP Version 6

ISP

Άλλα: Internet Service Provider

IP Firewall

IP Version 4

Ο Υποβάθρο 4 του πρωτογενούς IP, χρησιμοποιεί 32 bits για τον αριθμό. Ο Υποβάθρο 4 είναι ο παλαιότερος και ο πιο διαδεδομένος. Ο Υποβάθρο 6 είναι ο νεότερος και ο πιο σύγχρονος.

Άλλα Άλλα: IP Version 6.

IP Version 6

Ο Υποβάθρο 6 του πρωτογενούς IP. Ο Υποβάθρο 6 είναι ο νεότερος και ο πιο σύγχρονος. Ο Υποβάθρο 6 είναι ο παλαιότερος και ο πιο διαδεδομένος. Ο Υποβάθρο 6 είναι ο νεότερος και ο πιο σύγχρονος.

Input/Output

Intel's ASL compiler

Είναι ο μεταγλωττιστής του Intel για τον ASL και τον AML.

Internet Message Access Protocol

Είναι ο πρωτογενής αριθμός του πρωτογενούς του Υποβάθρου 3. Ο Υποβάθρο 3 είναι ο παλαιότερος και ο πιο διαδεδομένος. Ο Υποβάθρο 3 είναι ο παλαιότερος και ο πιο διαδεδομένος. Ο Υποβάθρο 3 είναι ο παλαιότερος και ο πιο διαδεδομένος.

Άλλα Άλλα: Post Office Protocol Version 3.

Internet Printing Protocol

Internet Protocol

Οι πρωτογενείς αριθμοί του πρωτογενούς του Υποβάθρου 3, οι οποίοι χρησιμοποιούνται για τον Υποβάθρο 3. Ο Υποβάθρο 3 είναι ο παλαιότερος και ο πιο διαδεδομένος. Ο Υποβάθρο 3 είναι ο παλαιότερος και ο πιο διαδεδομένος. Ο Υποβάθρο 3 είναι ο παλαιότερος και ο πιο διαδεδομένος.

Internet Service Provider

Η εταιρεία είναι ο παρόχος υπηρεσιών Internet.

K

KAME

Το έργο KAME είναι η υλοποίηση του πρωτοκόλλου IPv6. Το έργο KAME είναι η υλοποίηση του πρωτοκόλλου IPv6. Το έργο KAME είναι η υλοποίηση του πρωτοκόλλου IPv6. Το έργο KAME είναι η υλοποίηση του πρωτοκόλλου IPv6. Το έργο KAME είναι η υλοποίηση του πρωτοκόλλου IPv6.

KDC

Άλλα: Key Distribution Center

KLD

Άλλα: Kernel ld(1)

KSE

Άλλα: Kernel Scheduler Entities

KVA

Άλλα: Kernel Virtual Address

Kbps

Άλλα: Kilo Bits Per Second

Kernel ld(1)

Η εντολή ld(1) είναι η εντολή που χρησιμοποιείται για να συνδέσει τα αρχεία αντικείμενων με τα αρχεία βιβλιοθηκών. Η εντολή ld(1) είναι η εντολή που χρησιμοποιείται για να συνδέσει τα αρχεία αντικείμενων με τα αρχεία βιβλιοθηκών. Η εντολή ld(1) είναι η εντολή που χρησιμοποιείται για να συνδέσει τα αρχεία αντικείμενων με τα αρχεία βιβλιοθηκών. Η εντολή ld(1) είναι η εντολή που χρησιμοποιείται για να συνδέσει τα αρχεία αντικείμενων με τα αρχεία βιβλιοθηκών.

Kernel Scheduler Entities

Το KSE είναι η υλοποίηση του πρωτοκόλλου IPv6. Το KSE είναι η υλοποίηση του πρωτοκόλλου IPv6. Το KSE είναι η υλοποίηση του πρωτοκόλλου IPv6. Το KSE είναι η υλοποίηση του πρωτοκόλλου IPv6. Το KSE είναι η υλοποίηση του πρωτοκόλλου IPv6.

Kernel Virtual Address

Key Distribution Center

Kilo Bits Per Second

× ηχοειδίεάβδσάε αέα ος ιΎδηος οίρ άνιόδ ερίο (οσί οίρδσά οίρ άάηΎίρ οίρ δάνιΎάε άδύ εΎοίεί οάεάέηέΎίρ οςίάβι οά Ύία έάέηέοίΎίρ ÷ ηίέέυ άέΎόοί). ΆίάέάέέέΎ δηέΎίαόά αέα οί Kilo δάνέάίΎίρ οά Mega, Giga, Tera, έ.ί.έ.

L

LAN

Άβδσά: Local Area Network

LOR

Άβδσά: Lock Order Reversal

LPD

Άβδσά: Line Printer Daemon

Line Printer Daemon

Local Area Network

Άβδσά οίρ ÷ ηχοειδίεάβδσάε οά ίέα οίρδσά δάνέί ÷ P, δ. ÷. άνάόάβι, οδβέ έ.ί.έ.

Lock Order Reversal

Ί δδηΎιάδ οίρ FreeBSD ÷ ηχοειδίεάβ Ύία άηέέι άδύ resource locks αέα ίά αέα ÷ άέηβέάόάε οςί δηύόάάος οδέδ άέΎοίηάδ δςΎΎ οίρ. ίάδ ις ÷ άίέοίυδ άέΎίρδσά δηίάέΎίΎδύ ίά άδδΎ οά locks, ι ίδηβιδ έΎάάάε witness(4), δάνέάίΎίρδσά οοίρδ δάέηάίόέέίρδ δδηΎιάδ (άέΎ άάάέηάβδσά άδύ οίρδ δδηΎιάδ ούί οάάέηίρ άέάυόάύί) έέ άέΎ ÷ άέ έάδΎ οςί ηνά έάέοίρηάβδσά οίρ δδηΎιά οςί δέέάίρδσά δηίάέΎίΎδύ deadlock. (Ί ις ÷ άίέοίυδ witness(4) άβίάέ άάέέΎ άηέάδΎ οοίρδςδσάέέυδ οοίρδ άέΎ ÷ ιρδ οίρ εΎίάέ, ιδύόά άβίάέ δέέάίρ εΎοίεά άδύ οά έάάίρδσάέέΎ ιςίΎίάδ οίρ ίά άβίάέ οδάνίέέΎ.) ίά έάάίρδσάέέΎ ιΎίοίά άδύ οί ις ÷ άίέοίυδ άδδύ οςίάβίάε υδέ “άί άβδσά άηέάδΎ Ύδ ÷ ίέ, Ύία deadlock ιδηάβ ίά οοίάάβ οοί οςίάβι άδδύ”.

Όά δηάίάέέΎ LOR, οοίΎεδ, άέηέηίρδσά άηΎίηά, ιδύόά ίά άέΎ ÷ άδσά ος <http://lists.FreeBSD.org/mailman/listinfo/freebsd-current> έάε ος οάέβάά ούί LOR οίρ άβίάέ άίρδδΎ ιΎ ÷ ηέ οΎίάηά (<http://sources.zabbadoz.net/freebsd/lor.html>) δηέί οάάβέάδσά ιΎίοίά οά εΎοίεά άδύ οέδ έβδσάδςέέδηίέέίρδσά ÷ οάνηάβιρ.

M

MAC

Ἀββδᾶ: Mandatory Access Control

MADT

Ἀββδᾶ: Multiple APIC Description Table

MFC

Ἀββδᾶ: Merge From Current

MFP4

Ἀββδᾶ: Merge From Perforce

MFS

Ἀββδᾶ: Merge From Stable

MIT

Ἀββδᾶ: Massachusetts Institute of Technology

MLS

Ἀββδᾶ: Multi-Level Security

MOTD

Ἀββδᾶ: Message Of The Day

MTA

Ἀββδᾶ: Mail Transfer Agent

MUA

Ἀββδᾶ: Mail User Agent

Mail Transfer Agent

Ἰεᾶ ἀσᾶνῖτᾶ δῖο ÷ ἡζοέιῖδῖεᾶβδᾶέ ᾶέ ὁζῖ ἰᾶδᾶσῖνῖ email. Ἐᾶόῖ δᾶνῖᾶῖοζ, οῖ MTA ᾶδῖοᾶεῖγᾶ ὀῖτᾶ ὀῖο ᾶᾶοέεῖγ ὀδὀδῖᾶδῖο ὀῖο BSD. Ὀῖᾶᾶ, οῖ sendmail δᾶᾶᾶᾶᾶᾶᾶᾶ ὀδῖ ᾶᾶοέᾶ ὀγὀδῖᾶ ᾶᾶῖ ὀδῖᾶ ÷ ῖοῖ ᾶᾶ ὀῖᾶῖ ῖᾶᾶ MTAs, ῖδῖδῖ ὀᾶ postfix, qmail ᾶᾶ Exim.

Mail User Agent

Ἰεᾶ ἀσᾶνῖτᾶ ᾶέ ὁζ ᾶᾶ ÷ ᾶβᾶᾶᾶ, ᾶῖᾶῖᾶῖοζ ἰζῖῖῖῖῖῖ ᾶᾶᾶᾶᾶᾶᾶ ᾶᾶᾶᾶᾶᾶᾶ ᾶᾶ ὁζῖ ᾶδῖοᾶῖᾶ ᾶδᾶῖᾶᾶᾶᾶ ὀᾶ ᾶδὀῖ.

Mandatory Access Control

Massachusetts Institute of Technology

Merge From Current

Ο ορισμός της διακλάδωσης από τον κλάδο -CURRENT είναι η διακλάδωση -CURRENT ή η διακλάδωση -STABLE).

Merge From Perforce

Ο ορισμός της διακλάδωσης από τον κλάδο Perforce είναι η διακλάδωση -CURRENT.

Άλλαξη: Perforce.

Merge From Stable

Ο ορισμός της διακλάδωσης από τον κλάδο FreeBSD είναι η διακλάδωση -CURRENT branch ή η διακλάδωση -STABLE. Επίσης, η διακλάδωση -STABLE είναι η διακλάδωση -CURRENT.

Η διακλάδωση από τον κλάδο -STABLE branch ή η διακλάδωση security branches.

Άλλαξη: Merge From Current.

Message Of The Day

Η διακλάδωση από τον κλάδο ή η διακλάδωση από τον κλάδο ή η διακλάδωση από τον κλάδο ή η διακλάδωση από τον κλάδο.

Multi-Level Security

Multiple APIC Description Table

N

NAT

Άλλαξη: Network Address Translation

NDISulator

Άλλαξη: Project Evil

NFS

Άβδα: Network File System

NTFS

Άβδα: New Technology File System

NTP

Άβδα: Network Time Protocol

Network Address Translation

Ιέα οα ÷ ίεεP εάοÛ οçí ιδιβα όα όαéYόá IP ιάόάáÛεεήόάé εάοÛ οçí Yίπáι όιόò áðu ιέα όýεç áééόýιό (gateway), άδέοñYόήόάό Yόóé óá όιέεÛ ιç ÷ άίPιάόά όιό άñβόéήόάé όβόú áðu οçí όýεç ίά ιιέñÛεήόάé ιέα έιείP άñóάñέεP áéáyέόίόç IP.

Network File System

New Technology File System

ιά όýόόçιá άñ ÷ άβúι όιό άίάόόý ÷ εçéá áðu οç Microsoft έáé áéάίYιáόáé ίá όá έáéόιόñáééÛ όýόιό “New Technology”, ό. ÷. όá Windows 2000, Windows NT έáé Windows XP.

Network Time Protocol

ιάό όñúόιό óóā ÷ ñιέόιή όιό ñιέιáéή όñάάιáόééήý ÷ ñúñιό ιYόú áééόýιό.

O

OBE

Άβδα: Overtaken By Events

ODMR

Άβδα: On-Demand Mail Relay

OS

Άβδα: Operating System

On-Demand Mail Relay

Operating System

Ἡ εἰσαγωγή εἰς τὴν FreeBSD, ἀπεσκοπεῖται ὡς ἡ ἀναγκαῖα βιβλίο γιὰ τοὺς ἀρχάριους χρήστες τοῦ συστήματος. Ὁ σκοπὸς τῆς εἰσαγωγῆς εἶναι νὰ παρέχει τὴν ἀπαραίτητη γνώση γιὰ τὴν ἀρτιστικὴν ἐπιτέλεση τοῦ συστήματος. Ἡ εἰσαγωγή εἶναι ἀρτιστικὴ ἐπιτέλεση τοῦ συστήματος, ἀλλὰ οὐκ ἀρτιστικὴ ἐπιτέλεση τοῦ συστήματος. Ἡ εἰσαγωγή εἶναι ἀρτιστικὴ ἐπιτέλεση τοῦ συστήματος, ἀλλὰ οὐκ ἀρτιστικὴ ἐπιτέλεση τοῦ συστήματος.

Overtaken By Events

Ἡ εἰσαγωγή εἰς τὴν FreeBSD, ἀπεσκοπεῖται ὡς ἡ ἀναγκαῖα βιβλίο γιὰ τοὺς ἀρχάριους χρήστες τοῦ συστήματος. Ὁ σκοπὸς τῆς εἰσαγωγῆς εἶναι νὰ παρέχει τὴν ἀπαραίτητη γνώση γιὰ τὴν ἀρτιστικὴν ἐπιτέλεση τοῦ συστήματος. Ἡ εἰσαγωγή εἶναι ἀρτιστικὴ ἐπιτέλεση τοῦ συστήματος, ἀλλὰ οὐκ ἀρτιστικὴ ἐπιτέλεση τοῦ συστήματος.

P

p4

Ἄβδα: Perforce

PAE

Ἄβδα: Physical Address Extensions

PAM

Ἄβδα: Pluggable Authentication Modules

PAP

Ἄβδα: Password Authentication Protocol

PC

Ἄβδα: Personal Computer

PCNSFD

Ἄβδα: Personal Computer Network File System Daemon

PDF

Ἄβδα: Portable Document Format

PID

Ἄβδα: Process ID

POLA

Ἄβδα: Principle Of Least Astonishment

POP

Άβδδ: Post Office Protocol

POP3

Άβδδ: Post Office Protocol Version 3

PPD

Άβδδ: PostScript Printer Description

PPP

Άβδδ: Point-to-Point Protocol

PPPoA

Άβδδ: PPP over ATM

PPPoE

Άβδδ: PPP over Ethernet

PPP over ATM

PPP over Ethernet

PR

Άβδδ: Problem Report

PXE

Άβδδ: Preboot eXecution Environment

Password Authentication Protocol

Perforce

ία όύόόçιά äēÝā ÷ ïō äēäüóâüí òí ïðíβí ãñÛôâðáé áðü òçí Perforce Software (<http://www.perforce.com/>) éáé òí ïðíβí âβιάé ðéí ðñí ÷ ùñçìÝíí áðü òí CVS. Áí éáé äâí âβιάé áííéêòíý êðäééá, ç ÷ ñðóç òíð âβιάé äēäýêâñç óâ Ýñâá áííéêòíý êðäééá üðù òí FreeBSD.

ËÛðíéá ïÝëç òçð ñÛäâð áíÛððòíçð òíð FreeBSD ÷ ñçóéííðíéíýí Ýía áðíèâðñíéí Perforce ùð ðäéñáíáóééêð ðâñéí ÷ ð äéá êðäééá ðíð èâññâððáé éééáβðñâ ðäéñáíáóéééüð áéüñá éáé äéá òíí èèÛâí -CURRENT.

Personal Computer

Personal Computer Network File System Daemon

Physical Address Extensions

Ἡ νέα ἰσχύρις ἀεὶ ἀναπληροῦν τὸν ὀριζῶντα ἰσχύρις 64 GB RAM ὅταν ὁ ὀριζῶντα ἰσχύρις 32 bit ὀριζῶντα ἀεὶ ἀναπληροῦν (ἀεὶ ἀναπληροῦν εἰς τὸν ὀριζῶντα ἰσχύρις 4 GB - ὀριζῶντα PAE).

Pluggable Authentication Modules

Point-to-Point Protocol

Pointy Hat

Ἡ ἰσχύρις ὀριζῶντα ἀεὶ ἀναπληροῦν τὸν ὀριζῶντα ἰσχύρις 64 GB RAM ὅταν ὁ ὀριζῶντα ἰσχύρις 32 bit ὀριζῶντα ἀεὶ ἀναπληροῦν (ἀεὶ ἀναπληροῦν εἰς τὸν ὀριζῶντα ἰσχύρις 4 GB - ὀριζῶντα PAE).

Portable Document Format

Post Office Protocol

Ἡ ἰσχύρις ὀριζῶντα ἀεὶ ἀναπληροῦν τὸν ὀριζῶντα ἰσχύρις 64 GB RAM ὅταν ὁ ὀριζῶντα ἰσχύρις 32 bit ὀριζῶντα ἀεὶ ἀναπληροῦν (ἀεὶ ἀναπληροῦν εἰς τὸν ὀριζῶντα ἰσχύρις 4 GB - ὀριζῶντα PAE).

Post Office Protocol Version 3

Ἡ ἰσχύρις ὀριζῶντα ἀεὶ ἀναπληροῦν τὸν ὀριζῶντα ἰσχύρις 64 GB RAM ὅταν ὁ ὀριζῶντα ἰσχύρις 32 bit ὀριζῶντα ἀεὶ ἀναπληροῦν (ἀεὶ ἀναπληροῦν εἰς τὸν ὀριζῶντα ἰσχύρις 4 GB - ὀριζῶντα PAE).

Ἡ ἰσχύρις ὀριζῶντα ἀεὶ ἀναπληροῦν τὸν ὀριζῶντα ἰσχύρις 64 GB RAM ὅταν ὁ ὀριζῶντα ἰσχύρις 32 bit ὀριζῶντα ἀεὶ ἀναπληροῦν (ἀεὶ ἀναπληροῦν εἰς τὸν ὀριζῶντα ἰσχύρις 4 GB - ὀριζῶντα PAE).

PostScript Printer Description

Preboot eXecution Environment

Principle Of Least Astonishment

Ēāēpð áíáððóóáðáé ði FreeBSD íé áéēááÝð ðiō áβíáé īāóÝð óðīí ðāēēēū ÷ ñPóðç ðñÝðáé íá ðñīéáēīýí ūóī ði āóíáóūī íēēñūðāñāð éáé ēéāūðāñāð āēðēPíāéð. Ąéá ðāñŪāāēáíá, ç Ūóēīðç íāðīīāóóá íāóáāēçðPí ðiō āðçñāŪāēīóī ðçí Ýíáñīç ðiō óðóðPíáðēīð óðīí āñ ÷ āβī /etc/default/rc.conf ēāññāβóáé ðāñāāááóç ðiō POLA. Óá īÝēç ðçð ñŪāáð áíŪðððēīçð Ý ÷ īōí éáðŪ īñ ðiōð ði POLA ūðáí ēŪīñōí áéēááÝð óðīí óýóóçíá íé īðīβāð āðçñāŪāēīóī ðīí ðāēēēū ÷ ñPóðç.

Problem Report

Īéá ðāñēāñāóP ēŪðīēīō āβāñōð ðñīāēPíáðēīð ði īðīβī āñÝēçēā óðīí ðçāāβī ēPāēēā P óççí ðāēīçñβūóç ðiō FreeBSD. Ąāβðā ði Ūñēñī ĄñŪōīíðáð ÁíáóīñÝð ĐñīāēçīŪðūīí áéá ði FreeBSD (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/problem-reports/index.html).

Process ID

Íáð āñēēīūð ðiō áíáāññβāēáé īá īīíāāēēū ðñūðīí íéá áéāñāáóóá ðiō óðóðPíáðēīð éáé íáð āðēðñÝðáé íá āñŪóīñā óā áððP.

Project Evil

Ī ðñāñīáðēēēūð óβðēīð ðiō NDISulator ðiō Ýñāñā P í Bill Paul, ī īðīβīð ði īīñīáóá Ýóóé áéá íá āāβíáé ðūóī áðáβóēī áβíáé (áðū óēēīóīóēēēPð ŪðīPçð) íá ððŪñ ÷ áé ç áíŪāēç āéá ēŪðé ðÝðīēī. Ōī NDISulator áβíáé Ýíá áéāēēū Ūñēññīá óðīíāáðūçðáð ði īðīβī āðēðñÝðáé óā īāçāīýð óðóēāðPí áéēðýīð óýðīō Microsoft Windows™ NDIS miniport íá ÷ ñçóēīñðīēçēīýí óðīí FreeBSD/i386. Áððūð áβíáé óðīPèùð ī īūñð ðñūðīð íá ÷ ñçóēīñðīēçēīýí ēŪñðāð áéēðýīð ðūī īðīβūī íé īāçāīβ āāī áβíáé áéáēÝóēīñē óā īññP āēāýēāñīō P áñīé ÷ ðīý ēīāēóīēēīý. Ąāβðā éáé ði āñ ÷ āβī `src/sys/compat/ndis/subr_ndis.c` áéá ðāñēóóūðāñāð ēāððīñÝñāēáð.

R

RA

Ąāβðā: Router Advertisement

RAID

Ąāβðā: Redundant Array of Inexpensive Disks

RAM

Ąāβðā: Random Access Memory

RD

Ąāβðā: Received Data

RFC

Ἀπόβόα: Request For Comments

RISC

Ἀπόβόα: Reduced Instruction Set Computer

RPC

Ἀπόβόα: Remote Procedure Call

RS232C

Ἀπόβόα: Recommended Standard 232C

RTS

Ἀπόβόα: Request To Send

Random Access Memory

Revision Control System

To *Revision Control System* (RCS) ἀβιάε Ἰία ἀδὺ δά δᾶέεὺδᾶᾶά οὐδὸΠιᾶδᾶ διὸ οἰδῖεῖρῖ “Ἰεᾶᾶ-ῖ ἠεᾶιὺδᾶῖ” ἠεᾶ ἀδῆῦ ἠᾶ-ᾶβᾶ. Ἀδῆσᾶᾶ Ἰδᾶε ὄσι ἀδῖεᾶδᾶδᾶ, ἀῖῦῆδᾶδᾶ, ἠᾶ-ᾶεῖῆῦδᾶδᾶ, εᾶδᾶᾶᾶᾶδᾶ, ἀῖᾶᾶᾶᾶδᾶ εᾶε ὄδᾶ-ᾶᾶᾶδᾶ δῖεᾶᾶδῆᾶ ἠεᾶῖὺδᾶῖ ἠεᾶ εῦῆᾶ ἠᾶ-ᾶβῖ. Ὀῖ RCS ἀδῖὸᾶᾶᾶδᾶε ἀδὺ δῖεῖῦ ἰεῆᾶ ἠᾶᾶεᾶᾶβᾶ διὸ ὄδῖᾶᾶᾶᾶᾶᾶᾶ ἰᾶδᾶῖ ὀῖδᾶ. Ἀᾶῖ ἠεᾶῆῦδᾶε ἠᾶεῖῖῖῖ Ἰία ἀδὺ ὄᾶ -ᾶᾶᾶᾶδᾶεᾶεᾶεῖῦ διὸ δᾶᾶῖ -ῖῖδᾶε ἀδὺ δῆῖ ἠῖδῖᾶ ὄδᾶᾶᾶᾶᾶᾶ ἠῆῖᾶ-ῖῖ ἠεᾶῖὺδᾶῖ, ἠεῖῦ ἠβῖᾶε δῖεῖ ἠῖεῖῖ ὄδῖ ἠᾶεᾶδῖὸδᾶόε εᾶε ἠῖεῖῖ εᾶε δῖεῖ ἀδῆῦ ὄδῖ -ᾶᾶδᾶ ἠεᾶ ἰεῆᾶ ἠᾶεῖῖ ἠεᾶᾶ-ῖῖᾶῖῖ ἠᾶ-ᾶβῖ. Ὀῖ RCS ἠεᾶὸβῆᾶᾶε δᾶᾶεᾶεῖῦ ἠεᾶ εῦῆᾶ εᾶεῖῖᾶᾶεῖῖ διὸ ἠᾶὸβῆᾶᾶε ὄεῖδ ἠᾶ-ῖῖ ἠεᾶεῖῖᾶᾶδᾶ διὸ UNIX.

Ἀπόβόα Ἀδῖδᾶ: Concurrent Versions System, Subversion.

Received Data

ῖᾶ εᾶεᾶᾶῖ ᾶ ἠῆᾶῖῖδᾶ διὸ RS232C ὄδῖ ῖδῖᾶ ἠβῖᾶᾶεᾶ εᾶδᾶ ἠᾶᾶᾶῖῖ.

Ἀπόβόα Ἀδῖδᾶ: Transmitted Data.

Recommended Standard 232C

ῖᾶ δᾶῖῖδᾶ ἠεᾶ ἠδῆεῖῖῖῖᾶ ἰᾶδᾶῖ ὄεᾶᾶᾶᾶᾶᾶ.

Reduced Instruction Set Computer

Ἰεᾶ δᾶῖῖῖᾶεᾶεᾶ ὄδῖ ὄ-ᾶᾶᾶᾶ ἠδᾶᾶᾶᾶᾶᾶᾶᾶ διὸ ἀδῖεῖῖᾶᾶ ὀῖ ἠβᾶῖδᾶ ὀῖ εᾶεῖῖᾶᾶᾶᾶᾶᾶ διὸ ἰδῖᾶᾶ ῖᾶ ἠεᾶᾶῖῖᾶεᾶ ὀῖ ὀεῖῖῖ ᾶᾶ ῖᾶ ἠβῖᾶε εᾶδῖ ὀῖ ἠῖᾶᾶῖῖ ἠᾶῖεῖῖ ὀεῖῖῖ. Ἀδῖδᾶ ῖᾶᾶᾶ ὄᾶ -ᾶῖῖῖᾶᾶᾶ εᾶᾶᾶῖῖῖῖ ἠῖᾶᾶᾶᾶ, -ᾶῖῖῖῖῖῖῖ ἠεᾶῖῖᾶᾶᾶ ῖᾶᾶᾶῖῖῖ ἠεᾶ ὄᾶ ἠᾶεῖῖῖᾶδᾶ δᾶᾶᾶᾶᾶᾶᾶ ἠδῆῖῖᾶ-ῖῖᾶε εᾶεῖῖᾶᾶᾶ ἠδῖᾶῖῖῖ ἠεᾶ ἠῖῖῖῖῖῖ ὀεῖῖῖῖῖῖ. Ḍᾶᾶᾶᾶᾶᾶᾶᾶᾶᾶ RISC δᾶᾶῖῖᾶᾶᾶᾶᾶᾶ ὀῖδᾶ Alpha, SPARC, ARM ἠεᾶ PowerPC.

Redundant Array of Inexpensive Disks

Remote Procedure Call

repocopy

Āāβōā: Repository Copy

Repository Copy

Āðāðēāβāð áíðēāñāöP āñ ÷ āβūi iYóá óā Yíá áðīēāðPñēi CVS.

× ùñβð òç äéāāééāóβā ðiō repocopy, áí Yíá āñ ÷ āβi ÷ ñāēŪæāóáé íá áíðēāñāöāβ P íá iāðóāñēāβ óā Yíá Ūēēi óçīāβi iYóá óōi áðīēāðPñēi, i committer eā ðñYðāé íá āēðāēYóáé òçí áíðīēP cvs add āéá íá ðiðīēāðPóáé ði āñ ÷ āβi óòçí íYá ðiō èYóç éáé Yðāéóá òçí áíðīēP cvs rm óōi ðāēēū āñ ÷ āβi āéá íá ði āéāñŪøāé.

Ōi iāēiYēðçíá áððPð òçð iāēuāiō āβíáé ūðé āāí áíðēāñŪōāóáé ði éóðīñēēū (iē éáðā ÷ ùñPóáéð óōi āñ ÷ āβi éáóāāñāöPð ðiō CVS) óòç íYá èYóç. ÊāēPð ði FreeBSD Project eāññāβ ðīēy ÷ ñPóēiāð áððYð ðéð ðēçñīōiñβāð, āβíáðāé óð ÷ íŪ ÷ ñPóç òçð äéāāééāóβāð repocopy. ÊáðŪ òç äéāāééāóβā áððP, i āéá ÷ āēñéóPð ðiō áðīēāðçñβiō áíðēāñŪōāé óā āñ ÷ āβā áðāðēāβāð óòç íYá èYóç ðiō áðīēāðçñβiō, áíðβ íá ÷ ñçóēiðīēPóáé ði ðñūññāiá cvs(1).

Request For Comments

Íá óyñēi āāñŪōūi ðiō ðāñēāñŪōiōi óā ðñūðððā, óā ðñūðūēiēēā éáé ðéð ēiēðYð äéāñāáóβāð ðiō äéYðīōi òç ēāéðīōññāβā ðiō Internet. Āāβōā ði www.rfc-editor.org (<http://www.rfc-editor.org/>).

× ñçóēiðīēāβóáé áðβóçð ùð āāíēēūð ūñið ūðáí eŪðīēið ðñiðāβíáé iéá áēēāāP éáé ðāñēiYíáé ó ÷ ūēéá ó ÷ áðéēŪ iā áððP.

Request To Send

Íá óPíá óōi RS232C ðiō æçðŪāé áðū ði áðñāēñōóíYíi óyóðçíá íá óðíā ÷ βóáé òç iāðŪāiōç ðūi āāñYíúí.

Āāβōā Āðβóçð: Clear To Send.

Router Advertisement

S

SCI

Āāβōā: System Control Interrupt

SCSI

Άβδδ: Small Computer System Interface

SG

Άβδδ: Signal Ground

SMB

Άβδδ: Server Message Block

SMP

Άβδδ: Symmetric MultiProcessor

SMTP

Άβδδ: Simple Mail Transfer Protocol

SMTP AUTH

Άβδδ: SMTP Authentication

SSH

Άβδδ: Secure Shell

STR

Άβδδ: Suspend To RAM

SVN

Άβδδ: Subversion

SMTP Authentication

Server Message Block

Signal Ground

Άβδδ: Signal Ground

Simple Mail Transfer Protocol

Secure Shell

Small Computer System Interface

Subversion

Οι Subversion ἀβιάε Ἰία ὀγόοçία ἀεἸα ÷ ιο ἀεαυιόαυι, δαπνιιέι ια οἱ CVS ἀεεἸ ια δέι δπἱ ÷ ùñçìἸίαδ ἀοίαδουόçδὰδ.

Äâβδâ Äðβóçð: Concurrent Versions System.

Suspend To RAM

Symmetric MultiProcessor

System Control Interrupt

T

TCP

Äâβδâ: Transmission Control Protocol

TCP/IP

Äâβδâ: Transmission Control Protocol/Internet Protocol

TD

Äâβδâ: Transmitted Data

TFTP

Äâβδâ: Trivial FTP

TGT

Äâβδâ: Ticket-Granting Ticket

TSC

Äâβδâ: Time Stamp Counter

Ticket-Granting Ticket

Time Stamp Counter

Ο Time Stamp Counter (TSC) είναι ένας 32-bit αριθμός που αυξάνεται συνεχώς σε ορισμένους επεξεργαστές Pentium, και χρησιμοποιείται για να μετρηθεί ο χρόνος που απαιτείται για να εκτελεστεί μια εντολή.

Transmission Control Protocol

Το Transmission Control Protocol (TCP) είναι ένα πρωτόκολλο μεταφοράς δεδομένων που παρέχει αξιόπιστα, ελεγχόμενα και ελεγχόμενα δεδομένα. Είναι ένα από τα βασικά πρωτόκολλα του διαδικτύου.

Transmission Control Protocol/Internet Protocol

Το Transmission Control Protocol/Internet Protocol (TCP/IP) είναι ένα σύνολο πρωτοκόλλων που χρησιμοποιούνται για την επικοινωνία σε ένα δίκτυο. Είναι το βασικό πρωτόκολλο του διαδικτύου.

Transmitted Data

Το Transmitted Data είναι η ποσότητα δεδομένων που έχει μεταφερθεί μέσω ενός καναλιού επικοινωνίας. Είναι μετρήσιμο και χρησιμοποιείται για να ελεγχθεί η απόδοση του δικτύου.

Trivial FTP

U

UDP

Άλφα: User Datagram Protocol

UFS1

Άλφα: Unix File System Version 1

UFS2

Άλφα: Unix File System Version 2

UID

Άλφα: User ID

URL

Άλφα: Uniform Resource Locator

USB

Άλφα: Universal Serial Bus

Uniform Resource Locator

Īéá ĩÝēīāīō āéá ðçī āŷñāóç āíúð ðūñīō (ūðūð ð.÷. āíúð āāāñŪōīō) óðī Internet, éāēðð éāé Ýíá ĩÝōī āéá ðçī áíáāīþñéóç ðīō ĩā ĩīíāāéēū ðñūðī.

Unix File System Version 1

Ōī ðñūðōāñ÷éēū óýóðçīá āñ÷āβñī ðīō UNIX, āíúðōū āðβóçð éāé ùð Berkeley Fast File System.

Unix File System Version 2

Īéá āðÝēðáóç ðīō UFS1, ç ĩðīβá ðñūðīāīōāíβóðçēā óðī FreeBSD 5-CURRENT. Ōī UFS2 ðñīóēÝðāé āāβēðāð ĩðēīē 64 bit ðāñīþīóáð Ýðóé ðī ðñŪāīā ðīō 1Ō. ĀéāēÝðāé áēūīā ððīóðþñéīç āēðāðāīÝíūī āñ÷āβñī éāé Ūēēá ðñīçāīÝíá ÷āñāēðçñéóðéēŪ.

Universal Serial Bus

Ĵá ðñūðððī ðēēēīý ðīō ÷ñçóēīðīēāβðāé āéá ðçī áéáóýíāāóç ĩāāŪēīō ðēþēīōð ðāñéðāñāéāēþī ððīēīāéóðþī, ÷ñçóēīðīēþīóáð ĩéá ðððīðīéçīÝíç áéāðāðþ.

User ID

Ĵáð ĩīíāāéēūð āñēēīūð ðīō áíáðβēāðāé óā ēŪēā ÷ñþóðç āíúð ððīēīāéóðþ éāé ÷ñçóēīðīēāβðāé āéá ðçī áíáāīþñéóç ðūī ðūññī éāé ðūī áééāēūŪðūī ðīō Ý÷īōī āē÷ññçēāβ óā áððūī.

User Datagram Protocol

Ĵá áðēū éāé ĩç áíēūðéóðī ðñūðūēīēēī ðīō ÷ñçóēīðīēāβðāé āéá ðçī áíðāēēāāþ āāāñÝíūī óā Ýíá āβēððī TCP/IP. Ōī UDP āāī ðāñÝ÷āé Ýēāā÷ī éāé áēūñēùóç éāēþī ūðūð ðī TCP.

V

VPN

Āāβðā: Virtual Private Network

Virtual Private Network

Īéá ĩÝēīāīō ðīō ÷ñçóēīðīēāβ Ýíá āçīūóēī āβēððī āðēēīēíūīβáð (ūðūð ðī Internet), āéá ĩá ðāñÝ÷āé áðñīāēñðōīÝíç ðñūóāáóç óā Ýíá ðīðēēū āβēððī, ūðūð ðī LAN ĩéáð āðé÷āβñçóçð.

Êĩñùíβää

Άδού οι αέαέβι άβιάέ οι άδιόΎεάοία όçð ñääééβð άñääόβáð áεάοίíóÛàùí áεάεííόβι όçð “ËÛááð Õáείçñβùόçð οίö FreeBSD”. Άδού οι εάβιαíí άñÛóðçêá óá ññöP SGML, óγíöúía íá οι DocBook DTD εάέ Ύ÷άέ ññöíðíεçèáβ áðü όçí SGML óá ðíεéÛð áεάοíñáóééÛð ññöÛð ðáñíóóβáόçð ÷ñçóéííðíεβίόáð όçí áóáñíäP **Jade**, íεá íç÷áíP DSSSL áñé÷οίý êpáééá. ×ñçóéííðíεβçéáí óá DSSSL stylesheets οίö Norm Walsh íá Ύía áðéðéÛíí áðβðääí öñíðíðíβçόçð áεá íá äpóíðí óéð íäçáβáð ðáñíóóβáόçð όόçí **Jade**. Ç Ύíóððç ññöP áόóíý οίö εάéíÛíö ááí εá öðβñ÷á ÷ùñβð όçí äêpóóá óóíé÷áéíèáóβáð T_EX οίö Donald Knuth, οί L^AT_EX οίö Leslie Lamport, P οί macro package **JadeTeX** οίö Sebastian Rahtz.