

**Åã ÷ åéñßäéï ôïõ FreeBSD**

**ÏÜää Ôâêìçñßùóçò ôïõ FreeBSD**

## Άα ÷ αέñβάεί οίο FreeBSD

άδτι ñÛάά Ôάειçñβύοçð οίο FreeBSD

ΆçìíóέάοίÛíí ÔάññíòÛñέíò 1999

ΔíάοíάóέέÛ Άέέάέπíάόά © 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010 ñÛάά Ôάειçñβύοçð οίο FreeBSD

Έάεπð ðñέάοά οοί FreeBSD! Άóòτι οί άα ÷ αέñβάεί έάέýðòάέ όçí άάέάóÛóóάόç έάέ όçí έάέçìññέíð ÷ ñðóç οίò FreeBSD 7.3-RELEASE έάέ οίò FreeBSD 8.0-RELEASE. Ôí αέάέβí άóòτι άβíάέ ììíέíά όðì άάέòβúóç έάέ άíÛððóìç έάέ άðíòάέάβ οί άðíòÛέάοíά όçð άíòεάέÛð ðñέέπí άóòììí, ñðìòά εÛðíέά όìπíάόά ìðñάβ íά ðññέÛ ÷ íοí ó ÷ άóέέÛ ñάðñάοíÛíάð ðççñíοíñβάð έάέ íά ÷ ñάέÛάέííóάέ άíάíÛòç. Άí άíάέάóÛñάóóά íά ñάð άíçεðóάòά οά άóòτι οί Ûññí, άðέέíέíñíðóάά íάάβ ñάð όóçí çεάέòñííέέð εβóóά ñÛάάð όάειçñβύοçð οίò FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-doc>). Ç όάέάóóάβά Ûέάñóç άóóíý οίò έάέíÛíò άβíάέ ðÛíóά έάέάÛέéç άðì όçí έóóíóάέβάά οίò FreeBSD (<http://www.FreeBSD.org/>) (ðάέέúðññάð άέάúóάέð ñðññάβóά íά άññάβóά όóç έέάýέòíóç <http://docs.FreeBSD.org/doc/>). Ìðññάβóά άðβóçð íά ñάóάóìñðóáòά όóíí ððñέíάέóðð óáð οί βάέí άέάέβí οά Ûέέáð ññòÛò άñ ÷ άβíò έάέ ñά έέÛοíñáð ññòÛò óοìðβάóçð άðì οίí άíòðçñάóçðð FTP οίò FreeBSD (<ftp://ftp.FreeBSD.org/pub/FreeBSD/doc/>) ð Ûíά άðì óά ðñέέÛ mirror sites. Άí ðñíòέíÛóά Ûíά όòðòìÛíí άíóβóððí, ñðññάβóά íά άάñÛóóάðá Ûíά άíóβññάóí οίò Άα ÷ αέñέάβíò, άðì οί FreeBSD Mall (<http://www.freebsdmall.com/>). Ìðññάβóά άðβóçð íά ðÛíάòά οά úέí οί άέάέβí (<http://www.FreeBSD.org/search/index.html>).

Ç αέάññð έάέ ÷ ñðóç οά ññòð ðççάβíò έπáέέά (SGML DocBook) ð óά ñάóάέúððέóíÛíç' ññòð (SGML, HTML, PDF, PostScript, RTF έíέ) ñá ð ÷ ùñβð άέέάÛò, άðέòñÛðάóάέ άóóóíí íέ ðññάέÛòò ðñíòðñέÛóάέð ðççñíýíóάέ:

1. Ç αέάññð οά ññòð ðççάβíò έπáέέά (SGML DocBook) ðñÛðάέ íά αέάóçññάβ όçí ðññάðÛíò άðέúóç ðíάòíάóέέπí αέέάέúòÛòìí, άóðð όç εβóóά ñά ðñíòðñέÛóάέð έάέ όçí άðòììíç ðññÛññάóíí óóέð ðñðóáð ññάìÛò οίò άñ ÷ άβíò, άíáðÛάέçðáð.
2. Ç αέάññð οά ñάóάέúððέóíÛíάð ññòÛò (ñáðÛóñάóç οά Ûέέά DTD, ñάóάóñíðð óά PDF, PostScript, RTF ð Ûέέáð ññòÛò) ðñÛðάέ íά άíάðñÛάάέ όçí ðññάðÛíò άðέúóç ðíάòíάóέέπí αέέάέúòÛòìí, άóðð όç εβóóά ñά ðñíòðñέÛóάέð, έάέ όçí ðññάέÛòò ðññÛññάóíí οúοí όóçí όάειçñβύοç ñíοí έάέ οά Ûέέí ðέέέú ðíò ðññÛ ÷ άðάέ ñάάβ ñά όçí αέάññð.

**Όçíάíóέέú:** ΆÓÓÇ Ç ÔÁΕΙÇÑΕÛÓÇ ΑΕΙΆΟΆΕ ΑÐÌ ÔÇÍ ÌÌΆΆ ÔÁΕΙÇÑΕÛÓÇ ÓÌÕ FREEBSD "ÛÓ Å×ÁΕ" ΕΆΕ ΆΑÍ ÐΑÑÑ×ΑÓΆΕ ΕΑΙΕΆ ΑΙΆÓÇ Ç ΑΙΙΆÓÇ ΑΑΆÓÇÓÇ, ÓΟΙÐΑÑΕΕΑΙΙΑΑÌÌΑΙÛÍ, ΑΕΕΆ ×ÛΝΕÓ ÍΑ ÐΑÑΕΙÑΕÆΑÓΆΕ ÌÌÌÍ ÓΑ ΑÓÓΑÓ, ΕΆΕ ΟÛÍ ΑΙΙΆΟÛÍ ΑΑΆÓÇÓΑÛÍ ΑΕΆ ΑΙÐÌÑΑÓÓΕÍÏÓÇÓΑ Ç ΕΑÓΆΕΕÇΕÏÓÇÓΑ ΑΕΆ ÌÐÌΕÌΑÇÐÌÓΑ ÓΟΑΕΑΕÑΕΙΑÌÌÍ ÓΕΙÐÌ. ÓΑ ΕΑΙΕΆ ÐΑÑΕÐΟÛÓÇ ΆΑÍ ΑÓΕΟÍΑΟΆΕ Ç ÌÌΆΆ ÔÁΕΙÇÑΕÛÓÇ ÓÌÕ FREEBSD ΑΕΆ ÌÐÌΕΑÓΑÇÐÌÓΑ ΑΙΆÓΑÓ, ΑΙΙΆΟΑÓ, ÓÔ×ΑΕΑÓ, ΑΕΑΕΕΑÓ, ÓÇÍΑΙÓΕΕΑÓ, Ç ΕΑÓΑ ÐΑÑΕÐΟÛÓÇ ΑΕΑΑΑÓ (ÓΟΙÐΑÑΕΕΑΙΙΑΑÌÌΑΙÛÍ, ΑΕΕΆ ×ÛΝΕÓ ÍΑ ÐΑÑΕΙÑΕÆΑÓΆΕ ÌÌÌÍ ÓΑ ΑÓÓΑÓ, ΕΆΕ ÓÇÍ ΑΑÓÍΑΙΕΆ ÐΝÌΟΑΑÓÇ ÓΑ ΑΙΑΕΕΑΕΟΕΕΑÓ ÐÇΑΑÓ Ç ΟÐÇÑΑÓΕΑÓ, ÓÇÍ ΑΑÓÍΑΙΕΆ ×ÑÇÓÇÓ, ÓÇÍ ΑÐÛΕΑΕΆ ΑΑΑÌÌΑΙÛÍ Ç ΕΑÑΑÌÓΟ, ΕΆΕ ÓÇÍ ΑΕΑΕÌÐÇ ΑÐΕ×ΑΕÑÇΙΑÓΕΕÛÍ ΕΑΕΟÌÑΑΕÛÍ), ÐÌÕ ÐΝÌΕΑΕÌÓÍΟΆΕ ÌΑ ÌÐÌΕΑÇÐÌÓΑ ÒÑÌÐÌ ΑÐÌ ÓÇ ×ÑÇÓÇ ΑÓÓÇÓ ÓÇÓ ÔÁΕΙÇÑΕÛÓÇ.

Ôí FreeBSD άβíάέ Ûíά έάóí ÷ ðñòìÛíí άìðñέέú óýíάíέí οίò FreeBSD Foundation.

Ìέ εÛíάέð 3Com έάέ HomeConnect άβíάέ έάóí ÷ ðñòìÛíά άìðñέέÛ óýíάíέά όçð 3Com Corporation.

Íé eÝíáèò 3ware éáé Escalade áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò 3ware Inc.

Ç eÝíç ARM áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò ARM Limited.

Ç eÝíç Adaptec áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò Adaptec, Inc.

Íé eÝíáèò P òñÛóáèò Adobe, Acrobat, Acrobat Reader, éáé PostScript áβíáé áβòá éáòí÷òñùÝíá àìðñééÛ óýíáíéá P àìðñééÛ óýíáíéá òçò Adobe Systems Incorporated óòèò ÇñùÝíáò Ñíééòáβáò P/éáé óá Ûééàò ÷þñáò.

Íé eÝíáèò P òñÛóáèò Apple, AirPort, FireWire, Mac, Macintosh, Mac OS, Quicktime, éáé TrueType áβíáé àìðñééÛ óýíáíéá òçò Apple Computer, Inc., éáòí÷òñùÝíá óòèò ÇñùÝíáò Ñíééòáβáò éáé óá Ûééàò ÷þñáò.

Íé eÝíáèò Corel éáé WordPerfect áβíáé àìðñééÛ óýíáíéá P éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò Corel Corporation P/éáé òùí èðááòñééþí òçò óòíí ÉáíááÛ, óèò ÇñùÝíáò Ñíééòáβáò P/éáé óá Ûééàò ÷þñáò.

Ç òñÛóç Sound Blaster áβíáé àìðñééÛ óýíáíéá òçò Creative Technology Ltd. óòèò ÇñùÝíáò Ñíééòáβáò P/éáé óá Ûééàò ÷þñáò.

Ç eÝíç CVSup áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá òíò John D. Polstra.

Íé eÝíáèò P òñÛóáèò Heidelberg, Helvetica, Palatino, éáé Times Roman áβíáé áβòá éáòí÷òñùÝíá àìðñééÛ óýíáíéá P àìðñééÛ óýíáíéá òçò Heidelberger Druckmaschinen AG óòèò ÇÐÁ éáé óá Ûééàò ÷þñáò.

Íé eÝíáèò P òñÛóáèò IBM, AIX, EtherJet, Netfinity, OS/2, PowerPC, PS/2, S/390, éáé ThinkPad áβíáé àìðñééÛ óýíáíéá òçò International Business Machines Corporation óòèò ÇñùÝíáò Ñíééòáβáò, Ûééàò ÷þñáò, P éáé óòá äýí óáòòò÷þñííá.

Íé eÝíáèò IEEE, POSIX, éáé 802 áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá òíò Institute of Electrical and Electronics Engineers, Inc. óòèò ÇñùÝíáò Ñíééòáβáò.

Íé eÝíáèò Intel, Celeron, EtherExpress, i386, i486, Itanium, Pentium, éáé Xeon áβíáé àìðñééÛ óýíáíéá P éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò Intel Corporation éáé òùí èðááòñééþí òçò óòèò ÇñùÝíáò Ñíééòáβáò éáé óá Ûééàò ÷þñáò.

Íé eÝíáèò Intuit éáé Quicken áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá P éáòí÷òñùÝíá óýíáíéá òðçñáóéþí òçò Intuit Inc., P èÛðíéùí áðù óèò èðááòñééÝò òçò, óòèò ÇñùÝíáò Ñíééòáβáò éáé óá Ûééàò ÷þñáò.

Òí Linux áβíáé Ýíá éáòí÷òñùÝíá àìðñééÛ óýíáíéá òíò Linus Torvalds óòèò ÇñùÝíáò Ñíééòáβáò.

Íé eÝíáèò LSI Logic, AcceleRAID, eXtremeRAID, MegaRAID éáé Mylex áβíáé àìðñééÛ óýíáíéá P éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò LSI Logic Corp.

Íé eÝíáèò M-Systems éáé DiskOnChip áβíáé àìðñééÛ óýíáíéá P éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò M-Systems Flash Disk Pioneers, Ltd.

Íé eÝíáèò Macromedia, Flash, éáé Shockwave áβíáé àìðñééÛ óýíáíéá P éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò Macromedia, Inc. óòèò ÇñùÝíáò Ñíééòáβáò éáé/P óá Ûééàò ÷þñáò.

Íé eÝíáèò Microsoft, IntelliMouse, MS-DOS, Outlook, Windows, Windows Media, éáé Windows NT áβíáé áβòá éáòí÷òñùÝíá àìðñééÛ óýíáíéá P àìðñééÛ óýíáíéá òçò Microsoft Corporation óòèò ÇñùÝíáò Ñíééòáβáò éáé/P óá Ûééàò ÷þñáò.

Íé eÝíáèò Netscape éáé Netscape Navigator áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò Netscape Communications Corporation óòèò Ç.Ð.Á éáé Ûééàò ÷þñáò.

Íé eÝíáèò GateD éáé NextHop áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá éáé àìðñééÛ óýíáíéá òçò NextHop óòèò Ç.Ð.Á. éáé Ûééàò ÷þñáò.

Íé eÝíáèò Motif, OSF/1, éáé UNIX áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá éáé íé eÝíáèò P òñÛóáèò IT DialTone éáé The Open Group áβíáé àìðñééÛ óýíáíéá òíò The Open Group óòèò ÇñùÝíáò Ñíééòáβáò éáé óá Ûééàò ÷þñáò.

Ç eÝíç Oracle áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò Oracle Corporation.

Íé eÝíáèò PowerQuest éáé PartitionMagic áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò PowerQuest Corporation óòèò ÇñùÝíáò Ñíééòáβáò éáé/P óá Ûééàò ÷þñáò.

Íé eÝíáèò RealNetworks, RealPlayer éáé RealAudio áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò RealNetworks, Inc.

Íé eÝíáèò P òñÛóáèò Red Hat, éáé RPM áβíáé àìðñééÛ óýíáíéá P éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò Red Hat, Inc. óòèò ÇñùÝíáò Ñíééòáβáò éáé óá Ûééàò ÷þñáò.

Íé eÝíáèò SAP, R/3, éáé mySAP áβíáé àìðñééÛ óýíáíéá P éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò SAP AG óòç Ááñíáííá éáé óá ðíééÝò Ûééàò ÷þñáò òíò èùòíò.

Íé eÝíáèò P òñÛóáèò Sun, Sun Microsystems, Java, Java Virtual Machine, JavaServer Pages, JDK, JRE, JSP, JVM, Netra, Solaris, StarOffice, Sun Blade, Sun Enterprise, Sun Fire, SunOS, Ultra éáé VirtualBox áβíáé àìðñééÛ óýíáíéá P éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò Sun Microsystems, Inc. óòèò ÇñùÝíáò Ñíééòáβáò éáé óá Ûééàò ÷þñáò.

Íé eÝíáèò Symantec éáé Ghost áβíáé éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò Symantec Corporation óòèò ÇñùÝíáò Ñíééòáβáò éáé óá Ûééàò ÷þñáò.

Ç eÝíç MATLAB áβíáé Ýíá éáòí÷òñùÝíá àìðñééÛ óýíáíéá òçò The MathWorks, Inc.

Ç eÝíç SpeedTouch áβíáé Ýíá àìðñééÛ óýíáíéá òçò 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 όιð Xiph.Org.

ΔιέεΎð áδú όέð εΎίάέδ P οñÚóάέδ íé íδñβάð ÷-ñçóέιñδíέίγίόάέ áδú όιð έάόάόέάδóάóΎð P όιðð δùέçóΎð όιðð áέά íά άέάέñβñóí όά δñíúúíόά όιðð έάùñíγίόάέ άιδñέέú όγίάιέά. ¼δñó áδóΎð άιðάίβέñíόάέ όά áδóú όι έάβñáñ έάέ áέά úόάð áδú áδóΎð áññβέάέ ç ÏÚάά ÁíÚððóιçð όιð FreeBSD úðέ άβίάέ δέέάíúí íά άβίάέ άιδñέέú όγίάιέά, έά άάβθά Ύίά áδú όά όγίάιέά: “™” P “®”.

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# Ðñüëïäïò

## Òá Ðïéïò Æððèýíáðáé Áðü òï Äéäëßï

Ôï ðñðïï ðïðïá áðïéý ðïò äéäëßïò, ðáçááß ðïí ðÝï ÷ ðñððç óðç äéäéäéáðá äéäéðÜððáðçð ðïò FreeBSD, éäé ðïí äéðÜäé ðáéÜ ððç ðééïòòòá éäé ðïí ó÷: äéäéðïü ðïò UNIX®. Áðü ðï ðïðïá äáí Ý÷: äé éäéäððáðð äðäéððáðð. Áñéäß ðïí ç äéÜéäðç äéá äïñáýéçðç áñüð ðÝïò ðððððïáðïò, éäé ç äïñáðüðçðá äïñïßùðçð ðïí äïððáñ ðáé ðï FreeBSD éäèð äððÝð äéðÜäéðáé ððáäéäéÜ.

Áðïéý äéäéðÜððá ðï ðñðïï ðïðïá, ðï äáýððáñ, éäðÜ ðñéý ðáäéýððáñ ðïðïá, ðáñééäïáÜñéé ðéá äéððáð áñáðïñÜ ðá äéÜðïñá èÝñáðá ðïò äñáéäéÝñïò ðïòð äéá÷: äéñéððÝð ððððçìÜðïí FreeBSD. ðáñééÜ äðü äððÜ ðá éäðÜéäéä äßñéä äðéñéððáñ ðá ðá éäðáñððáðá áí Ý÷: äðá ðáç ðáéäððáé ðððéäéñééÝñá ðïðïáðá ðïò äéäëßïò. ¼ðïò ÷ ðáéÜéäððáé èÜðé ðÝðïéí, éä áñáéÝñáðáé ððç ðýñïç ðïò éäðáéäßïò ðïò ðüééð ðáéñððáðá ðá äéäéÜéäðá.

Äéä ðáñéððüððáðð ðçãÝð ðççñïòïñéðï, äáßðá ðï ÐáñÜñçðçíá B.

## ÄéäéäÝð äðü ðçí Õñßðç èäïíðç

Ç ðñÝ÷: ððá online Ýéäïòç ðïò Äá÷: äéñéäßïò, äßñéä ðï äðïòÝéäðïá ðçð ðñïòðÜéäéäð ðñéðï äéäðïòÜäñ äéäéñïðï ððï äéÜððçíá ðïí ðáéäððáßñ 10 ÷ ðñïñ. ðé ðéí ðçíáñéééÝð äéäéäÝð ðá ó÷: Ýðç ðá ðçí ðñßðç Ýñððç Ýéäïòç ðïò Äá÷: äéñéäßïò (2004) ðáßñïðáé ðáñáéÜðü:

- ÈäðÜéäéí 25, ðï DTrace, äßñéä Ýñá ðÝï èäðÜéäéí ðá ðççñïòïñßäð ó÷: äðééÜ ðá äððü ðï ðáñðð÷: ðñï äñáäéäßñ áñÜéððçð äðüäïòçð.
- ÈäðÜéäéí 20, ç Õðïòðñééç ÕðððçìÜðïí Äñ÷: äßñ, äßñéä Ýñá ðÝï èäðÜéäéí ðá ðççñïòïñßäð äéá ðððððïáðá äñ÷: äßñ ðïò äáñ ððïòðçñßñéððáé äáäáñð äðü ðï FreeBSD, ðððð ðï ZFS äðü ðçí Sun™.
- ÈäðÜéäéí 17, ðá÷: ððá÷: ðð ÕðïáÜñïðüí Áððáéäßäð, äßñéä Ýñá ðÝï èäðÜéäéí ðá ðççñïòïñßäð ó÷: äðééÜ ðá ðéð ðÝäð äðñáðüðçððá äéä ðçí ÷ ðñðç ðïò auditing ððï FreeBSD.
- ÈäðÜéäéí 22, ç Äéñéñééñïðçðç, äßñéä Ýñá ðÝï èäðÜéäéí ðá ðççñïòïñßäð ó÷: äðééÜ ðá ðçí äéäéðÜððáðç ðïò FreeBSD ðá ðñáéðïééü äéðÝéäðçð äéñéñéðï (virtual) ðç÷: áñçìÜðïí.

## ÄéäéäÝð äðü ðç Äáýððáñç èäïíðç (2004)

Ç ðñßðç Ýéäïòç áððïéý ðïò äéäëßïò ððáí ðï äðïòÝéäðïá ðçð ðñïòðÜéäéäð ðáñéððüððáñ äðü äýí ÷ ðñïñ äðü ðá ðÝçç ðçð ðñÜäð Õäéçñßùðçð ðïò FreeBSD. Ç Ýñððç Ýéäïòç äß÷: ä ðïðïí ðáÜñéí ðÝäéð, ðïò èñßðçéä áñáäéäßñ ðá ððððéäß ðá äýí ÷ ðñéððïéýð ðïòðð. ÐáñáéÜðü ðáßñïðáé ðé ðçíáñéééððáðð äéäéäÝð ðá äððð ðç ðÝá Ýéäïòç:

- ÈäðÜéäéí 11, Õï èäðÜéäéí Ñýéïéðçð éäé Äáéðéððïððïðçðçð ðïò FreeBSD, äðäéðÜéçéä ðá ðÝäð ðççñïòïñßäð äéá ðç äéá÷: äßñéðç áñÝñáäéäð éäé ðñïñ ðïò ðððððïáðïò ðÝðü ACPI, ðá ðáñéððüððáðð ðççñïòïñßäð äéá ðï ðýððçíá cron éäé ðá ðáñéððüððáðð äðéñáÝð ðáñáñáððñïðçðçð ðïò ððñðïá ðïò FreeBSD.
- ÈäðÜéäéí 14, Õï èäðÜéäéí ÁððÜéäéäð, äðäéðÜéçéä ðá ðÝäð ðççñïòïñßäð äéá Äßðððá VPN, äéá èßððáð äéÝá÷: ðð ðñïðáðçð äñ÷: äßñ (ACLs), éäé ðáñéððüððáðð ððïñáñééÝð ó÷: äðééÜ ðá ðçí áððÜéäéä ðïò FreeBSD.
- ÈäðÜéäéí 16, Ì Õðï÷: ðñáððééðð ðá÷: ðð ðñïðáðçð (MAC), äßñéä Ýñá ðÝï èäðÜéäéí ðá äððð ðçí Ýéäïòç. Äïçááß ðé äßñéä ð ðç÷: áñéðïðð MAC, éäé ððð ððñáß ðá ÷ ðççðéñðñéçéäß äéá ðá áñéð÷: ðéäß ç áððÜéäéä áñüð ðððððïáðïò FreeBSD.

- Εξομοίωση 18, Οι εξομοίωση αέρι οά ΑδρεχέααοοέεÜ ΙΥοά, αδαέοÜεçεά, ια ιΥαδ δεçññοιññΒαδ αέα οοοέαδΥδ αδιεΡεαοοçδ USB, οοέαιέυοδδθα οοοδΠιαοιò αν÷αβύι (snapshots), δανέιñέοιιγδ οδç ÷ñΠοç ουί οοοδçιÜδουί αν÷αβύι (quotas), οοοδΠιαοά αν÷αβύι διò ααοβæιιòαέ οά οδÜñ÷ιιòά αν÷αβά Ρ οοι αβέοδι, εάεηδ εάέ εñοδοιñαοçιΥιαδ εαοαοιΡοαέδ αβόεui.
- Εξομοίωση 21, Ι Αέα÷αέñεοδΠδ Ούιui Vinum, αβιαέ Υία ιΥι εαοÜεαέι οά αοδΠ οçι Υεαιòç. ΔανέανÜοαέ οιι οñυδñ ÷ñΠοçδ οιò Vinum, αñυδ οοοδΠιαοιò αέα÷αβñεοçδ αδιεçεαοοέεΡι ιΥοι διò οειδιέαβ οçι ιñαÜιουç οοοέεΡι αβόεui οιò οοοδΠιαοιò οά αεÜοαίç RAID-0, RAID-1 εάέ RAID-5.
- Οοι ΕαοÜεαέι 27, δñιòδΥεçεά Υία οιΠια ο÷αδóεεui ια οçι αδβέοοç δñιñεçιÜδουί οδóεδ οοιαΥοαέδ PPP εάέ SLIP.
- Εξομοίωση 28, Οι εξομοίωση αέα οι Çεαέδññιέεui Οά÷οανññαβι, αδαέοÜεçεά ια ιΥαδ δεçññοιññΒαδ αέα οçι ÷ñΠοç αιαέεαέοέεΡι MTA, δέοδιδñβçç οαδδουδçοαδ οοι SMTP, οι δñυδουέιέει UUCP, οά ανñαέαβά **fetchmail** εάέ **procmial**, εάέ ια Üεεά εΥιαοά αέα δñι÷υñçιΥιòδ.
- Εξομοίωση 29, Οι εξομοίωση Αιòδçññαδçοβι Αέέδýui, δανέεαιñÜιαοάε αέα δñηòç οññÜ οά αοδΠ οçι Υεαιòç. Αδδου οι εαοÜεαέι δανέανÜοαέ δυδ ια ααέαοαοδΠοαδδ οñ **ΑέάéñέοδΠ HTTP Apache**, οñ αιòδçññαδçοβ **ftpd** οιò FreeBSD, εάέ οñι αέαéñέοδΠ **Samba** αέα αδέέιέιñιβά ια δαéÜοαδ Microsoft® Windows®. Οοι εαοÜεαέι αδδου, Υ÷ιòι ιαοαοαñεαβ εÜθιέαδ αñυδçοαδ αδυ οι ΕαοÜεαέι 31 (Δñι÷υñçιΥία ΕΥιαοά Αέέδýουçδ), δñιέαιΥιò ια ααέοέυεαβ ç δανιòοβαòç οιòδ.
- Εξομοίωση 31, Οι εξομοίωση αέα Δñι÷υñçιΥία ΕΥιαοά Αέέδýουçδ, αδαέοÜεçεά ια ιΥαδ δεçññοιññΒαδ αέα οç ÷ñΠοç οοοέαδΡι Bluetooth® οοι FreeBSD, οçι ααέαδÜοδαòç αóγñιαδουί αέέδýui, εάέ οçι ΙΥειñ Αέέδýουçδ Αόγñ÷ñιçç ΙαοαοññÜδ (ATM).
- ΔñιòδΥεçεά Υία Εαιέευαέι, αέα ια οοαέαιòñηοαέ υειòδ οιòδ οα÷ιέειγδ υñιòδ εάέ οιòδ αεÜοιñιòδ ιñέοιγδ διò δανέΥ÷ιιòάε οά ιεüέεçñι οι αέαέβι.
- αείαι αέοδçοέéΥδ ααέοεΡοαέδ οοιòδ δβιαέαδ εάέ οδα ανñαδΠιαοά οά ιεüέεçñι οι αέαέβι.

## ΑεéαñΥò αδύ οçι Δñηòç éäiòç (2001)

Ç αáyοαñç Υεαιòç Ροái οι αδιòΥεαοία οιòεÜ÷έοοιι äýι ÷ññιuiñ ανñαοβαδ αδυ οά ιΥεç οçδ ñÜααδ Οαέιçññβυοçδ οιò FreeBSD. Ιέ δει οçιαίοέéΥδ αεéαñΥò οά αοδΠ οçι Υεαιòç Ροái ιέ δανέÜδου:

- ΔñιòδΥεçεά Υία ιεüέεçñιΥιñ ΑδññαδΡñει.
- ¼εά οά ανñαδΠιαοά οά ASCII αιδέεαοαοδÜεçεái αδυ ανñαοέéÜ αέαανÜñιαοά.
- ΔñιòδΥεçεά ιεά οδδñιέιçιΥιç οýñηçç οά εÜεα εαοÜεαέι, ç ιδñιβά δανέΥ÷αé ιεά οýιδñç αιαέαοαέαβυοç δουί δεçññοιññεΡι διò δανέΥ÷αé οι εαοÜεαέι, εάέ οé αιñιΥιαοάε ια αñññβæαé αδυ δñει ι αιñαñΡοδçδ.
- Οι δανέα÷υññιñ αιñαέιññαñβεçεά οά δñβά εñαέéÜ ιΥñç: “ΙαέέΡιòαδ ια οι FreeBSD”, “Αέα÷αβñέοç ΟοοδΠιαοιò”, εάέ “ΔανññδΠιαοά”.
- Οι ΕαοÜεαέι 2 (“ΑαέαέοδΡιòαδ οι FreeBSD”) ιαιñññÜοδçεά αδυ οçι αν÷Ρ ια δñεéΥδ αέέυιñαδ, ηοοά ια αέαοειέγιαέ οιòδ ÷ñΠοδαδ ια εαοαñηΡοιòι οι εαβññιñ.
- Οι ΕαοÜεαέι 3 (“ΑαοέéΥδ ññεαδ οοι UNIX”) αδαέοÜεçεά ηοοά ια οοιδανέεαιñÜιαέ δñυοεαοαδ δεçññοιññΒαδ αέα οέδ αέανñαοβαδ (processes), οιòδ ααβññιñαδ (daemons), εάέ οά οΡιαοά (signals).
- Οι ΕαοÜεαέι 4 (“ΑαέαδÜοδαòçδ ΑοανññαΡι: ΔαéΥοά εάέ Ports”) αδαέοÜεçεά ηοοά ια οοιδανέεαιñÜιαέ δñυοεαοαδ δεçññοιññΒαδ αέα οçι αέα÷αβñέοç δñññαοαέυδδóεοιΥιñ δαéΥοιñ (packages).
- Οι ΕαοÜεαέι 5 (“Οι Ογòδçια X Window”) ιαιñññÜοδçεά αδυ οçι αν÷Ρ ια Υιòαòç οδçι ÷ñΠοç ññòΥññιñ οά÷ñειάεΡι, υδδου οά δανέαÜεειñοά ανñαοβαδ **KDE** εάέ **GNOME** οά XFree86™ 4.X.

- Οι Έκδοσεις 12 (“C Αεαεεεαοβα Αεεβιςοδ οιο FreeBSD”) αδαεοϋεεεα ια δανεοουοαηαδ δεχνηοιηβαδ.
- Οι Έκδοσεις 18 (“Αδρεεαοδεεϋ ΙΥοα”) ιααηηοοδεα ια αϋοε οα δαεαεϋοαηα αϋι εαοϋεαεα “Αβοειε” εαε “Αιοβηηαοα Αοοαεαβαδ”. Δεοοαϋιοια υδε οα εϋιαοα αοοϋ αβιαε δει αοειειϋεοα υοαι δαηιοοεϋαειοαε ιαεβ οαι ϋια εαοϋεαει. Δηιοοϋεεεα αδβοεο ιεα αϋιοδεοα εεα RAID (οειοβιςοε ιϋου οεεειϋ P ειρεοιεειϋ).
- Οι Έκδοσεις 26 (“Οαεηεαεϋδ Αδεειεϋιηβαδ”) αιαεειηααηεεεα αδϋ οει αν÷P εαε αιεηηηεεεα εεα οεδ αεαυοαεδ FreeBSD 4.X/5.X.
- Οι Έκδοσεις 27 (“PPP εαε SLIP”) αιεηηηεεεα οα οειαοιεεϋ ααειϋ.
- Διεειβ ιϋιε οηηαδ δηιοοϋεεεα οοι Έκδοσεις 31 (“Δηι÷υηειϋια Εϋιαοα Αεεδυοεο”).
- Οι Έκδοσεις 28 (“Cεαοοηιιεεϋ Οα÷οαηηαβι”) αδαεοϋεεεα εεα ια οοιδανεεαηαϋιαε δανεοουοαηαδ δεχνηοιηβαδ εεα οεδ ηοειβοαεδ οιο **Sendmail**.
- Οι Έκδοσεις 10 (“Οοιααουοεοα ια Αεοαεϋοεια οιο Linux®”) αδαεοϋεεεα εεα ια οοιδανεεαηαϋιαε δεχνηοιηβαδ εεα οει ααεαοϋοαοε οεο αϋοεο ααηηϋι **Oracle®** εαε οιο **SAP® R/3®**.
- Οοει ααϋοαηε ϋεαοε εαεϋοοιηοαε αδβοεο οα δαηαεϋοδ ιϋα εϋιαοα:
  - Νϋειοεο εαε Ααεοεοοιηβιςοε (Έκδοσεις 11)
  - Διεοιϋοα (Έκδοσεις 7)

## Ιηαϋιουοε Αοοιϋ οιο Αεαεβιο

Αοοϋ οι αεαεβι ÷υηβεαοαε οα δϋιαοα εαεηεοϋ ειρεεϋ οηβιαοα. Οι δηοοι οηβια, *Ιαεηηηοαδ ια οη FreeBSD*, δαηεαηϋοαε οει ααεαοϋοοαοε εαε οει ααοεεP ÷ηβοε οιο FreeBSD. Ι δηιοαεϋιηαηο οηϋοιο αϋαϋιουοεο αοοιϋ οιο οηβιαοιο αβιαε ϋια-ϋια εαοϋεαει, ια οε οαεηϋ, δηιοδαηηηηοαδ εαοϋεαεα ια αϋοοϋ εϋιαοα. Οι ααϋοαηη οηβια, *Ααοεεϋδ Αηααοβαδ*, δαηεαηϋοαε ιαηεεϋ ÷αηαεοεηεοοεεϋ οιο FreeBSD οα ιοηβα ÷ηεοειηοιεϋοαε οο÷ϋϋ. Ιδηηαβοα ια εααϋοοαοα οα εαοϋεαεα οα αοοϋ οηβια (εαεηο εαε οα υεα οα οηβιαοα διο αειηοειϋ) ια υοηεα οαεηϋ εϋεαοα. Εϋεα εαοϋεαει ιαεειϋ ια ιεα οαοP εαε οϋοιηε οϋηηε, ε ιοηβα δαηεαηϋοαε οα δαηεα÷υηαηα οιο εαοαεαβιο εαεηο εαε οε ÷ηαεϋαοαε ια αϋηηβεαε Pαε ι αιααηποεο. Αοοϋ αδεοηϋδαε οοιη δανεοοαοεαεϋ αιααηποεο ια δηιοδαηηϋ αηβαηηα αϋιοεοαδ, εεα ια αηαε εαοϋεαεα οα ιοηβα οηη αιαεαοϋηηοι δανεοοουοαηη. Οι οηβοι οηβια, *Αεα÷αβηεοε Οοοοβιαοιο*, δαηεϋ ÷αε εϋιαοα ο÷αοεεϋ ια οε εεα÷αβηεοε οοοοειϋοηη FreeBSD. Οι οϋοαηηοι οηβια, *Αεεοδαεϋδ Αδεειεϋιηβαδ*, εαεϋδοαε εϋιαοα εεεδυοεο εαε αεαεηεοοη. Οι δϋιοοι οηβια δαηεϋ ÷αε δαηαηοβιαοα ια αεϋοηηαδ δεχνηοιηβαδ.

### Έκδοσεις 1, ΑεοααυαP

Δαηιοοεϋαε οη FreeBSD οοι ιϋι ÷ηβοε. Δαηεαηϋοαε οει εοοηηβα οιο FreeBSD Project, οιοδ οοϋ ÷ιοδ οιο, εαε οη ηηοϋει αϋδδοηε οιο.

### Έκδοσεις 2, Ααεαεοοηηοαδ οη FreeBSD

Ιαεααβ οη ÷ηβοε οοει αεααεεαοβα οεο δεβηεο ααεαοϋοοαοεο. Αδβοεο οοιδανεεαηαϋηιοαε ιαηεεϋ εϋιαοα ααεαοϋοοαοεο εεα δηι÷υηειϋηοδ, υδϋο ε ααεαοϋοοαοεο ιϋου οαεηεαεPδ ειροϋεαδ.

### Έκδοσεις 3, Ααοεεϋδ ηηεαδ οοι UNIX

Δαηεϋ ÷αε οεδ ααοεεϋδ αηοηεϋδ εαε εαεοηηηαβαδ οιο εαεοηηηαεειϋ οοοοβιαοιο FreeBSD. Αϋι αβοα αηηεεαεϋηηο ια οη Linux P ια ϋεει εαεοηηηαεεϋ οϋοιο UNIX ιδηηαβοα δεεαηηο ια δηιοδαηηϋοαδ αοοϋ οη εαοϋεαει.

*Εσοτήρα 4, ΑσέασΟόόας Ασάνηάη: ΔάέΥόά έάέ Ports*

ΔάνεάνΟόάέ οη όηύδι άάέασΟόόαςόό έηάέόέέύ όηβόυ έάόάέάόάόόη ίά όçί έάέήόύη “ΟόέήαP όυí Ports (Ports Collection)” όηó FreeBSD έάέ ίά όά όόήPεç δññάάάέúðóέóίÝίά δάέΥόά (packages).

*Εσοτήρα 5, Όí Óýóóçιά X Window*

ΔάνεάνΟόάέ άάέέÜ όí óýóóçιά X Window έάέ άέέέúòάñά όí X11 όηó FreeBSD. Άδβόçò δάνεάνΟόάέ ηέήεçñύíά δάνέαÜέήιόά άñάόβáò üðùò όí **KDE** έάέ όí **GNOME**.

*Εσοτήρα 6, Desktop ΑσάνηάÝò*

ΑίάóÝñάέ έάέ άιçάáβ ίáñέέÝò áδú όέò δέí óοίPεάέò άóάνηάÝò áέά όδñέηάέόóÝò áñáóάβñ, üðùò δññáñÜñάόά δέηPáçóçò έóóίòáέβáυί έάέ άóάνηάÝò άñáóάβñ, έάέ δάνεάνΟόάέ ðùò ίά όέò áάέάόάόóPόάόá óοί FreeBSD.

*Εσοτήρα 7, ΔñέοιÝóá*

Όδñάέέήýάέ ðùò ίά áάέάόάόóPόáóá áóíáúóçòáð áíáδáñááυáPò P÷íò έάέ áβíóáí óοί óýóóçιά óáð. Άδβόçò δάνέέάíáÜíáέ áάέάíáóñέçðóέέÜ έÜðñέáð άóάνηάÝò P÷íò έάέ áβíóáí.

*Εσοτήρα 8, Ñðñβñíòáð όηí ΔðñPία όηó FreeBSD*

Αίçááβ όηóð éúáñòð áέá όηóð ηðñβñòð έá δñÝðáέ ίά áçñέíòñáPόáóá Ýíá íÝí ðòñPία, έάέ δáñÝ÷άέ έáðóññáñáβò ηáçáβáð áέá όçí ηýέίέόç, ίáóááêPðóέόç, έάέ áάέασΟόόαςόό όηó íÝíò óáð δññóáññíóíÝíò ðòñPία.

*Εσοτήρα 9, ΑέòððPóáέð*

ΔάνεάνΟόάέ ðùò ίά áέá÷áέñβæáóóá áέòððòðÝò óοί FreeBSD. ÓòíδάνέέάíáÜíáέ δέçññíòñβáð áέá óáέβááð έññíóýðυí, έñááñέáóñýð áέòððòðñí, έάέ áñ÷έέÝò ðòέíβóáέð.

*Εσοτήρα 10, Óóíááúóçòά ίá ΑέòáéÝóέíá όηó Linux*

ΔάνεάνΟόάέ όέò áóíáúóçòáð óóíááúóçòάð όηó FreeBSD ίá άóάνηάÝò Linux. Άδβόçò δάñÝ÷áέ έáðóññáñáβò ηáçáβáð áάέασΟόόαςόό áέá δñέÝò áñúóóÝò άóάνηάÝò όηó Linux üðùò **Oracle**, **SAP R/3**, έάέ **Mathematica**®.

*Εσοτήρα 11, Ñýέίέóç έάέ Αάέóέóóðñβçóç*

ΔάνεάνΟόάέ όέò δάñáÝòññòð δñò Ý÷íòí óóç áέÜέáóç όηóð ηέ áέá÷áέñέóóÝò όηó óóóðñáóíòð, Póáá ίá ðòέíβóóíóí Ýíá óýóóçιά FreeBSD áέá áÝέóέóóç áδúáíóç. Άδβόçò δάνεάνΟόάέ óá áέÜóññá áñ÷áβá ðòέíβóáυί δñò ÷ñçóέññέήýíóáέ όοί FreeBSD έάέ δñò ίá óá άñáβóá.

*Εσοτήρα 12, Ç Αέááέέáóβá Αέέβίççòð όηó FreeBSD*

ΔάνεάνΟόάέ όçí áέááέέáóβá áέέβίççòð όηó FreeBSD έάέ áιçááβ ðùò ίðññíýíá ίá όçí áέÝá÷íòñá ίá όç áñPεάέά áðέέήáPí έάέ ðòέíβóáυί.

*Εσοτήρα 13, ×ñPóóáð έάέ ΑáóέêP Αέá÷áβñέóç ΈñááñέáóñPí*

ΔάνεάνΟόάέ όçí áçñέíòñáβá έάέ όçí áέá÷áβñέóç óυί έñááñέáóñPí ÷ñçóðñí. Άδβόçò δάνεάνΟόάέ όηύðñòð ίá όηóð ηðñβñòð ίðññíýí ίá óáέήýí δάñέñέóññβ óóíòð ÷ñPóóáð υóí áóññÜ óç ÷ñPóç ðυññύí όηó óóóðñáóíòð, έáέPð έάέ Üέέáð έáέóíòñáβáð áέá÷áβñέóçò έñááñέáóñPí.

*Εσοτήρα 14, ΑóòÜέέá*

ΔάνεάνΟόάέ áέÜóññá áέáéÝóέíá áñááέáβá δñò έá óáð áιçέPóóíóí ίá έñáðPόáóá όí FreeBSD óýóóçιά óáð áóóáéÝò. ÓòíδάνέέάíáÜññóáέ ηέ óέíðñέPóáέð Kerberos, IPsec έάέ OpenSSH.

Έκδο 15, Jails

Δημιουργία οίκοι φυλάκισης με τη χρήση του jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail.

Έκδο 16, Οδηγός για τον FreeBSD

Αίτηση για ενημέρωση του οδηγού για τον FreeBSD (MAC) είναι ο τρόπος με τον οποίο ενημερώνεται ο οδηγός για τον FreeBSD, είναι ο τρόπος με τον οποίο ενημερώνεται ο οδηγός για τον FreeBSD.

Έκδο 17, Οδηγός για τον FreeBSD

Δημιουργία οίκοι φυλάκισης με τη χρήση του audit trails, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail.

Έκδο 18, Αδελφότητα

Δημιουργία οίκοι φυλάκισης με τη χρήση του RAID, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail.

Έκδο 19, GEOM: Αξιοπιστία

Δημιουργία οίκοι φυλάκισης με τη χρήση του RAID, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail.

Έκδο 20, Οδηγός για τον FreeBSD

Αίτηση για ενημέρωση του οδηγού για τον FreeBSD, είναι ο τρόπος με τον οποίο ενημερώνεται ο οδηγός για τον FreeBSD, είναι ο τρόπος με τον οποίο ενημερώνεται ο οδηγός για τον FreeBSD.

Έκδο 21, Vinum

Δημιουργία οίκοι φυλάκισης με τη χρήση του RAID-0, RAID-1, RAID-5, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail.

Έκδο 22, Αξιοπιστία

Δημιουργία οίκοι φυλάκισης με τη χρήση του RAID, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail.

Έκδο 23, Οδηγός για τον FreeBSD

Δημιουργία οίκοι φυλάκισης με τη χρήση του RAID, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail.

Έκδο 24, Αίτηση για ενημέρωση του οδηγού για τον FreeBSD

Αίτηση για ενημέρωση του οδηγού για τον FreeBSD, είναι ο τρόπος με τον οποίο ενημερώνεται ο οδηγός για τον FreeBSD, είναι ο τρόπος με τον οποίο ενημερώνεται ο οδηγός για τον FreeBSD.

Έκδο 25, DTrace

Δημιουργία οίκοι φυλάκισης με τη χρήση του DTrace, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail, είναι ο τρόπος με τον οποίο δημιουργούνται οι jail.



# Όσοι θέλουν να μάθουν

## Διαβάστε πρώτα

Σε αυτή την ενότητα θα μάθετε πώς να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία, να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία, να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία.

## Ανασκόπηση

Σε αυτή την ενότητα θα μάθετε πώς να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία, να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία, να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία.

## Προβλήματα

Σε αυτή την ενότητα θα μάθετε πώς να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία, να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία, να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία.

# Ανασκόπηση

Σε αυτή την ενότητα θα μάθετε πώς να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία, να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία, να χρησιμοποιείτε τις URLs, να δημιουργείτε αρχεία.

## Ctrl+Alt+Del

Όταν πατήσετε τα πλήκτρα Ctrl+Alt+Del, ο υπολογιστής θα πραγματοποιήσει μια επανεκκίνηση.

Όταν πατήσετε τα πλήκτρα Ctrl+Alt+Del, ο υπολογιστής θα πραγματοποιήσει μια επανεκκίνηση.

## Ctrl+X, Ctrl+S

Όταν πατήσετε τα πλήκτρα Ctrl+X, ο υπολογιστής θα πραγματοποιήσει μια επανεκκίνηση.

# Διαβάστε πρώτα

Όταν πατήσετε τα πλήκτρα Ctrl+Alt+Del, ο υπολογιστής θα πραγματοποιήσει μια επανεκκίνηση.

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

Όταν πατήσετε τα πλήκτρα Ctrl+Alt+Del, ο υπολογιστής θα πραγματοποιήσει μια επανεκκίνηση.

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

Όταν πατήσετε τα πλήκτρα Ctrl+Alt+Del, ο υπολογιστής θα πραγματοποιήσει μια επανεκκίνηση.

```
% top
```



# I. Îâêéíþíôáò ìà ôï FreeBSD

Áðòò òï ìÝíïò òïò Áã÷áñéñáβïò òïò FreeBSD áβíáé áéá òïò ÷ ñþóðáð éáé òïò ÷ áéá÷áñéñóðÝð òðóðçìÛò òïò ðïò ìáí Ý÷íïí þáç ìááÛçç ìïðáññá ìà òï FreeBSD. Óá êáòÛéáéá ðïò áéñéïðéíýí:

- Áβíáé áéóáãñáééÛ áéá òï FreeBSD
- Óáð éáèñáçáíýí éáðÛ òç áéÛñéáéá òçð ðéááééáóβáð ìáéáðÛóðáóçð
- Óáð áéóÛáíïí òðéð ìáóééÝð Ýííéáð òïò UNIX
- ÐáñéáñÛïí òç áéááééáóβá ìáéáðÛóðáóçð òçð ðéçèþñáð áóáññáþí ðïò áβíáé áéáéÝóéíáð òïò FreeBSD
- Óáð áéóÛáíïí òïò ìáñáóééù ðáñéáÛééí òïò UNIX, òï óýóðçíá ×, éáé óáð éáèñáçáíýí ó÷áðééÛ ìà òéð áñ÷ééÝð ñòèìβóáéð áíùð ìáñáóééý ðáñéáÛééí òïò ìáñáóβáð, ìà òï ìðíβí ìðíñáβòá ìá áβóðá áéñíá ðéí ðáñáãñáééíβ

Óá áðòò òï òïþíá òïò áéáéβïò, Ý÷íïí ðñíóðáðþóáé ìá ìáéþóíïíá òðïí áéÛ÷éóïí òéð áíáóíñÝð òá òïþíáðá þ éáòÛéáéá òïò Áã÷áñéñáβïò òá ìðíβá ìáí Ý÷áðá þáç áéááÛóáé. Áðòò ìðíóéíðáβ òðïí ìá áβíáé ðéí áýéíçç ç áíÛáíùóç òïò òïþíáðïò áðòý òïò Áã÷áñéñáβïò áðù òçí áñ÷á ìÝ÷íé éáé òï òÝéò, ÷ ùñβ ìá áðáéóáβóáé ìá ðÛ÷áðá òóíá÷ð òá áðñíáíá þ ðñíáçáíýíá òïþíáðá.

# ΕαοÛεάει 1 Αέοάãùãß

Αιάο÷çιάόέοιÛí, αίαέειñάαίùíí, εάέ ιãñέêðò ίαίαãñάùíí áðu òíí Jim Mock.

## 1.1 Óýííøç

Άð÷ãñέοóιγία áέα òι áιαέάóÛííí óáo ãέα òι FreeBSD! Ôι áεúειòει εαοÛεάει εάεγððάε äεÛοιñáð ððò÷Ûð òιò FreeBSD Project, ùðùð òçí έóðíñá òιò, òιòð óðu÷íðð òιò, òι ñíðÛέι áíÛððòιçð, ε.ð.ε.

ÌáðÛ òçí áíÛáñóç áðòιγ òιò εáòáέáβιò, εά áñññæáðá:

- Ðùð ó÷ãðæáðάέ òι FreeBSD ìá Ûεέα εάέοιòñάέÛ óðóðßιαάá Ç/Ï.
- Ôçí έóðíñá òιò FreeBSD Project.
- Ôιòð óðu÷íðð òιò FreeBSD Project.
- Ôέð áάóέéÛð áñ÷Ûð òιò open-source ñíðÛέιò áíÛððòιçð òιò FreeBSD.
- Έάέ ððóέéÛ: áðu ðιò ðñιÛñ÷ãάέ òι ùíñá “FreeBSD”.

## 1.2 Έάεðò ðεέάðά òοι FreeBSD!

Ôι FreeBSD áβιαέ Ýíá εάέοιòñάέú óýóðçíá áάóέοιÛíí óòι 4.4BSD-Lite, òι ñðιβι ìðñãß íá ÷ñçóειòðιέçðáß óá Ç/Ï Intel (x86 εάέ Itanium®), AMD64, Alpha™, εάέ Sun UltraSPARC®. Óá áíÛέέιç áñβóεáðάέ áðβóçð ç äέαάέέάóá ìáðáοιñÛð òιò FreeBSD óá Ûεέáð áñ÷έóáέòιέéÛð. Ìðñãßðá áðβóçð íá äέαáÛóáðá áέα òçí έóðíñá òιò FreeBSD, ð áέα òçí ðει ðñúóóáðç áðβóçιç Ýέαιòç òιò. ΆÛí áιαέάóÛñáóáð íá óòιαÛεέáðá ìá εÛðιέι ðñúðι òοι Project (εðáέέáð, hardware, ιç-ðñιòçíáέùíÛíá ÷áñòιññßοιαάá), áέαáÛóáð òι Ûñεñ ÏòíáέóóÛñιíóáð óçí ÁíÛððòιç òιò FreeBSD ([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/articles/contributing/index.html](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/contributing/index.html)).

### 1.2.1 Ôέ ìðñãß íá εÛíáέ òι FreeBSD;

Ôι FreeBSD Ý÷áε ðñεÛú áιέúειάá ÷áñáέðçñέóóέéÛ. ÌáñέéÛ áðu áððÛ áβιαέ:

- *Preemptive ðιέðáðáíðñááóá* (preemptive multitasking) ìá äοíáιέέù Ýέáã÷ι ðñιðáñáέúðçðáð áέα íá áíáóóáέέóðáß ñáέùð εάέ áβέαέιð áέαíιέáíáοιùð ðùí ðññι òιò Ç/Ï ìáðáíγ äòáññáðí εάέ ÷ñçóððí, áεùιç εάέ óóέð ðει áíðβñáð óòιèðεáð.
- *Ðιέð÷ñçóðέέÛð äòíáðúðçðáð* (multi-user facilities) ìέ ñðιβáð áðέòñÛðιòí óá ðñεÛÛ Ûòíñá óáððu÷ññíá íá ÷ñçóειòðιέðοιòí Ýíá óýóðçíá FreeBSD áέα äέαóιñáðέéÛ ðñÛáιαá. Άððu óçíáβιαέ, áέα ðáñÛááέáíá, ùðέ óá ðáñέóáñáέéÛ òιò óðóðßιαðιò, ùðùð áεðððùðÛð εάέ ñαçáñß óáέιεðí áβιαέ óùóðÛ ñεñáóíÛ íá ìáðáíγ ùεùí ðùí ÷ñçóððí òιò óðóðßιαðιò ð òιò áέέðγíò εάέ ðùð ìðññιγí íá ðáειγí óðáέáèñειÛ íá ùñέα óá ÷ñçóðáð ð ñÛáð ÷ñçóððí, ðñιòáðáγííóáð εñβóειòð ðññιòð òιò óðóðßιαðιò áðu ððáñáíέέéð ÷ñçóç.
- Έó÷òñÛð äòíáðúðçðáð *äέέðγúóçð TCP/IP* (TCP/IP networking) ìá ððιòðñέιç áέα áειñç÷áέéÛ ðñúðððá ùðùð óá SCTP, DHCP, NFS, NIS, PPP, SLIP, IPsec εάέ IPv6. Άððu óçíáβιαέ ðùð Ýíá ιç÷Ûίçíá FreeBSD ìðñãß íá áεεçáððεáñÛ áγέιεá ìá Ûεέα óðóðßιαá εάέ íá áñáÛæáðάέ óáí áðάέñέéùð áιðççñáðçððð, ððιòðçññáειòáð εάέοιòñáβáð æùðέéðð óçíáóáð, ùðùð NFS (áðñáèñòοιÛίç ðñúóááóç óá áñ÷áβá) εάέ ðççñáóáð çεáέòñιέέιγ

όα÷δάνηάβιό (e-mail), P όγι δάνηόόβά όιό ηνάάιέόηγ όάό όόι αέάάβέόόι ιΰού όυι όδγñάόέπi WWW, FTP, routing έάέ firewall (άόΰεάέάδ).

- Ç δñηόόάόβά όçð ηPιçð (memory protection) άηάόόάέβæάέ υόέ ηέ æΰöηñάð άόάνηιäΰð (P ηέ ÷ñPόόάð) άάη έέççέάδéάñηγί ηάόάγ όιόð. ηέά άόάνηιäP ðηό δάνηόόέΰæάέ έΰðηέη δñηυάεçηά άά ηðñάβ ηά άδçññáΰόάέ ΰεέάð ηά έάηΰηάη όñυðη.
- Όη FreeBSD άβηάέ ΰηά έάέόηöñάέευ όγόόçηά 32-bit (64-bit όά Alpha, Itanium, AMD64, έάέ UltraSPARC) έάέ ό÷άæΰόόçéά ηά άόόυ όη όñυðη άñ` άñ÷Pò.
- Όη άέñç÷άηέέυ δñηóððη X Window System (X11R6) δñηόóΰñάέ άñάόέέυ δñáéáΰεεηί άñάάόβáð (GUI) όόη έυόόηð ηέάð έηέηPò έΰñόáð VGA έάέ ηέáð ηέυιçð έάέ αέάόβéáðάέ ηά όη δéPñç ðçάάβη έpáέέá.
- Όόηάάóυúðçðά áéðáéΰόέηυη ηά ðηεέΰ δñηñáΰηηάόά ðηό ΰ÷ηόη ηάόάάέυóóéóóάβ áéá Linux, SCO, SVR4, BSDI έάέ NetBSD.
- ×έέέΰάáð ΰόηηáð-ðñηð-áéðΰéáðç άόάνηιäΰð άβηάέ αέάέΰόέηáð áðυ όçη όóέεηιäP ports έάέ packages áéá όη FreeBSD. Άέάόβ ηά øΰ÷ηáðά όόη αέάάβέόόη υόάη ηðñάβóá ηά όά άñάβóá υέá άáP;
- Όόη αέάάβέόόη άβηάέ áðβóçð αέάέΰόέηáð ÷έέέΰάáð δñηóéáðάð έάέ άγέηéáð όóçη δñηόáñηιäP άόάνηιäΰð. Όη FreeBSD ΰ÷άέ όóηάάóυúðçðά ðçάάβηð έpáέέá ηά όά δéη άçηηóέέΰ άηðñέέΰ όóóðPηάόά UNIX, άðñηΰúð ηέ δñáéóóóúðáñáð άόάνηιäΰð ÷ñáéΰæηíðάέ έβááð ΰúð έάέυεηó ηάόáðñηðΰð áéá ηά ηάόááέυóóéóóηγί (compile).
- Ç ΆóηηέέP óáééáηðñβçðç áééηééPò ηPιçð έάέ όη “ηέηέççñùηΰñη VM/buffer cache” δάñΰ÷ηόη ðççèP áðυáηóç όά άόάνηιäΰð ηά άóηçηΰηáð άηΰáéáð όά ηPιç, άñP αέάóçñηγί όçη έέάñðηέçðééP áðυéñéóç ðηό όóóðPηάόηð όóηðð ΰεεηóð ÷ñPόόáð.
- ΌðηóðPñέηç SMP áéá ηç÷άηPηάόά ηά ðηεéáðéΰð CPU.
- ΔéPñçð όáéñΰ άñάάéάβñη άηΰððóηçð áéá C, C++, έάέ Fortran. Όðç ΌóέεηιäP όυη Ports έάέ όυη ΰόηηηυη δάéΰóυη, éá άñάβóá ðηεέΰð áéυηά áεpóóáð δñηñáñηηάóéóηγ, éáðΰεéçéáð όυóη áéá ΰñáðηά υóη έάέ áéá άηΰððóηç éηáéóηέεηγ.
- Ç áéáéáóéúðçðά όηð ðçάάβηð έpáέέá ηέυéççñηó ðηό όóóðPηάόηð óçηάβηáé υóé ΰ÷άáð όη ðççéúðáñη ááéηυ áéΰá÷ηó όόη δñáéáΰεεηί όáð. Άέάόβ ηά áβóðá ééáéáñηΰñé όá ΰηά ééáéóóóυ όγóóçηά έάέ ηά áβóðá άñáðççηΰñé áðυ όη δññçéáðóP όáð, υóáη ηðñάβóá ηά ΰ÷άáð ΰηά δñáñηáóééΰ άñé÷÷ όυ όγóóçηά;
- Άéðáðáηΰçç online ðáéηçñβúóç.
- Έάέ ðηεέΰ ΰεéá!

Όη FreeBSD άάóβæáðάέ όóçη ΰέáηóç 4.BSD-Lite όηó Computer Systems Research Group (CSRG) όηó Δάηáðéóóçηβηó όçð Έáééóυñηέáð όόη Berkeley, έάέ όóη÷βæáé όçη áéáéáñéñéηΰç δάñΰáηóç όηó όóçη άηΰððóç όóóóçηΰóυη BSD. Άðéðñηóéáðά όόη άñáβñáðη ΰñáñ ðηó δάñάβ÷á όη CSRG, όη FreeBSD Project ηúááøá ðηεέΰð ÷έέέΰάáð ηñáð όðç άáéðéóóóηðñβçðç όηó όóóðPηάόηð áéá ηΰáéóóáð áðéáυóáéð έάέ áηέηðéóóðá όá έáéççñáñéηΰð έáóáóóΰόáéð δñáñηáóééηγ óυñðηó άñááóβáð. Άη έάέ ðηεεηβ áηðñééηβ éηεηóçηβ áóóéηáγñηóáé ηά δñηóóΰñηó ηáéóηöñáéέΰ όóóðPηάόά ηά ðΰóηéá ÷áñáéðçñéóóééΰ, áðéáυóáéð έάέ áηέηðéóóðá, όη FreeBSD ηðñάβ ηά όá δñηóóΰñáé ðpñá!

ηέ άόάνηιäΰð όóéð ηðñáðð ηðñάβ ηά ÷ñçóéηððηέçéáβ όη FreeBSD, δñáñηáóééΰ δñáñéñβæηíðάέ ηυηί áðυ όçη óáηóáóβá όáð. Άðυ άηΰððóçç éηáéóηέéηγ ηΰ÷ñé áóóηñáóéóηγð άñáñηóáóβñη, áðυ áðñáñáðP áéáPη ηΰ÷ñé όçη áéυñéðóç όηó áæéηγέéηó áðñáéñóóηΰñηúññóöηñéçPη éáñáéPη, áΰη ηðñάβ ηά áβηáé ηά ΰηά áηðñééú δñηúññ UNIX, άβηάέ δάñáðΰñη áðυ δééáñη υóé ηðñάβ ηά áβηáé έάέ ηά όη FreeBSD! Όη FreeBSD áðβóçð ðóáéáβóáé óççñáñééΰ áðυ éðñéηéáðééΰ ÷έέέΰάáð άόάνηιäΰð ðççèPò ðηέυóçðáð ðηó áñáðçóóçηíðáé áðυ éΰηóñá άñáðçPη έάέ δάñáðéóóðPηéá όá υεη όη έυóη, έάέ όó÷ηΰ áéáóβéáñηóéá όá ÷áççú έυóóóðð P áυñáΰη. Όη δéPñçð όυη áηðñéçPη άόάνηιäPη ðηó αέáóβéáñηóéá áéá όη FreeBSD, áóηΰáðáé áðβóçð έáéççñáñéηΰ.

Ï ðçᾶᾶβῖò ἑπαέεᾶò ðῖò βαέἰò ðῖò FreeBSD ᾶβἰᾶέ ðεPἡνὸ ðεᾶέYόεἰò, ἑᾶέ Yόóé ðῖ ὀYόóçἰᾶ ἰðῖἡᾶβ ἰᾶ ðἡἰόᾶἡἰῖóðᾶβ ὀᾶ ᾶòÛἰόᾶóᾶ ðḣçèῦ ᾶðβðᾶἰἰ ᾶεᾶ ᾶεᾶέYò ᾶóᾶἡἰᾶYò P projects, ἑᾶέ ἰᾶ ðἡἰðῖòð ᾶἰἰέεÛ ἰç ðἡᾶἰᾶóἰðἰέPóεἰῖòð ὀᾶ Ûεᾶᾶ εᾶεóἰῖἡᾶεᾶÛ ᾶἰðἡἰεἑἰἰ ðἡἡçεᾶòðἰ. ÐᾶἡᾶÛòῦ ἑᾶ ᾶἡᾶβòᾶ ἰᾶἡééÛ ἰῖἡἰ ðᾶἡᾶᾶᾶβᾶἰᾶóᾶ ᾶðῦ ᾶóᾶἡἰᾶYò ὀóéò ἰðῖἡᾶò ἰðῖἡᾶβ ἰᾶ ÷ἡçóεἡἰðἰέçεᾶᾶ ᾶòðP ὄç ὀóéᾶἡP ὀἰ FreeBSD:

- *Ïðçἡᾶóβᾶò* ðῖ-ἰóᾶἡἰᾶð: Õἰ ἑó÷ðἡῦ ὀYόóçἰᾶ ᾶééðYúòçò TCP/IP ὀἰ FreeBSD, ὀἰ ᾶἰᾶᾶᾶéἰYᾶé ὀᾶ ἑᾶᾶḣᾶç ðεᾶéðῖῖἡᾶ ᾶεᾶ ἰεᾶ ἰᾶᾶÛεç ᾶéÛἰᾶ ὀðçἡᾶóεἰἰ ðῖ-ἰóᾶἡἰᾶð ὕðῖð:
- ἈἰððçἡᾶóçòYò FTP
- ἈἰððçἡᾶóçòYò ἑóðἰóᾶεᾶβᾶἡἰ World Wide Web (εἰἰἰYòð P ἰᾶ ᾶóóᾶεP ὀYἰᾶᾶóç [SSL])
- Ἀἡἡἡεῦᾶçòç ðἡἡðἰεῦἰεῦἰ IPv4 ἑᾶέ IPv6
- Firewalls ἑᾶέ ðYᾶð NAT (“IP masquerading”)
- ἈἰððçἡᾶóçòYò çεᾶᾶðἡἰἰéἰY ὀᾶ÷ðᾶἡἡᾶβῖò
- USENET News P Bulletin Board Systems
- Êᾶέ Ûεᾶᾶ...

Ïᾶ ὀἰ FreeBSD, ἰðῖἡᾶβòᾶ ᾶYἰεἰᾶ ἰᾶ ἰᾶéἰἰPóᾶᾶðᾶ ᾶðῦ ÷ᾶἰçèÛ ἰᾶ Yἰᾶ ὀðçἰῦ PC ὄçò ἰéἰᾶYἰᾶéᾶð 386, ἑᾶέ ἑᾶἑð ḣ ᾶðé÷ᾶβἡçòç ὀᾶð ἰᾶᾶἑἰἰᾶé, ἰᾶ ᾶἰᾶᾶéἰεóðᾶβòᾶ ὀᾶ Yἰᾶ ðᾶðἡᾶðYἡçἡἰ ᾶðᾶἡᾶἡᾶᾶóðP Xeon ἰᾶ ᾶβóεἰòð RAID.

- *Ἀεðᾶβᾶᾶðóç*: Ἀβóðᾶ ἰἰéðçòðPð ðεçἡἰῖῖἡééPð P εÛðἰεἰò ὀ÷ᾶðéἰY ὀἡYᾶ; Ἀᾶἰ ððÛἡ÷ᾶé ἑᾶéYóðᾶἡἰò ðἡἡðῖò ἰᾶ ἰÛεᾶðᾶ ᾶεᾶ εᾶεóἰῖἡᾶεᾶÛ ὀóóðPἰᾶóᾶ, ᾶἡ÷εðᾶεòἰἰééYò Ç/Õ, ἑᾶέ ὀóóðPἰᾶóᾶ ᾶééðYῦἰ ᾶðῦ ὄçἰ ðἡᾶéðééP ᾶἰðᾶéἡβᾶ ἑᾶέ ὄçἰ ὀᾶ ᾶÛεἰò ᾶἡPóç ðῖò ἰðῖἡᾶβ ἰᾶ ὀᾶð ðᾶἡY÷ᾶé ὀἰ FreeBSD. Õἰ ἰᾶᾶÛεἰ ðεPεἰò ðῖῦ ᾶἡἡᾶÛἰ ᾶεᾶYόεἰῦἰ ðᾶéYóῦἰ ᾶóᾶἡἰᾶἡἰ CAD, ᾶἡᾶóééPð ὀ÷ᾶᾶβᾶóçò, ἑᾶέ ἰᾶéçἰᾶðéἑἰἰ, εÛἡἰῖò ὀἰ FreeBSD ᾶἰᾶéἡᾶðééÛ ÷ἡPóεἰἰ ὀᾶ ὕἰῖòð ὀἰ éYἡἰἰ ᾶἰᾶéᾶòYἡἡἰ ὀἰðò ὀἰðῖòð ὀðἰεἰᾶéóðYò ᾶβἰᾶέ ἰᾶ *εÛἡἰῖò ὄç ᾶἰðεᾶéÛ ὀἰðò!*

- *ἡᾶðἰᾶ*: Ïᾶ ᾶεᾶYόεἰἰ ὀἡἰ ðçᾶᾶβἰ ἑπαέεᾶ ἰεῦἰεççἡἰò ὀἡῖ ὀóóðPἰᾶóᾶἰò, ὀἰ FreeBSD ᾶβἰᾶέ ἰβᾶ ᾶἰᾶβἡᾶðç ðεᾶéðῖῖᾶ ᾶεᾶ ὄçἰ Yἡᾶóἰᾶ ὀᾶᾶ εᾶεóἰῖἡᾶεᾶÛ ὀóóðPἰᾶóᾶ ὕðῖð ᾶðβóçò ᾶεᾶ Ûεἰῖòð éεÛᾶἰòð ὄçò ðεçἡἰῖῖᾶééPð. Ç ὀYóç ὄçò ᾶεᾶYεᾶἡçò ᾶéÛεᾶóçò ὀἡῖ FreeBSD ᾶðéðἡYðᾶé ᾶðβóçò ὀᾶ ᾶðἡᾶéἡἡòἰYἰᾶð ἡÛᾶᾶð ἰᾶ ὀἰἰᾶἡᾶÛᾶἰἰóᾶé ὀᾶ éᾶYᾶð P ἰᾶ ἡἰἡᾶἰᾶἰóᾶé ὄçἰ ᾶἰÛððῖç ᾶóᾶἡἰᾶἡἰ, ÷ἡἡβò ἰᾶ ᾶἰçóð÷ἰYἰ ᾶεᾶ Ûᾶᾶéᾶð ÷ἡPóçò ἑᾶέ ÷ἡἡβò ἰᾶ ðᾶἡἰἡἡᾶεᾶðᾶé ç ᾶðἰᾶðῖðçòᾶ ὀἰðò ᾶεᾶ ᾶεᾶYεᾶἡç ὀðᾶPóçòç ἰðἰεἰῖᾶPðἰᾶ éYἰᾶðἰò ὀᾶ ᾶἡἰé÷ðYò ἡÛᾶᾶð ὀðᾶPóçòçò (forums).

- *ἈééðYúòç*: ×ἡᾶéÛᾶᾶóᾶ Yἰᾶ ἑᾶἰἡYἡᾶἰ router (ᾶἡἡἡἰᾶçòðP); ἰᾶ ᾶἰððçἡᾶóçòðP DNS; ἰᾶ firewall ᾶεᾶ ἰᾶ éἡᾶðÛðᾶ ὀἡἰ éῦὀἡἰ Yἡῦ ᾶðῦ ὀἰ ᾶóῦðᾶἡἰéῦῦ ὀᾶð ᾶβéðῖ; Õἰ FreeBSD ἰðῖἡᾶβ ᾶYἰεἰᾶ ἰᾶ ἰᾶðᾶðἡYðᾶé ᾶéᾶβῖ ὀἰ Û÷ἡçóðἰ 386 P 486 PC ðῖò εÛεᾶðᾶé ὀðçἰ ᾶἡἰβᾶ, ὀᾶ Yἰᾶ ðἡἡçᾶἰYἡἡ ᾶἡἡἡἰᾶçòðP ἰᾶ ᾶἰᾶçòçἰYἰᾶð ᾶðἰᾶðῖðçòᾶð ὀééðἡᾶἡᾶβὀἰᾶἰòð ðᾶéYóῦἰ.

- *Óðᾶéἡἡð ᾶἡᾶᾶóβᾶð ἰᾶ X Window*: Õἰ FreeBSD ᾶβἰᾶέ ἰεᾶ ᾶἰᾶβἡᾶðç ᾶðéἰᾶP ᾶεᾶ Yἰᾶ ἰéἰἡἡἰéῦῦ ᾶἰððçἡᾶóçòðP × ὀᾶἡἰᾶðéἑἰἰ, ÷ἡçóεἡἰðἰéἡἰᾶð ὀἡἰ ᾶεᾶYᾶᾶἡᾶ ᾶεᾶYόεἰἰ ᾶἰððçἡᾶóçòðP X11. Õᾶ ᾶἰóβεᾶóç ἰᾶ ὀᾶ ᾶðεÛ ὀᾶἡἰᾶðééÛ X, ἰᾶ ὀἰ FreeBSD ἰðῖἡᾶβòᾶ, ᾶòῦὀἡἰ ὀἰ ᾶðééὀἰᾶβòᾶ, ἰᾶ ᾶéðᾶéᾶβòᾶ ðἡἰεYò ᾶóᾶἡἰᾶYò ὀἡðééÛ, ᾶðᾶéÛὀἰἰᾶðᾶð Yόóé ὀἡἰ éᾶἰðἡἰéῦῦ ᾶἰððçἡᾶóçòðP ᾶðῦ ðᾶἡἰéðῖ ὀἡἡòβἰ. To FreeBSD ἰðῖἡᾶβ ἰᾶ ἰᾶéἰἰPóᾶé ᾶéῦἰᾶ ἑᾶέ “diskless” (÷ἡἡβò ὀéççἡἰ ᾶβóεἰ), εÛἡἡἰᾶðᾶð Yόóé ὀἡἰðò ðἡἡἰòðééἰYò ὀðᾶéἡἡYò ᾶἡᾶᾶóβᾶð ᾶéῦἰç ðéἰ ὀðçἡἡYò ἑᾶέ ᾶðéἰεῦὀᾶἡἡἰòð ὀðç ᾶεᾶ÷ᾶβἡéóç.

- *ἈἰÛððὀἰç ÈἡᾶéὀἰéἡἰY*: Õἰ ᾶᾶóéῦῦ ὀYόóçἰᾶ ὀἡῖ FreeBSD ᾶεᾶðβεᾶðᾶé ἡἰἰéççἡἡἰYἡἡ, ἰᾶ ðεPἡç ὀᾶἡἡÛ ᾶἡᾶᾶᾶβῖἰ ᾶἰÛððὀἰçò, ðῖò ðᾶἡἰéᾶἰᾶÛἡἡἰ ὀἡἰ ᾶἰᾶἡἡἡἡéὀἰYἡἡ GNU C/C++ compiler ἑᾶέ debugger.

Õἰ FreeBSD ᾶβἰᾶέ ᾶεᾶYόεἰἰ ὀᾶ ἡἡòP ðçᾶᾶβῖò ἑπαέεᾶ ᾶεᾶÛ ἑᾶέ Yἰὀἰεἡῖò, ἰᾶðᾶᾶεῦðééὀἰYἡἡ ᾶéðᾶéYόéἡῖò ὀᾶ CD-ROM, DVD, ἑᾶέ ἰYóῦ ᾶἡἡἰἡῖò FTP. Ἀᾶβòᾶ ὀἰ ÐᾶἡÛἡòçἰᾶ A ᾶεᾶ ðᾶἡéóóὀᾶἡᾶð ðεçἡἰῖῖᾶð ᾶεᾶ ὀἰ ðῖò ἰᾶ ᾶðἰéðPóᾶᾶð ὀἰ FreeBSD.

### 1.2.2 Θίειò ÷ ñçόείιθίείáß FreeBSD;

Ôï FreeBSD ÷ ñçόείιθίείáßόάέ ùð áÛόç áέá ôçí áíÛððóιç ôðóéáðñí éáé ðñíúúíòùí óá íáñέéÛò áðu ôéð íáááéýóáñáð áðáέñßáð ðεçñíòíñέéPð, ðáñέéáíáááñÛíúí ðùí:

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

Ôï FreeBSD ÷ ñçόείιθίείáßόάέ áέá íá ðθίόóçñíßæáé íáñέéÛò áðu ôéð íáááéýóáñáð ðíθίέáóßáð óòí εíóáñíáð, ðáñέéáíáááñÛíúí 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/>)

έάé ðíεéñí áéúιç.

### 1.3 Δεçñíòíñßáð áέá ðí FreeBSD Project

Ôï áéúεíðéè ðιPíá ðáñÛ ÷ áé íáñέéÛò ðεçñíòíñßáð ó ÷ áðééÛò íá ðí project, éáé ðáñέéáíáÛíáé íéá óýíóιç εóòíñßá ðíð FreeBSD, ðíðð óðú ÷ íðð, éáé ðí ñíóÛéí áíÛððóιçð ðíð.

#### 1.3.1 Íéá óýíóιç εóòíñßá ðíð FreeBSD

*ÓðíáέóòíñÛ ðíð Jordan Hubbard.*

To FreeBSD Project ááíPεçéá óðéð áñ ÷ Ûð ðíð 1993, íáñέéPð óáí áíÛέéιç ðíð “Unofficial 386BSD Patchkit” áðu ðíðð 3 ðáéáððáßíðð óðíðíéóðÛð ðíð patchkit: ðíí Nate Williams, ðíí Rod Grimes éáé áíÛíá.

Í ðñùðáñ ÷ εéúð óðú ÷ íð íáð Pðáí íá ðáñÛáíðíá Ûíá áíáéÛíáóíí óðéáíéúðððí (snapshot) ðíð 386BSD Pððá íá áéíñεPóíðíá íáñέéÛ ðñíáεPíáðá ðíð í ιç ÷ áíέóíúð ðíð patchkit ááí Pðáí ééáíúð íá éýóáé. Íáñέéíß áðu óáð, ßòúð íá εðííýíóáé ðùð í



εεΰαι 2.2 αυεεεάι οά εεεεειοηβα οι εαειεαβνε εαε οι οεειυδνηι οιο '97, ε οαεαοοαβα ουι ιδιβυι (ε 2.2.8) αιοαιβοεεα οι ιρυιανε οιο 1998. Ε δηποε αδβοεεε Υεαιοε 3.0 αιοαιβοεεα οι ιεοπαηει οιο 1998 εαε οειΰααα οει αν-P οιο οΥειοδ εαε οι εεΰαι 2.2.

Ι εινηο εεεεααεεεα δΰεε οοεδ 20 Εαηοανβιο 1999, ιααρηιαο οοει 4.0-CURRENT εαε οοι εεΰαι 3.X-STABLE. Άδου οι 3.X-STABLE, ε 3.1 εοεειουηεοα οοεδ 15 Οαηιοανβιο 1999, ε 3.2 οοεδ 15 ΙαΑιο 1999, ε 3.3 οοεδ 16 Οαδδαηανβιο 1999, ε 3.4 οοεδ 20 Ααεηανβιο οιο 1999, εαε ε 3.5 οοεδ 24 Ειοιβιο 2000, οει ιοιβα εειειγεεοα εβααο ιΥηαο ιαοΰ ιβα ιεεηπο οΰηαο αιααΰειοε, ε 3.5.1, εαε ια οοηδαηεεεοειρι εΰθιεαο αιααεηβοαεο αοοαεααο οεο οαεαοαβα οοεαηπο οοι Kerberos. ΑοοP ποαι εαε ε οαεεεP Υεαιοε αδου οι εεΰαι οεο 3.X.

ια ιΥι θαναεεΰε αειεοηαεεεα οοεδ 13 Ιαηοβιο 2000, αειεοηαρηιαο Υοοε οι εεΰαι αΰδοοεο 4.X-STABLE. Αειεοηαεεεα ηεΰοηαο εεαυοαεο αδου αοου οι εεΰαι: Ε 4.0-RELEASE εοεειουηεοα οι Ιΰηει οιο 2000, εαε ε οαεαοοαβα 4.11-RELEASE εοεειουηεοα οι Εαηοΰηει οιο 2005.

Ιαοΰ αδου ιααΰει - ηηιεου εεΰοοεια αηηηπο, ε 5.0-RELEASE αηιειρηεεα οοεδ 19 Εαηοανβιο οιο 2003. ΰο αθιεηηοηια ο-ααηι οηηει - ηηηηι αηααοαο, ε Υεαιοε αοοP αεοPααα οι FreeBSD οοι ηηηθΰοε ουι αηεεαηΥηηι θιεοαδαηααοοηι εαε οοει οθιοοηηειε αοαηηαηι ια threads, αηη αεοPααα εαε οθιοοηηειε εαε οοε δεαοουηαο UltraSPARC εαε ια64. ΑοοP οει Υεαιοε αειειγεεοα ε 5.1 οι Ιειηει οιο 2003. Ε οαεαοαβα Υεαιοε 5.X αδου οι εινηο οεο -CURRENT ποαι ε 5.2.1-RELEASE, θιο εοεειουηεοα οι Οαηιοΰηει οιο 2004.

Ι εινηο οεο RELENG\_5, αειεοηαεεεα οι Αγαοοοι οιο 2004, εαε αειειγεεοα ε 5.3-RELEASE, ε ιοιβα οειΰααα οει αν-P ουι εεαυοαεο αδου οι εεΰαι 5-STABLE. Ε δεη δηηοοαοε 5.5-RELEASE εοεειουηεοα οι Ιΰει οιο 2006. Ααη Εα οδΰηηοι δηηοεαοαο εεαυοαεο αδου οι εινηο οεο RELENG\_5.

Ι εινηο εεεεααεεεα δΰεε οι Ιηγεει οιο 2005, αοοP οε οηηΰ εαε οει αειεοηαβα οιο εεΰαιο RELENG\_6. Ε 6.0-RELEASE αβιαε ε δηποε Υεαιοε οεο οαηηΰο 6.X, εαε εοεειουηεοα οι Ιρυιανει οιο 2005. Ε δεη δηηοοαοε 6.4-RELEASE εοεειουηεοα οι Ιρυιανει οιο 2008. Ααη εα οδΰηηοι δηηοεαοαο εεαυοαεο αδου οι εινηο οεο RELENG\_6.

Ι εεΰαιο αΰδοοεο RELENG\_7, αειεοηαεεεα οι Ιεοπαηει οιο 2007. Ε δηποε Υεαιοε αδου αοου οι εεΰαι, ποαι ε 7.0-RELEASE ε ιοιβα εοεειουηεοα οι Οαηιοΰηει οιο 2008. Ε δεη δηηοοαοε 7.3-RELEASE εοεειουηεοα οι Ιΰε 2008. Εα οδΰηηοι δηηοεαοαο εεαυοαεο αδου οι εεΰαι RELENG\_7.

Ι εινηο εεεεααεεεα δΰεε οι Αγαοοοι οιο 2009, αοοP οε οηηΰ εαε οει αειεοηαβα οιο εεΰαιο RELENG\_8. Ε 8.0-RELEASE αβιαε ε δηποε Υεαιοε οεο οαηηΰο 8.x εαε εοεειουηεοα οι Ιϋ 2009.

Άεα οει ηα, ε ιαηηηηηηεαοε αΰδοοεο οοια-εαεαε οοι εεΰαι 9.X-CURRENT. ΙΥαδ εεαυοαεο Snapshot οιο 9.X οα CD-ROM (εαε οδοεεΰ οοι Αεααεοοοι), εεαοεαηοαε αδου οι οηι snapshot server (<ftp://current.FreeBSD.org/pub/FreeBSD/snapshots/>) εαηπο οοια-εαεαε ε αΰδοοεο.

### 1.3.2 Οου -ιε οιο FreeBSD Project

*Οοιαεοοηηΰ οιο Jordan Hubbard.*

Ιε οου-ιε οιο FreeBSD Project αβιαε ια θανΥ-εε ηηεοηεεη θιο εα ιθηηαβ ια -ηεοειηθιεεεαβ εαε ιθιεααPθιοα θανβοοαοε εαε αβ-υο ααοιαγοαεο. θηηηηβ αδου ιαο Υ-ιοηι εΰηαε οειαιεεεP αδΥηαοεο οοηι εηαεεα (εαε οι project) εαε οβαηοηα αα εα ιαο θαηηαεα θυοα-θυοα ιεα ιεεηP ιεειηηεεP οοηαεοοηηΰ, εεηΰ οβαηοηα ααη αβιαοοα Υθιεηιε ια αθελιαβηθια οα αοου. θεοοαγθιοα ηοε ε δηηοαη-εεεP εαε οθιοααεηοαηε “αθιοοηεεP” ιαο αβιαε ια θανΥ-ιοηια εηαεεα οα οδΰη-ηιοαο εαε ιαεηηθιεεεηρδ -ηποοαο, εαε εαε ιθιεηαPθιοα οεηθυ, ηοοα ι ηηαεεαο ιαο ια Υ-εε οει αοηγθιαηε θεεαηP -ηποε εαε ια αθιοΥηηαε οι ιααεηγθαηη αοιαοη ηοαεηο. Αοου αβιαε, θεοοαγυ, Υηαο αδου οηοδ οειαιεεηυοαηηοδ οου-ιοδ οιο Αεαηεαηηο Εηεοηεειηρ εαε Υηαο αδου οηοδ ιθιηθιοδ οθιοοεηηεαηηο ια αηειοοεαοηηο.



### The FreeBSD core team

Ç *FreeBSD core team* έά Pάάί έόίάγίαιç ιά οι άείέέçðέέυ όοίαιγέεί άί οι FreeBSD Project Pάάί ιέα άίβίοιç άόάέηάβá. Ĩ ðñòáñ÷έέυò óðυ÷ìò òçð core team άβίάέ ίά άίάόόάέβóάέ υòέ οι project, óοι όύγίηει όιò, άβίάέ óá έάέP έάóÜòόάόç έάέ ίά οι ιάçάάβ ðñιò òçί óυóðP έάóάγέοίóç. Ĩέα áðu ðέò έάέοιòñάβáð òçð core team άβίάέ ίά ðñιόέάέάβ άοιόέυιΥίñò έάέ ððάγέðññòð developers ίά óοιιáó Ý÷ìοι òçί ñÜáá άίÜððóιçð (οιòð committers) έάέðð έάέ ίά άñβóέάέ Ýά ιΥέç áέά òçί βάέά òçί core team έάέðð έÜðιέιέ άðι÷ññίγί. Ç ðáñίγóά core team áέέÝ÷÷òçέά áðu Ýίά όύγίηει ððιòçòβυί committers όñί Έίγέεί όιò 2008. ΆέειάÝò áέάίÜáñíόάέ έÜέά 2 ÷ñυίέά. ĨáñέέÜ ιΥέç òçð core team Ý÷ìοι áðβóçð áέάέειγýð ðñάβð áðέγίçð, έάέ áðòυ óçιáβίáέ ðυò ááóιáγίíóáέ ίά άίάόόάέβóιοι υòέ Ýίά ιááÜει ιΥñιò όιò óóóðPιáóιò έάέόιòñάáβ υðυò ðñÝðáέ. Άέά ιειέέçñυιΥίç έβóóά òçð ñÜááð άίÜððóιçð όιò FreeBSD έάέ òυι ðñÝυι áðέγίçð όιòð, ðáñáέάέγίγá ááβóá òçί Έβóóά òυι ÓóιáñááðPι ίáð (http://www.FreeBSD.org/doc/el\_GR.ISO8859-7/articles/contributors/article.html).

**Óçιáβυóç:** Óá ðáñέóóυòáñá ιΥέç όιò core team άβίάέ áέάέιíðÝò υóιι άοιñÜ òçί άίÜððóιçð όιò FreeBSD έάέ ááι Ý÷ìοι ιέέιñιέέPð όγóáυò ιòÝέç áðu òι project, áðñίγίυò ç "áÝóιáóóç" ááι έά ðñÝðáέ ίά ðáñáñιçιáγáóáέ υò "áááóçιΥίç òðιòðPñέιç". Ç ðáñáðÜιυ ðáññιβυóç ιά οι "άείέέçðέέυ όοίαιγέεί" ááι άβίάέ ðιέγ áέñέάPð, βóυò άβίάέ έáóáέέçέυòáñι ίά ðιγίá υòέ ðñυέάέóáέ áέά άιέñðñιòð ðιò έóóáóáάι ðέò æυÝò όιòð áέά ÷Üñç όιò FreeBSD άίÜιðέά òçί έάέγóáñç όιòð έñβóç!

### Άñòáñέειβ όóιáñáÜóáð

ÓÝειò, áέέÜ ιðuóáPðιòá υ÷έ ιέέñυòáñçð óçιáóβáð, ç ιáááέγóáñç ñÜáá άίÜððóιçð άβίάέ ιέ βáέιέ ιέ ÷ñPóáð ðιò ιáð ðáñÝ÷ìοι ó÷ιέέά έάέ áειñέðóáέð òυι bug óá ó÷ááυι óóáέáñP áÜóç. Ĩ έγñειò ðñυðιò áέά ίά έñáóÜóá áðáóP ιá òçί ιç-óóáέáιòñυέέP ñÜáá άίÜððóιçð όιò FreeBSD άβίάέ ίά άβίáðá óóιáñιçðÝò òççί çέáέðñιέέP έβóóá óá÷ιέέPι ððæçðPóáυι όιò FreeBSD (http://lists.FreeBSD.org/mailman/listinfo/freebsd-hackers) υðιò áβñιíóáέ ιέ άίÜειááð óðæçðPóáέð. Άáβóá òι ðáñÜñççιá C áέά ðáñέóóυòáñáð ðççñιοιñβáð ó÷áðέέÜ ιá ðέò áέÜοιñáð έβóóáð çέáέðñιέέγί ðá÷ðáññáβñιò όιò FreeBSD.

Ç Έβóóá ÓóιáñááðPι όιò *FreeBSD*  
(http://www.FreeBSD.org/doc/el\_GR.ISO8859-7/articles/contributors/article.html) άβίάέ ιááÜέç έάέ óóιá÷ðð áóιáιυιáιç, áðñÝγίυò áέáðβ ίά ιçι áβιáðá έάέ áóáβð ιÝειò òçð έάέ ίά óοιáÜέέáðá óPιáñá óá έÜðέ όοι FreeBSD;

Ç ðáñι÷P έðáέέά ááι άβιáέ ι ιυñιò ðñυðιò áέά ίά óóιáέóóÝñáðá óοι project. Άέά ιέα ιειέέçñυιΥίç έβóóá òυι ðñááñÜóυι óóá ιðιβá ÷ñáέáæυιáóóá áñPεáέá, ðáñáέάέγίγá áðέóέáðέáβóá òççί ΆέέðóáέP ðιðιέáóβá όιò FreeBSD Project (http://www.FreeBSD.org/index.html).

Óðñιðβáειíóáð, όι ñιòÝει άίÜððóιçð ιáð άβιáέ ñáááññιΥñι óáι Ýίá ÷έááñυ όύγίηει ñυέáιòñυι έγέέυι. Óι óðáέáιòñυòέέυι ñιòÝει άβιáέ ó÷áέáóιÝñι áέά ίά áέáðειγίáέ όιòð ÷ñPóáð όιò FreeBSD, óοιòð ιðιβιòð ðáñÝ÷ìοι áóáέ Ýóóέ Ýίáð áγέιειò ðñυðιò ðáñáειγίγέçðð όιò ááóέειγί έðáέέá, έάέ υ÷έ áέά ίά áðιέέáβñιòá ðέéáñγýð óóιáñáÜóáð! Άðέέóιβá ιáð άβιáέ ίά ðáñιòέέÜοιòιá Ýίá óóáέáñυ έáέóιòñáέέυ όγóóçιá óá óοιÜñççóç ιá ιέα ιááÜέç áéÜιá áðu ðñιáñÜιáóá áóáñιáPι ðιò ιέ ÷ñPóáð ίá ιðιñίγί áγέιέá ίá ááέáέóóóιγί έάέ ίá ÷ñçóέιðιέιγί — áέά òççί áέðέPñυòç áóðPι òυι óóυ÷ιι, όι ñιòÝει áðòυ áñöéáγáέ ðιέγ έáέÜ.

Óι ιυñιò ðιò æçðÜιá áðu υóιòð áíáέáóÝññιóáέ ίá áñυέιγί ιáæβ ιáð òççί ñÜáá άίÜððóιçð όιò FreeBSD, άβιáέ έβáç áðu òççί βáέá áοιóβυóç òçð ðññέιPð ñÜááð, áέά ιέα óóιá÷P ðññáβá òççί áðέóð÷βá όιò!

### 1.3.4 Ç ÔñÝ ÷ ιϊοά έαϊϊόç ôïð FreeBSD

Ôï FreeBSD άβίάε άεάγέάνα άεάεΎοείι, άάόβæάόάε ιεüεεçñï óοίι δççάβι έpάεάά ôïð 4.4BSD-Lite, έάέ άίάδδύόόάόάέ άεά óóóðPιάόά çεάεöñίέέpί ðñίεάεóðpί άάόέοιΎίά óά άðáíáñάάóðΎð Intel i386™, i486™, Pentium®, Pentium Pro, Celeron®, Pentium II, Pentium III, Pentium 4 (P óöíááóίγð), Xeon™, DEC Alpha έάέ Sun UltraSPARC. Άάόβæάόάé έöñβùð óοίι software όçð ïñÜááð U.C. Berkeley CSRG, íá éÜðίεάð άάεöέpóάéð ðίò ðñίΎñ ÷ ιϊοάέ áðu óά NetBSD, OpenBSD, 386BSD, έάέ ôï Free Software Foundation.

Άðu όçί Ύέαϊόç ôïð FreeBSD 2.0 óάά ðΎέç ôïð 1994, ç áðuάϊόç, ôï óύγίεϊ ðùί ÷ άñάέöçñέóóέέpί, έάέ ç óóάéáñüóçóά ôïð FreeBSD Ύ ÷ άé άάéöέüèáβ όçίáίóέέÜ. Ç íáάάέγóáñç áέέéáP άβίάé ç άðάίáó ÷ áάβáóç ôïð óóóðPιάóïð άέέίίέέPð ίPιçð (virtual memory) íá Ύίά ίεϊέεçñüíΎίí VM/file buffer cache ôï ίðίβι ü ÷ é ιüíí áóίÜíáé όçί áðuάϊόç, áέéÜ áðβóçð íáέpίáé óéð áðάéðPóáéð ίPιçð ôïð FreeBSD, άðéöñΎðίίόáð ùð áéÜ ÷ έóóι áðίááéöü ùñéí óά 5 MB. ÐáñéΎ ÷ ιϊοάέ άðβóçð έάέ Üέéáð άάéöέpóáéð, üðùð ðéPñçð ððίóðPñéίç ðáéÜöç έάέ άίöðçñáóçðP NIS, ððίóðPñéίç óóίáééáäpí TCP, dial-on-demand PPP, áίóüíáóüíΎίç ððίóðPñéίç DHCP, Ύίá άάéöέüíΎίí ððίόγóóçίá SCSI, ððίóðPñéίç ISDN, ððίóðPñéίç áéá ATM, FDDI, ðñίóáñίíááβð áέέóγίó Fast έάέ Gigabit Ethernet (1000 Mbit), άάéöέüíΎίç ððίóðPñéίç áéá ôïðð óáéáðóáβίöð áéááéöΎð όçð Adaptec έάέ ðίέéΎð ÷ éééÜááð áéίñèpóáéð éáèpí (bug).

Άέöüð áðu όç άάóέéP ôïð áéáñP, ôï FreeBSD ðñίóóΎñáé ίεά óééεíäP έίáέóίέέγύ íá ÷ éééÜááð ðñίáñÜíáóá áéá éáéçíáñéίP ÷ ñPóç. Óçί óééáñP ðïð áñÜöίίóáé áóðΎð ίé áñáñΎð, ððÜñ ÷ ίóί ðÜíü áðu 20,000 ports! Ç έβóóá ðùί ports íáέéíÜáé áðu άίöðçñáóçðΎð http (WWW), íΎ ÷ ñé ðáé ÷ íβáéá, áèpóóáð ðñίáñáíáóéóίγύ, éáéíáñáñÜöίöð, έάé ιïéáPðίóá Üέéí áíáéÜíáóá. Ç óñίέééP ÓéééíäP ðùί Ports áðάéóáβ ðñίóáááéóóééÜ 417 MB áðίεçéáðóééü ÷ pñí, áóίγ üéá óά ports áéöñÜáéίíóáé íá “deltas” (áñ ÷ áβá áéáóñpí) ðùί áðéáíóéépí ðççápí ôïðð. Ôï áááíüð áóóü íáð áðéöñΎðáé íá áíáááéβίóίíá óά ports ðίέγύ áðéíεüðáñá, έάέ íáέpίáé áñáóóééÜ óéð áðάéðPóáéð óá óééçñü áβóéí óά ó ÷ Ύóç íá όçί ðáééáéüðáñç ÓéééíäP Ports 1.0. Άέá íá íáóááéüðóéóóáβ (compile) Ύίá port, ÷ ñáéÜæáóáé áðèpð íá íáóáááβóá óóίí éáóÜέíáí ôïð ðñίáñÜíáóáð ðïð áðééöíáβðá íá ááéáóáóðPóáóá, íá ðéçéöñίéíäPóáðá make install, έάέ íá áóPóáðá ôï óýóóçίá óáð íá éÜíáé óá ððüéíéðá. Ιεüεεçñç ç áóéáíóééP áéáñP áéá éÜéá port ðïð éÜíáðá build ðáñΎ ÷ áóáé áðίáééÜ áðu ôï CD-ROM P áðu íβá ôíðééP ôíðίεáóáβá FTP, Ύóóé óá ports ðïð ááí ÷ ñáéÜæáóóá ááí éáóáéáíáÜíóí Üóéíðí ÷ pñí óóίí óééçñü óáð áβóéí. Ó ÷ ááüí éÜéá port ðáñΎ ÷ áóáé áðβóçð έάέ óáí ðñί-íáóááéüðóéóίΎίí (pre-compiled) “ðáéΎöí (package)”, ôï ιðίβι ίðίñáβ íá ááéáóáóáéáβ íá ίεá áðèP áίóίéP (pkg\_add) áéá áéáβíöð ðïð ááí áðééöίγύ íá íáóááéüðóβæéíóí óá ports ôïðð áðu ôίí ðççááβι έpάééá. Ðáñéóóüðáñáð ðéçñίöíñβáð áéá óá packages έάέ óá ports ίðίñáβóá íá áñáβóá óóί Έáöΰεάει 4.

ÔðÜñ ÷ áé áñéáóÜ íááÜέç áðéðéΎίí óáéιçñβùóç όçί ιðίβá ίðίñáβ íá áñáβóá ðίέγύ ÷ ñPóéιç áéá όçί áéááééáóá ááéáóÜóóáóçð έάé ÷ ñPóçð ôïð FreeBSD. Ιðίñáβóá íá όçί áñáβóá ááéáóáóóçίΎίç óóίí éáóÜέíáí /usr/share/doc óá ιðίéíäPðίóá óýá ÷ ñííí ιç ÷ Üίçίá FreeBSD. Óá ôíðééÜ ááéáóáóóçίΎίá áá ÷ áéñβáéá ίðίñáβóá íá óá ááβóá óá ιíñöP HTML, ÷ ñçóéíιðίépíóáð ιðίéíäPðίóá éáóÜέéçéí browser óóéð áéüéíöéáð URL:

Ôï Άá ÷ áéñβáéí × ñPóçð ôïð FreeBSD  
/usr/share/doc/handbook/index.html

Óð ÷ íΎð áñüðPóáéð ôïð FreeBSD (FAQ)  
/usr/share/doc/faq/index.html

Ιðίñáβóá áðβóçð íá ááβóá óá ðñüðüöððá (έάé óð ÷ íÜ áíáááéίéæüíáíá) áίóβáñáóá óóί http://www.FreeBSD.org/.

# ΈαοÛεάει 2 Άãêáèéóôþíôáò ôï FreeBSD

Αίάó÷çιάóέοιÝñ, άιááεïñááíúïÝñ, éáé ìáñέþò ìáíáãñáúïÝñ áðu ðïí Jim Mock. Ç áÞá ðñò áÞá üéάáέάάóβá ðïò sysinstall, ïé áééüíáò, éáé áάééÝò áéïñþóáéò εάεïÝñò áðu ðïí Randy Pratt.

## 2.1 Óýñïç

Ôï FreeBSD áεάíÝíáóáé ìá Ýíá áý÷ñçóòï ðñüñáñáíá áãéáðÛóóáóçò, ðï ïðïß ðñÝ÷áé óá éáðÛóóáóç éáεïÝñò: ðï sysinstall. Άβίáé ðï ðñüñáðéεááïÝñ ðñüñáñáíá áãéáðÛóóáóçò áεά ðï FreeBSD, áεéÛ üðïéïò áεάíÝíáé ðï FreeBSD áβίáé áéáýεáñò ìá ðáñÝ÷áé áééü ðïò ðñüñáñáíá áãéáðÛóóáóçò. Ôï éäüÜεάéí áóòü ðáñéáñÛóáé ðüò ìðñáβá ìá ÷ñçóéïðïéÞóáðá ðï sysinstall áéá ìá áãéáðáóáðóáðá ðï FreeBSD.

Άòý áεάáÛóáðá áóòü ðï éäüÜεάéí, éá ìÝñáðá:

- ðüò ìá áçïéïñáÞóáðá áéóéÝóáò áãéáðÛóóáóçò áεά ðï FreeBSD.
- ðüò áíáðÝñáðáé óðïòò óéεçñýð áβóéïò óáò ðï FreeBSD éáé ðüò ðïò ÷ññáεé óá éáðáðïÞóáéò.
- ðüò ìá ìáééíÞóáðá ðï sysinstall.
- Óéò áñòðóáéò ðïò éá óáò éÛíáé ðï sysinstall, ðé óçíáβíïí, éáé ðüò ìá ðéò áðáíóÞóáðá.

ðñéí áεάáÛóáðá áóòü ðï éäüÜεάéí, éá ðñÝðáé:

- ìá áεάáÛóáðá ðç éβóðá ðïò ððïóçñέæüìáñïò ðéééý ðïò Ýñ÷áóáé ìá ðçí Ýéäïóç ðïò FreeBSD ðçí ìðïßá éá áãéáðáóáðóáðá, éáé ìá áðáéçεáýóáðá üóé ðï ðéééü ðïò Ý÷áðá ððïóçñáεáðáé áðu ðï FreeBSD.

**Óçíáβóóç:** Óá ááíééÝò áñáíïÝò áóðÝò ìé ìáçáβáò áãéáðÛóóáóçò áβίáé áñáíïÝíáð áéá ðïò i386 ("PC óðïááðïýò") áñ÷έááéðïééþð ððïéíáέóðÝò. ¼ðïò ÷ñάéÛáðáé, éá áïóáíβæííóáé óðáéáñéíÝíáð ìáçáβáò áéá Ûéáð ðéáðúñíáð (áéá ðáñÛáéáíá, Alpha). Αí éáé áóòüò ìéáçáüò áεáðçñáβóáé üóï ðï áðïáðïí ðéí áçïñáñïÝñò, áβίáé ðéááíïí ìá áñáβðá ìééñÝò áεáòïñÝò ìáðáý ðïò ðñüñáñáíáðïò áãéáðÛóóáóçò éáé áóòïý ðïò ðáβίáðáé ááþ. Óáò ðñïðáβíïíá ìá ÷ñçóéïðïéÞóáðá ðï éäüÜεάéí áóòü ðáñέóóðñáñï óáí ááíééü ìáçáü ðáñÛ óáí Ýíá éáðÛ áñüíá áãéñβáéí áãéáðÛóóáóçò.

## 2.2 ΆðáéôÞóáéò Ôéééîý

### 2.2.1 ΆέÛ÷έóáðò ΆðáéôÞóáéò

Ëé áéÛ÷έóáðò áðáéôÞóáéò áéá ðçí áãéáðÛóóáóç ðïò FreeBSD ðïééβéïí áíÛéíáá ìá ðçí Ýéäïóç ðïò FreeBSD éáé ðçí áñ÷έáéðïééþ ðïò ðéééý.

ðçñïññáð áéá ðéò áéÛ÷έóáðò áðáéôÞóáéò áβίáé áεάéÝóéíáð óðéð Óçíáéþóáéð ΆãéáðÛóóáóçò, óðçí óáéβáá ðçñïññáð éäïóçò (<http://www.FreeBSD.org/releases/index.html>) óðï éééðóáéü ðüðï ðïò FreeBSD. Óá ðáñáéÛóò ðïÞáðá áβίáðáé ìéá ðáñβέççç ðïð ðçñïññέþí áóðïí. ΑíÛéíáá ìá ðïð ðñüðï ðïò éá áðééÝíáðá ìá áãéáðáóáðóáðá ðï FreeBSD, ìðñáβ ìá ÷ñáéáðáβá ìïÛáá áéóéÝóáð, Ýíá ððïóçñέæüìáñï ìáçáü CD-ROM, éáé óá ìñέóïÝíáð ðáñéðóáéð, éÛñóá áééðýïò. Óá ðáñáðÛóò éáéýððïéíáé óðï ÔïÞá 2.3.7.



## 2.2.2 Õðíóðçñæùíáíí Õèééü

Ç èβóðá íá ðí ððíóðçñæùíáíí ðèééü, ðáíÝ ÷ áðáé óðéð Óçíáéðóáéð Õèééíý (Hardware Notes) íá èÙèá Ýæáíðç ðíð FreeBSD. Õí Ýááñáçí áóòù íðññáβ ððíðèùð íá áñáæáβ ðí ùííá áñ÷áβíð HARDWARE.TXT, óðíí ñéæééü èáðÙèíáí íéá áéáíñðð CDROM ð FTP, ð èáé óðíí ðáíý documentation ðíð **sysinstall**. Άéá èÙèá áñ÷éðáèðíéèð, èá áñáβðá íéá èβóðá óðóèáðñí íé ððíðáð áðéááááéùíÝ íá ððíóðçñæùíðáé áðu ðí FreeBSD. Áíðβáñáóá ðíð èáðáéùáíð ððíóðçñæùíáííð ðèééíý áéá æèÙíñáð áéäüóáéð èáé áñ÷éðáèðíééÝð ððíñíý áðβóçð íá áñáèíý íðç óáèβáá ðèçñíðñèðí çáíðçð (<http://www.FreeBSD.org/releases/index.html>) óðí áéèððáèü ðüðí ðíð FreeBSD.

## 2.3 Άñááóβáð ðñéí ðçí ΆãéáðÙóðáóç

### 2.3.1 Άðíáñáðβ Õèééíý ðíð Õðíèíáéóðð óáð

ðñéí áãéáðáóððóáðá ðí FreeBSD ðñÝðáé íá áðé÷áñðóáðá íá áðíáñÙðáðá óá áíáñððíáðá ðíð ððíèíáéóðð óáð. Íé ñíððñíáð áãéáðÙóðáóçð ðíð FreeBSD èá óáð ááβñíðí óá áíáñððíáðá (óèéçñíýð áβóèíðð, èÙñðáð áééðýíð, íáçáíýð CDROM èèð.) íá óá ðíñíáðá ðùí ðíðÙèùí èáé ðùí èáðáéáðáóðñí ðíðð. Õí FreeBSD èá áðé÷áñðóáé áðβóçð íá ðñíðáéíñβóáé ðéð ðúðóÝð ñðèíβóáèð áéá ðéð óðóèáðÝð áðóÝð, ððððáñééáíááííÝíùí èáé ðùí ðèçñíðñèðí áéá ðç ÷ñðç IRQ èáé èðñíð IO. Èüüò ðùí èáéíññóèðí ðíð ðèééíý ðùí PC, ç áéááééáóβá áððð ááí áβíáé ðÙíðá áðéðð÷ðð, èáé βóùð ÷ñáéáóðáβ íá áéíñèðóáðá ðéð ñðèíβóáèð ðíð áíβ÷íáðóá ðíð FreeBSD.

Áí Ý÷áðá ðäç Õèèè èáéðíðñáééü óýðóçíá áãéáðáóðçíÝíí, ùðùð Windows ð Linux, áβíáé ááíéèÙ èáèð èáÝá íá ÷ñçóèíðñèðóáðá ðéð áðíáðùíðçðáð ðíð óáð ðáíÝ ÷áé áéá íá ááβðá ðéð ñðèíβóáèð ðíð ðèééíý óáð. Áí ááí áβóðá óβáíðñíé áéá ðéð ñðèíβóáèð íéáð èÙñðáð áðÝèðáóçð, βóùð íá ðéð áñáβðá ðððùíÝíáð ðÙíù óðçí βáéá ðçí èÙñðá. ÓðíççéóíÝ íá IRQ áβíáé óá 3, 5 èáé 7 áññ íé èýñáð IO ððíðèùð áñÙíðíðáé ùð ááéáíáíáééèíβ áñéèííβ, ð.÷. 0x330.

Óáð óðíéóíèýííá íá áñÙðáðá ð íá áèððððóáðá ðéð ðèçñíðññáð áððÝð ðñéí ðçí áãéáðÙóðáóç ðíð FreeBSD. Óáí ððüááéáíá, ððñáβðá íá ÷ñçóèíðñèðóáðá Ý íá ðβíáéá ùðùð ðíð ðáñáéÙóù:

#### ðβíáéáð 2-1. Õðüááéáíá Άðíáñáðβð Óóóèáðñí

¼íñíá Óóóèáððð	IRQ	IO èýñáð	Óçíáéðóáéð
ðñðíðð Óèéçñíðð Άβóèíð	N/A	N/A	40 GB, ðçð Seagate, master óðí ðñðñíð IDE
CDROM	N/A	N/A	slave óðí ðñðñíð IDE
Άáýðáñíð Óèéçñíðð Άβóèíð	N/A	N/A	20 GB, ðçð IBM, master óðí ááýðáñíð IDE
ðñðíðð Άéááèððð IDE	14	0x1f0	
ÈÙñðá Áééðýíð	N/A	N/A	Intel 10/100
Modem	N/A	N/A	3Com® 56K faxmodem, óðçí COM1
...			

¼ðáí ðáéáéðóáðá ðçí áðíáñáðβ áíáñçíÙóùí ðíð ððíèíáéóðð óáð, èá ðñÝðáé íá áèÝáíáðá áí ðáèñèÙæíðí íá ðéð áðáéððóáéð ðèééíý ðçð Ýæáíðçð FreeBSD ðíð óèíðáýáðá íá áãéáðáóððóáðá.

### 2.3.2 Èñáððóáð Άíðβáñáóá Áóóáèáβáð ðùí ΆááñÝíùí óáð

Áí ððíèíáéóððð óðíí ððíðí èá áãéáðáóððóáðá ðíð FreeBSD ðáñèÝ÷áé ðñéýðéíá áááñÝ íá, ááááéùèáβðá ùèé Ý÷áðá



Ἰθίναβόα ίά ÷ ηζόείηθίεΠράοά εὐθίεί ηιθίηέεὐ αέάεὕόείη ηηάαέάβι υδὐδ όι **PartitionMagic**®, Π εὐθίεί ηέηέηηη ηηάαέάβι υδὐδ όι **GParted**, αέά ίά αέεὐίάόά ίάηὕεζ όόέδ έάόάόιΠράέδ όάδ έάέ ίά αζέίεηθάΠράάόά ÷ ηηί αέά όι FreeBSD. Ἰ έάόὐέηαηδ tools όόι CDROM θάηεὕ ÷ αέ ηῦί όὕόιέά ηέηέηηηά ηηάαέάβά, όά ηθίβά ηθίηῦί ίά ηέόαεὕόιθί άόδΠ όζ έάέόηθάβά, όι **FIPS** έάέ όι **PResizer**. ζ όάέηζηβόζ αέά όέδ ηῦί άόόὕδ άόάηηάὕδ ηηβόέάόάέ άδβόζό όόηί βάεί έάόὐέηαι. Ὀί **FIPS**, όι **PResizer** έάέ όι **PartitionMagic** ηθίηῦί ίά αέεὐίθί όι ηὕάάεηδ όά έάόάόιΠράέδ FAT16 έάέ FAT32 θηό ÷ ηζόείηθίέῦίόάέ όόι MS-DOS ηδ έάέ όά Windows ME. Ὀὐόι όι **PartitionMagic** υόί έάέ όι **GParted** ηθίηῦί ίά ÷ ηζόείηθίέζέῦί όά έάόάόιΠράέδ NTFS. Ὀί **GParted** άβίάέ αέάεὕόείη όά ηηέάόὕδ αέάηηὕδ Linux Live CD, υδὐδ αέά θάηὐάάέαιά όι SystemRescueCD (<http://www.sysresccd.org/>).

, ÷ ίθί άίάόάηέάβ θηίηέπιαόά έάόὐ όζι αέέάαΠ ίάηὕέηδ έάόάόιΠράάι όὐη Microsoft Vista. Ὀθίβόόάόάέ ίά ὕ ÷ άόά θηῦ ÷ αέηη ὕίά CDROM ηάέάόὐόόάόζ όὐη Vista θηέί άδέ ÷ αέηηΠράάά άόδΠ όζ ηέάάέέάόβά. ¼θὐδ έάέ ίά ηέάδ όέδ άίόβόθίέ ÷ άδ ηέάάέέάόβάδ άβόέη, όθίβόόάόάέ άδβόζό ίά ὕ ÷ άόά ὕίά άίζηαηῦίηί όάδ άίόέηηὐόὐή άόόάέάβάδ.

**θηίάέάηθίβζόζ:** Ἐάίέάόιὕίζ ÷ ηΠόζ όὐη ηηάαέάβη άόόπ ηθίηάβ ίά ηαζάΠράέ όά αέάάηάόΠ όὐη ηάαηὕῦί όηό άβόέηθ όάδ. θηέί όά ÷ ηζόείηθίεΠράόά, ηάάάέηέάβόά υόέ ὕ ÷ άόά θηῦόόάά άίόβάηάόά άόόάέάβάδ όά ηθίβά άηόέηθί.

### **θάηὐάάέαιά 2-1. × ηζόείηθίεπράόά ίέά Ὄδὐη ÷ ηόόά Ἐάόὐθίζόζ ÷ ηηβδ ίά όζι Ἀέεὐίάόά**

Ὀθίεὕόόά υόέ ὕ ÷ άόά ὕίά όθίεηέόδΠ ηά ὕίά ηῦηί όέέζηῦη άβόέη 4 GB όόηη ηθίβη ὕ ÷ άόά Παζ ηάέάόάόόζὕίζ ίέά ὕέηθζ όὐη Windows έάέ όηη ὕ ÷ άόά ÷ ηηβόάέ όά ηῦί ηαζάῦθ ηά ηηῦίηάόά C : έάέ D : , έάέ ὕίά ηά ηὕάάεηδ 2 GB. , ÷ άόά 1 GB ηάαηὕῦί όόι C : έάέ 0.5 GB ηάαηὕῦί όόι D :

Ἀόόη όζιάβίάέ υόέ η άβόέθ όάδ ὕ ÷ αέ ηῦί έάόάόιΠράέδ, ηβά άίὐ ηηῦίηά ηαζάῦ. Ἰθίηάβόα ίά άίόέηηὐάόά υέά όά όδὐη ÷ ηθίά ηάαηὕίά όάδ άθῦ όηη D : όόι C : έάέ ίά ηέάόέηηθάόά ὕόόέ όζι ηάὕόαηζ έάόὐθίζόζ, ηόόά ίά άβίάέ ὕθίεηζ αέά όι FreeBSD.

### **θάηὐάάέαιά 2-2. Ὄθηέέηηθίόά ίέά Ὄδὐη ÷ ηόόά Ἐάόὐθίζόζ**

Ὀθίεὕόόά υόέ ὕ ÷ άόά ὕίά όθίεηέόδΠ ηά ὕίά ηῦηί άβόέη 4 GB όόηη ηθίβη ὕ ÷ άόά Παζ ηάέάόάόόΠράέ ίέά ὕέηθζ όὐη Windows. ¼όάί ηάέάόάόόΠράόά όά Windows, αζέίεηθάΠράόά ίέά ηάηὕεζ έάόὐθίζόζ ηά όι ηηῦίηά C : έάέ ηὕάάεηδ 4 GB. ἈόδΠ όζ όόέηηΠ ÷ ηζόείηθίέάβόάέ 1.5 GB ÷ ηηθί έάέ εὕέάόά ίά ηθόάόά όόι FreeBSD 2 GB ÷ ηηί.

Ἀέά ίά ηάέάόάόόΠράόά όι FreeBSD έά θη ὕθάέ άβόά:

1. Ἰά θὐηάόά άίόβáηάόη άόόάέάβάδ όὐη ηάαηὕῦί όάδ όὐη Windows έάέ ὕθάέόά ίά όά ηάέάόάόόΠράόά ίάίὐ, αζέίεηθάπράόά άόδΠ όζ όηηὐ ίέά έάόὐθίζόζ ηάηὕέηδ 2 GB έάόὐ όζι ηάέάόὐόόάόζ.
2. Ἰά ÷ ηζόείηθίεΠράόά εὐθίεί άθῦ όά ηηάαέάβά υδὐδ όι **PartitionMagic** θηό θάηέηηὐθάίά θάηάδὐῦη ηόόά ίά όθηέέηηθίόά όζι έάόὐθίζόζ όὐη Windows.

### 2.3.3.2 ἘάòÙόιçç Ἄβóέìò áέά ðç Ἄñ ÷έóáέòìíέèÞ FreeBSD/alpha

Ἐά ÷ñάέάóðáβòά Ἰάí óέέçñù áβóέì áðìέέάέóðέέÙ áέά ÷ñÞçç áðù ðì FreeBSD óðìí Alpha. Ἄáí áβίάέ áðíáðùí áðòÞ ðç óðέάìÞ íá ÷ñçóέìðìέÞóáðá ðìí βáέì áβóέì ìá èÙðìέì Ùέέì éáέðìðñáέέù óýóðçíá. ἌíÙέñáá ìá ðì ìç ÷ Ùíçíá Alpha ðìò Ἰ ÷ áòá, ì áβóέìò áðòùð ìðìñáß íá áβίάέ áβòá SCSI áβòá IDE, áòùóìí ðì ìç ÷ Ùíçíá óáð ìðìñáß íá áέέέìÞóáέ áðù áðòùí.

Óýìòùíá ìá ðέð óðìáÙóáέð ðìò áέìέìðέìýíóáέ óðá áá ÷ áέñβáέá ðçð Digital / Compaq, ùέáð ìέ áíòìέÝð SRM ááβ ÷ ìíóáέ ìá éáòáέáβá ññÙìáóá. Ùóóùóì ðì SRM ááí èÙíáέ áέÙέñέóç ìέέñÞí / éáòáέáβùí.

Ἄέá íá áñáβòá óá ìíùíáóá éáέ ðìòð óýðìòð ðùí áβóέùí ðìò ìç ÷ áíÞíáðìò óáð ÷ñçóέìðìέÞóáð ðçí áíòìέÞ SHOW DEVICE óðçí ðñìòñìðÞ áíòìέÞ ðìò SRM:

```
>>>SHOW DEVICE
dka0.0.0.4.0          DKA0          TOSHIBA CD-ROM XM-57  3476
dkc0.0.0.1009.0      DKC0          RZ1BB-BS             0658
dkc100.1.0.1009.0    DKC100        SEAGATE ST34501W     0015
dva0.0.0.0.1         DVA0
ewa0.0.0.3.0         EWA0          00-00-F8-75-6D-01
pkc0.7.0.1009.0      PKC0          SCSI Bus ID 7        5.27
pqa0.0.0.4.0         PQA0          PCI EIDE
pqb0.0.1.4.0         PQB0          PCI EIDE
```

Óì ðáñÙááέáíá áβίάέ áðù Ἰάí Digital Personal Workstation 433au éáέ ááβ ÷ íáέ ðñáέð óðóέáòÝð óðìááááì Ἰíáð óðì ìç ÷ Ùíçíá. Ç ðñÞçç áβίάέ Ἰάí CDROM ìá ùìñá DKA0 éáέ ìέ Ùέέáð áýì áβίάέ áβóέìέ ìá ìíùíáóá DKC0 éáέ DKC100 áíòβóðìέ ÷ á.

Ἄβóέìέ ìá ìíùíáóá ðçð ìñòÞð DKx áβίάέ óýðìò SCSI. Ἄέá ðáñÙááέáíá, ì DKA100 áíáóÝñáðáέ óá Ἰάí áβóέì SCSI ìá SCSI target ID 1 óðìí ðñÞðì (Á) áβáðέì SCSI, áñÞ ì DKC300 áíáóÝñáðáέ óá Ἰάí áβóέì SCSI ìá SCSI ID 3 óðìí ðñβðì (C) áβáðέì SCSI. Ç óðóέáòÞ PKx áíáóÝñáðáέ óðìí áέááέòÞ (èÙñóá) SCSI. ¼ðùð óáβíáðáέ áðù óá áðìðáέ Ἰóíáóá ðçð áíòìέÞð SHOW DEVICE, ìέ ìáçáñß CDROM áíòέìáðùððβæìíóáέ ùðùð éáέ ìðìέááÞððìá Ùέέç SCSI óðóέáòÞ óέέçñìý áβóέìò.

Ἰέ óέέçñìß áβóέìέ óýðìò IDE Ἰ ÷ ìòì ìíùíáóá ðìò óýðìò DQx, áñÞ ìέ áíòβóðìέ ÷ ìέ IDE áέááέðÝð ðìò óýðìò PQx.

### 2.3.4 ÓðέέÝíòá ðέçñìòìñβáð áέá ðç Ἰýέìέóç ðìò Ἄέέóýìò óáò

Ἄí óέìðáýáðá íá óðìááέáβòá óá Ἰάí áβέðòì éáòÙ ðç áέÙñέáέá ðçð ááέáðÙóðáóçð ðìò FreeBSD (áέá ðáñÙááέáíá áí ðñùέáέóáέ íá èÙíáðá ááέáðÙóðáóç ìÝóù èÙðìέáð ðìðìέáóβáð FTP Þ ìÝóù áέáέñέóðÞ NFS), ðùðá ðñÝðáέ íá áíññæáðá ðέð ñðèìβóáέð ðìò áέέóýìò óáð. ἘáòÙ ðç áέÙñέáέá ðçð ááέáðÙóðáóçð, éá áñùðçέáβòá áέá áðòÝð ðέð ñðèìβóáέð þóðá ðì FreeBSD íá ìðìñÝóáέ íá óðìááέáß óðì áβέðòì éáέ íá ìέìέçñÞóáέ ðçí ááέáðÙóðáóç.

#### 2.3.4.1 Óýíááóç ìá Ἄβέðòì Ethernet Þ Modem Cable/DSL

Ἄí óðìáÝáóðá óá áβέðòì Ethernet Þ áí Ἰ ÷ áðá óýíááóç Internet ìá ÷ ñÞçç áέááέòÞ Ethernet ìÝóù éáέùáέáέÞð Þ DSL óýíááóçð, éá ÷ ñáέáóðáβòá ðέð áέùέìòέáð ðέçñìòìñβáð:

1. Ἄέáýèðìóç IP (IP Address)
2. Ἄέáýèðìóç IP ðçð ðñìáðέέááì Ἰýçð ðýέçð (default gateway)
3. ¼íñá ððìέìáέóðÞ (hostname)
4. Ἄέáðέýíóáέð IP ðìò áέáέñέóðÞ DNS (DNS server IP addresses)

### 5. Ἰὺόέα Ὀδρῖέέόγῖο (Subnet Mask)

Αἱ ἀρῖ ἀρῖνβᾶάδ ἄδὸ ὄέδ δέχῖνῖοῖνβᾶδ, ῖνὸβόά οἱ ἄέᾶ ÷ ἄέῖέόδρ ὄόόδρῖᾶόῖδ β οἱ δᾶῖ ÷ Ἰᾶ ὄδχῖᾶόέβῖ Internet δῖο ὄάδ ἄἰδὸχῖᾶάδ. Ḷ ἄδἸόόόγ ἰδῖᾶβ ἰᾶ ἄβῖᾶέ ὑόέ ἰέ δέχῖνῖοῖνβᾶδ ἄδὸ ὄδ ἄέ ÷ ῖῖῖῖῖῖῖῖῖ ἄδὸῖῖῖῖῖῖ ἰᾶ ÷ ῖβόγ DHCP. Ὀχῖᾶέβόά ὄχῖ δέχῖνῖοῖνβᾶ ἄδὸβ.

### 2.3.4.2 Ὀγῖᾶάόγ Ἰᾶὸὸ Modem

Αἱ ÷ ῖῖῖῖῖῖῖῖῖ ἄδῖῖῖῖῖῖῖῖῖ (dial up) ὄγῖᾶάόγ ἰᾶ ἔἸδῖῖῖ δᾶῖ ÷ Ἰᾶ Internet (ISP) ἰᾶ ÷ ῖβόγ ἄδῖῖῖ modem, ἰδῖᾶβόᾶ ἔᾶέ δἸῖῖ ἰᾶ ἄἄῖᾶᾶᾶᾶᾶᾶ οἱ FreeBSD ἰᾶὸὸ Internet, ἄῖῖ ἔᾶ ÷ ῖᾶῖᾶᾶᾶᾶᾶ δἸῖᾶ δῖῖῖ ÷ ῖῖῖῖ.

Ἐᾶ ÷ ῖᾶῖᾶᾶᾶᾶ ἰᾶ ἰᾶῖᾶᾶᾶ:

1. Ὀῖ ἄῖῖῖῖῖ ἔῖβόγδ οἱῖ ISP ὄᾶδ
2. Ὀγ ὄᾶῖῖῖῖῖ ἔγῖᾶ (COM:) ὄόχῖ ῖδῖᾶ ἄβῖᾶέ ὄῖᾶᾶἸᾶῖ οἱ modem ὄᾶδ
3. Ὀῖ ῖῖᾶ ÷ ῖβόγ (username) ἔᾶέ ἔῖᾶῖῖῖῖ (password) ἄῖᾶ οἱ ῖῖᾶῖῖῖῖῖῖ ὄᾶδ ὄῖῖ ISP

### 2.3.5 Ἄῖᾶῖᾶᾶ ἄῖᾶ Ḷᾶῖῖῖῖῖῖῖῖ (Errata) ὄῖῖ FreeBSD

Αἱ ἔᾶέ οἱ FreeBSD project δᾶᾶ ÷ βᾶᾶ ἄῖᾶ ἰᾶ ἄῖᾶᾶᾶᾶᾶᾶ ὑόέ ἔἸῖᾶ Ἰῖᾶῖῖ οἱῖ FreeBSD ἔᾶ ἄβῖᾶέ ῖῖῖ δῖῖ ὄᾶᾶᾶᾶᾶ ἄβῖᾶᾶᾶ, ῖῖῖῖῖῖῖ ὄῖῖ ὄᾶ ἄῖᾶᾶᾶᾶᾶᾶ ἄδὸβ ἄῖᾶ ῖῖῖ ÷ ῖῖῖῖ ἔἸῖῖ. Ὀᾶ δῖῖῖ ὄδἸῖῖᾶδ δᾶῖῖῖῖῖῖῖῖῖ, ὄᾶ ἔἸῖῖ ἄδὸἸ ἄδῖῖᾶᾶῖῖῖῖ ὄχ ἄῖᾶᾶᾶᾶᾶᾶ ἄᾶῖᾶᾶᾶᾶᾶᾶ. Ἐᾶῖβδ ὄᾶ δῖῖᾶῖῖῖῖῖ ἄδὸἸ ἄβῖῖῖῖῖῖ ἄῖᾶῖῖῖῖῖ ἔᾶῖ ἄδῖᾶῖῖῖῖῖῖῖῖῖ, ὄχῖᾶῖῖῖῖῖῖ ὄᾶ Ḷᾶῖῖῖῖῖῖῖῖῖ FreeBSD (FreeBSD Errata) (<http://www.FreeBSD.org/releases/8.0R/errata.html>) ὄᾶ ῖῖῖᾶ ἄῖβῖῖῖῖῖῖῖ ὄόχῖ ἄῖῖῖῖῖῖῖ ὄῖῖῖῖῖῖῖῖῖ οἱῖ FreeBSD. δῖῖῖ ἰᾶῖῖῖῖῖῖῖ ὄχῖ ἄᾶῖᾶᾶᾶᾶᾶᾶ, Ἐᾶ δῖῖᾶῖῖ ἰᾶ ἄῖᾶῖῖῖῖῖ ὄᾶ Ḷᾶῖῖῖῖῖῖῖῖῖ ἄῖᾶ ἰᾶ ἄᾶᾶῖῖῖῖῖῖῖ ὑόέ ἄᾶῖ ὄδἸῖῖ ÷ ῖῖῖ ῖῖᾶῖῖῖῖῖῖ ὄχδ ὄᾶῖᾶᾶᾶᾶᾶ ὄῖῖῖῖῖῖ ὄᾶ ῖῖῖᾶ ἔᾶ Ἰῖᾶᾶᾶ ἰᾶ ἄῖῖῖῖῖῖῖῖῖ.

δῖῖῖῖῖῖῖῖῖ ἄῖᾶ ῖῖᾶδ ὄῖῖ ἄῖᾶῖῖῖῖῖῖ, δᾶῖῖῖῖῖῖῖῖῖ ῖῖῖ ἔᾶῖ ὄῖῖ ῖῖῖῖῖῖῖῖῖ ἄῖᾶ ἔἸῖᾶ ἰβᾶ, ἰδῖῖῖῖ ἰᾶ ἄῖᾶῖῖῖῖ ὄόχ ὄᾶῖῖᾶᾶ δῖῖῖῖῖῖῖῖῖ Ἰῖᾶῖῖῖῖῖῖῖῖῖ (<http://www.FreeBSD.org/releases/index.html>) ὄχδ ἄῖῖῖῖῖῖῖ ὄῖῖῖῖῖῖῖῖῖ οἱῖ FreeBSD (<http://www.FreeBSD.org/index.html>).

### 2.3.6 Ἀῖᾶῖῖῖῖῖ ὄᾶ Ἄῖ ÷ ἄβᾶ Ἄῖᾶᾶᾶᾶᾶᾶᾶ ὄῖῖ FreeBSD

Ḷ ἄῖᾶᾶᾶᾶᾶᾶ ἄᾶῖᾶᾶᾶᾶᾶᾶ οἱῖ FreeBSD ἰδῖᾶβ ἰᾶ ἄᾶῖᾶᾶᾶᾶᾶᾶ ὄῖ ἔᾶῖῖῖῖῖῖῖῖ ὄγῖᾶῖῖ ÷ ῖῖῖῖῖῖῖῖῖῖ ἄῖ ÷ ἄβᾶ ἄδῖῖ ὄῖῖ δᾶῖᾶῖῖῖῖ ὄῖῖῖῖῖῖῖῖῖ:

#### Ὀῖῖῖῖῖ Ἰᾶᾶ

- CDROM β DVD
- Ἰῖᾶ ἔᾶᾶᾶᾶᾶᾶ DOS δῖῖ ἄῖβῖῖῖῖῖ ὄῖῖ βᾶῖῖ ὄῖῖῖῖῖῖῖῖ
- Ἰῖᾶ ὄᾶῖῖᾶ SCSI β QIC
- Ἀῖῖῖῖῖῖῖ

#### Ἀῖῖῖῖῖ

- Ἰῖᾶ ὄῖῖῖῖῖῖῖῖῖ FTP, ἰᾶὸὸ firewall β ἰᾶ ÷ ῖβόγ ἄῖᾶῖῖῖῖῖῖ ἰᾶῖῖῖῖῖῖῖῖῖ (HTTP proxy) ἄῖ ἄβῖᾶέ ἰᾶῖῖῖῖῖῖῖῖῖ.
- ἰᾶ ἄἰδὸχῖᾶᾶᾶᾶᾶ NFS



Ἄδῃ εἰς τὴν ἀντιγραφή image τοῦ ἐλεύθερου λογισμικοῦ, ὁ ἄνθρωπος ἔχει ἀποδοτικότερα ἀποτελέσματα. Ἀπλάς ἀπλοποιεῖται, ἔχει ἀποδοτικότερα ἀποτελέσματα ἢ ἀπλοποιεῖται. Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς. Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς. Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς.

**Ὁδηγίες:** Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς. Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς.

### 3. Ἀντιγραφή τῆς ἀντιγραφῆς Image εἰς τὸν ἄνθρωπο

Ὁ ἀνθρώπος .flp ἀπλάς ἀπλοποιεῖται ἀπλάς τοῦ ἀνθρώπου ἢ ἀπλοποιεῖται ἀπλάς. Ἀπλάς images τοῦ ἀνθρώπου ἔχει ἀπλοποιεῖται ἀπλάς. Ἀπλάς ἀπλοποιεῖται ἀπλάς ἀπλοποιεῖται ἀπλάς. Ἀπλάς ἀπλοποιεῖται ἀπλάς ἀπλοποιεῖται ἀπλάς.

Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς. Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς.

Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς. Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς.

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

Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς. Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς.

Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς. Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς.

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

Ὁδηγίες τοῦ FreeBSD εἰς τὸν ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς. Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς.

Ἀπλάς ἀπλοποιεῖται ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς τοῦ FreeBSD.

## 2.4 Ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς

**Ὁδηγίες:** Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς. Ἡ ἀπλοποίηση τοῦ ἀνθρώπου ἀπλάς ἔχει ἀπλοποιεῖται ἀπλάς.

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!

Ἐὰν ἀποβῇ ἀπὸ τοῦ δίσκου περιεχόμενα, οὐκ ἔσμεν ἐπιφοιτησόμενοι ἐπὶ τῇ ἀποβῇ. Ἐὰν ἀποβῇ ἀπὸ τοῦ δίσκου περιεχόμενα, οὐκ ἔσμεν ἐπιφοιτησόμενοι ἐπὶ τῇ ἀποβῇ. Ἐὰν ἀποβῇ ἀπὸ τοῦ δίσκου περιεχόμενα, οὐκ ἔσμεν ἐπιφοιτησόμενοι ἐπὶ τῇ ἀποβῇ.

## 2.4.1 Ἀεὶκίνητο

### 2.4.1.1 Ἀεὶκίνητο ὁμοίως Ἄν-ἰ386™

1. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™.
2. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™.
3. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™.
4. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™.

Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™.

1. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™.
  2. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™.
  3. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™.
5. Ἐπιφοιτῶντες ἐπὶ τῷ ἰ386™, ὁμοίως ἰ386™.

```
Booting from CD-Rom...
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 1.01
Console: internal video/keyboard
BIOS CD is cd0
BIOS drive C: is disk0
BIOS drive D: is disk1
BIOS 639kB/261120kB 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+00
x88e9d]
\
```

Ἄν ἐπιθυμᾶτε ἀεὶ βίβλος ἀδῦ τῶν ἑαυτοῦ ἀεὶ βίβλος, ἐὰν ἀβδὸν ἰεῖ τῶν εἰρηστικῶν ἰα ὅς τὸ δῆλῶν ἑαυτοῦ (Ἦ - ἰοῖ δῆλῶν ἑαυτοῦ ἰε  
δῆλῶν ἑαυτοῦ Ἦ ἑαυτοῦ):

```
Booting from Floppy...
Uncompressing ... done
```

```
BTX loader 1.00 BTX version is 1.01
Console: internal video/keyboard
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...

Ἄν ἐπιθυμᾶτε ἀεὶ βίβλος ἀδῦ τῶν ἑαυτοῦ ἀεὶ βίβλος, ἐὰν ἀβδὸν ἰεῖ τῶν εἰρηστικῶν ἰα ὅς τὸ δῆλῶν ἑαυτοῦ (Ἦ - ἰοῖ δῆλῶν ἑαυτοῦ ἰε  
δῆλῶν ἑαυτοῦ Ἦ ἑαυτοῦ) **Enter**. Ἄν ἐπιθυμᾶτε ἀδῦ ὅς τὸ δῆλῶν ἑαυτοῦ, ἐὰν ὑδῶν ὅς τὸ ἀεὶ βίβλος, ἀνῆλθῶν ὅς τὸ ἑαυτοῦ ἰε  
ἀδῶν ἑαυτοῦ.

6. Ἄν ἐπιθυμᾶτε ἀεὶ βίβλος ἀδῦ ἀεὶ βίβλος, ἀβδὸν ἀδῦ CDROM, ὅς ἀεὶ βίβλος ἀεὶ βίβλος ἐὰν ὁ δῆλῶν ὅς τὸ ἰα τῶν ὁῖο FreeBSD  
boot loader:

### Ó÷Þιά 2-1. Ìάñý Áêêßçóçð (FreeBSD Boot Loader)



ÐάñέÝíáðά äÝέά ääöðånüéáððá, ð áðêð ðέÝóðά **Enter**

#### 2.4.1.2 Áêêßçóç ðóçì Áñ÷έðåðìíέêß Alpha

1. ÌáêéíÞóðά ìά ðíí ððñéäέóðß óáð áðñáññäñέçìÝíí.
2. ÌáêéíÞóðά ðíí ððñéäέóðß óáð έάέ ðάñέÝíáðά áέά ðçì ðñíðññðß ðñð boot monitor.
3. Άί ðñáέÙóççά ñá ðññáðñέíÙóáðά áέóέÝðáð áêêßçóçð, ùðùð ðάñέαñÙóáðάέ óðí ÔìÞιά 2.3.7 ñß áðü áððÝð έá áßíáέ áêêßçóçð, ðέéáñð áððß ðñð ðάñέÝ÷áέ ðí boot.flp. Ôñðñèáðßððá ðç áέóέÝðá áððß óðñí ñäçåü έáέ åñÙððá ðçì áέüññðèç áñðñßß áέά ñá ñáêéíÞóáðά áðü ðç áέóέÝðá (áñðέέáέέóðññóáð ðì ùññá ðçð ññÙááð áέóέÝðáð áí ðñáέÙæáðáέ):

```
>>>BOOT DVA0 -FLAGS " -FILE "
```

Άí ñáêéíÙðά áðü CDROM, ðñðñèáðßððά ðñ CDROM óðñí ñäçåü έáέ åñÙððá ðçì áέüññðèç áñðñßß áέά ñá ñáêéíÞóáðά ðçì ååέáðÙóóáç (áñðέέáέέóðññóáð ðì ùññá ðñò ñäçåñý CDROM áí ðñáέÙæáðáέ):

```
>>>BOOT DKA0 -FLAGS " -FILE "
```

4. Έά åñ÷ßóáέ ç áêêßçóç ðñð FreeBSD. Άí ñáêéíÙðά áðü ðçì áέóέÝðá, óá êÙðñέí ðçìáßìì έá åáßðά ðñ áέüññðèè ñÞññá:
 

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

Άέññðèðßððά ðέð ñäçåßáðð áððÝð, ååÙæññðáð ðç áέóέÝðá boot.flp, åÙæññðáð ðç áέóέÝðá kern1.flp έáέ ðέÝæññðáð **Enter**.

5. Άßðά ñáêéíÞóáðά áðü áέóέÝðá, åßðά áðü CDROM, ç áέáέέέáóßá áêêßçóçð έá ððÙóáέ óðñí áέüññðèè ðçìáßìì:
 

```
Hit [Enter] to boot immediately, or any other key for command prompt.
Booting [kernel] in 9 seconds... _
```

ÐάñέÝíáðά äÝέά ääöðånüéáððá, ð áðêð ðέÝóðά **Enter**. ðóέ έá ñáêéíÞóáðά ðñ ñáñý ñýñέíóçð ððñÞιά.



```

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
sio1 at port 0x2f8-0x2ff irq 3 on isa0
sio1: 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 ata1-slave PIO4
Mounting root from ufs:/dev/md0c
/stand/sysinstall running as init on vty0

```

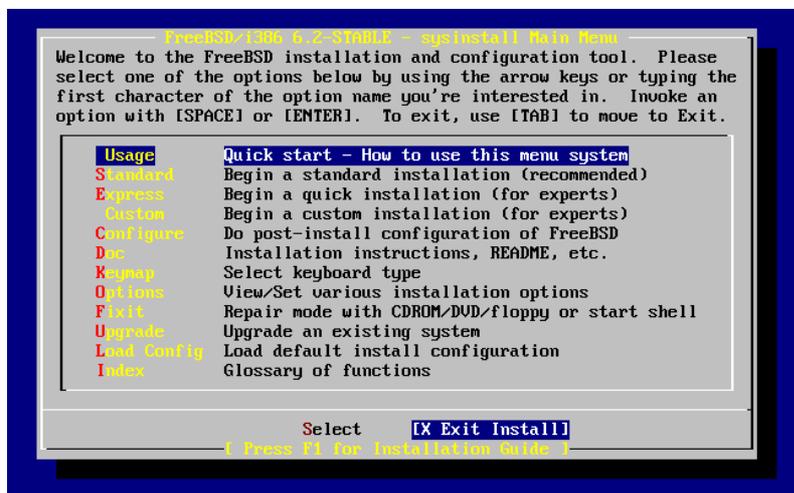
ÆéÝáíóá ðñíóáéóééÛ óá áðíóáéÝóíáóá ðçð áíß÷íáðóçð áéá íá ááááéùèáßðá ùéð ðí FreeBSD áíß÷íáðóá ùéáð ðéð óðóéáðÝð ðíð áíáíÝíáóá. Áí íéá óðóéáðP ááí áñÝéçéá, ðüóá ááí éá ðç ááßðá óðç èßóóá. Ìá ðç áíPèáéá áíáéáéáðíÝñó ððñPíá íðñáßðá íá ðñíóéÝóáðá ððíóðPñéíç áéá óðóéáðÝð íé íðíßáð ááí ðáñééáíáÛñíóáéé óðíí ððñPíá GENERIC, ùðùð ðéð èÛñðáð P÷íð.

Áðü ðí FreeBSD 6.2 éáé íáðÛ, óðí ðÝéíð ðçð áéááééáóßáð áíß÷íáðóçð óðóéáðPí, éá ááßðá ðí Ó÷Píá 2-3. ×ñçóéíðíéPóóá óá ááèÛééá áéá íá áðééÝíáðá ðáñéí÷P P ÷Pñá. Ðáéóá ðéÝóóá **Enter**, áéá íá ñðèíßóáðá áýéíéá ðç ÷Pñá éáé ðç áéÛðáíç ðéçéðñíéPáßíð. Áßíáé áðßóçð áýéíéí íá áááßðá áðü ðí **sysinstall** éáé íá íáééíPóáðá áðü ðçí áñ÷P.

**Ó÷Píá 2-3. ÁðééÝíáðóá ðí Ìáñý ×Pñáð**



**Ó÷Píá 2-4. ÁðééÝíóá ñíáí áðü ðí Sysinstall**



×ñçóéíðíéPóóá óá ááèÛééá áéá íá áðééÝíáðá Exit Install áðü ðí Ìáñý Main Install. Éá ááßðá ðí áéüéíðèí íPíóíá:

```
User Confirmation Requested
Are you sure you wish to exit? The system will reboot
```

(be sure to remove any floppies from the drives).

[ Yes ] No

Ôí ðñüãñáíá áãéáóÛóóáóçð éá íãééíPóáé íáíÛ, áí äöPóáðá ðí CDROM óðíí íãçãü éáé áðééÝíáðá [ Yes ].

Áí íãééíÛðá áðü äéóéÝðáð éá ÷ñáéáóðáß íá áãÛéáðá ðçí äéóéÝóá boot.flp ðñéí ðçí áðáíáéêéßíçóç.

## 2.5 ÁéóáãüãP óðí Sysinstall

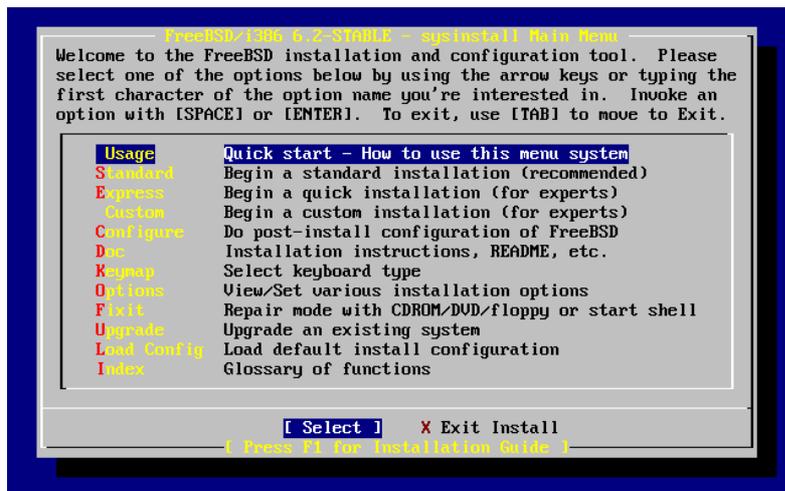
Ôí ðñüãñáíá **sysinstall** áßíáé ç äóáñíãP áãéáóÛóóáóçð ðíð ðáñÝ ÷áðáé áðü ðí FreeBSD Project. Ááóðæáðáé óá ðãñéáÛëëíí éáéíÝíð éáé ÷ññæáðáé óá íéá óáéñÛ áðü íáñý éáé íèùíáð ðíð ðñíãáðá íá ÷ñçóéíðíéPóáðá áéá íá ðçèíßóáðá éáé íá äéÝáíáðá ðçí äéáéééáóá áãéáóÛóóáóçð.

Ôí óýóóçíá íáñý ðíð **sysinstall** äéÝá ÷áðáé íá óá áãéÛééá, ðí **Enter**, ðí **Space** éáé Ûééá ðéPéðñá. ÊãððñãñP ðãñéãñáðP ðüí ðéPéðñüí áððí éáé ðüí éáéðíðñáéðí ðíðð ðãñéÝ ÷áðáé óðéð íãçããáð ÷ñPóçð ðíð **sysinstall**.

Áéá íá áãðá ðéð ðççñíðñíãáð áððÝð, áãááéùéãáðá üðé áßíáé ðüðéóíÝíç ç äðééíãP Usage éáé üðé áßíáé áðééãñÝí ðí ðéPéðñí [Select] üððð óáßíáðáé óðí Ó ÷Píá 2-5, éáé ðéÝóðá **Enter**.

Éá áãðá ðéð íãçããáð ÷ñPóçð ðíð óðóðPíáðíð íáñý. Êáðüðéí ðéÝóðá **Enter** áéá íá áðéóðñÝðáðá óðí éýñéí íáñý (Main Menu).

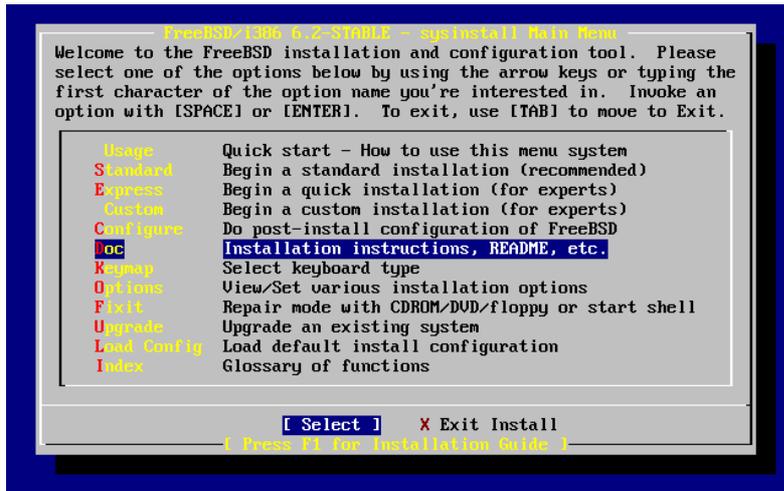
### Ó ÷Píá 2-5. ÁðééÝáííóáð Usage áðü ðí Main Menu ðíð SysInstall



### 2.5.1 ÁðééÝáííóáð ðí íáñý Documentation (Ôãèíçñßùóçð)

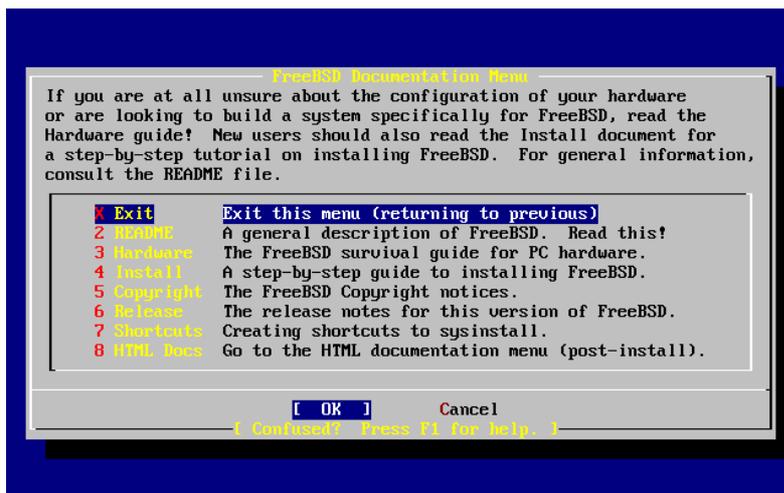
Áðü ðí Main Menu, áðééÝíðá Doc íá óá áãéÛééá éáé ðéÝóðá **Enter**.

Ó÷ Ðíá 2-6. ÅðéÛáííóäð ðí Ìáíÿ Documentation



Åðöü èä äãßíäé ðí Ìáíÿ Documentation.

Ó÷ Ðíá 2-7. Õí Ìáíÿ Documentation ðí Sysinstall



Åßíäé óçíáíóééü íá äéäáÛóäðä ðçí ðáñã ÷üíáíç ðäèíçñßüóç.

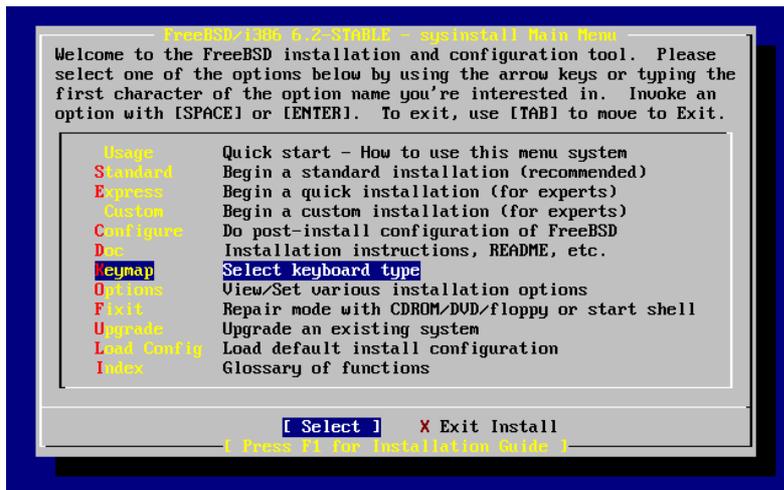
Ãéá íá äãßðä Ýíá Ýãããäöí, äðééÝíðä ðí ìä ðá äãéÛééá éäé ðéÝóðä **Enter**. ¼ðáí ðäéäéðóäðä ðçí áíÛáíóç áíüð äããñÛíöí, ðéÝæííóäð **Enter** èä äðéóðñÝðäðä óðí ìáíÿ Documentation.

Ãéá íá äðéóðñÝðäðä óðí Êðñßüð Ìáíÿ ÅãéäóÛóäóáçð, äðééÝíðä **Exit** ìä ðá äãéÛééá éäé ðéÝóðä **Enter**.

2.5.2 ÅðéÛáííóäð ðí ìáíÿ Keypad (ÄéÛóáíç Ðéçéðñíëíãßíö)

Ãéá íá äééÛíäðä ðç äéÛóáíç ðíð ðéçéðñíëíãßíö, ÷ñçóéíðíéðóðä ðá äãéÛééá ãéá íá äðééÝíðä Keypad áðü ðí ìáíÿ éäé ðéÝóðä **Enter**. Åðöü äðäéóäßðäéé üííí áí ÷ñçóéíðíéäéãßðä äéÛóáíç ðéçéðñíëíãßíö ðíð äãí äßíäíä óóÛíóáñ éäé äðßóçð äéá äéäóÛíäéð äéöüð ðçð Äããééëðð ÇÐÄ.

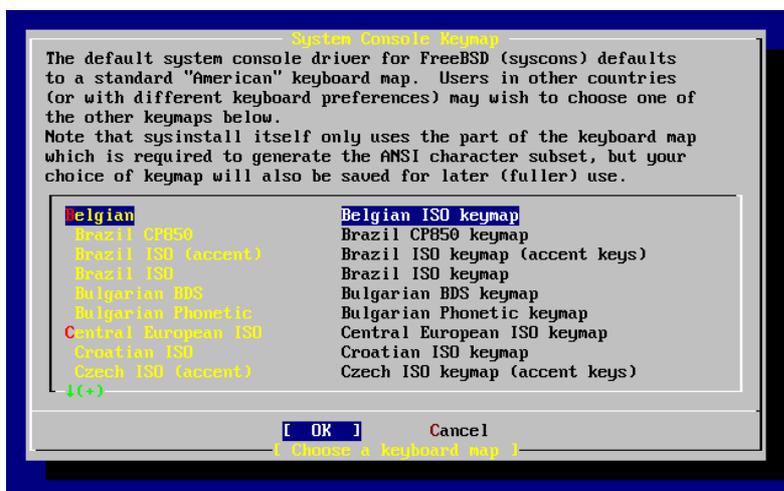
### Ó÷ Ðιά 2-8. Êýñεί Ιάñý ÅãääóÛóóáóçð (Sysinstall Main Menu)



Ìðíñáðá íá äðéeÝíáðá äääóíñáðéèß æÛóáíç ðεççðñíεíáßíð εÛñíóáð ðçí áíðßóðíε÷ç äðéeíáß áðu ðí ðáñý ÷ñçóεíðíεíðóáð ðá äääÛéέα, éáε ðεÝáííóáð **Space**. ðεÝáííóáð ðáíÛ **Space** éá éáðáñáßóáðá ðçí äðéeíáß. ¼ðáí ðáéáεðóáðá, äðéeÝíðá [ OK ] ðá äääÛéέα éáε ðεÝóðá **Enter**.

Óðçí ðáñáεÛóð áðáεéúíεóç ðçð íεúíçð ðáßíáðáé ðñí ðÝñíð ðçð εßóðáð. Áí äðéeÝíáðá [ Cancel ] ðεÝáííóáð ðí **Tab** éá ÷ñçóεíðíεíðóáðá ðçí ðñíáðéέαíÝíç æÛóáíç ðεççðñíεíáßíð éáε éá äðéóðñÝóáðá ðóí Êýñεί Ιάñý ÅãääóÛóóáóçð.

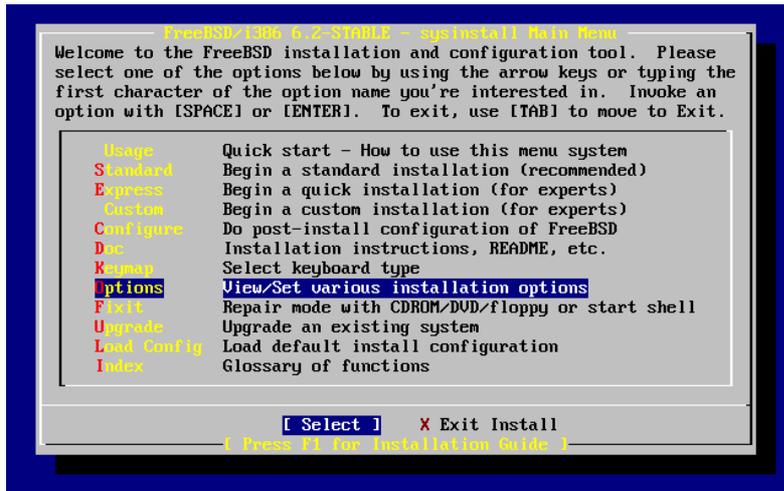
### Ó÷ Ðιά 2-9. Õí Ιάñý Keymap ðí Sysinstall



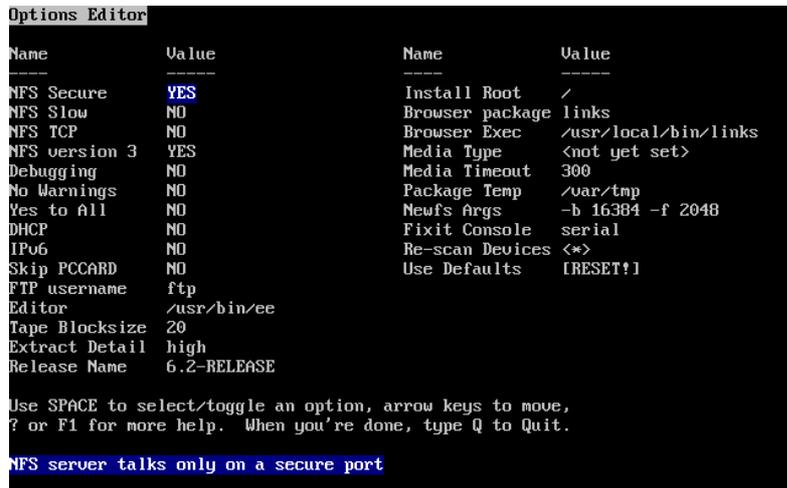
### 2.5.3 Ç Ìεúίç Installation Options (Åðéeíáßí ÅãääóÛóóáóçð)

ÅðéeÝíðá Options éáε ðεÝóðá **Enter**.

## Ὀψὸν Σελὶς 2-10. Ὁ Ἐκὸς Λογὸς τοῦ Sysinstall



## Ὀψὸν Σελὶς 2-11. Ἄδελφὰς τοῦ Sysinstall (Options)



Ὁ ἔκτος λογὸς τοῦ sysinstall ἀφαιρᾷ τὸν ὄνομα τοῦ FreeBSD (Release Name) ἀφαιρᾷ τὸν ὄνομα τοῦ sysinstall.

Ὁ ἔκτος λογὸς τοῦ sysinstall ἀφαιρᾷ τὸν ὄνομα τοῦ sysinstall.

Ὁ ἔκτος λογὸς τοῦ sysinstall ἀφαιρᾷ τὸν ὄνομα τοῦ sysinstall.

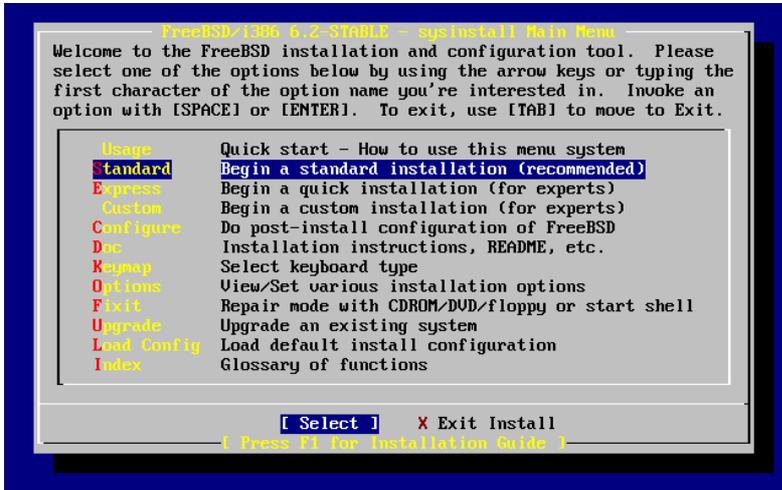
Ὁ ἔκτος λογὸς τοῦ sysinstall ἀφαιρᾷ τὸν ὄνομα τοῦ sysinstall.

### 2.5.4 Ἰσὸς Λογὸς τοῦ Sysinstall (Standard Installation)

Ὁ ἴσος λογὸς τοῦ sysinstall ἀφαιρᾷ τὸν ὄνομα τοῦ sysinstall.

× ñçóëíðñéßðäð äá äáëÛééá äéá íá äðééÝíäðä Standard áðu òí íáñíý, éáé ðéÝðää Enter äéá íá íäééíßðäðä ðçí äáëäðÛðäðäóç.

### Ó ÷ Ðíá 2-12. Ãëëßçóç ðçð Óððééßð ÄëéáðÛðäðäóçð (Standard Installation)



## 2.6 Ä ÷ ðñçóç × ðñíð óðí Äßðéí

Ôí ðñðíðí óäð äÐíá äßíáé íá äê ÷ ùñßðäðä ÷ ðñí äßðéíð äéá ðí FreeBSD éáé íá äçíéíðñáßðäðä íéá äðééÝðä (label) óðí ÷ ðñí áððù ððäð íá ðñíÝðäé íá ðíðñäðñéÛðäé ðí sysinstall. Äéá ðí óéíðù áððù ðñÝðäé íá áññðæäðä ðíð ðñùðñí íá ðíð ðñíß ðññéíÝíáé ðí FreeBSD íá äñáé ðéð ðççñíðññáð óðí äßðéí.

### 2.6.1 Äñßèíçóç ðñí Äßðéí ðí äÛóç ðí BIOS

Ðñéí äëéáðäðððäðä éáé ðñèíßðäðä ðí FreeBSD óðí óýóðçíá óäð, ððÛñ ÷ äé Ýíá ðçíáíðééù ðÝíá ðí ðñíß ðñÝðäé íá áññðæäðä, äéáéÛ äí Ý ÷ äðä ðñéíýðð óéççñíýðð äßðéíðð.

Óä Ýíá PC ðí ðñíß ÷ ñçóëíðñéáß éáéðññééù óýóðçíá ðí ðñíß áñáñðÛðäé áðu ðí BIOS, ùððð äßíáé ðí MS-DOS ð ðä Microsoft Windows, ðí BIOS äßíáé óä ðÝóç íá óðíðñÛíáé ðç óáéñÛ ðñíðñáéùðçðäð ðñí äßðéíð éáé ðí éáéðññééù óýóðçíá áðððð óðíááßæáé íá áððß. Áððù äðéðñÝðäé óðí ÷ ñßðóç íá äéééíßðäé áðu Ýíá äßðéí äéáðñáðééù áðu áððñí ðñð óð ÷ íÛ éáéíýíá “primary master”. Áððù äßíáé éáéáßðñá äñéééù äéá èÛðñéíðð ÷ ñßððäð ðñð Ý ÷ íðí áñáéáéýðäé ùðé ðí äðéíèùðñíð éáé ðççíððñíð ðñùðñíð íá Ý ÷ íðí Ýíá áñðßñáðñí áóðáéáßáð ðñð óðóðßíáððíð ðñðð, äßíáé íá áññÛóíðí Ýíá äáýðáñí ùññéíð óéççñíð äßðéí, éáé íá áñðéáñÛóíðí áñÛ óáéðÛ äéáððßíáðä ðñí ðñðñíð ðñðð äßðéí ððí äáýðáñí ÷ ñçóëíðñéíððð ðñíáñÛíáðä ùððð ðí Ghost® ð ðí XCOPY. ððé, áñ ðí ðñðñíð äßðéíð ÷ äéÛðäé, ð äá ÷ èáß äððéáóç áðu éù, ð ðáñíðóéÛðäé ðñíáéçíá áñáéóßáð èÛðñéíð äéáððßíáððíð ðñð éáéðññééíýðð óðóðßíáððíð, ð ÷ ñßðóçð ððñíáß äýéíéá íá äðáíáðÝñáé ðí óýóðçíá ðñèíßæííðäð ðí BIOS íá áñðéóðñÝðäé ðç èñáééßð óáéñÛ ðñí äßðéíð. Äßíáé óáí íá áñðéíáðäéÝðñíðä ðç óáéñÛ ðñí éáéùáßñíð óðñíð äßðéíðð äééÛ ÷ ùññð íá ÷ ñáéÛæáðäé íá áñíßñíðñí ðí èíððß.

Óä ðéí áéñéáÛ óðóðßíáðä íá äéááéðÝðð SCSI, óð ÷ íÛ ðñáñééáñáÛñíðí äðäéðÛðäéð ððí BIOS ðñð äðéðñÝðñíð ðçí äééááß ðçð äñßèíçóçð ðÝ ÷ ñé äððÛ äßðéíð SCSI, íá ðñáñíñéíð ðñùðñíð.

Íáð ÷ ñßðóçð áññééáéùíÝñíð ðí ðçí ðñáñáðÛíð äðíáððñçðä, ðñíáß íá äñáéáß ðñí äéððßíáðð ùðáí ðä äñíðäéÝðñíáðä ðí FreeBSD äáí äßíáé ðä áñáíáññíáíá. Ôí FreeBSD äáí ÷ ñçóëíðñéáß ðí BIOS éáé äáí áññðæáé ðçí “éáðÛ ðí BIOS èñáééßð

άέÛόάιç οίι ιάçāβι". Άδου ιδñāβ ίά ιάçāβόάέ οά έάέάβδāñā δāñβδēιέάδ έάδάόδÛόάέδ, áέάέÛ άί ιέ άβόέιέ Ý÷ ιοί δāññιιέά āññιāññā έάέ Ý÷ ιοί άδβόçδ οά βάέά āāñÝίά (άβίάέ ι Ýίάδ έēβñιδ οίö Ûέēιδ).

¼όάί ÷ ñçόέιιδιέάβδā οί FreeBSD άδέόδñÝόδā δçί οάέñÛ οίι ιάçāβι οίι BIOS οόçί οδóέιιέάέēβ οίιδδ δñέί āāέάόδóδβόδā οί FreeBSD έάέ άββόδā δçί Ýόóέ. Άί δñÝδāέ ίά άίάέÛιιāδā οίιδδ άβόέιδδ ιāδāίγ οίιδδ, έÛίτā οί άέēÛ ιā οί άγόέιι δññιδ: άñβιδā οί έιρδδβ έάέ άέēÛιδā εÝόάέδ οδā jumpers (āñā÷ δēδέēυδπñāδ) έάέ οδā έάέβāέά.

**Ιέά Έόδñβā áδυ οά Άñ÷ άβā οίι Άίάέñāδóέβι δāñέδāδāέβι οίö Bill έάέ Fred:**

Ο Bill άέάέγāέ Ýίά δāέέυι ιç÷ Ûίçιā Wintel áέά ίά οδóέÛιáέ Ýίά áέυιā FreeBSD ιç÷ Ûίçιā áέά οί Fred. Ì Bill āāέάέέóδÛ Ýίά οέέçñυ άβóέι SCSI ùδ οδóέάδβ ιā άñέèιυ ιçāÝί έάέ āāέάέέóδÛ οά άδδβ οί FreeBSD.

Ì Fred ίāέέίÛ ίά ÷ ñçόέιιδιέάβδ οί óγóδçιā, áέēÛ ιāδÛ áδυ άñέāδÝδ ιÝñāδ δāñāδçññāβ υδέ ι δāέέυδ SCSI άβóέιδ άίάóÝñāέ άñέāδÛ ιç έάδάόδññóέēÛ εÛέç (soft errors) έάέ άίάóÝñāέ οί āāññιυδ áδδυ οóιι Bill.

ÌāδÛ áδυ ιāñέέÝδ áέυιā ιÝñāδ, ι Bill άδιιόάββāέ υδέ Ý÷ áέ Ýñēáέ ç βñā ίά άίδέιāδυδββóáέ οί δñυāέçιā, έάέ Ýδóέ δέÛιáέ Ýίά άίδβδóιέ÷ ι SCSI άβóέι áδυ οί "āñ÷ άβι" οóι δβδυ āñÛδέι. ίād āñ÷ έέυδ Ýέāā÷ ιδ άδέδÛίάέάδ āāβ÷ ίάέ υδέ ι άβóέιδ έάέδιιñāáβ έάñιέέÛ, έάέ Ýδóέ ι Bill āāέάέέóδÛ οί άβóέι áδδυ ùδ SCSI ññÛāá δÝóóāñā έάέ άίδóéāñÛóáέ (ιÝóυ image) δέβñυδδ οά āāññÝίά áδυ οί άβóέι ιçāÝί οóι άβóέι δÝóóāñā. Όβñā διö ι ιÝιδ άβóέιδ άβίάέ āāέάδāδóçιÝñιδ έάέ έάέδιιñāáβ óυδóδÛ, ι Bill άδιιόάββāέ υδέ άβίάέ έάέβ έāÝā ίά āñ÷ βóáέ ίά οίι ÷ ñçόέιιδιέάβ, έάέ Ýδóέ áÛæāέ οά áóāññιāβ δç άδιāδυδçδā οίö BIOS ίά áέēÛæáέ δç άñβèιçόç οίι άβóέιι βρδā οί óγóδçιā ίά ίāέέίÛáέ áδυ οί άβóέι δÝóóāñā. Οί FreeBSD ίāέέίÛáέ έάέ áéδāέάβδāέ έάñιέέÛ.

Ì Fred οδιā÷ βāέέ δç āιδéáέÛ οίö áέά άñέāδÝδ áέυιā ιÝñāδ, έάέ óγίτñā ι Bill έάέ ο Fred άδιιόάββāέιδι υδέ Ý÷ áέ Ýñēáέ ç βñā áέά ιέā áέυιā δāñέδÝδāέά — βñā ίά άίάάέιβóιιδ οόçι ιÝā Ýέāιόç οίö FreeBSD. Ì Bill áóáέñāáβ οί άβóέι ιçāÝί ιέā έάέ βδāί έάéδñβδ δñιāέçιāδóέέυδ έάέ οίι άίδέέáέέóδÛ ιā Ýίά Ûέēι υñιιέ άβóέι áδυ οί "āñ÷ άβι". Ì Bill έáδυδέί āāέάέέóδÛ δç ιÝā Ýέāιόç οίö FreeBSD οóιι ιÝι άβóέι ιçāÝί ÷ ñçόέιιδιέβιδāδδ óέδ ιāáέέÝδ Internet FTP áέóέÝδāδ οίö Fred. Ç āāέáδÛóδáόç άβίáδáέ ÷ ùñβδ δññιāέβιáδā.

Ì Fred ÷ ñçόέιιδιέάβδ δçι ιÝā Ýέāιόç οίö FreeBSD áέā ιāñέέÝδ ιÝñāδ, έάέ δέóδιδιέάβ υδέ άβίάέ άñέāδÛ έάέβ áέā ÷ ñβόç οóι διβιā ιç÷ άίέέβδ. ÷ áέ Ýñēáέ ç βñā ίά άίδóéāñÛóáέ υέç δç āιδéáέÛ οίö áδυ δçι δāέέÛ Ýέāιόç. óóέ ι Fred δñιíāñδāáβ οί άβóέι ιā άñέèιυ δÝóóāñā (οί δāέéāδδāβι άίδβāñāóι δçδδ δāέέÛδ Ýέāιόçδ οίö FreeBSD). Ì Fred áδιιáçδāγāδāέ υδάί άίάέáέγδδāέ υδέ āāι δδÛñ÷ áέ δβδιδā áδυ δçι διέγδδέιç āñāáδā οίö οóι άβóέι ιā άñέèιυ δÝóóāñā.

διö δβāáί δā āāññÝίά;

¼όάί ι Bill Ýέáίā óυδιñāñāóέέβ άίδóéāñāδβ οίö āñ÷ έέιγ SCSI άβóέιδ ιçāÝί οóι SCSI άβóέι δÝóóāñā, ι άβóέιδδ δÝóóāñā Ýáέίā ι "ιÝιδ έēβñιδ". ¼όάί ι Bill Ûέéáíā δçι άñβèιçόç οóι SCSI BIOS βρδā ίά ιδññÝóáέ ίά ίāέέίβóáέ áδυ δç ññÛāá SCSI δÝóóāñā, áδέβδ έιññέāāδā οίι āáδδυ διö. Το FreeBSD ÷ ñçόέιιδιέίγóá áέυιā δç ññÛāá SCSI ιçāÝί. εóυδ άδδβ ç áέéāāβ οóι BIOS ίά δññιέáέÝóáέ δçι ιāñέέβ β ιέέέβ óññδυδóç οίö έβāέéā Boot β έάέ οίö Loader áδυ οίι áδέéāñÝñ áδυ οί BIOS άβóέι, áέēÛ υδάί άίάέÛāιιδā δā δññññÛιιāδā ιāβāçόçδ οίö δδñβιā οίö FreeBSD ç άñβèιçόç οίö BIOS έā áāññçéāáβ, έάέ οί FreeBSD έā áδāíÝέéáέ óδç οδóέιιέάέēβ άñβèιçόç οίι άβóέιι. Óδι δāñÛāáέāíā ίāδ, οί óγóδçιā οóιÝ÷ έóā ίά έάέδιιñāáβ οóιι āñ÷ έέυι SCSI άβóέι ιçāÝί, έάέ υέā δā āāññÝίά οίö Fred βδāί áéāβ, έάέ υ÷ έ óοιι SCSI άβóέι δÝóóāñā. Οί āāññιυδ υδέ οί óγóδçιā óáέιυδάί ίά έάέδιιñāáβ áδυ οί SCSI άβóέι δÝóóāñā βδāί áδέβδ Ýίά έáδáóέāγáóíā δçδ άίέñβδέίçδ δñιíāιέβāδ.

Άβιáδāά áδδδ÷ áβδ ίá άίάέιιβóιιδā υδέ āāι ÷ Ûέçéáί έáέυιö āāññÝίά έáδÛ δçι άίάέÛέδøç οίö óáέíñÝñö áδδιγ. Ì δāέέυδ SCSI άβóέιδδ ιçāÝί άίάέδβέçéā áδυ οί óññυ, έάέ υέç ç āñāáδā οίö Fred áδέóδñÛóçéā óā áδδυí (έάέ όβñā ι Bill ιÝñāέ υδέ ιδññāβ ίá ιāδñÛáέ ùδ οί ιçāÝί).

Άί έάέ óδçι έóδñβā áδδβ ÷ ñçόέιιδιέβέçéáί ιāçāíβ SCSI, ιέ āñ÷ Ýδ έó÷ γιιδι άίβóιö έάέ áέā ιāçāíγδ IDE.



Óēāóāβōā óē ēā āēíúōáí áí āβ÷áóā āýí IDE āβōēíōð, Ýíá ùò master óōí ðñþōí IDE āēāāēōðP, ēāē Ýíá ùò master óōí āāýóāñí IDE āēāāēōðP. Áí ðí FreeBSD ðíōð āñēēíñýóā ùðòð ðíōð Ýāñēóēā, āçē. ùò ad0 ēāē ad1 ùēā ēā ēāēōíōñāíñýóáí ēāñíēēÛ.

Áí ùòð ðñíōēÝóāíā íāōÛ Ýíá ðñþōí āβōēí, ùò óóóēāðP slave óōí ðñþōí IDE āēāāēōðP, áóðP ēā āēíúōáí ðēÝíí ad1, ēāē ç ðñíçāíñýíáíç ad1 ēā āēíúōáí ad2. ĀðāēāP óā íñíúáóā ðúí óóóēāðí (ùðòð ad1s1a) ÷ñçóēíñíēíñýóáē āēā óçí āýñāóç ðúí óóóðçíÛòúí āñ÷āβúí, íðñāβ íā íāíēāēýððāóā íāóíēēÛ ùðē ēÛðíēā áðú óā óóóðíāóā āñ÷āβúí óāð āāí āíōāíβāñíóāē ēāñíēēÛ ēāē ðñÝðāē íā āēēÛíāóā óçí ñýēíēóç ðíō FreeBSD óāð.

Āēā íā íāðāñāóóāβ ðí ðñúāēçíā áóðú, í ðññíāð íðñāβ íā ñðēíēóóāβ íā íñíÛāēē ðíōð āβōēíōð IDE áíÛēíāā íā óçí èÝóç ðíōð, ēāē ù÷ē íā óç óāēñÛ íā óçí íðñíā áíē÷íāñíóāē. Íā ðíí ðñúðí áóðú, í master āβōēíōð óōí āāýóāñí IDE āēāāēōðP ēā āβíāē ðÛíóā, ad2, āēúíā ēāē áí āāí ððÛñ÷āē óóóēāðP ad0 P ad1.

Ç ñýēíēóç áóðP āβíāē ēāē ç ðñíāðēēāñÝíç āēā ðíí ðññíāð ðíō FreeBSD, ēāē āēā ðí ēüāí áóðú ç ðēúíç āāβ÷íāē ad0 ēāē ad2. Óí íç÷Ûíçíā áðú ðí íðñíβí ēPðēçēā ç āēēúíā āβ÷ā āβōēíōð master ēāē óðíōð āýí āēāāēōðÝð IDE, āñþ āāí āβ÷ā ēāíÝíá āβōēí slave.

ðñÝðāē íā āðēēÝíāóā ðí āβōēí óōíí ðñíβí ēā āβíāē ç āāēāóÛóóāóç ðíō FreeBSD ēāē íā ðēÝóāóā [ OK ]. Óí **FDisk** ēā íāēēíPóāē, íā ðēúíç áíóβóóíē÷ç íā áóðP ðíō óāβíāóāē óōí Ó÷Píā 2-14.

Ç ðēúíç ðíō **FDisk** āβíāē ÷ññēóíÝíç óā ðñβā ðíPíāóā.

Óí ðñþōí ðíPíā, ðí ðñíβí ēāēýððāē ðēð āýí ðñþóáð āñāñÝð óçð ðēúíçð, āāβ÷íāē ēāððñÝñāēāð āēā ðíí āðēēāñÝíí āβōēí, ðíō ðāñēēāíāÛíñí ðí ùññā ðíō óōí FreeBSD, óç āāñíāðñβā ðíō, ēāē ðí óðñēēēú íÝāāēíð ðíō.

Óí āāýóāñí ðíPíā āāβ÷íāē óā slices óā ðñíβā ððÛñ÷íōí óōí āβōēí óç āāññÝíç óðēāñP, óā óçíāβā óóā ðñíβā íāēēíñýí ēāē óāēāēññí, ðúóí íāāÛēā āβíāē, óçí íñíāóβā ðíō Ý÷íōí óōí FreeBSD ēāē óçí ðāñēāñāðP ðíōð ēāē ðíí óýðí ðíōð. Óí ðāñÛāāēāíā áóðú āāβ÷íāē āýí íēēñÛ á÷ñçóēíñíēíçóā slices, óā ðñíβā āβíāē ðāññíÝñāēēāð ðíō ðñúðíō āēÛóáíçð ðúí āβóēúí óóā PC. Āāβ÷íāē áðβóçð Ýíá íāāÛēí FAT slice, ðí ðñíβí óβāññā āíōāíβāēóāē ùò c: óóā MS-DOS ēāē Windows, ēāēð ēāē íēā āēóāðāíÝíç ēáðÛòíçóç ç ðñíβā íðñāβ íā ðāñēÝ÷āē ēāē Ûēēā āñÛíāóā íāçāñí āēā ðí MS-DOS P óā Windows.

Óí ðñþōí ðíPíā, āāβ÷íāē ðēð áíóñēÝð ðíō āβíāē āēāēÝóēíāð óóçí **FDisk**.

**Ó÷Píā 2-14. ÓððēēÝð Fdisk ÊāóāðíPóāēð ðñēí óçí Āðāíāñāāóβā**

```

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.
    
```

Óí óē ēā ēÛíāóā ðññā áíāñðÛóāē áðú ðí ðúð èÝēāóā íā ÷ññβóāóā ðí āβōēí óāð.

Áí ēÝëäðä ðî FreeBSD íá ÷ñçóëîðîéÞóäë üëî ðî äðöëî óäð (ðáÞîííóäð Ýðóë üëá óá Ûëëá ääâîíÝíá äðü äððüí, üðáí äðëäááëÞóäðä äñäüðäñá óççí ääëäðÛóðäóç üðë ēÝëäðä ðî **sysinstall** íá ðñî ÷ ùñÞóäë) îðîñáððä äðëÞð íá ðéÝóäðä **A** ðî îðîÞî áíðëóðîé ÷ äð îä óççí äðëëîäÞ Use Entire Disk (×ñÞóç ðëüëççñîð ðîð äðöëîð). Íë ððÛñ ÷ îóðð ìäððäðîÞóäëð ìä äëäâñäðîÝí, ìäë ìä áíðëäððäðäëòíÝ íä ðëä íëëñÞ ðäñëî ÷ Þ íäñëäñëóíÝíç ùð unused (ä ÷ ñçóëí ðîðîççðç) (íáfÛ, íëä ðäñáíÝñáäëä ðüí äëäðÛíäüí äðöëîð óðî PC) êäë íä Ýíá íääÛëî slice äëä ðî FreeBSD. Áí ðî ēÛíäðä äððü, ìä ðñÝðäë íá äðëëÝíäðä íä óá ääëÛëëä ðî íÝí FreeBSD slice êäë íá ðî íäñëÛñäðä ùð äëëëîÞóëî (bootable) ðéÝäîðä ðî ðëÞëðñî **S**. Ç ðëüíç óäð ìä äðíäë äñäððÛ ðäñüíëä íä óççí Ó ÷ Þîä 2-15. ÐäñäóçñÞóäðä ðî **A** óççí óðÞëç **Flags**, ðî îðîÞî ääð ÷ íäë üðë ðî slice äðíäë *active* (äíäñäü), êäë ðñüëäëðäë íá äðíäë äëëÞíççç äðü äððü.

Áí ðñüëäëðäë íá äëäâñÛðäðä Ýíá ððÛñ ÷ íí slice äëä íá äçíëîðñáÞóäðä ÷ Þñî äëä ðî FreeBSD, ìä ðñÝðäë íá äðëëÝíäðä ðî slice íä óá ääëÛëëä, êäë íá ðéÝóäðä **D**. Ìðîñáððä ìäðüðëí íá ðéÝóäðä **C**, êäë ìä äñùðçëäððä äëä ðî íÝääëòð ðîð slice ðîð ēÝëäðä íá äçíëîðñáÞóäðä. Ç ðñîäðëëäñÝíç ðëÞð ððî äëÛëñ äíðëðñîðäÝäë ðî íÝäëóðî äðíäðü slice ðîð îðîñáððä íá äçíëîðñáÞóäðä, ðî îðîÞî îðîñáð íá äðíäë ðî íÝäëóðî óðîä ÷ ùíäñ îðëò äëäÝëäñîð ÷ Þñîð **P** ðî íÝääëòð ðëüëççñîð ðîð äðöëîð.

Áí Ý ÷ äðä Þäç äçíëîðñáÞóäë ÷ Þñî äëä ðî FreeBSD (ðòðð íä óç ÷ ñÞóç ēÛðîéò ïñäëäðîð üððð ðî **PartitionMagic**) îðîñáððä íá ðéÝóäðä **C** äëä íá äçíëîðñáÞóäðä íÝí slice. Èä äñùðçëäððä êäë ðÛëë äëä ðî íÝääëòð ðîð slice ðîð ēÝëäðä íá äçíëîðñáÞóäðä.

### Ó ÷ Þîä 2-15. ÈäðÛðîççç **Fdisk** ðîð ×ñçóëîðîéäÞ ðëüëççñîð ðî Äðöëî

```

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            16514001     16514063     ad0s1 3        freebsd 165      CA

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.
  
```

¼ðáí ðäëäëÞóäðä, ðéÝóäðä **Q**. Íë äëëääÝð óäð ìä äðîðçëäððîÝí óðî **sysinstall**, äëëÛ ääí ìä äñäððîÝí äëüíä óðî äðöëî.

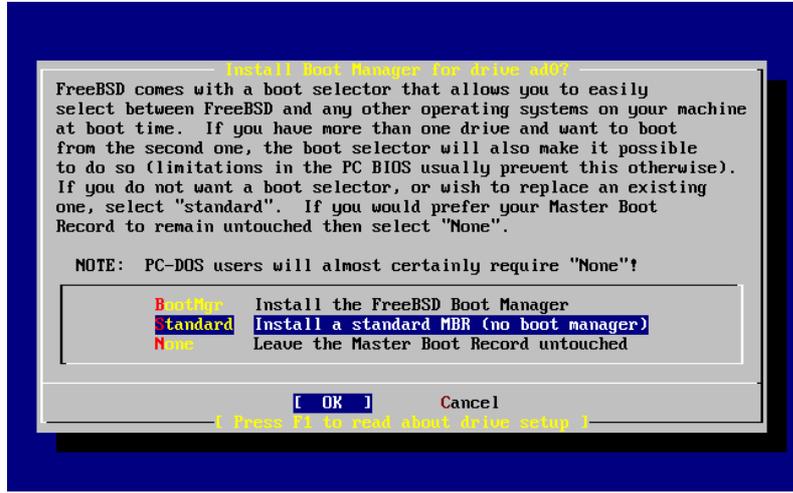
## 2.6.3 ĀäëäðÛóðäóç Āëä ÷ äëñëóðÞ ÄêëÞíçççð (Boot Manager)

÷ äðä ðÞñä óççí äðëëîäÞ íá ääëäðäðððäðä äëä ÷ äëñëóðÞ äêëÞíçççð (boot manager). Óä ääíëëÝð äñäñîÝð ìä ðñÝðäë íá äðëëÝíäðä íá ääëäðäðððäðä ðî äëä ÷ äëñëóðÞ äêëÞíçççð ðîð FreeBSD áí:

- ÷ äðä ðäñëóðüðäñîðð äðü Ýíá äðöëîðð, êäë Ý ÷ äðä äðëëÝíäë íá ääëäðäðððäðä ðî FreeBSD óä äðöëîð ðîð ääí äðíäë í ðñÞðòð.
- ÷ äðä ääëäðäðððäë ðî FreeBSD íäëð íä Ýíá Ûëëî ìäëðîðñäëëü óýððçíä óðîð Þäëî äðöëî, êäë ēÝëäðä íá îðîñáððä íá äðëëÝíäðä áí ìä íäëëîÞóäðä ðî FreeBSD Þ ðî Ûëëî ìäëðîðñäëëü, üðáí íäëëîÛðä ðîð ððîðîäëóðÞ óäð.

Αίτη της FreeBSD διαθέτει ένα βασικό εργαλείο διαμόρφωσης ονόματος **boot**, το οποίο μπορεί να εγκαταστήσει ή να διαγράψει τον διαμορφωτή της FreeBSD. Το εργαλείο **boot** είναι διαθέσιμο ως πρόγραμμα εγκατάστασης της FreeBSD. Είναι σημαντικό να κατανοήσετε την σημασία του **boot**.

### 2.16. Το εργαλείο Boot Manager ή Sysinstall



Το εργαλείο **boot** είναι σημαντικό να κατανοήσετε την σημασία του **boot**. Είναι σημαντικό να κατανοήσετε την σημασία του **boot**.

### 2.6.4 Απαιτήσεις διαμόρφωσης Slices και της ημερομηνίας Αρχειοθέτησης

Αίτη του **boot** είναι σημαντικό να κατανοήσετε την σημασία του **boot**. Είναι σημαντικό να κατανοήσετε την σημασία του **boot**.

**Όλες οι πληροφορίες:** Αίτη των απαιτήσεων της FreeBSD είναι σημαντικό να κατανοήσετε την σημασία του **boot**. Είναι σημαντικό να κατανοήσετε την σημασία του **boot**.



ἘάóÙòìçóç	Óýóóçìá Ἀñ ÷ ἄβùí	ÌÝääèìò	Ðáñéññáòþ
b	N/A	2-3 x RAM	<p>Óá áóðþ ðçí éáóÙòìçóç ἄñβóέάóáέ ÷ þñìò swap ðìò óóóóðìáòìò. Ç ἄðέέìἄþ òúóóìý ìääÝέìòò swap ìðìñἄβ ìá éàùñçéἄβ Ýìá ἄβἄìò òÝ ÷ ìçò. ìáò éáέùò ἄáíέέùò éáíúíáò ἄβìáέ ÷ ÷ þñìò áóòùò ìá ἄβìáέ áýì ùò òñἄέò òìñÝò ðì ìÝääèìò ðçò ἄέáέÝóέìçò òðóέέþò ìþìçò (RAM). Ἀðβóçòò éá ðñÝðἄέ ìá Ý ÷ ἄòἄ òìòέÙ ÷ éóóìí 64 MB swap, Ýðóέ áí Ý ÷ ἄòἄ ééäùòἄñἄ áðù 32 MB RAM óóìí òðìέìἄέóðþ óáò, ìñβóòἄ ðì swap óóἄ 64 MB.</p> <p>Ἀí Ý ÷ ἄòἄ ðἄñέóóùòἄñìòò áðù Ýìá ἄβóέìòò ìðìñἄβòἄ ìá ìñβóἄòἄ ÷ þñì swap óἄ éÙèἄ ἄβóέì. Òì FreeBSD éá ÷ ñçóέìðìέἄβ òùòἄ éÙèἄ ἄβóέì ἄέἄ swap, òì ìðìβì ἄðέóἄ ÷ ýìáέ ðç ἄέἄἄέἄóἄἄ. Óðçí ðἄñβðòðòç áóðþ, òðìέìἄβóòἄ ðì óðìέέέù ìÝääèìò ðìò swap ðìò ÷ ñἄέÙἄἄòἄ (ð. ÷. 128 MB) ἄέἄ ììέñÙóóἄ ðì ìá ðì ðεþèìò òùì ἄβóέùì ðìò Ý ÷ ἄòἄ (ð. ÷., áýì ἄβóέìέ) ἄέἄ ìá ἄñἄβòἄ ðì ìÝääèìò òìò swap ðìò éá ἄçìέìòñἄþἄòἄ ἄἄ éÙèἄ ἄβóέì, óἄ áóòù òì ðἄñÙἄἄέἄìἄ, 64 MB áíÙ ἄβóέì.</p>
e	/var	256 ùò 1024 MB	<p>Ì éáóÙέìἄìò /var ðἄñέÝ ÷ ἄέ ἄñ ÷ ἄβἄ óἄ ìðìβἄ óóìἄ ÷ þò ìἄóἄἄÙέέìíóἄέ, ùðòò ἄñ ÷ ἄβἄ éáóἄἄñἄòþò (log files) ἄέἄ Ùέἄἄ ἄñ ÷ ἄβἄ ðìò Ý ÷ ìòì ìá éÙìíòì ìá ἄέἄ ÷ ἄέñέóóέέÝò ἄñἄἄóἄò.</p> <p>ÐìέέÙ áðù óἄ ἄñ ÷ ἄβἄ áóòÙ ἄέἄἄÙἄέìíóἄέ ἄέἄ ἄñÙòìíóἄέ óóìÝ ÷ ἄέἄ éáóÙ ðçí éἄççìἄñέìþ ÷ ñþóç ðìò FreeBSD. Ç òìðìέÝðçóç òùì ἄñ ÷ ἄβùì áóòþì óἄ ÷ ùñέóòù òýóóçìá ἄñ ÷ ἄβùì ἄðέóñÝðἄέ óóì FreeBSD ìá ἄἄέðέóóìðìέἄβ ðçí ðñùóἄἄóç óἄ áóòÙ ÷ ùñβò ìá ἄðçñἄÙἄέìíóἄέ ἄñ ÷ ἄβἄ óἄ Ùέέìòò éáóἄéùἄìòò ðìò ἄἄí Ý ÷ ìòì ðἄñùììέἄ óò ÷ ìþ ðñùóἄἄóç.</p>
f	/usr	Óðùέìέðìò × þñìò Ἀβóέìò (òìòέÙ ÷ éóóìí 2 GB)	<p>¼ἄἄ óἄ òðùέìέðἄ ἄñ ÷ ἄβἄ óáò éἄ ἄβìáέ òððέέÙ ἄðìέçéἄòìÝìá óóì /usr ἄέἄ ðìòò òðìέἄóἄéùἄìòò òìò.</p>

**Ðñìἄέἄìðìççóç:** Ìἄ ðἄñἄðÙì ðéìÝò ἄβìííóἄέ ìùí ùò ððìἄἄβἄìἄóἄ éἄἄ ðñìñβἄἄἄἄἄἄ ἄέἄ ἄἄéἄóἄóóÙóἄéò áðù ðñì ÷ ùñçìÝìòò ÷ ñþóἄò. Óἄò óóìέóóìýìἄ ìá ÷ ñçóέìðìέἄþἄòἄ ðç ἄðìἄòùòçóἄ áóòùìἄòçò éáóÙòìçóçò, ç ìðìβἄ ἄìἄóÝñἄἄἄἄἄ ùò Auto Defaults óóìí ἄðἄìἄñἄἄóðþ éáóἄòìþἄòùì ðìò FreeBSD.

Ἀí ðñùἄἄἄἄἄἄ ìá ἄἄéἄóἄóðþἄòἄ ðì FreeBSD óἄ ðἄñέóóùòἄñìòò áðù Ýìá ἄβóέìòò, éἄ ðñÝðἄέ ìá ἄçìέìòñἄþἄòἄ ἄἄóἄòìþἄἄἄἄ éἄἄ óἄἄ Ùέἄἄ slices ðìò Ý ÷ ἄòἄ ἄçìέìòñἄþἄἄἄ. Ì ἄἄέìἄἄἄἄἄἄ ðñùðìò ἄβìáέ ìá ἄçìέìòñἄþἄἄἄ ἄýì éἄóἄòìþἄἄἄἄ óἄ éÙèἄ ἄβóέì, ìἄἄ ἄἄἄ ðì swap, ἄἄἄ ìἄἄ ἄἄἄ Ýìá òýóóçìá ἄñ ÷ ἄβùì.

**Ðβìἄἄἄò 2-3. ἈέÙἄἄίç Ἐἄóἄòìþἄἄì ἄἄἄ ðìò Òðùέìέðìò Ἀβóέìòò**

ἘάóÙòìçóç	Óýóóçìá Ἀñ ÷ ἄβùí	ÌÝääèìò	Ðáñéññáòþ
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ΈάοÛοιζός	Όγόςζιά Άñ÷åßùí	Ìÿάάεìò	ĐañéãñáöÞ
b	N/A	Άάßòå òçí đañéãñáöÞ	¼ðùò Û÷åέ Þαç óðæçðçèåß, ìðñåßòå íå ÷ ùñßòåòå òí ÷ þñí swap αίÛíåóå óå ðñèéñýò åßóèíòð. Áí έåέ ç έåòÛοιζός a åßíåέ åèåýèαñç, ç óýíååός åðéåÛèèåέ òç ÷ ðÞός òçð έåòÛοιζόςò ð åέå òí ÷ þñí swap.
e	/diskn	Õðùεíéðí ÕìÞíå òíð Åßóèíò	Õí òðùεíéðí èñìÛóé òíð åßóèíò έåòååìåìåÛíåóåέ åðù íεå íååÛèç έåòÛοιζός. Ìðñåßòå åýèèå íå òçí åÛèåòå òòçí έåòÛοιζός a αίòß åέå òçí e. Ûóóúòí, ç óýíååός ðñæåέ ùðé ç έåòÛοιζός a óå Ûí slice ååòíåýåòåέ åέå òí óýóçíå åñ÷åßùí root (/). Ååí åßóòå òðí÷ñåùíÛíé íå åèèèòèÞóåòå åððÞ òç óýíååός, åèèÛ òí <b>sysinstall</b> òçí åèèèòèåß, ððùòå αί òçí åèèèòèÞóåòå έåέ åóåßò ç ååέåòÛóóåός εå åßíåέ ðéí έåéåñÞ. Ìðñåßòå íå ðñíóåñòÞóåòå åðù òí óýóçíå åñ÷åßùí ùðíò èÛèåòå. Óòí ðåñÛååèåìå íåò, ç ðñíóÛñðççç åßíåóåέ óòíòð έåòåèèèèòð /diskn , ùðíò òí n åßíåέ Ûíåò åñèèèòð ðíò åèèÛæåέ åέå èÛèå åßóèí. ÁèèÛ ìðñåßòå, αί ðñíòéìÛóå, íå ðñóåòå åέèÞ óåò åèÛóåíç.

÷ñòåòå åðíòåóßòåέ òçí åèÛóåíç òùí έåòåòèÞóåòå óåò, ìðñåßòå òÞñå íå òçí åçèèòèñåÞóåòå ÷ ðçóèíðñèðíóåò òí **sysinstall**. Έå ååßòå òí ðåñåèÛò ìÞíå:

```

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 (200MB 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 ]

```

ĐéÛóå **Enter** åέå íå íåèéíÞóåòå òñ åðåíåñåóòÞ έåòåòèÞóåòå òíò FreeBSD, ðíò ðñÛæåòåέ **Disklabel**. Õí Õ÷Þíå 2-18 ååß÷íåέ òçí ðèùíç ùðåí íåèéíÞóåòå åέå ðñÞçð òñÛ òí **Disklabel**. Ç ðèùíç ÷ ùññæåòåέ óå ðñßå òìÞíåóå. Ìé ðñÞòåò åñåñÛð ååß÷ñíò òí ùññå òíð åßóèíò óòñ ððíßí ðñðèåýåòå, έåέ òí slice ðíò ðåñéÛ÷åέ òéò έåòåòèÞóåέð ðíò åçèèòèñåßòå (óòí óçíåßí åðù òí **Disklabel** òéò ðñÛæåέ Partition name αίòß åέå òí ùññå òíò slice). Ç ðèùíç åðßçðð ååß÷íåέ òçí ðíóúðçðå åèåýèåñíò ÷ þñíò ìÛóå óòí slice, åçè. òí ÷ þñí ðíò Û÷åέ èñåðçèåß ìÛóå óòí slice åèèÛ ååí Û÷åέ åðñèèåß åèùíå óå èÛðèèå έåòÛοιζός.

Õí ìÛóí òçð ðèùíçð ååß÷íåέ òéò έåòåòèÞóåέð ðíò Û÷íò åçèèòèñæçèåß, òí ùññå òíð óóóðÞíåòíð åñ÷åßùí ðíò ðåñéÛ÷åέ èÛèå έåòÛοιζός, òí ìÿåèèò òíòð, έåέ èÛðèèåò åðèèåÛð ðíò ó÷åòßæíðåέ ìå òç åçèèòèñåßå òíò óóóðÞíåòíð åñ÷åßùí.

Õí èÛòù ìÛñíò òçð ðèùíçð ååß÷íåέ óå ðèÞðèñå ðíò ìðñåßòå íå ÷ ðçóèíðñèðåòå óòí **Disklabel**.

Ó ÷ Ðíá 2-18. ÆðáíññááóðÐò Disklabel ðí Sysinstall



Ïí Disklabel ðñíñáß íá äçëíññáßáóáë áððñíáóá éáðáðíáóáéð áéá áóÛð, éáé íá ðíðð áðñáßáóáë ðñíáðééááíÝíáð ðéíÝð. Ìé ðñíáðééááíÝíáð ðéíÝð ððñíáßáóáé íá ççí áíÐéáéá áíñð áíóñíáðñíÝíáð éáñíñáßáóáé íáááëðí, í ðñíáßáóáé íá áÛóç ðí ÌÝááëíð ðíð ðáðéíð. ÆíééíÛóðá ðí ðñíá ðéÝáñíóáð ðí **A**. Èá ááßðá íéá ðéñíç ðñíá íá áððÐí ððí Ó ÷ Ðíá 2-19. ÁíÛéíáá íá ðí ÌÝááëíð ðíð ðáðéíð ðíð ÷ ñçóéíñðñéáßðá, Ìé ðñíáðééááíÝíáð ðéíÝð ðñíñáß íá áßíáé Ð éáé íá ðçí áßíáé éáðÛéççéáð. Áððñí ááí Ý ÷ áé ççíáóáá, áéáðß ááí ÷ ñáéÛáéðáé íá ðéð áðñáá ÷ éáßðá.

**Ïçíáßáóá:** Ì ðñíáðééááíÝíáð ðñíñðð éáðÛðíççð áðñáßááé óðñí éáðÛéíáí /tmp ðçí áééß ðíð éáðÛðíççð áíðß íá ðñí éáééóðÛ ÌÝñíð ðçð éáðÛðíççð /. Áððñí áíçéÛáé óççí áðñððáß ðéßññóçð ðçð éáðÛðíççð / Ìá ðñíóññéíÛ áñ ÷ áßá.

Ó ÷ Ðíá 2-19. Ì ÆðáíññááóðÐò Êáðáðíáóáñí Disklabel ðí Sysinstall Ìá ðéð Áððñíáóáð ðñíáðééíáÝð

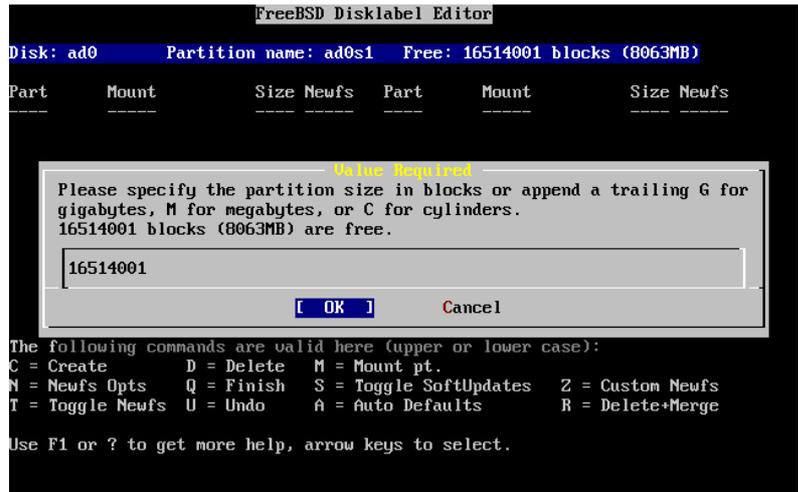


Áí áðééÝíáðá íá ðç ÷ ñçóéíñðñéáßðáðá ðéð ðñíáðééááíÝíáð éáðáðíáóáéð éáé èÝéáðá íá ðéð áíðééáðáóððáðá Ìá ðéð

áééÝð óáð, ÷ ñçóéíðíéÞóðá ðá ááéÛééá áéá íá áðééÝíáðá ðçí ðñþðç éáðÛðíççç éáé ðéÝóðá **D** áéá íá ðç óáÞóðá. ÁðáíáéÛááðá áéá íá óáÞóðá üéáð ðéð ðñíóáéííáíáð éáðáðíÞóáéð.

Áéá íá áçíéíðñáÞóðá ðçí ðñþðç éáðÛðíççç (a, (ç íðíßá ðñíóáñðÛðáé ùð / — root), ááááéùèáßðá üðé Ý ÷ áðá áðééÝíáé ðí óóðóðí slice ðóí ðÛíü Ýñíð ðçð ðéíçð, éáé ðéÝóðá **C**. Èá àíóáíéóðáß Ýíá ðéáßóéí áéáéüáíð áéá íá áéóÛááðá ðí íÝááèð ðçð íÝáð éáðÛðíçççð (üððð óáßíáðáé óðí Ó ÷ Þíá 2-20). Ìðñáßðá íá áéóÛááðá ðí íÝááèð ùð ðíí áñééíü ðíð ðáßóéíð ðíð èÝéáðá íá ÷ ñçóéíðíéÞóðá Þ ùð áñééíü áéíéíðéíýíáíí áðü **M** áéá megabytes, **G** áéá gigabytes, **P** **C** áéá èðéßíáñíðð.

**Ó ÷ Þíá 2-20. Áéáéáñíð × þñíð áéá ðçí ÊáðÛðíççç Root**



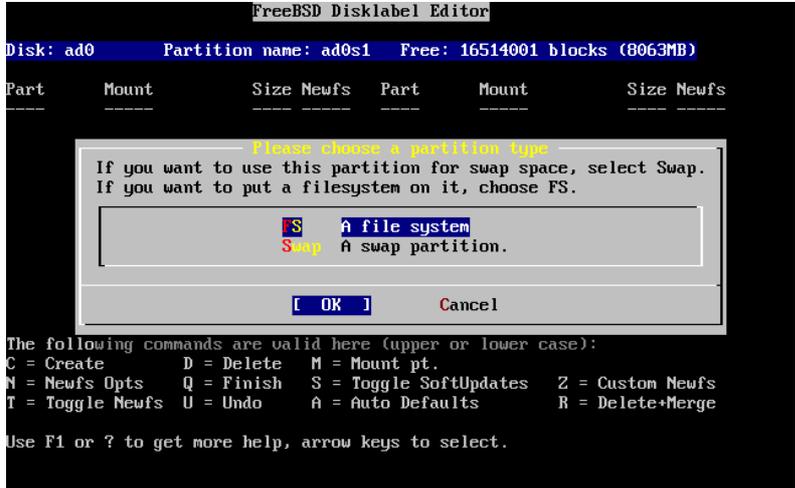
Ïí ðñíáðééááíÝíí íÝááèðð ðíð óáßíáðáé éá áçíéíðñáÞóðáé íéá éáðÛðíççç ðíð éáðáéáíáÛíáé üéí ðíí ððüéíéðí áéáéáñí ÷ þñí ðíð slice. Áí ÷ ñçóéíðíéáßðá ðá íááÝèç ðóí éáðáðíÞóðáíð ðíð ðáñéáñÛðáíá ðóí ðñíçáíýíáíí ðáñÛááéáíá, óáÞóðá ðíí áñééíü ðíð óáßíáðáé íá ðí **Backspace**, éáé ðéçððñíéíáÞóðá **512M**, üððð óáßíáðáé óðí Ó ÷ Þíá 2-21. Êáðóðéí ðéÝóðá [ OK ].

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



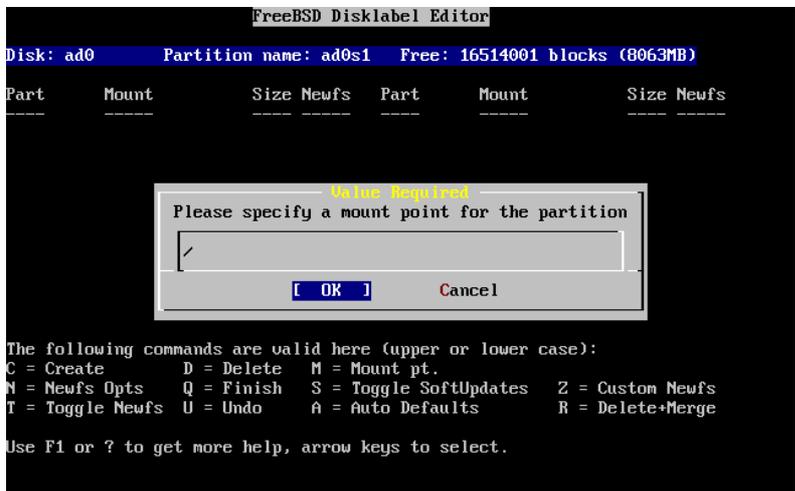
÷ῖοάο ἀδεέΥῖαε δῖ ἰΥᾶεῖο δçð εάοÛοῖççò, εά ἄνῖοççεᾶβòᾶ εάοῖδεῖ ᾶεά δῖ ᾶῖ ç εάοÛοῖççò εά δᾶñεΥ ÷ᾶε εÛδῖεῖ ούοόçῖᾶ ἄñ ÷ ᾶβῖῖ, P εά ᾶβῖᾶε ÷ ḥñῖο swap. Ἰ ᾶεÛεῖᾶῖο ἀοδῖοδ ᾶβῖᾶοᾶε οδῖ **Ó ÷ Πῖᾶ 2-22.** Ç δñḥçç ᾶδòP εάοÛοῖççò εά δᾶñεΥ ÷ᾶε ούοόçῖᾶ ἄñ ÷ ᾶβῖῖ, ᾶεά ᾶοδῖ ᾶεΥᾶῖòᾶ ῖοε ᾶβῖᾶε ᾶδεεᾶᾶἸΥῖῖ δῖ FS εάε δεΥόοᾶ **Enter.**

**Ó ÷ Πῖᾶ 2-22. ἈδεέΥῖοᾶ δῖῖ Ούοῖ δçð ΕάοÛοῖççò Root**



Ούεῖο, ᾶδᾶεᾶP ᾶçῖεῖòñᾶβòᾶ ούοόçῖᾶ ἄñ ÷ ᾶβῖῖ, δñΥδᾶε ῖᾶ ᾶççḥòᾶᾶ οδῖ **Disklabel** δῖο εΥεᾶᾶᾶ ῖᾶ ᾶβῖᾶε ç δñῖóÛñççòçç οῖο. Ἰ ᾶῖόβòῖε ÷ ÷ῖο ᾶεÛεῖᾶῖο ᾶβῖᾶοᾶε οδῖ **Ó ÷ Πῖᾶ 2-23.** Οῖ οçῖᾶβῖ δñῖοÛñççòçç δçð εάοÛοῖççòδ root ᾶβῖᾶε δῖ /, ᾶεά ᾶοδῖ ἄñÛøᾶ /, εάε δεΥόοᾶ **Enter.**

**Ó ÷ Πῖᾶ 2-23. ἈδεέΥῖοᾶ δῖ Οçῖᾶβῖ ΔñῖóÛñççòçç δῖῖ Root**



Ç ῖεῖῖç εάοῖδεῖ εά ᾶῖᾶῖᾶεᾶβ ᾶεά ῖᾶ οάο ᾶᾶβῖᾶε οçῖ εάοÛοῖççòçç δῖο ῖῖεέο ᾶçῖεῖòñᾶPòᾶᾶ. Εᾶ δñΥδᾶε ῖᾶ ᾶδᾶῖᾶεÛᾶᾶᾶ ᾶδòP οçῖ ᾶεᾶᾶεᾶᾶᾶ ᾶεά οεó Ûεεᾶδ εάοᾶᾶῖPòᾶεó. Ἰᾶᾶῖ ᾶçῖεῖòñᾶPòᾶᾶ οçῖ εάοÛοῖççòçç swap, ᾶᾶῖ εά οάο ᾶççòçεᾶβ ῖᾶ ᾶδεεΥῖᾶᾶᾶ οçῖᾶβῖ δñῖοÛñççòçç, εᾶçḥð ῖε εάοᾶᾶῖPòᾶεó swap ᾶᾶῖ δñῖοᾶñòḥῖᾶε δῖοΥ. Ἰᾶᾶῖ ᾶçῖεῖòñᾶPòᾶᾶ οçῖ ᾶᾶεᾶᾶᾶᾶ εάοÛοῖççòçç, οçῖ /usr, ῖδῖñᾶβòᾶ ῖᾶ ᾶòPòᾶᾶᾶ δῖ δñῖοᾶεῖῖᾶῖῖ ἰΥᾶεῖο, ᾶεά ῖᾶ ÷ ñççóçῖῖῖεPòᾶᾶᾶ ῖεῖ δῖῖ ᾶδῖεῖᾶῖ ÷ ḥñῖ οῖο slice.

Ç óάεάοδάβá ðεiúç ðið FreeBSD ΆδáiññάóòP DiskLabel, εá äåβ÷íáε iúieá iá ðçí Ó÷Pia 2-24, áí εάε iε äééÝð óáo ðεiÝð εá äβiáε äéáöiññáóééÝð. ΔεÝóðá Q äéá óÝεið.

Ó÷Pia 2-24. I ΆδáiññάóòPò Disklabel ðið Sysinstall



## 2.7 ΆδéeÝáiiíóáo ðé εá ΆεέάóáóòPóáðá

### 2.7.1 ΆδéeÝiðá Distribution Set (Óáo ΆεέάóÜóóáóçò)

Ç áδiúóáóç äéá ði ðiei distribution set εá ÷ñçóeiðiePóáðá, áíññÜóáε εáoÜ éýñei eüai áδi ði äβaið ÷ñPóçð ðið iç÷áPiaðið εάε ðii äéáéÝóeiñ ÷Pñi óðii äβóei. Iε ðñieáeiñéóiiÝiáð áðéεiãÝð éðiaβñiiðáε áδi ðçí äεÜ÷éóðç äóPáðP äéáiiññóùóç iÝ÷ñε ðçí ðεPñç. ¼óie äβiáε εáéñiýñeié óðii UNIX P / εάε óðii FreeBSD εá ðñÝðáε ó÷ääüií óβáiiññá íá áðééÝiñi íéá áδi óéð óððiðieçiiÝiáð áðéεiãÝð. Ç äéáiiññóùóç áiaéáééäòiiÝñið distribution set óðiiβóóáóáε óðiiPèèð óðii ðei Ýiðáeiñi ÷ñPóçð.

ΔεÝóðá ði F1 äéá ðañéóóúðañáð ðεçñiiññáð äéá óéð áðéεiãÝð εÜεá distribution set εáεPð εάε äéá óá ðañéá÷uiáPá ðið. ¼óái ðáéáεPóáðá iá ðçí áÜáiiññóç ðçð áiPèáéáð, iá ðçí ðβáóç ðið **Enter** εá áðéóðñÝðáðá óðii iáñiý Select Distributions.

Áí áðééðiaβðá añáóééü ðañéáÜεeiñ aññáóβáð, εá ðñÝðáε íá áðééÝiáðá Ýiá distribution set ði iðiiβi iáééiÜáé iá x. H ñýèieóç ðið X server εáε ç áðéεiãP añáóééiý ðañéáÜεeiñiðð (desktop) ðñÝðáε íá äβiáε iáðÜ ðçí äéáóÜóóáóç ðið FreeBSD. Δañéóóúðañáð ðεçñiiññáð ó÷áðééÜ iá ðçí ñýèieóç ðið X server iðiiññáðá íá äβðá óðii ÊáóÜεáei 5.

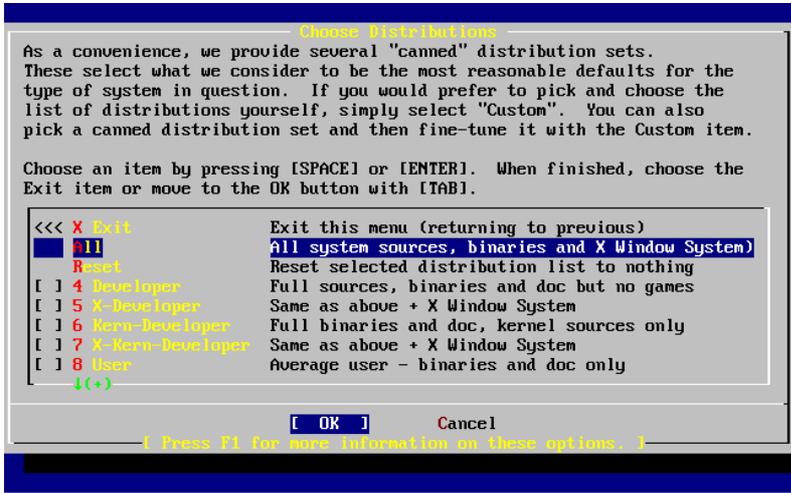
Ói **Xorg** äβiáε ç ðñiáðééáñiÝiç ðñið äéáóÜóóáóç Ýéaiñóç ðið X11.

Áí íáiiÝiáðá iúé εá iáóááéüððβóáðá äééü óáo áiaéáééäòiiÝñi ðñPíá, äéáéÝiðá εÜðieá áδi óéð áðéεiãÝð ðið ðañéÝ÷iñi ðii ðçááβi εPáééá. Άéá ðañéóóúðañáð ðεçñiiññáð ó÷áðééÜ iá ði äéáóβ íá iáóááéüððβóáðá äééü óáo ðñPíá P äéá ði ðið äβiáðáé, äáβðá ði ÊáóÜεáei 8.

ΔñiióPð ði ðei áóÝéééði óóóçPia äβiáε áðóü ðið óá ðañéÝ÷áé üéá. Áí Ý÷áðá áñéáðü ÷Pñi óðii äβóei, áðééÝiðá All üðüð óáβiáðáé óðii Ó÷Pia 2-25 ÷ñçóeiðiePíóáð óá äáéÜéáé εáε ΔεÝóðá **Enter**. Áí óáo ðñiáéçiaðβáεé i äéáéÝóeiñið

÷ þñìò óðí äáðëí, êÛíóá íéá éáóÛëëçç äðëëíáð áéá òçí ðáñáððòóç. Ìçí ðñíáëçíáóðáóðáóð éáéáððáñá ó ÷ áðëéÛ íá òçí ðÝéáéá äðëëíáð, éáëðð ìðñááðá íá áãëáóóðáóðáóð ðñúóëáðá óáð éáé íáðÛ òí ðÝëíð òçð ááóééðð áãëáóóðáóðçð.

Ó ÷ Ðíá 2-25. ÁðëéÝíðá Distributions (Óáð Áãëáóóðáóðçð)



2.7.2 Áãëáóóðáóð òçð Óðëëíáððò Ports

ÍáðÛ òçí äðëëíáð òíð äðëéðíçðíý distribution set, éá Ý ÷ áðá òçí äðëéáñá íá áãëáóóðáóðáóðáóð òçí óðëëíáð ports òíð FreeBSD. Ç óðëëíáð ports ááíáé íéá áýêíëç éáé áñëééð ìÝëíáð áéá íá áãëáóóðáóðáóðáóð éñáéóíééú. Ç óðëëíáð òíð ports ááí ðáñéÝ ÷ áé òíð ðçáááð ððáééá ðíð äðáéóáððáé áéá íá íáðááëùðððáóðáóð òí éñáéóíééú. ÁðëÛ ááíáé íéá óðëëíáð áñ ÷ ááú ðíð áððíáðíðíéááð òí éáóÝááóíá, òç íáðááëððóéóç éáé òçí áãëáóóðáóðç ðáéÝòí éñáéóíééý ðñáðíð òáðáóéáðáóðð. Òí ÊäöÛëáëí 4 ðáñéáñÛðáé ðùð íá ÷ ñçóéíðíéðáóðáóð òçí óðëëíáð òíð ports.

Òí ðñúáñáíá áãëáóóðáóðç ááí áéÝá ÷ áé áí ððÛñ ÷ áé áñéáðíð áéáýéáñíð ÷ þñìð. ÊÛíóá òçí äðëëíáð áððð ìúíí áí ððÛñ ÷ áé áñéáðíð ÷ þñìð. Áðú òçí Ýéáíóç òíð FreeBSD 8.0, ç óðëëíáð ports òíð FreeBSD éáðáéáíáÛíáé ðáñáððíð 417 MB ÷ þñí óðí äáðëí. Ìðñááðá íá áóóÛëéá íá éáññðáóðáóð ùóé ì ÷ þñìð áððíð éá ááíáé íáááéýðáñíð áéá ðéí éáéíýñéáð áéáúóáéð òíð 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.

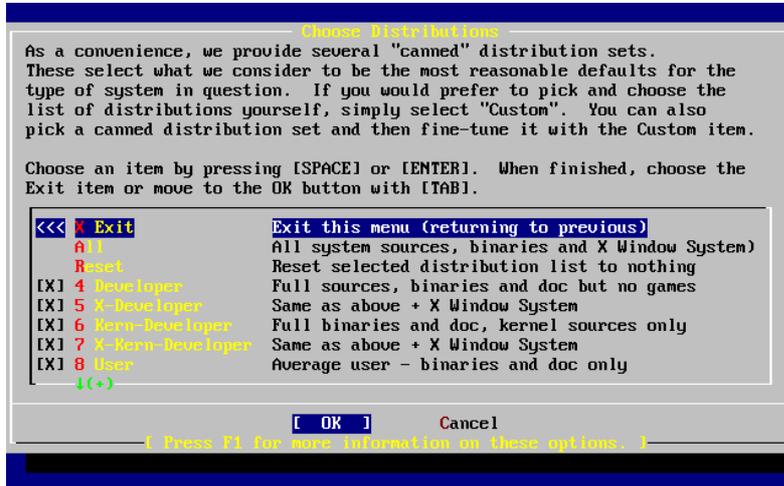
For more information on the Ports Collection & the latest ports, visit:

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

[ Yes ] No

Ἀποκρίσεσθε [ Yes ] ἢ ὅχι ἀπεκρίσεσθε ἂν ἴσχυροὺς ὄντες ἁπλῶς [ No ] ἂν ὄχι ἐπιθυμῆτε. **Enter** ἂν ἴσχυροὺς ὄντες. Ἐὰν ἐπιθυμῆτε Choose Distributions (ἁπλῶς ὄχι ἀνασχεδιασμοὶ).

### Ὁ Πίνακας 2-26. Ἀνασχεδιασμοὶ Distribution Set



Ἡ ἀνασχεδιασμοὶ ἐπιθυμῶντες ἀπὸ τοῦ ἀνασχεδιασμοῦ ὄχι, ἀποκρίσεσθε Exit ἢ ὅχι ἀπεκρίσεσθε, ἀνασχεδιασμοὶ ἢ ὅχι ἀνασχεδιασμοὶ ἢ ὅχι ἀνασχεδιασμοὶ [ OK ] ἂν ὄχι ἀνασχεδιασμοὶ **Enter** ἂν ἴσχυροὺς ὄντες.

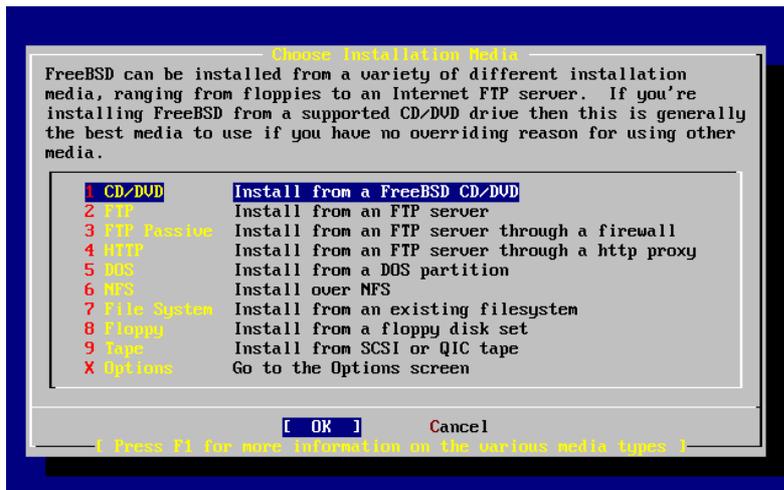
## 2.8 Ἀνασχεδιασμοὶ τοῦ Ἰσχύου Ἀνασχεδιασμοῦ

Ἡ ἀνασχεδιασμοὶ ἀπὸ CDROM ἢ DVD, ἢ ἄλλοι ἀνασχεδιασμοὶ ὄχι ἀνασχεδιασμοὶ Install from a FreeBSD CD/DVD. Ἀνασχεδιασμοὶ ἢ ὅχι ἀνασχεδιασμοὶ [ OK ] ἂν ὄχι ἀνασχεδιασμοὶ **Enter** ἂν ἴσχυροὺς ὄντες.

Ἐὰν ἂν ἴσχυροὺς ὄντες ἀνασχεδιασμοὶ, ἂν ὄχι ἂν ἴσχυροὺς ἀνασχεδιασμοὶ ἂν ἴσχυροὺς ὄντες ἂν ἴσχυροὺς ὄντες.

Ἐὰν ὄχι **F1** ἂν ἴσχυροὺς ὄντες ἀνασχεδιασμοὶ ἂν ἴσχυροὺς ὄντες. Ἐὰν ὄχι **Enter** ἂν ἴσχυροὺς ὄντες ἀνασχεδιασμοὶ ἂν ἴσχυροὺς ὄντες.

Ó÷ Ðíá 2-27. ĀðēēÝíōā ĨÝōí ĀāēāōÛōōāōçō (Installation Media)



Ōñūōīē ĀāēāōÛōōāōçō ĨÝōū FTP: ŌðÛñ÷íōí ðñāēō ĨÝēīāīē āāēāōÛōōāōçō ĨÝōū FTP āēá íá āðēēÝíōāō: āíāñāū (Active) FTP, ðāēçðēēū (Passive) FTP, ð ĨÝōū āēāēīēōðð ĩāōīēÛāççōçō (proxy) HTTP.

Āíāñāū FTP: Install from an FTP server

Ĩá ðçí āðēēīāð áðōð íē ĩāðāōñÝō āñīīōāē ĨÝōū “Āíāñāīý (Active)” FTP. Ç āðēēīāð áðōð āāí ēā ēāēōīōñāðōāē ĨÝōū firewalls āēēÛ óð÷ÍÛ ēāēōīōñāð ĩā ðāēēūðāñīōð āēāēīēōðÝō FTP ðīō āāí ðīōíōçññæīōī ðāēçðēēð ĩāðāōñÛ. Āí ç óýíāāōç óāō ēīēēðōāē ĩā ðāēçðēēū FTP (ðī īðīññī āñīāē ç ðñīāðēēīāð), āīēēīÛōōā ðī āíāñāū!

ðāēçðēēū FTP: Install from an FTP server through a firewall

H āðēēīāð áðōð ĩāççāāñ ðī **sysinstall** íá ÷ñçōēīīðīēðōāē “ðāēçðēēð (Passive)” ĩāðāōñÛ āēá ũēāð ðēō FTP ēāēōīōñāðñāð. Āðōū āðēðñÝðāē óðī ÷ñðōðç íá ðāñīÛāē ĨÝōū firewalls ðā īðīññā āāí āðēðñÝðīōī āēōāñ÷ūīāīāð óðīāÝōāēō óā ðð÷āññāð TCP ðūñðāð.

FTP ĨÝōū HTTP ĩāōīēÛāççōçō: Install from an FTP server through a http proxy

Ç āðēēīāð áðōð ĩāççāāñ ðī **sysinstall** óðç ÷ñðōç HTTP ðñūðīēūēēīō (ũðūð íē ððēēīāðñççōÝō) āēá íá óðīāāēāñ ĩā Ýíā āēāēīēōðð ĩāōīēÛāççōçō āēá ũēāð ðēō ēāēōīōñāðñāð ðīō FTP. Ĩ āēāēīēōðð ĩāōīēÛāççōçō āíāēāíāÛíāē íá ĩāðāōñÛōāē ũēāð ðēō āīðīēÝō ēāē íá ðēō óðāññāē óðīī āēāēīēōðð FTP. Āðōū āðēðñÝðāē óðī ÷ñðōðç íá ðāñÛōāē ĨÝōū firewalls ðīō āāí āðēðñÝðīōī ēāēūēīō FTP, āēēÛ ðñīōóÝññīōī ēāēōīōñāðñā āēāíāçōīēÛāççōçō ĨÝōū HTTP. Óðçí ðāññðōúōç áðōð ðñÝðāē íá ĩññōāðā āēōūð áðū ðīī āēāēīēōðð FTP, ēāē ðī āēāēīēōðð ĩāōīēÛāççōçō.

Āēá āēāēīēōðð ĩāōīēÛāççōçō FTP server, ðñÝðāē óðīðēùð íá āðōāðā ðī ũīñīā ðīō āēāēīēōðð ĩā ðīī īðīññī ēÝēāðā óðçí ðñāñīāðēēūðçðā íá óðīāāēāñðā, ũò ĨÝñīō ðīō username, ĩāðÛ áðū ðī óýíāīēī “@”. Ĩ āēāēīēōðð ĩāōīēÛāççōçō “íēíāñðāē” ðūðā ðīī ðñāñīāðēēū āēāēīēōðð. Āēá ðāñÛāēāíā, ððīēÝōðā ũēē ēÝēāðā íá ēÛíāðā āāēāðÛōōāççō áðū ðī ftp.FreeBSD.org, ÷ñçōēīīðīēðíōāð FTP ĩāōīēāāççð ðīī foo.example.com, Ĩ īðīññī ðñçōēīīðīēāñ ðçí ðūñðā 1234.

Óðçí ðāññðōúōç áðōð, ðçāāñīāðā óðī ĩāñīý āðēēīāðí (options), ēÝðāðā ũò FTP username ðī ftp@ftp.FreeBSD.org, ēāē ũò ēūāēēū (password) ðçí āēāýēðíōç email óāð. Óāí ĨÝōí āāēāðÛōōāççō



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

[ OK ]

Οἱ ἰριῶα αῶου ἡοαίβεαῶε ἡαἡαP ἡἡ Ἰαείἡ εἡεἸ ἡεἡοἸοῶαῶ. ΔεἸεἸοᾶ **Enter** εἡ ἡεῶοηἸῶᾶ ὡἰ ΕᾶνἸο ἡἡἸ ἈεἡοἸοῶαῶ (Main Installation Menu) εἡ ἡ ἡἡβᾶ ἡἡ ὡἰ ἡεἡοἸοῶαῶ.

## 2.10 ἡᾶἸ ὡἰ ἈεἡοἸοῶαῶ

ἡᾶἸ ἡἡ ἡεἡ ὡἰἸ ἈεἡοἸοῶαῶ, εἡεἡεἡεἡ ε ἡἡεἡεῶε ἡεἸᾶἡ ᾡἡἡεἡεἡεἡ ἡεἡεἡἡ. ἡε ἡᾶἡεἡεἡ ἡᾶἡἡἡ ἡ ἡᾶἡἡἡ ἡ ἡεἡεἡεἡ ἡᾶἡἡἡ ὡἰ ἡᾶἡἡἡ (configuration options) ᾡἡεἡ ἡᾶἡἡεἡἡᾶᾶ ὡἰ ἡᾶἡ FreeBSD ὡᾶᾶ ὡᾶ ᾶ ἡᾶἸ ὡἰ ἈεἡοἸοῶαῶ, ὡᾶᾶᾶᾡᾡεἡᾶ ὡἰ sysinstall εἡε ἡεἡ Ἰαἡᾶᾶ ᾶᾶ Configure.

### 2.10.1 ἡἡεἡεῶε ὄᾶᾶᾶᾡᾡ Ἀεἡᾶᾶᾶ

Ἀἰ Ἰ ᾶᾶ ἡᾶἡεἡεἡ εᾡᾡᾡᾡἡᾶ ὡἰ PPP εἡ ἡ ἡᾶᾶ ἈεἡοἸοῶαῶ ἡᾶᾶ FTP, ε ἡεἡεἡ ᾶᾶᾡ ἡᾶ ἡ ἡᾶἡεἡεἡεἡ, εἡεἸ ἡᾶᾶᾶ ἡ ὡἰ ἡᾶἡεἡεἡ ἡᾶᾡᾶᾡ ἡ ὡἰ ᾡᾡᾡᾡ ᾡᾡ ᾡᾡᾡᾡᾡᾡᾡ ᾡᾡᾡᾡᾡᾡᾡ.

Ἀεἡ εᾡᾡᾡᾡᾡᾡ ᾡεᾡᾡᾡᾡᾡ ὡ ᾡᾶᾶ ἡ ὄἡεἡᾡ Ἀβεᾡᾶ (LAN) εἡε ἡεἡ ἡἡεἡεῶε ὡᾡ FreeBSD ἡᾶ ᾡᾶεᾡ / ᾡᾡᾡᾡᾡᾡᾡ (gateway/router), ἡᾶᾡᾡᾡᾡ ὡἰ εᾡᾡᾡεἡ Advanced Networking.

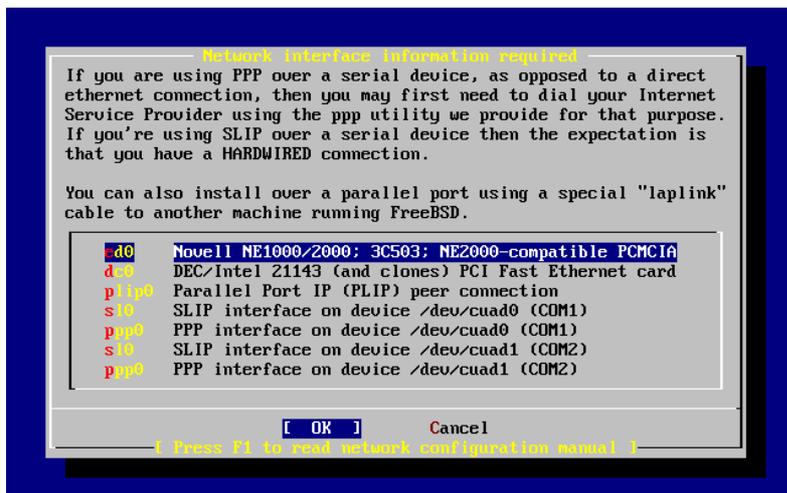
User Confirmation Requested

Would you like to configure any Ethernet or SLIP/PPP network devices?

[ Yes ] No

Ἀεἡ ἡ ἡᾶἡεἡεἡ ἡεἡ ὡᾶᾡᾡᾡ Ἀεἡᾶᾶᾶ, ᾡεἡᾶᾡᾡ [ Yes ] εἡε ᾡεᾶᾶ **Enter**. Ἀεἡᾡᾡᾡεἡᾡ, ᾡεἡᾶᾡᾡ [ No ] εἡ ἡ ὡᾶᾡᾡᾡ.

### ὄᾶᾡᾡ 2-28. Ἀεἡᾶᾡᾡᾡ ἡεἡ ὄᾶᾡᾡᾡ Ethernet



Ἀεἡᾶᾡᾡ ὡἰ interface ᾡᾡ ἡ ἡᾶἡεἡεἡ ἡ ὡ ἡᾡᾡεἡ, εἡε ᾡεᾶᾶ **Enter**.



### IPv4 Gateway (Ἐπέκ)

Ὁ ἄρχειος ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει. Ἐὰν δὲ ἔσται ἡ ἀσκήσις ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει. Ἐὰν δὲ ἔσται ἡ ἀσκήσις ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει. Ἐὰν δὲ ἔσται ἡ ἀσκήσις ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει.

### Name server (Ἀσκήσις ἐπιπέδου Ἰντερνέτ)

Ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει. Ἐὰν δὲ ἔσται ἡ ἀσκήσις ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει. Ἐὰν δὲ ἔσται ἡ ἀσκήσις ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει.

### IPv4 address (Ἀσκήσις ἐπιπέδου)

Ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει.

### Netmask (Ἰσοπέδου Ὀριζόντιο)

Ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει.

### Extra options to ifconfig (Ἀσκήσις ἐπιπέδου ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει)

Ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει.

× Ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει.

```
User Confirmation Requested
Would you like to Bring Up the ed0 interface right now?

[ Yes ]      No
```

Ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει.

## 2.10.2 Ἐπιπέδου Ἐπέκ (Gateway)

```
User Confirmation Requested
Do you want this machine to function as a network gateway?

[ Yes ]      No
```

Ἐπιπέδου τῆς ἀσκήσεως ἂν ὀφείλῃ νὰ ἐπιπέδου τὴν ἀσκήσιν ἐν τῇ ἐπιπέδου ἀσκήσει.

## 2.10.3 Ἐπιπέδου Ὄψων ἀσκήσεως Ἰντερνέτ (Internet Services)

```
User Confirmation Requested
```

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

Yes [ No ]

Áí äðééÝíäðä [ No ], êÛðíéäð ððçñáóβáð ùðùð òí **telnetd** äâí éä áíâñäíðíéçèíýí. Áðòù óçíáβíäé ùðé äðñáéñòòíÝíé ÷ ñðóóáð äâí éä ìðñíýí íá ÷ ñçóéíðíéðóíòí òí **telnet** äéä íá áéóÝèèòí óòí ìç ÷ Ûíçíá. Íé ðíðééíβ ÷ ñðóóáð éä ìðñíýí ùóðùòí íá Ý ÷ ðí ðñüóääóç óä äðñáéñòòíÝíá ìç ÷ áíðíáðä ìÝòù òíò **telnet**.

Íé ððçñáóβáð áððÝð ìðñíýí íá áíâñäíðíéçèíýí íäðÛ óçí ääéäðÛóðáóç ìä óçí äðáíâñááóβá ðíò äñ ÷ äβíò /etc/inetd.conf ìä òí ðñíðéìðíáíí óäð äðáíâñááóðð äâéíÝíñ. Äâβòä òí Õìðíá 29.2.1 äéä ðññéóóúðññäð ðççñíòññβáð.

ÄðééÝíðä [ Yes ] áí èÝéäðä íá ñðèìβóáðä ðéð ððçñáóβáð áððÝð éäðÛ óçí ääéäðÛóðáóç. Èä äñùðçéââðä äéä ìéä áéñíä äðéääááβùç:

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

ÄðééÝíðä [ Yes ] äéä íá óðíá ÷ βóáðä.

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

ÄðééÝáííóáð [ Yes ] éä ìðñÝóáðä íá ðñíðééÝóáðä ððçñáóβáð óâðíííóáð òí # áðù óçí äñ ÷ ð ìéäð äñáíðð.



δεçñïïñβâð ó÷-âðέέÛ ïá ðçí áóöÛεάέá, äâβðâ ðï ÊäöÛεάει 14.

Άέá íá äðέöñÝðáðâ ðï áίρβιöïï FTP, ÷-ñçóειïðιερðóðâ ðá äâεÛεάέá äέá íá äðέεÝíäðâ [ Yes ] έáέ íá ðεÝóáðâ **Enter**. Έá ÷-ñâέáóðâβ íá äðέáââέερðóðâ íáfÛ ðçí äðέειñäð óáð:

```

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.
    
```

```

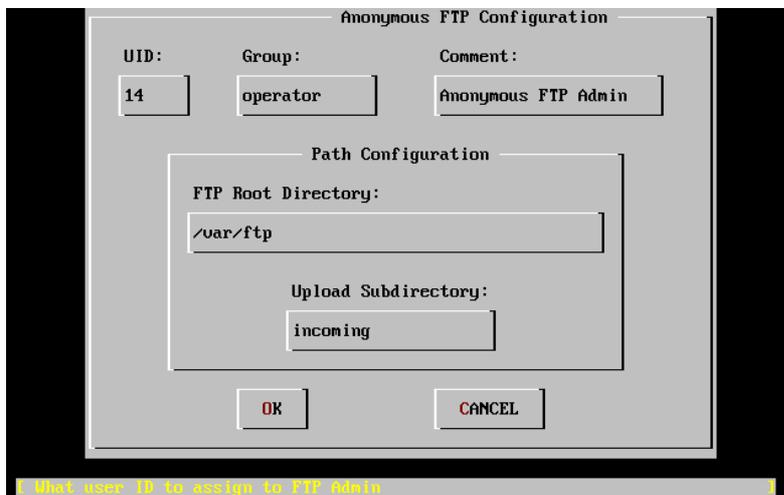
If you want the server to be read-only you should leave the upload
directory option empty and add the -r command-line option to ftpd(8)
in inetd.conf(5)
    
```

Do you wish to continue configuring anonymous FTP?

[ Yes ]                      No

Ïï ïβιöíá äðöü óáð áέáïðιεáβ äðβðçð ùðέ ç ððçñáóβá FTP έá ðñÝðáέ äðβðçð íá áíññäïðιεçέâβ óöï /etc/inetd.conf óâ ðññβððöüç ðïð εÝέäðâ íá áíññäïðιεçειγί íε áίρβιöïä ððíáÝóáέð FTP (äâβðâ ðï Ïïβιá 2.10.3). ΆðέεÝíäð [ Yes ] έáέ ðεÝóðâ **Enter** äέá íá óðíá÷-βóáðâ. Έá äâβðâ ðçí áέïειðεç ïεïïç:

**Ï÷-βιá 2-31. ÐññäðέέáñíÝíäð Ñðειβóáέð Áίρβιöïï FTP**



ðññäð user ID to assign to FTP Admin

×ñçóειïðιερðóðâ ðï **Tab** äέá íá äðέεÝíäðâ έáέ íá óöïðεçñβóáðâ ðá áðññáβðçðá ðäââá ðεçñïïñβι:

**UID**

Ï áíááíùñέóðέέεüð áñέέïüð (user ID) ðïð εÝέäðâ íá áðññáβðçðá óöïï áίρβιöïï FTP ÷-ñβððç. ¼έá ðá áñ÷-âβá ðïð έá áíáááβίρöï óöïï äέáέñέóðβ FTP έá áίβειρöï óâ äðöü ðï ID.

**Group**

Όλα τα χρήματα (group) είναι για την ομάδα FTP.

**Comment**

Εάν θέλετε να δημιουργήσετε ένα αρχείο /etc/passwd.

**FTP Root Directory**

Οι χρήστες θα έχουν πρόσβαση στο αρχείο FTP.

**Upload Subdirectory**

Οι χρήστες θα έχουν πρόσβαση στο αρχείο FTP.

Η ρίζα (root) είναι το /var, όπου βρίσκονται οι αρχεία /usr (FTP Root Directory) και /usr/ftp.

Κατά την εμφάνιση του μηνύματος **Enter** πατήστε το πλήκτρο **Enter** για να συνεχίσετε.

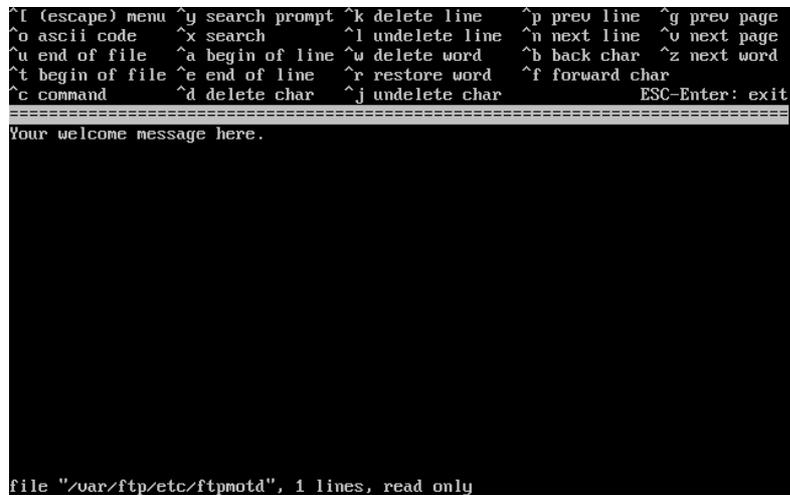
```

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

[ Yes ] No
    
```

Αν πατήσετε **[ Yes ]** θα δημιουργηθεί ένα αρχείο με το όνομα **ftplib** στο /var/ftp/etc. Αν πατήσετε **No** δεν θα δημιουργηθεί.

**Όχι - Πίνακας 2-32. Αδειολογία του Αρχείου Μηνύματος (Welcome Message) του FTP**



Η αδειολογία είναι η ακόλουθη: **ee**. Χρησιμοποιήστε το πλήκτρο **ee** για να επεξεργαστείτε το αρχείο **ftplib** στο /var/ftp/etc. Εάν θέλετε να δημιουργήσετε ένα αρχείο **ftplib** στο /var/ftp/etc, πατήστε το πλήκτρο **ee** στο αρχείο **ftplib** στο /var/ftp/etc.

Για να κλείσετε τον επεξεργαστή πατήστε το πλήκτρο **a)** leave editor. Για να συνεχίσετε πατήστε το πλήκτρο **Enter** ή το πλήκτρο **Enter** για να συνεχίσετε.

## 2.10.6 Ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων (Network File System)

Ὁ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων (NFS) ἀπερὶ τὴν ἐξέλιξιν αὐτοῦ ἀντιμετώπιση εἶναι ὅτι ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων. Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων.

### 2.10.6.1 Ἡ ἐξέλιξις τοῦ NFS

```

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

Yes      [ No ]
    
```

Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων. Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων.

Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων. Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων.

```

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 ]
    
```

Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων. Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων.

### Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων exports

```

^_ (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
    
```

Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων. Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων.

Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων. Ἡ ἐξέλιξις αὐτοῦ εἶναι ἡ ἐξέλιξις τοῦ Ὁλοῦ Συστήματος Ἀντιμετώπισης Ἀρχείων.

### 2.10.6.2 Ἐπιβεβαιώστε τὸ NFS

Ἡ ἐπιβεβαίωσις τῆς NFS ἀπλοποιήσιμὸς ὁδηγὸς ἔχει τὴν ἑξῆς μορφήν:

```

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

Yes   [ No ]

```

Ἡ ἐπιβεβαίωσις τῆς NFS ἀπλοποιήσιμὸς ὁδηγὸς ἔχει τὴν ἑξῆς μορφήν: **Enter**.

### 2.10.7 Ἐπιβεβαιώστε τὰ ἰδιοκείμενα (System Console Settings)

Ἡ ἐπιβεβαίωσις τῆς ἰδιοκείμενα ἀπλοποιήσιμὸς ὁδηγὸς ἔχει τὴν ἑξῆς μορφήν:

```

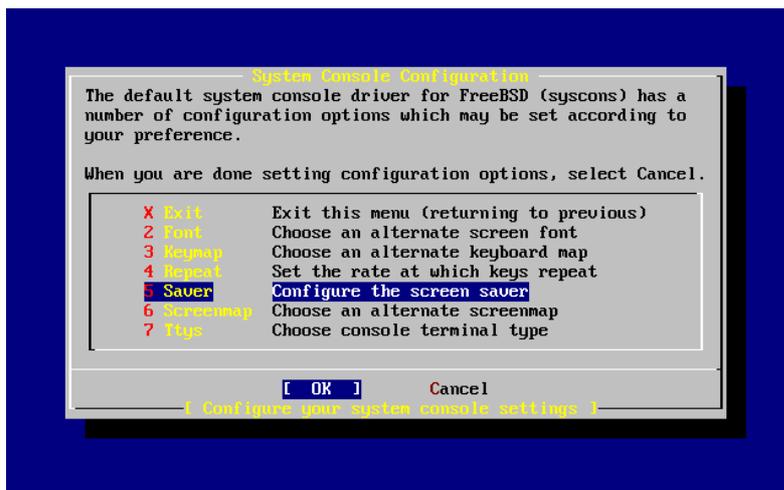
User Confirmation Requested
Would you like to customize your system console settings?

[ Yes ] No

```

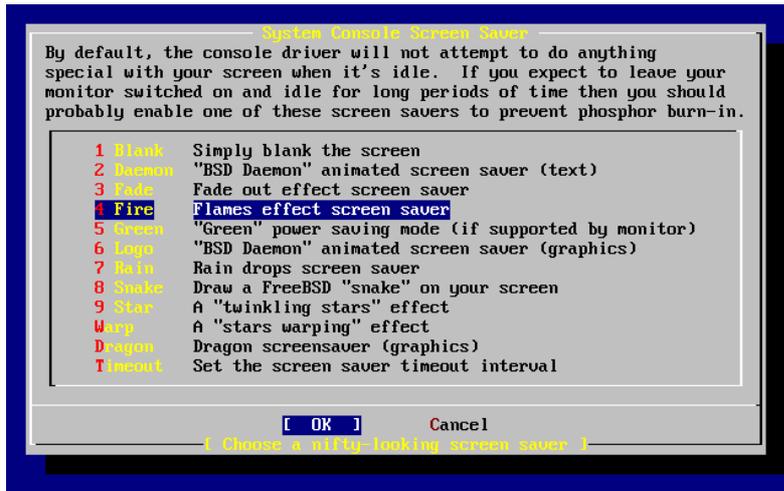
Ἡ ἐπιβεβαίωσις τῆς ἰδιοκείμενα ἀπλοποιήσιμὸς ὁδηγὸς ἔχει τὴν ἑξῆς μορφήν: **Enter**.

#### Ὁδηγὸς 2-34. Ἐπιβεβαιώστε τὰ ἰδιοκείμενα ὁδηγὸς



Ἡ ἐπιβεβαίωσις τῆς ἰδιοκείμενα ἀπλοποιήσιμὸς ὁδηγὸς ἔχει τὴν ἑξῆς μορφήν: **Enter**.

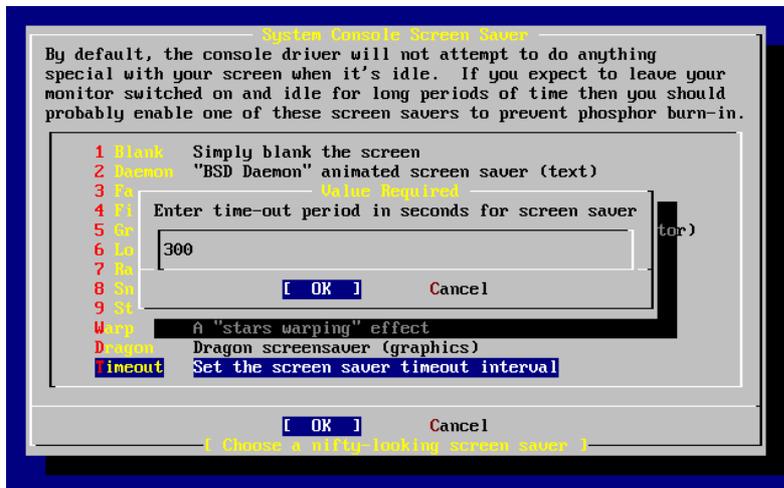
Ότι Πία 2-35. Άδεςΐτο Δτιόόάόάο ΐεΐο



Άδεςΐτο όγι άδεςοιςο Δτιόόάόάο ΐεΐο ιά όά άεΐέέα, έάέ δεΐόόά **Enter**. Έά ιάάάάόά όι ιάιΐΐ Νΐεοόοο έιόόέάο ΌόόΠιόοο.

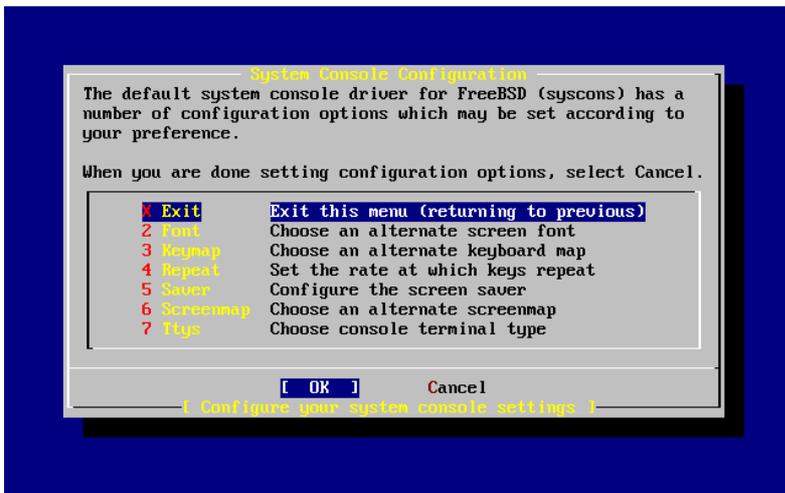
Όι Δτιόέέάΐΐτι - νιέέυ άεΐόόά άβιάέ 300 άάόάνέάόά. Άέα ιά άεΐΐάόά όι άεΐόόά, άδεςΐτο ιάΐΐ Saver έάέ άδύ όι ιάιΐΐ Screen Saver Options άδεςΐτο Timeout ιά όά άεΐέέα, έάέ δεΐόόά **Enter**. Έά άιόάέόάβ ΐία άίάάΐΐΐΐΐΐΐΐ:

Ότι Πία 2-36. × νιέέυ Άεΐόόά Δτιόόάόάο ΐεΐο



Άεΐΐάόά όγι όέιΠ, άδεςΐτο [ OK ] έάέ δεΐόόά **Enter** έέα ιά άδεςόοΐΐΐάόά όόι ιάιΐΐ Νΐεοόοο έιόόέάο ΌόόΠιόοο.

Όπως φέρει το Σχήμα 2-37. Η διαδικασία ρύθμισης των παραμέτρων του συστήματος.



Από τον πίνακα επιλογών **Exit** πατάμε το **Enter** και οφείλουμε να ορίσουμε τις προτιμήσεις μας για το σύστημα. Η επιλογή **Exit** πατάμε το **Enter** και οφείλουμε να ορίσουμε τις προτιμήσεις μας για το σύστημα.

### 2.10.8 Ζώνη Ώρας (Time Zone)

Το σύστημα ρύθμισης οφείλει να ορίσει την ζώνη ώρας. Η ζώνη ώρας είναι η περιοχή όπου ο χρόνος είναι ο ίδιος. Η ζώνη ώρας είναι η περιοχή όπου ο χρόνος είναι ο ίδιος.

Οι διαδρομές που υπάρχουν είναι οι παρακάτω. Η ζώνη ώρας είναι η περιοχή όπου ο χρόνος είναι ο ίδιος.

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

[ Yes ] No

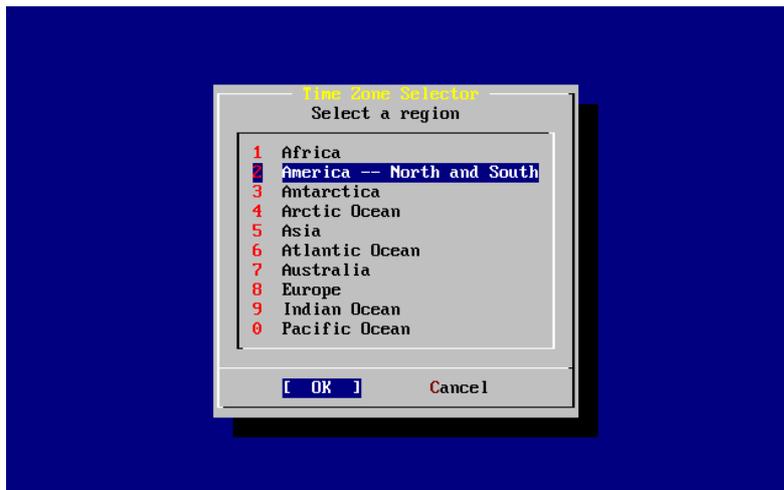
Από τον πίνακα επιλογών **[ Yes ]** πατάμε το **Enter** και οφείλουμε να ορίσουμε τις προτιμήσεις μας για το σύστημα.

```
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 ]

Από τον πίνακα επιλογών **[ Yes ]** ή **[ No ]** πατάμε το **Enter** και οφείλουμε να ορίσουμε τις προτιμήσεις μας για το σύστημα.

Ó ÷ Ðíá 2-38. ÅðéçĩãÐ ðçò Ðãñéí ÷ Ðò óáò



Åðéç Ýíòã ðçí éáòÛëçççç ðãñéí ÷ Ð (region) ìã óá äãÛëéá éáé ðéÝóáä **Enter**.

Ó ÷ Ðíá 2-39. ÅðéçĩãÐ ðçò ×þñáò óáò



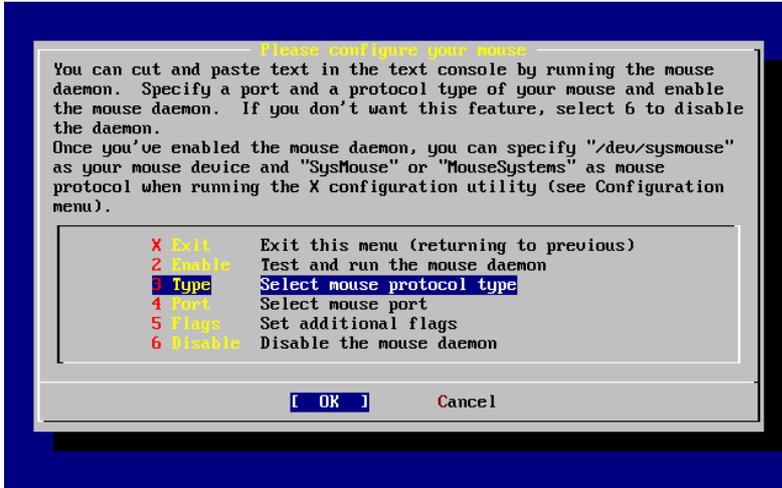
Åðéç Ýíòã ðçí éáòÛëçççç ÷ þñá ÷ ñçóéíðíéþíóáò óá äãÛëéá éáé ðéÝóáä **Enter**.



User Confirmation Requested  
 Does this system have a non-USB mouse attached to it?  
 [ Yes ] No

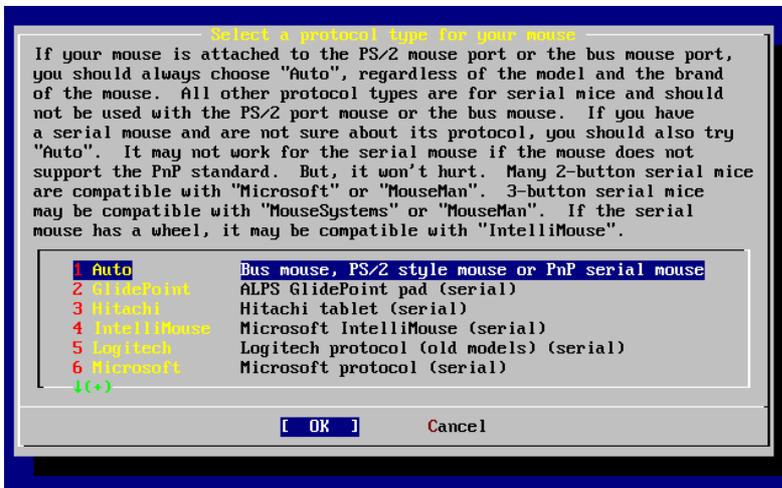
Ἄδειάστε [ Yes ] ἀνὰ ἰσχύος-USB πονοκέρ, ἢ [ No ] ἀνὰ USB πονοκέρ ἐὰν θέτε ἔχει **Enter**.

Ὁ - Πίνακας 2-41. Ἄδειάστε τὸ ἔργο τοῦ Πονοκέρ (Mouse Protocol Type)



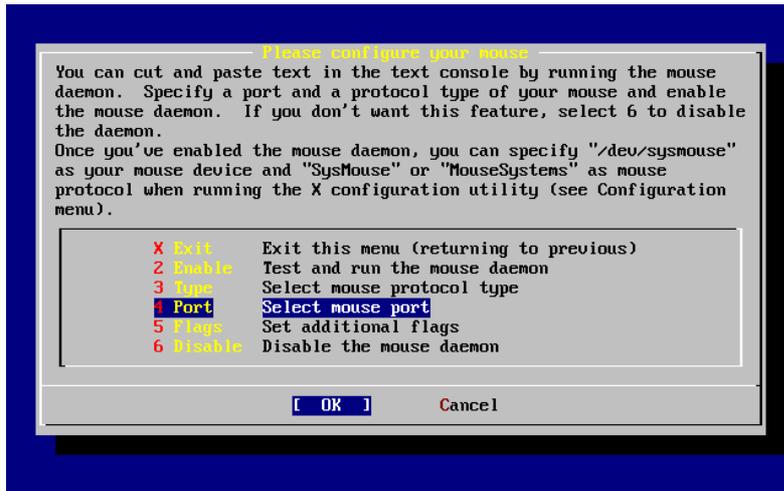
Ἐπιλέξτε τὸν τύπο τοῦ πονοκέρ Type ἐὰν θέτε ἔχει **Enter**.

Ὁ - Πίνακας 2-42. Ἄδειάστε τὸ ἔργο τοῦ Πονοκέρ (Mouse Protocol)



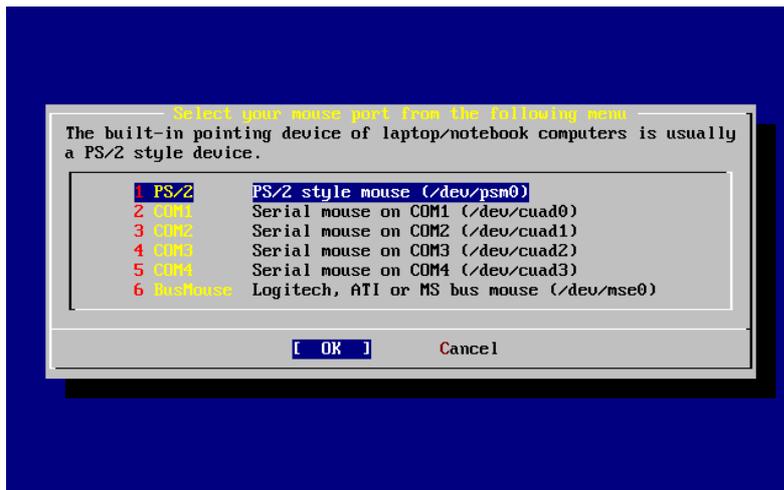
Ὁ πονοκέρ τοῦ PS/2 ἢ τοῦ ἰσχύος πονοκέρ, ἐὰν θέτε ἔχει ἰσχύος πονοκέρ, ἐὰν θέτε ἔχει ἰσχύος πονοκέρ. Ἄδειάστε τὸ ἔργο τοῦ Πονοκέρ, ἐπιλέξτε τὸν τύπο τοῦ πονοκέρ Auto. Ἄδειάστε τὸ ἔργο τοῦ Πονοκέρ, ἐπιλέξτε τὸν τύπο τοῦ πονοκέρ IntelliMouse. Ἄδειάστε τὸ ἔργο τοῦ Πονοκέρ, ἐπιλέξτε τὸν τύπο τοῦ πονοκέρ Logitech. Ἄδειάστε τὸ ἔργο τοῦ Πονοκέρ, ἐπιλέξτε τὸν τύπο τοῦ πονοκέρ Microsoft. Ἄδειάστε τὸ ἔργο τοῦ Πονοκέρ, ἐπιλέξτε τὸν τύπο τοῦ πονοκέρ Hitachi. Ἄδειάστε τὸ ἔργο τοῦ Πονοκέρ, ἐπιλέξτε τὸν τύπο τοῦ πονοκέρ GlidePoint. Ἄδειάστε τὸ ἔργο τοῦ Πονοκέρ, ἐπιλέξτε τὸν τύπο τοῦ πονοκέρ Auto.

Ὁρῶντα 2-43. Ἐπιλογή Πύλου Ποντικίου (Mouse Port)



× ἠχοῦντὴς τὸ πῶς ὁ ἀπλοποιεῖται ἡ ἐπιλογή τῆς Πύλης τῆς Ποντικίου μετὰ τὴν πατάξη τοῦ **Enter**.

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



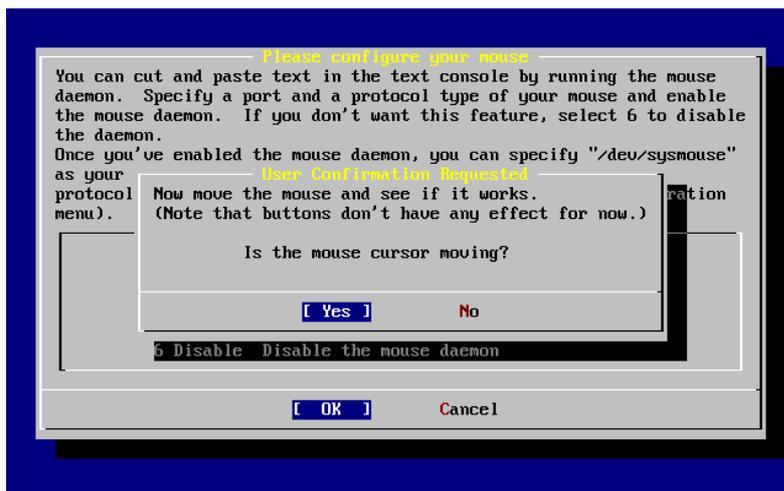
Ὁι ὁμοίως ἀπλοποιεῖται ἡ ἐπιλογή τῆς Πύλης τῆς Ποντικίου μετὰ τὴν πατάξη τοῦ **Enter**. Ἐπιλέξτε τὴν ἐπιλογή τῆς Πύλης τῆς Ποντικίου, ὁμοίως, μετὰ τὴν πατάξη τοῦ **Enter**.

### Ὁ Διάγραμμα 2-45. Ἀπλοποίηση τοῦ Ἀρμόνη τοῦ Ποντικιοῦ (Mouse Daemon)



Ὁ ἔλεγχος, ἡ ἐπιλογή τοῦ 2 ἂν ἐπιλεγῆτε τὸ Enable, ἐπεὶ δεξιά τοῦ Enter ἔχει τὴν ἀπλοποίηση τοῦ ἀρμόνη τοῦ ποντικιοῦ.

### Ὁ Διάγραμμα 2-46. ἔλεγχος τοῦ Ἀρμόνη τοῦ Ποντικιοῦ



Ὁ ἔλεγχος τοῦ ἀρμόνη τοῦ ποντικιοῦ ἐπιβεβαιώνει ἂν ἔχει κινηθῆναι τὸ ποντικιοῦ. Ἄν ἀβίαστὸς ἀποκρίσητε, ἂν ἐπιλεγῆτε [ Yes ] ἔπεὶ δεξιά τοῦ Enter. Ἄν ἄλλω, ἂν ἀποκρίσητε ἂν ἔλεγε ἂν ἀποκρίσητε — ἂν ἐπιλεγῆτε [ No ] ἔπεὶ ἂν ἀποκρίσητε τὴν ἀπλοποίηση τοῦ ἀρμόνη τοῦ ποντικιοῦ.

Ὁ ἔλεγχος τοῦ Exit ἂν ἔλεγε ἂν ἐπιλεγῆτε τὸ Enter ἔπεὶ ἂν ἀποκρίσητε τὸ ποντικιοῦ, ἂν ἔλεγε ἂν ἀποκρίσητε τὸ ποντικιοῦ ἂν ἀποκρίσητε τὸ ποντικιοῦ ἂν ἀποκρίσητε τὸ ποντικιοῦ.

### 2.10.11 Ἀπλοποίηση τοῦ Ἀρμόνη τοῦ Ποντικιοῦ

Ὁ ἔλεγχος τοῦ ἀρμόνη τοῦ ποντικιοῦ ἐπιβεβαιώνει ἂν ἔχει κινηθῆναι τὸ ποντικιοῦ, ἂν ἀποκρίσητε τὸ ποντικιοῦ ἂν ἀποκρίσητε τὸ ποντικιοῦ ἂν ἀποκρίσητε τὸ ποντικιοῦ.

Ἐὰν οὖν ἀβῆτε ὅτι ἀετὸς ἔχει ἀνὰ τὸν ὅμοιον τὸν ὅμοιον ἀετὸς. Ἰδιότης αὐτῶν ἐστὶν ἡ ἀετὸς ὁδηγῶν διὰ FreeBSD ἡ ἀετὸς ὁδηγῶν διὰ FreeBSD ἡ ἀετὸς ὁδηγῶν διὰ FreeBSD.

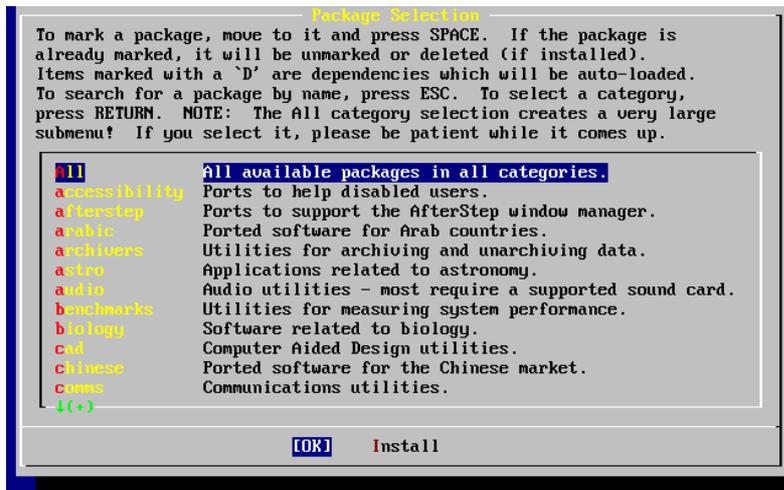
User Confirmation Requested

The FreeBSD package collection is a collection of hundreds of ready-to-run applications, from text editors to games to WEB servers and more. Would you like to browse the collection now?

[ Yes ] No

Ἐὰν ἀβῆτε [ Yes ] ἔχει ὁδηγῶν **Enter** ἐὰν ἀβῆτε ὅτι ἔχει ὁδηγῶν διὰ FreeBSD.

### Ὁδηγῶν 2-47. Ἐἰς τὴν ἑξῆς ὁδηγῶν διὰ FreeBSD

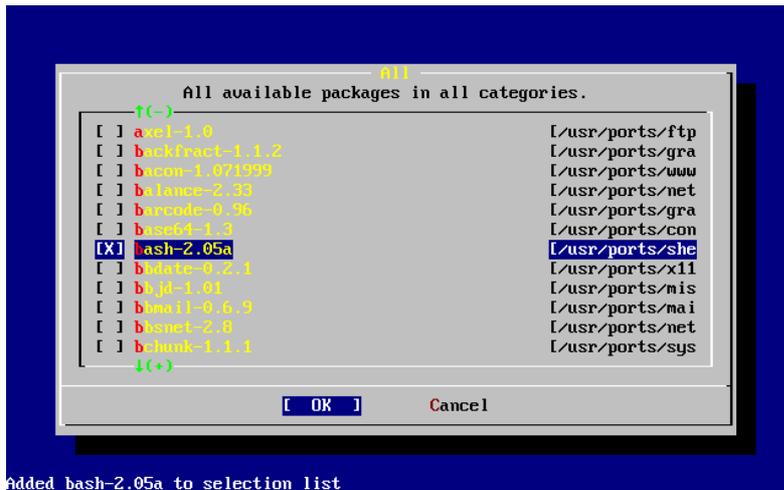


Ἰδιότης αὐτῶν ἐστὶν ἡ ἀετὸς ὁδηγῶν διὰ FreeBSD ἡ ἀετὸς ὁδηγῶν διὰ FreeBSD ἡ ἀετὸς ὁδηγῶν διὰ FreeBSD.

Ἐὰν ὅτι ἀβῆτε All ἐὰν ἀβῆτε ὅτι ἀετὸς ὁδηγῶν διὰ FreeBSD, ἡ ἑξῆς ὁδηγῶν διὰ FreeBSD ὁδηγῶν διὰ FreeBSD. Ὁδηγῶν ὅτι ἀβῆτε ὅτι ἔχει ὁδηγῶν **Enter**.

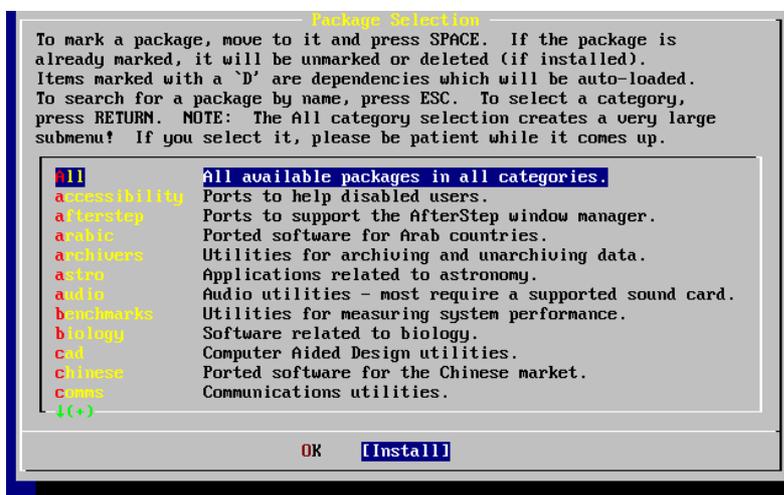
Ἐὰν ἀβῆτε ὅτι ἔχει ὁδηγῶν διὰ FreeBSD ἡ ἀετὸς ὁδηγῶν διὰ FreeBSD ἡ ἀετὸς ὁδηγῶν διὰ FreeBSD.

Όχι Πίνακας 2-48. Αδειοδοτημένο Διαθέσιμο



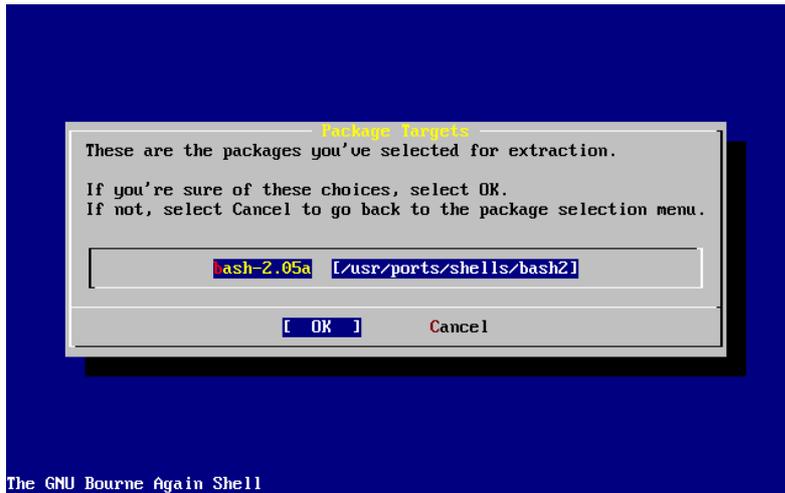
Οι εγχειρίδιο (shell) **bash** οαβίαοάε αδεεααίΥί. ΑδεεΥίοα υοά οάεΥοά αδεεοιαβοά, ουοβαεϊοάο οί οάεΥοί εάε δεΥαίοάο οί δεΠεοηι **Space**. Εά ααβοά ιεά ούοίοηε οαηεαηαοΠ αεά εΥεα οάεΥοί οοί εΥοου αηεοοαηυ ιΥηιο οεο ιευίεο. ϸ οβαοε οίο δεΠεοηιο **Tab** αίαεεΥοοάε ιαοαίυ οίο οάεαοοαβιο αδεεααίΥίο οάεΥοίο, οίο [ OK ], εάε οίο [ Cancel ]. 1/οάί Υ ÷ αοά οαεεοοάε ια οί ιαηεΥηεοία ουί οάεΥοίοι οηιο ααεαοΥοοάοε, δεΥοοά ιεά οηιΥ **Tab** αεά ια ιαοάεείεαβοά οοί [ OK ] εάε δεΥοοά **Enter** αεά ια αδεοοηΥοαοά οοί ιαηίΥ ΑδεεαΠο οάεΥοίοι (Package Selection). Οί αηεοοαηυ εάε ααηβ ααεΥεε αίαεεΥοοάε αδβοεο ιαοαίυ οίο [ OK ] εάε οίο [ Cancel ]. Ιοηιαβοά ια ÷ ηεοεηιοίεΠοαοά αοδΠ οε ιΥεηαί αεά ια αδεεΥίοα [ OK ] εάε δεΥοοά **Enter** αεά ια αδεοοηΥοαοά οοί ιαηίΥ ΑδεεαΠο οάεΥοίοι.

Όχι Πίνακας 2-49. ΑαεαοΥοοάοε Διαθέσιμο



× ηεοεηιοίεΠοαοά οί **Tab** εάε οά ααεΥεεα αεά ια αδεεΥίοα [ Install ] εάε δεΥοοά **Enter**. Εά ÷ ηαεαοαβ ια αδεεααεοοάοα υοε εΥεαοά ια ααεαοαοδΠοαοά οά οάεΥοά:

### Όχι Διά 2-50. Ανεξάρτητο εγχειρίδιο της FreeBSD



Ανεξάρτητο εγχειρίδιο [ OK ] είναι δεξιά του **Enter** και φαίνεται πως η ανεξάρτητο εγχειρίδιο της FreeBSD. Είναι απλά ένα τεστ για να δείτε αν η ανεξάρτητο εγχειρίδιο της FreeBSD είναι σωστά εγκατεστημένη.

Η ανεξάρτητο εγχειρίδιο της FreeBSD είναι απλά ένα τεστ για να δείτε αν η ανεξάρτητο εγχειρίδιο της FreeBSD είναι σωστά εγκατεστημένη. Είναι απλά ένα τεστ για να δείτε αν η ανεξάρτητο εγχειρίδιο της FreeBSD είναι σωστά εγκατεστημένη.

### 2.10.12 Δημιουργία Χρήστών / Ομάδων (Users/Groups)

Εάν θέλετε να δημιουργήσετε ορισμένους χρήστες ή ομάδες στην ανεξάρτητο εγχειρίδιο της FreeBSD, πρόκειται να δημιουργηθούν ορισμένοι χρήστες και ομάδες στην ανεξάρτητο εγχειρίδιο της FreeBSD. Η διαδικασία αυτή είναι απλή και μπορεί να γίνει από τον root.

#### 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

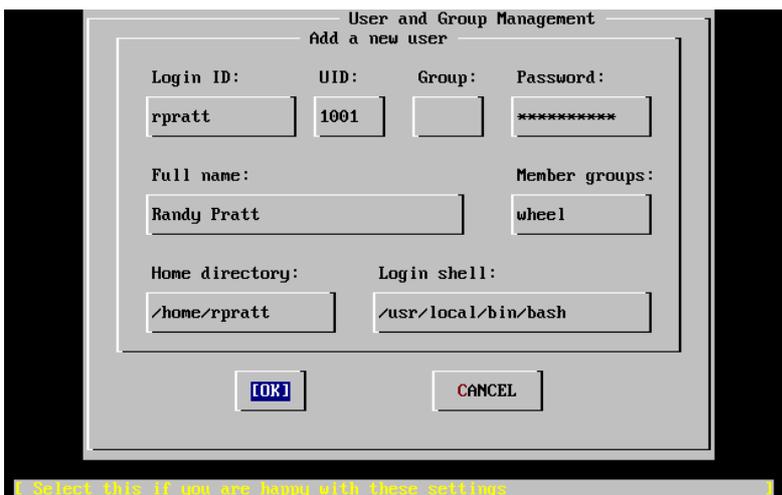
Ανεξάρτητο εγχειρίδιο [ Yes ] είναι δεξιά του **Enter** και φαίνεται πως η ανεξάρτητο εγχειρίδιο της FreeBSD είναι σωστά εγκατεστημένη.

Ó÷ Ðíá 2-51. ÁðéíãÐ ×ñÐóç



ÁðééÝíôá User ìá óá ääÛééá éáé ðéÝóóá Enter.

Ó÷ Ðíá 2-52. ÐñíòèÐçç Ðççñíöíñéþí ×ñÐóç



Êáèðð éá áéóÛããðð óá óðíé÷ áβá ðéÝæííóäð ðí **Tab** éá äìóáíβæííóáé íé ðáñáéÛòð ðáñéãñáóÝð óðí éÛòð ìÝñíð ðçð ðéííçð áéá íá óáð äìççÐóíóí óðçí áéóáãñãÐ ðùí áðáéóíγìáñúí ðççñíöíñéþí:

Login ID

To ùññá ÷ñÐóç (login name) áéá ðí íÝí ÷ñÐóç (ððí÷ñãùðééü).

UID

Ï áíááññéóóééüð áñééìüð (numerical ID) áéá áððü ðí ÷ñÐóç (áóÐóðá ðíí éáñú áéá áððüìáðç áðééíãÐ).

### Group

Ότ υνάρ όνο ύάο (group name) άέά άόόυ ότ ÷ ύόό (άόόόά ότ έάύ άέά άόόύάό άέέή).

### Password

Ό έυάέέύό (password) άέά άόόυ ότ ÷ ύόό (άόόά άήόό÷ύ όότ άάβ ύόό!).

### Full name

Ότ άέάά ύνάρ ότ ÷ ύόό (ό÷έέ).

### Member groups

Ό έόύέέόό ύάο (groups) όόέό ύόόά άύέέ άόόύό ύ ÷ ύόό (Ψ÷άέ άέ. όά έέέέήάόά όύό).

### Home directory

Ό άήόόέέύό έάόέύό άñ÷άβύ (home directory) όύό ÷ ύόό (άόόόά έάύ άέά όύό άήάέέάίΨ άέέή).

### Login shell

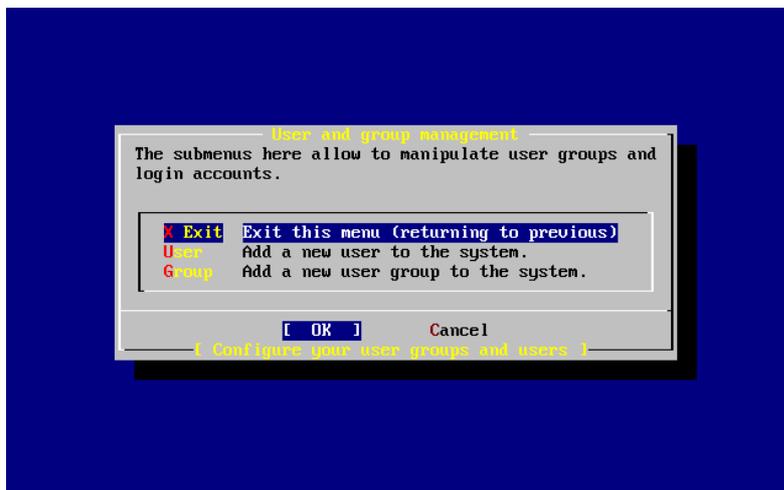
Ό άήάέέάίΨ έέέόό (login shell) όύό ÷ ύόό (άόόόά έάύ άέά όύό άήάέέήΨ, ά. ÷. /bin/sh).

Ό έέέόό άέόύάό άέέύ÷όό άύ /bin/sh όά /usr/local/bin/bash άέά ίά ÷ ήόόύόέέά ότ έέέόό **bash** ότ ύόό έέέάόόόόά άήάάύόύό ύόό ύόό άέέόό. Όό άήάέέάόόά ίά ÷ ήόόύόέέάόόά έέέόό έέέόό όύό άή άόόñ÷άέ, έέάόύέέέέ ύά έά ύόόάόά ίά έέέάό login. Όό άήάή ήόόέέόύό έέέόό όόύ έύόό όύό BSD άβίάέ ότ C shell, ότ ύόό ύόόάόά ίά άñύάόά ύó /bin/tcsh.

Ό ÷ ύόόό άήόόύέέά άόόόό όόύ ύά wheel άέά ίά Ψ÷άέ όύ άόόóóóά ίά άβίάέ άάñ ÷ ύόόό (superuser) ίά έέέέήάόά root.

½όά ύόόά έέάύόέέΨ άύ όέό άέέήΨόό, άέΨόά [ OK ] έέ έά ήόάέόάβ ίάύ ότ ίάύ User and Group Management:

## Ό÷ύά 2-53. ύάό άύ όύ Άέá÷άβήέό × ήόόύ έέ έύάύ



Όόάό άόόό όύ άάάΨ άέήά ίά άήόéΨόά ύάάό, άύ άόόñ÷άέ όόάέέέΨ άύάέ. Άέάόύέέέέ, ύόόάόά ίά άήάΨέάά όó ήέέέό άόό ύόό όύ άέάόóóó, ύόó όύ sysinstall.

Εάν ο χρήστης είναι ο root, η διαδικασία διαμορφώσεων διακομίσματος για το FreeBSD θα είναι:

### 2.10.13 Διαμορφώνοντας το root password

```

    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 ]

Εάν ο χρήστης είναι ο root, η διαδικασία διαμορφώσεων θα είναι:

Εάν ο χρήστης είναι ο root, η διαδικασία διαμορφώσεων θα είναι:

```

Changing local password for root.
New password :
Retype new password :

```

Η διαδικασία διαμορφώσεων του root password είναι:

### 2.10.14 Κατάσταση του συστήματος

Εάν ο χρήστης είναι ο root, η διαδικασία διαμορφώσεων θα είναι:

```

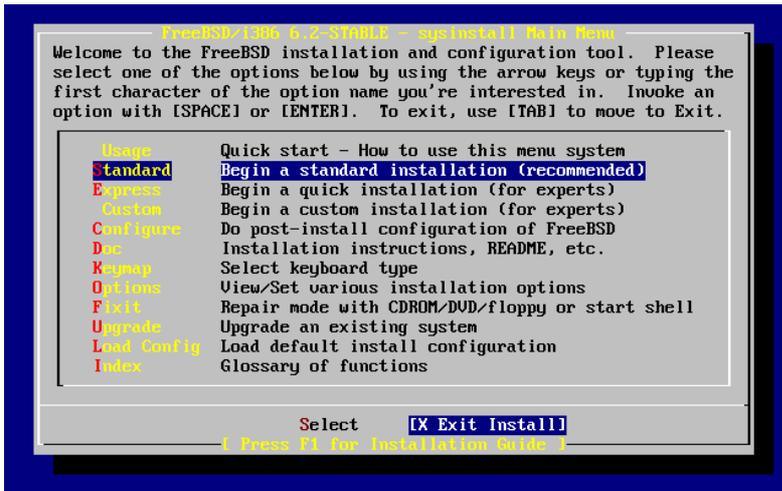
    User Confirmation Requested
    Visit the general configuration menu for a chance to set any last
    options?

```

Yes [ No ]

Εάν ο χρήστης [ No ] είναι ο root, η διαδικασία διαμορφώσεων θα είναι:

Ó÷ Ðíá 2-54. ðñäö áðü öçí ÆãéáöÛóóáóç



ÅðéëÝíðá [X Exit Install] ðá öá äãëÛëéá éáé ðéÝóðá Enter. Èá èëçëáððá íá äðéááááéðóáðá öçí Ýíñáí áðü öçí äãéáöÛóóáóç:

```

User Confirmation Requested
Are you sure you wish to exit? The system will reboot (be sure to
remove any floppies from the drives).

[ Yes ] No

```

ÅðéëÝíðá [ Yes ] éáé áí Ý÷ ððá íáééíðóáé áðü áéóéÝðá, äãÛëðá öçí. Ì ðáçäüð CDROM éá ðáñáíáðíáé èééäüñÝíðó ðíÝ÷ ðé íá äñ÷ðóáé ç äðáíáééðíóç öíð ðç÷ áíðíáðíð. Èáöüðéí íáééáéçðíáé, éáé ðíñáððá (äñðáíñá) íá äãÛëðá ðí CD áðü öíí ðáçäü.

Ïí óýðóçíá éá äðáíáéééíðóáé, éáé ðñíóÝíðá áéá ðð÷ ðí ðçíýíáðá èÛëíðð ðíð éá äíðáíéóðíýí.

2.10.15 Ñýëíéóç ðñüóéáðüí Õðçñáóéðí Æééðýíö

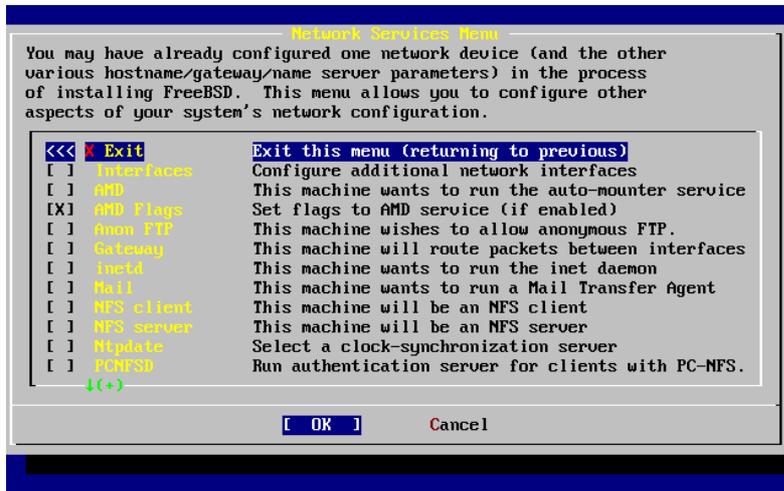
ÓðíáéóðíÛ áðü öíí Tom Rhodes.

Ç ðýëíéóç ððçñáóéðí áééðýíö ðñíñáð íá äðíáé íéá äýóéíçç áéááééáóðá áéá íÝíðð ÷ ðñóðáð ÷ ðñðð äíðáéñðá óðíí áíððóðíé÷ ðñÝá. Ç áééðýíóç, ðáñééáíááñíÝíð éáé öíð Internet, äðíáé èñðóéç óá ðéá óá ðíðóÝñíá éáéðíðñáéÛ óðóððíáðá, ðáñééáíááñíÝíð éáé öíð FreeBSD. Æéá öí èüáí áðüð äðíáé ÷ ðñóéíí íá Ý÷ ððá èÛðíéá éáóáíóçç ðüí äéððááÝíñí ééáíðððüí áééðýíóçð öíð FreeBSD. ÈÛñíóáð öí áðüð éáðÛ öç äéÛñéáéá öçð äãéáöÛóóáóçð äðéááááéðíáðáé ç äðíáðüðçðá ðüí ÷ ðçóððí íá éáóáíððíðí ðéð äéÛöíñáð ððçñáóððð ðíð öíðð ðáñÝ÷ ðíðáé.

Ìé áééððáéÝð ððçñáóððð äðíáé ðñíáñÛíáðá ðíð áÝ÷ ðíðáé äðíáí áðü ððíéñáððíðá öçíáðí óíí äðéððí. ÈáóááÛééáðáé èÛéá ðñíððÛéáéá áéá íá äðíáé óðáñðñí ðéé óá ðñíáñÛíáðá áððÛ ááí éá èÛñíðí ðééáððíðá “äðéæðíéí”. Äðóðð÷ðð íé ðñíáñáíáðéóðÝð ááí äðíáé öÝéáéíé éáé éáðÛ éáéñíýð Ý÷ ðíðí äíðáíéóðáð ðáñéðððóáéð ðíð óðÛéíáðá óá áééððáéÝð ððçñáóððð Ý÷ ðíðí äðíáé áíðééáðíáíá áéíáðÛééáððóçð áðü áéóáíñéáðð áéá öçí äéðÝéáóç éáéüáíðéüí ðñÛíáñí. Äðíáé óçíáíðééü íá ðçí áíáñáíðíéðóáðá éáíéÛ áééððáéð ððçñáóðá ðÝ÷ ðé íá áíáéáéýðáðá ðéé öçí ÷ ðñáéÛæáððá. Ìðñáððá ðÛíðá íá öçí áíáñáíðíéðóáðá áñáñðáñá, áéðáéðíðáð íáíÛ öçí áóáñíñáð sysinstall ð ÷ ðçóéíðíéðíðáð ðéð äðíáðüðçðáð ðíð ðáñÝ÷ ðíðáé áðü öí äñ÷áñí /etc/rc.conf.

Το αρχείο `networking` είναι η βάση για την διαμόρφωση της δικτύου:

Οι Πίνακες 2-55. Διαμόρφωση Upper-level (Αντιπροσωπικό Διαμορφωτικό)



Στην οθόνη διαμόρφωσης, **Interfaces**, είναι ο κατάλογος των επιλογών για την διαμόρφωση της δικτύου. Στην Πίνακα 2.10.1, είναι επιλεγμένα τα αρχεία `amd` και `amd flags`.  
 Η επιλογή **AMD** διαμορφώνει το `amd` (αυτόματη φόρτωση) της FreeBSD. Αυτό επιτρέπει στην διαμόρφωση του `amd` να λειτουργήσει ως NFS (απόδοση δικτύου) και αρχείο `amd` διαμορφώνει το `amd` να λειτουργήσει ως NFS. Η επιλογή `amd flags` επιτρέπει στην διαμόρφωση της `amd` να λειτουργήσει ως NFS.

Η επιλογή **AMD Flags** επιτρέπει στην διαμόρφωση της `amd` να λειτουργήσει ως NFS. Η επιλογή `amd flags` επιτρέπει στην διαμόρφωση της `amd` να λειτουργήσει ως NFS. Η επιλογή `amd flags` επιτρέπει στην διαμόρφωση της `amd` να λειτουργήσει ως NFS.

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

Στην οθόνη διαμόρφωσης, η επιλογή `amd` επιτρέπει στην διαμόρφωση της `amd` να λειτουργήσει ως NFS. Η επιλογή `amd` επιτρέπει στην διαμόρφωση της `amd` να λειτουργήσει ως NFS. Η επιλογή `amd` επιτρέπει στην διαμόρφωση της `amd` να λειτουργήσει ως NFS.

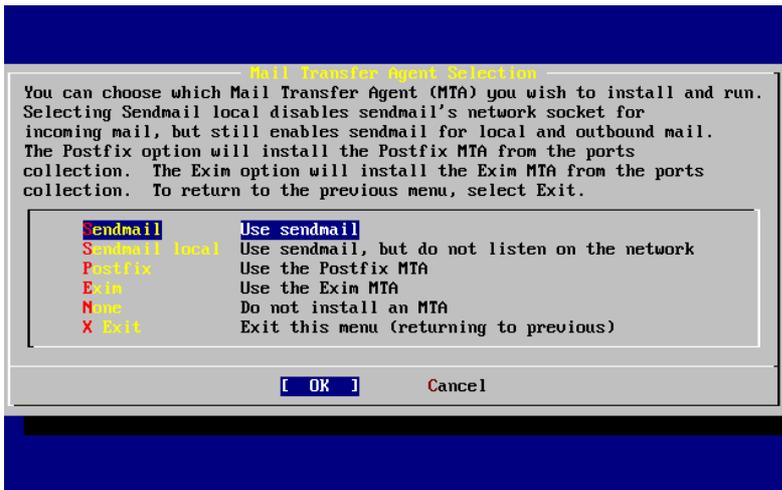
Στην οθόνη διαμόρφωσης, η επιλογή `anon ftp` επιτρέπει στην διαμόρφωση της `anon ftp` να λειτουργήσει ως NFS. Η επιλογή `anon ftp` επιτρέπει στην διαμόρφωση της `anon ftp` να λειτουργήσει ως NFS. Η επιλογή `anon ftp` επιτρέπει στην διαμόρφωση της `anon ftp` να λειτουργήσει ως NFS.

Η επιλογή `Gateway` επιτρέπει στην διαμόρφωση της `Gateway` να λειτουργήσει ως NFS. Η επιλογή `Gateway` επιτρέπει στην διαμόρφωση της `Gateway` να λειτουργήσει ως NFS. Η επιλογή `Gateway` επιτρέπει στην διαμόρφωση της `Gateway` να λειτουργήσει ως NFS.

Στην οθόνη διαμόρφωσης, η επιλογή `inetd` επιτρέπει στην διαμόρφωση της `inetd` να λειτουργήσει ως NFS. Η επιλογή `inetd` επιτρέπει στην διαμόρφωση της `inetd` να λειτουργήσει ως NFS. Η επιλογή `inetd` επιτρέπει στην διαμόρφωση της `inetd` να λειτουργήσει ως NFS.

Στην οθόνη διαμόρφωσης, η επιλογή `Mail` επιτρέπει στην διαμόρφωση της `Mail` να λειτουργήσει ως NFS. Η επιλογή `Mail` επιτρέπει στην διαμόρφωση της `Mail` να λειτουργήσει ως NFS. Η επιλογή `Mail` επιτρέπει στην διαμόρφωση της `Mail` να λειτουργήσει ως NFS.

### Ó÷ Ðíá 2-56. ÄðéíäP ÐñíäðéäáñÝñö MTA



Óðí óçíáβí áðöü óáð äβíáðáé ç äðíáðüðçðá íá äðééÝíáðá ðíéí MTA íá ääéáðáóðPóáðá éáé íá ñðèíβóáðá ùð ðñíäðéäáñÝñö Õí MTA ááí äβíáé ðβðíóá ðñéóóüðññí áðü ðíí äéáéñéóðP óá÷ ðññíñáβíð í ðíβíð ðññááβááé óá ðçýíáðá óðíð ÷ ñPóáð ðíð óðóðPíáðíð P ðí Internet.

Áí äðééÝíáðá Sendmail éá ääéáðáóðPóáðá óçí áçííóééP äóáñííäP äéáéñéóðP **sendmail** ç ðíβá äβíáé éáé ç ðñíäðéäáñÝñö áéá ðí FreeBSD. Ìá óçí äðééíäP Sendmail local éá ñðèíβóáðá ðí **sendmail** íá äβíáé ðí ðñíäðéäáñÝñö MTA, áééÛ éá áðñáññáðíðéçðáβ ç ééáíüðçðá ðíð íá éáíäÛíáé email áðü ðí Internet. Ìé Ûééáð äðééíäÝð ááP, Postfix éáé Exim áñíðí ðññíñéá ðá ðí Sendmail. Éáé íé äýí äéáíÝñöí email. Ûóðüóí éÛðíéíé ÷ ñPóáð ðñíðéííýí áððÝð ðéð áíáééáðéðééÝð éýóáéð MTA áðü ðí **sendmail**.

ÌáðÛ óçí äðééíäP áíüð MTA, P áí áðíóáóβóáðá íá ðçí äðééÝíáðá Ýíá MTA, éá äíðáíéóðáβ ðí ðññý ñýèíéóçð áééðýíð, ðá óçí áðüíáíç äðééíäP ðíð äβíáé NFS client.

Ç äðééíäP NFS client éá ñðèíβóáé ðí óýóðçíá óáð íá äðééíéíüíñáβ ðá Ýíá áíððçññáðçðP ðÝóü NFS. ðáð áíððçññáðçðP ðð NFS éáééóðÛ óðóðPíáðá áñ÷ áβñí äéáéÝóéíá ðñíð Ûééá ðç÷ áíPíáðá ðÝóü ðíð áééðýíð, ÷ ñçóéíððéíPíáð ðí ðññóüéíééí NFS. Áí ðí ðç÷ Ûíçíá óáð ááí äéáéÝóáé óýíááóç ðíðééíý áééðýíð, ðññáβðá íá áðPóáðá óçí éáéðíðñáβá áððP áðíäðéäáñÝñö. Õí óýóðçíá ðññáβ íá ÷ ñáéáóðáβ ðñéóóüðññáð ñðèíβóáéð áññüðñáíá. Äáβðá óðí ÕíPíá 29.3 áéá ðñéóóüðññáð ðççñíðññáð ñýèíéóçð ðíð ðñéÛðç éáé ðíð äéáéñéóðP.

ÉÛðü áðü óçí äðééíäP áððP ððÛñ÷ áé ç áíðβóðíé÷ç NFS server ç ðíβá áððéðñÝðáé íá ñðèíβóáðá ðí óýóðçíá óáð ùð áíððçññáðçðP NFS. Ðñíðóβéáíðáé ðá ðíð ðññðí áððü íé áðñáñáβðçðáð ðççñíðññáð áéá óçí áééβíçóç ðçð ððçññáóβáð RPC (remote procedure call). Õí RPC ÷ ñçóéíððéíáβóáé áéá ðíð óðíðíéóíü ðñí óðíáÝóáñí ðáðáíý ðñí éññáñí éáé ðñí ðññáññáñÛðñí.

Óðçí áðüíáíç áññáñP áñβóéáðáé ç äðééíäP Ntpdate ç ðíβá ÷ áéñβæáðáé ðíð óðá÷ ñííéóíü ðññáð. ¼ðáí äðééä÷ éáβ, áíðáíβæáðáé Ýíá ðññý ùðð ðí ðññáéÛðñ:





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```

Timecounter "i8254" frequency 1193182 Hz
CPU: AMD-K6(tm) 3D processor (300.68-MHz 586-class CPU)
  Origin = "AuthenticAMD" Id = 0x580 Stepping = 0
  Features=0x8001bf<FPU,VME,DE,PSE,TSC,MSR,MCE,CX8,MMX>
  AMD Features=0x80000800<SYSCALL,3DNow!>
real memory = 268435456 (262144K bytes)
config> di sn0
config> di lnc0
config> di le0
config> di ie0
config> di fe0
config> di cs0
config> di bt0
config> di aic0
config> di aha0
config> di adv0
config> q
avail memory = 256311296 (250304K bytes)
Preloaded elf kernel "kernel" at 0xc0491000.
Preloaded userconfig_script "/boot/kernel.conf" at 0xc049109c.
md0: 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 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 atkbdc0
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 0xfffff00 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 rsal 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:
```

Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου. Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου. Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου.

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### 2.10.16.2 Ἀσφάλεια FreeBSD/alpha

Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου. Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου. Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου.

```
>>>BOOT DKCO
```

Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου. Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου. Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου.

```
>>> SET BOOT_OSFLAGS A
>>> SET BOOT_FILE "
>>> SET BOOTDEF_DEV DKCO
>>> SET AUTO_ACTION BOOT
```

Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου. Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου. Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου.

### 2.10.17 Ἀσφάλεια FreeBSD

Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου. Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου. Ἡ ἀσφάλεια ἔχει ἠρῶσθαι εἰς τὸν ἰσχυρισμὸν τοῦ κλειδοκλειδίου.

The operating system has halted.





**2.** ÊäöÛöåñå íå íåêéíPóø ãðu ðí óêéçñí ãβóêí åéå ðñþòç öîñÛ íåðÛ ðçí ååéåðÛóóåç ðíø FreeBSD, í ðñþíáð öîñðíåíå éåé åíé÷÷ íåýåé ðí ðééëú ïíð, åêëÛ óðåíåðÛåé íå ðçíýíåðå ùðùð:

```
changing root device to ad1s1a panic: cannot mount root
```

Óé åβíåé êÛêíð; Óé ðñþíå íå êÛíú;

Óé åβíåé ðí ðíðíå bios\_drive: interface(unit, partition) kernel\_name ðíø åíðåíåðåé óçç åíðååéå ðçð åêéβíççðç;

ÓðÛñ÷åé åðu ðåéêÛ Ýíå ðñúåçíå ùðåíí í óêéçñíð ãβóêíð ãðu ðí ðñþíå βíñåðåç ç åêéβíççðç ååí åβíåé í ðñþíð ãβóêíð ðíø óóóðíåðíð. Óí BIOS ÷ñçóëíðñíéåβ åéåöíñåðééú óýóðçíå åñβéíççðç ãðu ðí FreeBSD éåé ç åýñåóç ðíø óóóðíý åñéëíý åéå êÛåå óóóåðP åβíåé åýóêéç.

Óççí ðåñβððóç ðíø ðí ãβóêíð åêéβíççðç ååí åβíåé í ðñþíð ãβóêíð ðíø óóóðíåðíð, ðí FreeBSD ðññåβ íå ÷ñåéåóåβ êÛðíååå åíðåååå åéå íå ðíñåé. ÓðÛñ÷íñí åýí óóíçééóíÝíåð ðåñéððóðåéð, åêëÛ éåé óóéð åýí ðñÝðåé íå ðåβðå óðí FreeBSD ðíø åå åñåé ðí ñéåéëú (root) óýóðçíå åñ÷åβñí. Áððú βñíåðåé ïñβåííðåð ðíñ åñééëú ðíø ãβóêíð óýíðùíå íå ðí BIOS, ðíñ óýðí ðíø ãβóêíð, éåé ðíñ åñééëú ðíø ãβóêíð óðí FreeBSD åíÛêíñå íå ðíñ óýðí ðíø.

Ç ðñþòç ðåñβððóç åβíåé åí Ý÷åðå åýí ãβóêíðð IDE, éåéÝíåð ïñéóíÝíð ùð master óðí åíðβóðíé÷÷ í IDE éåíÛéé, éåé êÝéåðå íå íåêéíPóåð ðí FreeBSD ãðu ðí ååýðåñí ãβóêí. Óí BIOS ðíð ãéÝðåé ùð ãβóêíðð 0 éåé 1, åñþ ðí FreeBSD ðíð ãéÝðåé ùð ad0 éåé ad2.

Óí FreeBSD åñβóéåðåé óðí ãβóêí 1 ðíø BIOS, óýðíð ad åñþ óðí FreeBSD óåβíåðåé ùð ãβóêí 2, Ûñå ðñÝðåé íå åðóåðå:

```
1: ad(2, a) kernel
```

Óçíåðóðå ùðé åí Ý÷åðå ãβóêí slave óðí ðñðòåýíñ éåíÛéé, ðí ðåñåððÛñ ãåí åβíåé åðåñåβòçðí (éåé åβíåé ðóóéåóðééÛ êÛêíð).

Ç ååýðåñç ðåñβððóç ðåñééåíåÛíåé óççí åêéβíççðç ãðu ãβóêí SCSI, ùðåí Ý÷åðå åðβòçð Ýíå P ðåñéóóúðåñíðð IDE ãβóêíð óðí óýóðçíå. Óççí ðåñβððóç åððP í åñééëúð ðíø ãβóêíð óðí FreeBSD åβíåé ÷åíçêúðåñíð ãðu ðíñ åíðβóðíé÷÷ ðíø BIOS. Áí Ý÷åðå åýí ãβóêíðð IDE éåé ðí SCSI ãβóêí, í SCSI ãβóêíð óåβíåðåé óðí BIOS ùð ãβóêíð 2, óýðíð da éåé åíåññññβåðåé óðí FreeBSD ùð ãβóêíð 0, éå åñÛóåðå:

```
2: da(0, a) kernel
```

Åéå íå ðåβðå óðí FreeBSD ùðé êÝéåðå íå åêééíPóåðåå ãðu ðíñ ãβóêí 2 ðíø BIOS ðíø åβíåé í ðñþíðð SCSI ãβóêíð ðíø óóóðíåðíð. Áí ãβ÷åðå Ýíå ùñññ IDE ãβóêí, éå ÷ñçóëíðñíéýóåðå ðí 1: åíðβ åéå 2:.

Ïúééð åñåβðå óéð óóóÝð ðéíÝð, ðññåβðå íå åÛéåðå ðççí åíðñéP, åéñéåþð ùðùð éå ðç åñÛóåðå, óðí åñ÷åβñí /boot.config ÷ñçóëíðñíéýóåð Ýíå óóíçééóíÝíð åðåñåñåóðP éåéíÝññ. Áí ååí ïñβóåðå åéåöíñåðééÛ, ðí FreeBSD éå ÷ñçóëíðñíéåβ ðå ðåñéå÷÷ ùíåíå ðíø åñ÷åβñí óóðíð ùð ðñíåðééñåP óççí ðñíðñíðP boot:.

**3.** Íåêéβíççðå åðu ðí óêéçñí ãβóêí åéå ðñþòç öîñÛ íåðÛ ðçí ååéåðÛóóåç ðíø FreeBSD, åêëÛ í Åéå÷åñéóððð Åêéβíççðç (Boot Manager) ðððñíåé åðéþð F? êÛåå öîñÛ óðí íåñýñ åêéβíççðç éåé ååí óðíñ÷÷βæåé ðåñéóóúðåñí.

Ååí ñðéíβóåðå óóóðÛ ðç ååñíåðñβå ðíø óêéçñíý ãβóêíð óðíñ åðåñåñåóðP éåðåöíPóåñí ùðåí ååéåðåððóåðå ðí FreeBSD. Ðçååβíåðå íåíÛ óðíñ åðåñåñåóðP éåðåöíPóåñí éåé ïñβóðå ðç óóóðP ååñíåðñβå ðíø óêéçñíý óåð ãβóêíð. ÐñÝðåé íå åðåñåñåóðåðåðåðå ðí FreeBSD åðu ðççí åñ÷P, íå ðç óóóðP ååñíåðñβå.

Άί άάί ίδρπνάβόά ίά άναβόά ίά έάΥίά όπνύδρ όç óóόδρ άάύίάόñβά άέά όι ίç÷Ùίçιά óάό, άρεέίÙόόά όρρ άέυετρεέι όπνύδρ: Ἀçίετρεñάρβόά ίέά ίέέñρ έάόÙόιçόç DOS óóçί άñ÷ρ ότρε άβóέτρε, έάέ άάέάόάόδρβόά όι FreeBSD ίάόÙ άδύ άόóú. Ότ όπνύάñάίά άάέάόÙόόάόç έά άάέ όçί έάόÙόιçόç ότρε DOS έάέ έά όπνύόδρερβόάέ ίά άίέ÷ίάγέάέ άδύ άόδρβί όçί óóόδρ άάύίάόñβά, έÙόέ όι ίδρβί ότρερεùδ όάόó÷άβίάέ.

Άάί óάó όóίέόóτγίά ίά άετρετρερβόάόά όι όάñάέÙόú, άέέÙ όι άόρβόάίά άαρ άδερβό ùó άίάóτñÙ:

Άί όóέÙ÷íάόά Υίά ίç÷Ùίçιά desktop ρ άίόδçñάόçόρ άέά άδρεέάέόόέέρ ÷ñρβóç άδύ όι FreeBSD έάέ άάί óάó άίάέάóΥñάέ όέέάίρ (ίάέετρεέέέρ) óóίάάóúόçόά ίά DOS, Linux ρ Ûέέτρε έάέότρεñάέέú óγóόçιά, Υ÷άόά άδβόçó όçί άδέέτρερ ίά ÷ñçóέτρετρερβόάά ίέúέέçñί όι άβóέτρε (óέΥάετρεόά όι A όóτρε άδάίάñάάόóρ έάόάóτρερβόάί), έάέ άδέέΥάετρεόά όç ίç÷óóÙίόάñ άδέέτρερ úδτρε όι FreeBSD έάόάέάίάÙίάέ ίέúέέçñί όι άβóέτρε άδύ ότρε όπνύδρ ùó ότρε óάέάόόάβί όñΥά. Ιά ότρε όπνύδρ άóóú άίάέάβóτρεόάέ úέά óά όπνύέρβίάόά ότρε άίάóΥñίόάέ óóç άάύίάόñβά, άέέÙ όδÙñ÷τρε έÙóτρεέ όάñέτρεόίτρε, άέóúó άί άάί όπνύέάέόάέ ότρεΥ ίά ÷ñçóέτρετρερβόάά ίδρετρερβόάά Ûέέτρε έάέότρεñάέέú άέóúó άδύ FreeBSD όóτρε óάέάέñέτρεΥñί άβóέτρε.

**4.** Ότ óγóόçιά άίέ÷íάγέάέ όçί έÙñόά άέέόγίτρε ñó ed(4), άέέÙ όάβññύ όóτρεΥ ÷άέά ίçγίάόά έÙετρεò (device timeout). Ç έÙñόά óάó άβίάέ όέέάίρβό óά άέάóτρεñάέέú IRQ άδύ άóóú ότρε Υ÷άέ ίñέóέάβ όóτρε άñ÷άβί /boot/device.hints Ότ όπνύάñάίά ίάρβáçόç ed(4), άδύ όπνύάδέέτρερ, άάί ÷ñçóέτρετρερβόάέ όέó ñόέτρεβόάέó ότρε άίάά÷ñΥñò Υ÷άόά έÙίάέ óóçί έÙñόά ίΥóú ότρε όπνύάñáότρε ñγέιέóçó ότρε όάñΥ÷άέ ί έάόάόέάόάóóρβό (‘‘soft configuration’’, όέó όέίΥó ότρε άρβόάόά ίΥóú EZSETUP όóτρε DOS). Ûóóúóί έά όέó ÷ñçóέτρετρερβόάέ άί ίñβóάóά όçί όέίρ -1 óóά hints όçó óóóέάόρβό.

Άβόά ίάόάέέτρερβόά όι άñά÷όέóέέúóρñά (jumper) όÙíú óóçί έÙñόά ρόóά ίά άρβόάά ÷άέñτρεβίçόάó (hard) ñόέτρεβόάέó (άέέÙάετρεόά έάέ όέó ñόέτρεβόάέó ότρε όόñρβίά άί άóóú άβίάέ άόάñάβóçóτρε), ρ άέέÙίόά όι IRQ óóçί όέίρ -1 ñόέτρεβίάέó όι hint hint.ed.0.irq=-1". Ιά ότρε όπνύδρ άόóú, ί όόñρβίάó έά ÷ñçóέτρετρερβόάέ όέó ñόέτρεβόάέó ότρε έÙίάόά ίΥóú ότρε όπνύάñáότρε EZSETUP.

Ιέά Ûέέç όέέάίτρεçóά άβίάέ ç έÙñόά óáó ίά ÷ñçóέτρετρερβόά όι IRQ 9 όι ίδρβί άβίάέ έίέίτρε ίά όι IRQ 2 έάέ άδτρεάέάβ óó÷ίÙ όçάρ όπνύέçίÙόúτρε (άέάέέÙ άί Υ÷άόά έÙñόά άñάóέέρβί ότρε ÷ñçóέτρετρερβόά όι IRQ 2!). όπνύόάέρβόά, άί άβίάέ άόίάóúτρε, ίά άδτρεγáάóά άίόάέρβό όç ÷ñρβóç óúτρε IRQ 2 ρ 9.

**5.** ¼όάί ÷ñçóέτρετρερβόάέ όι **sysinstall** óά Υίά όάñίάόέέú X11, ç έβόñέçç άñάίάόίóάέñÙ όÙίú όóτρε άίέ÷óú άέñέ óúφóί άβίάέ άóóάίÙάñúóç. ΌδÙñ÷άέ όπνύδτρε ίά άάέóέέέάβ ç άίόβέάόç óά άóóρ όçί άóάñίάρ;

Άί Υ÷άόά ράç άάέάόάóóçίΥίτρε όι X11, έάέ óά όπνύάδέέάάίΥίά ÷ñρβίάόά ότρε **sysinstall** έÙίτρε όι έάβίάτρε άóóάίÙάñúóóτρε όóτρε xterm(1) ρ ότρε rxvt(1), όπνύέΥóóά όι όάñάέÙóú όóτρε ~/ .xdefaults άέά ίά άçίετρεñάρβόάά Υίά όέτρε όέτρετρερ άέñέ óúφóί: XTerm\*color7:#c0c0c0

## 2.12 Ιάçäúò ἈέέάόÙόóάόçò άέά όñτρε÷úñçίΥίτρεò

*ΌόίάέόóτñÙ άδύ ότρε Valentino Vaschetto.*

Ότ ότρερβίά άóóú όάñέάñÙóάέ όúó ίά άάέάόάόóρβόάόά όι FreeBSD óά έάέάβóάñά ίç÷άίρβίάόά ρ / έάέ ίά ίç όóίçέέóίΥίτρεò όπνύδτρεò.

### 2.12.1 Άääääέóðñíðάð ðι FreeBSD óå Ýíά Óύóóçιά ÷ ùñßð Ìèùíç Þ Ðεçέðññέüääέι

Ïι åβårð áðøù ðçð åääåðÛóðάóçð ìñÛæåðåέ "headless install (åέÝóåç åääåðÛóðάóç)", åðåέß ðι ìç ÷ Ûíçιά ðøι ðñßì ãåέåßßóðάóå ðι FreeBSD åβðå åår Ý ÷ åέ óðíåñÝíç ðèùíç, åβðå åår Ý ÷ åέ ååί Ýñår VGA. Αί åíåñùðéÝóðå ðùð åβíåέ ðεέåíι ðÛðé ðÝðίέι, åβíåðåέ ìå ðçí ÷ ãßçç óåñéåέßð éñíóüéåð. Ç óåñéåέß ðñíóüéåå ååóéέÛ ÷ ãçóéñðñέåß Ýíå Ûέéι ìç ÷ Ûíçιά ðι ðñßì åñå ðð éýñéåå ðèùíç ååέ ðεçέðññέüääέí åέå ðι óýóóçιά. Άέå ðι óéñðø ððøù, åðεðð åéñέðεßððåðå ðå åßíåðååå ðçí åçíέðñåß åéóéåðñí åääåðÛóðάóçð, ùððð åíçååβðåέ ðøι ÏιÞíå 2.3.7.

ðåέðå, åέå ìå ìåðåðñÝøåðå ðεð åéóéÝðåð åððÝð ðððå ìå ìåέíÛíå ðå óåñéåέß ðñíóüéåå, åéñέðεßððåðå ðå åðùíååå åßíåðåå:

1. Åçíέðñåß åéóéåðñí Åέéβíççðð åέå Óåñéåέß Òñíóüéåå  
 Αί åðññέåéðι ìå åέέéìßððåðå åðù ðεð åéóéÝðåð ðñð ìüééð ððéÛíåðå, ðι FreeBSD åå ìåέβíååå ðççí ååñíέéß ðåðÛóðάóçç åääåðÛóðάóçð. ÒÝðñòìå ðι FreeBSD ìå ìåέìßððåέ ðå óåñéåέß ðñíóüéåå åέå ðçí åääåðÛóðάóçç ìåð. Άέå ìå ðι åÛíåðåå ððøù, åå ðñÝðåέ ìå ðñíóåñðßððåðå (mount) ðι boot . flp ðøι FreeBSD óýóóçιά óåð, ÷ ãçóéñðñέðñíðåð ðçí åíðñέßß mount(8).

```
# mount /dev/fd0 /mnt
Ïðñå ðñð Ý ÷ åðå ðñíóåñðßððåέ ðç åéóéÝðåå, ðñÝðåέ ìå ðÛðå ððñí ååðÛέñåí /mnt:
```

```
# cd /mnt
Ååð ðñÝðåέ ðεÝñí ìå ãðéìβðåðå ðçí åéóéÝðåå ðððå ìå ìåέíÛíå ç óåñéåέß ðñíóüéåå. ÐñÝðåέ ìå åçíέðñåßððåðå Ýíå åñ ÷ åβì ðñð ìñÛæåðå boot . config ååέ ðåñéÝ ÷ åέ ðι /boot/loader -h. Ïι ìññí ðñð åÛíåέ ððøù, åβíåέ ìå ðåññÛåέ ìåå ðåññÛåðññí (flag) ðøι boot loader ðððå ç åέéβíççç ìå åβíåðåå ðå óåñéåέß ðñíóüéåå.
```

```
# echo "/boot/loader -h" > boot.config
Ïðñå ðñð Ý ÷ åðå ãðéìβðåέ ðùóðÛ ðç åéóéÝðåå, ðñÝðåέ ìå ðçí åðñðñíóåñðßððåðå, ÷ ãçóéñðñέðñíðåð ðçí åíðñέßß umount(8):
```

```
# cd /
# umount /mnt
Ïðñåßðåå ððñå ìå óðåέñÝðåðå ðç åéóéÝðåå åðù ðññ ðåçåü.
```

2. ÓðíåÝñððåð Êåéßåέí Óýðñð Null-modem  
 × ãåέÛæåðåå ððñå ìå óðñåÝðåðå Ýíå ååéßåέí óýðñð null-modem ìåðåíý ðùí åýí ìç ÷ åíçíÛðùí. Άðεðð óðñåÝðåðå ðι ååéßåέí ððéð óåñéåέÝð ðññðåð ðùí åýí ìç ÷ åíçíÛðùí. *Αåí ðññðåðåðå ìå åñðéÝøåέ ååññέéü ðåñéåέüå ðåéßåέí, ÷ ãåέÛæåðåå ååéßåέí óýðñð null modem, ùðñð åÛðñέåå åðù ðå æåýæç ååèùåβñí åέåðåððñññíðåέ åðððåñέέÛ.*

3. Åέéβíççç åέå ðçí ÅääåðÛóðάóçç  
 ÷ åέ Ýñååέ ç ðñå ìå ðññ ÷ ùñßððñòìå ðççí åääåðÛóðάóçç. ÅÛέðå ðç åéóéÝðåå boot . flp ðøñ ðåçåü ðñð ìç ÷ åíçíÛðøðð ðñð èÝéåðå ìå åääåðåððððåðå ÷ ùñßð ðèùíç/ðεçέðññέüääέí, ååέ åíåñåñðñέððåðå ðι.

4. Óðñåääåßððå ìå ðι Headless Ìç ÷ Ûíçιά  
 Êå ðñÝðåέ ððñå ìå óðñåääåßððå ìå ðι ìç ÷ Ûíçιά óåð, ÷ ãçóéñðñέðñíðåð ðçí cu(1):
- ```
# cu -l /dev/cuad0
```

Αðøù åβíåέ! Ïðñåßðåå ððñå ìå åéÝåñåðå ðι headless ìç ÷ Ûíçιά ìÝðð ðçð óýíååðð cu. Êå óåð æçðßðåέ ìå åÛέåðå ðçí åéóéÝðåå kern1 . flp, ååέ åå óåð æçðßðåέ ååðððéí ìå åðééÝñåðå ðι åβåñð ðñð ðåññåðééñý ðñð åå ÷ ãçóéñðñέççåßß. ΆðééÝñåðå ðçí Ýå ÷ ãñüç éñíóüéåå (FreeBSD color console) ååέ óðñå ÷ βððå ìå ðçí åääåðÛóðάóçç óåð.









**Όσιάβυός:** Έαερε ίάεείΰοά οσι άεεάοΰοόαός, ς οάείβιά δñÝδαέ ίά άβιάέ οοί ίαϭά δñεί ίάεείΠοάοά άδυ ος άεοέΥοά άεεβίσοδο. Άεάοιñάοεέΰ, ίδιñάβ ίά άδοίόϭ-άε ς άίβ-ίάοός ος άδυ ος άεάάεεάοβιά άεεάοΰοόαός.

### 2.13.6 Δñεί ΆεέαόαόοΠοάοά ίΎού Άεέοýιό

Όδΰñ-ίοί οñάεο άεάεΎοείρε όýθιε άεέδοάεΠο άεάοΰοόαόςο. Ethernet (οδοθίθιέσιΎίπο άεάεοδΠο Ethernet), ΟάεέαεεΠο Έýñάο (SLIP Π PPP), Δάñΰεέϭεϭο Έýñάο (PLIP (εάεθαεί laplink)).

Άεά οσι αñϭαίñυοάñϭ άοίάοΠ άεάοΰοόαός ίΎού άεέοýιό, Ύιάο άεάεεοδΠο Ethernet άβιάέ θΎίοά εάεΠ άδεείαΠ! Οι FreeBSD οθίροϭñβαεέ οεο δάñεοοóυοάñάο είείΎο εΰñοάο Ethernet. Ιδιñάβοά ίά αñάβοά Ύία θβιάέά ουί οθίροϭñεαυιλάñυί έαñoθρί (εάε οεο άδαέοίγίλáiάο ñοειβοάέο θιτοδ) οόεο ΌσιάεΠοάέο Όεείγ (Hardware Notes) εΰεά Ύεαίροϭ FreeBSD. Αί ϭ-ñϭοείθιεάβδó εΰθιεά άδυ οεο οθίροϭñεαυιλάñυί εΰñοάο Ethernet PCMCIA άάαέυεάβδó υοε οσι Ύ-άοά άΰεάε οοσι οθίάι-Π δñεί αíαñάθιεΠοάοά δι οιñοδυ οθιεαέοοδΠ οάο! Οι FreeBSD άαί οθίροϭñβαεέ άοοόο-Ππο άδοΠ ος οδεάΠ οσι άθεοúθιρ άεοάαυαΠ έαñoθρί PCMCIA εάοΰ ος άεΰñεάέα ος άεάοΰοόαόςο.

εά δñÝδαέ άδβόϭο ίά ίΎñάοά εέα δι άβεοοί οάο, ος άεάγέοίρος IP οάο, οσι οείΠ ος ιΰοεάο οθίρεέοýιό (netmask) εέα ος έεΰοϭο οίρ άεέοýιό οάο, έάε οί υñιά οίρ ίϭ-άίβιάοίρ οάο. Αί εΰΎίάοά άεάοΰοόαός ίΎού όγίάαοϭο PPP έάε άαί Ύ-άοά οόάοεεΠ άεάγέοίρος, ίϭί άίϭοϭ-άβδó εάεΠο ι ISP οάο ίδιñάβ ίά οάο άποάε άεάγέοίρος άοίάιέΰ. Ι εέα-άεñεοοδΠο οίρ οοόοΠιάοίρ οάο, ίδιñάβ ίά οάο άποάε οεο οείΎο θιρ δñÝδαέ ίά ϭ-ñϭοείθιεΠοάοά εέα οί άβεοοίρ οάο. Αί δñυέεοάε ίά αíαάñεάβδó οά ΰεέα ίϭ-άίβιάοά ίά ϭ-ñβόϭ οίρ ίñυιάοίρ οίρδ άίββ εέα οσι εάγέοίρος IP οίρδ, εά ϭ-ñεάοόάβδó άδβόϭο Ύία εέαñεοόοΠ ίñΰουί (DNS) έάε δεέαίυί ος εάγέοίρος ίεάο θýϭεο (gateway) (άί ϭ-ñϭοείθιεάβδó PPP, δñυέεοάε εέα ος εάγέοίρος IP οίρ δάñ-Ύά οάο) εέα ίά άδεείεíυΠοάοά ίά άδουί. Αί εΎεάοά ίά εΰΎίάοά FTP άεάοΰοόαός εέαΎοίρ ίάοίεάαϭοΠ HTTP, εά δñÝδαέ ίά ίΎñάοά άδβόϭο ος εάγέοίρος οίρ ίάοίεάαϭοΠ (proxy). Αί άαί ίΎñάοά οεο άδαίρΠοάέο οά υεάο Π οεο δάñεοοóυοάñάο άδυ άδοΎο οεο άδαίρΠοάέο, εά δñÝδαέ δñΰάιάδε ίά ίεεΠοάοά οοί εέα-άεñεοοδΠο οίρ οοόοΠιάοίρ οάο Π οίρ ISP οάο δñεί άδε-άεñΠοάοά άδοδυ οίρ όγθί άεάοΰοόαόςο.

ϭ οθίροδΠñείϭ SLIP άβιάέ εΰδουο δñυοαίϭ, έάε δñάεοεέΰ δάñείñβαεάοάε οά οδοέεΎο οοίΎάοεο, υδου εέα δάñΰάεεαίΎά Ύία οάεñεάευ εάεθαεί άΰΎάοά οά Ύία οιñοδυ εέα Ύία ΰεείρ οθιεαεέοδΠο. ϭ όγίάαός δñÝδαέ ίά άβιάέ οδοέεεΠ έάε ΰιάοϭ, εάεΠο ϭ άεάοΰοόαός ίΎού SLIP άαί δάñΎ-άε άδοΠ ος οδεάΠ άοίάουοϭοάο άδεείαεέΠο (dial up) όγίάαόςο. ϭ άοίάουοϭοά άδοΠ δάñΎ-άοάε άδυ οί δñυαñάιΎά PPP, οί ίθίβι εέα εά δñÝδαέ ίά δñυοείϭεάβ οά ο-Ύός ίά οί SLIP υθίρ άδοδυ άβιάέ άοίάουί.

Αί ϭ-ñϭοείθιεάβδó modem, ουοά οί PPP άβιάέ ο-άαυί οβάιροñά ϭ ιυίϭ οάο άδεείαΠ. Άάαέυεάβδó υοε Ύ-άοά ΰιάοά εέαεΎοείλδ οεο δϭϭñίοίñβάο εέα οίρ δάñ-Ύά οάο, εάεΠο εά οεο ϭ-ñεάοόάβδó ο-άοεέΰ ίñυβδ οοϭ εέαεέαόβιά άεάοΰοόαόςο.

Αί ϭ-ñϭοείθιεάβδó PAP Π CHAP εέα ίά οοίΎάεάβδó ίά οίρ ISP οάο (ίά ΰεέα ευαέα, ίδιñάβδó οόά Windows ίά οοίΎάεάβδó ίά οίρ ISP οάο ϭ-ñβδο ίά ϭ-ñϭοείθιεΠοάοά script), ουοά οί ιυιί θίρ εά ϭ-ñεάοόάβδó άβιάέ ίά αñΰοάοά οςί άίθίεΠ dial οοϭί δñίθñίρδ οϭε άοάñίρδ **ppp**. Άεάοιñάοεέΰ, εά δñÝδαέ ίά ίΎñάοά δουο ίά εάεΎοάοά οίρ ISP οάο, ϭ-ñϭοείθιεΠρίόάο άίθίεΎο “AT commands” ίε ίθίββάο άβιάέ οόάεάεñείΎίάο εέα οί modem οάο, εάεΠο οί δñυαñάιΎά εεΠοάυί οίρ PPP (dialer) δάñΎ-άε Ύία θίεγ άθευ αñιυέυοδΠο οάñίάοεείγ. ΑίάοñΎίόά οοί user-ppp handbook εέα FAQ ([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/books/faq/ppp.html](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/faq/ppp.html)) εέα δάñεοοóυοάñάο δϭϭñίοίñβάο. Αί Ύ-άοά δñίάεΠιάόά, ίδιñάβδó ίά εάοάοεýίάοά οςί εάοάαñάοΠ (logging) οοϭί ρευίϭ ίά οςί άίθίεΠ set log local . . .

Αί οδΰñ-άε εέαεΎοείϭ οδοέεΠ όγίάαόςο ίά ΰεείρ ίϭ-ΰίϭία FreeBSD (Ύεαίροϭ 2.0-R Π ίάοάαήΎοόάñϭ), ίδιñάβδó άδβόϭο ίά άεάοάοδΠοάοά ίΎού δάñΰεέϭειρ εάευαβίθ “laplink”. ϭ οά-γοϭοά ίάδΰάιρδ άάαñΎίυί ίΎού οςο δάñΰεέϭεϭο έýñάο άβιάέ άñεάοΰ οϭϭευοάñϭ οοίΠεουο άδυ υοε οςο οάεñεάεΠο (ίΎ-ñε 50 kbytes/sec), ίά άθίρΎεάοίΎά αñϭαίñυοάñϭ άεάοΰοόαόςο.



# ΕὰοÛεάεί 3 ΆάόέέÛò ίίίεάò óοι UNIX®

ΑίάέαυñçιÛί άδυ όι Chris Shumway.

## 3.1 Óýίίøç

Ôι άευειόει εάοÛεάεί εά εάέÛøάέ όέδ άάόέέÛò άίόιεÛò εάέ εάέόιόñάβάò όιò εάέόιόñάέειÛ όόόóΠιάόιò FreeBSD. Ôι ίάάάέÛόάñι ίÛñιò άόóòò όçò ÷έçò ó÷-άóβεάόάέ ίά υέά όά È.Ó. ðιò άβίάέ άάόέóιÛίά όóι UNIX. ΆÛί ç ÷έç óάò óάβίάόάέ ίέέάβά ίðñάβóά ίά εέάóñÛίάόά άñΠάíñά άόóυ όι εάοÛεάεί. ΆÛί - άίόέέÛòò - άβóóά ίÛιò óóι FreeBSD óυóά ίðυóάΠðιόά εά ðñÛðάέ ίά εέάáÛóáóά ðñιόάέóέέÛ ίευίέçñι όι εάοÛεάεί.

ÎάóÛ όçί άίÛάñύç όιò εάóάέάβιò, εά άññβεάóά:

- ðυò ίά ÷ñçóειíðιεάβóά όέδ “άέέίέέÛò έίίóυέάð” όιò FreeBSD.
- ðυò εάέόιόñάίí ίέ Ûάάέάð άñ÷-άβυí óóι UNIX εάέ εά εάόάέÛάάóά όçί ÷ñΠóç óυí file flags óóι FreeBSD.
- Ôçί ðñιáðέέάάίÛίç εέÛóάίç όιò óóóóΠιάόιò άñ÷-άβυí όιò FreeBSD.
- Ôçί ññáÛύóç óυí άβóέυí óóι FreeBSD.
- Ôέ άβίάέ εάέ ðò εάέόιόñάβ ç ðñιóÛñóç (mount) εάέ άðιðñιóÛñóç (unmount) óóóóçìÛóυí άñ÷-άβυí.
- Ôέ άβίάέ ίέ εέάñάάóβáð (processes), óά óΠιáóá (signals) εάέ ίέ άάβιííáð (daemons).
- Ôέ άβίάέ όι εÛέóóιò (shell) εάέ ðυò ίά εέέÛεάóά όι ðñιáðέέάάίÛί ðñéáÛεεíí άñάáóβáð.
- ðυò ίά ÷ñçóειíðιεάβóά άάόέέÛ ðñιáñÛιáóά áðáíñάáóβáð εάέίÛίíò (editors).
- Ôέ άβίάέ ίέ óóέáóÛò (devices) εάέ óά άñ÷-άβά óóóέáóòò (device nodes).
- ðιεά Ûέαιóç εέóáεÛóέιυí ÷ñçóειíðιεάβóάέ óóι FreeBSD.
- ðυò ίά εέάáÛεάóά όέδ óάέβáð άιççέάβáð (manual pages) áέά ðñéóóóυóáñáð ðççñιíñβáð.

## 3.2 ΆέέίίέέÛò Èίίóυέáò εάέ ÓáñιáóέέÛ

Îðñάβóά ίά ÷άέñέóóάβóά όι FreeBSD ίά εέÛóειíðιò óñυðιò. ίάð άδυ άóóίÛò, άβίάέ ðççéóñιεάβίόáð άίόιεÛò εάέίÛίíò óά Ûίά óáñιáóέέυ. Îά άóóυ όιí óñυðι Û÷-άóά óóá ÷Ûñέά óáð Ûίά áóÛέέóι εάέ áóíáóυ εάέόιόñάέέυ óýóóçιá UNIX. Άóóò ç áíυóçóά ðñéáñÛóáé óé άβίάέ óά “óáñιáóέέÛ” εάέ ίέ “έίίóυέáð” εάέ ðυò ίðñιííί ίά ÷ñçóειíðιεçèίíί óóι FreeBSD.

### 3.2.1 Ç Èίίóυέά

ΆÛί άáí Û÷-άóά ñóειíβóáέ όι FreeBSD ίά ίάέέíÛ áóóυιáóά εÛðιεíí áñáóέέυ ðñéáÛεεíí άñάáóβáð, óυóά άίÛóυð ίáóÛ όçί áέέβίçç όιò óóóóΠιáόιò εάέ όçί ίεíεεΠñóç óυí óáíáñβυí áέέβίççóçò (startup scripts) εά άιόáίέóóάβ ç ðñιðñιð óýíááççò (login prompt). Èά άάβóά εÛóέ ðáñυíεíí óóçί ίευίç óáð:

```
Additional ABI support:.  
Local package initialization:.  
Additional TCP options:.
```

















Ίέα ðëÞñç ðãñéãñáòÞ óçò éãñãñ ÷ βáò òìò óòóòÞιáòìò áñ ÷ áβùì áβιáέ áεάεΎóειç óòì hier(7). Άέεϊεòεáβ ιέα óύíòìç áιáóεùðçόç ιá ðìòò ðέι όðìÞεάέò éáòáεùüáìòò.

| Έαοΰεαίεò       | ðãñéãñáòÞ                                                                                                                                                                                                                                                                                                                                 |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /               | Ñέæéεùò (root) éáòΰεαίεò òìò óòóòÞιáòìò áñ ÷ áβùì.                                                                                                                                                                                                                                                                                        |
| /bin/           | × ñÞóειá áñááέáβá áεά ðãñéáΰεεϊί áíúò Þ ðìεéáðëÞι ÷ ñçόòÞι.                                                                                                                                                                                                                                                                               |
| /boot/          | ðñìãñΰìáòá éáέ áñ ÷ áβá ñòεìβóáùì ðìò ÷ ñçόεìðìεíýíóáέ éáòΰ óçι áêéβίçόç òìò éáέòìòñáεêý óòóòÞιáòìò.                                                                                                                                                                                                                                      |
| /boot/defaults/ | ðñìεáεìñέóìΎίá áñ ÷ áβá ñòεìβóáùì áêéβίçόçò, äáβòá loader.conf(5).                                                                                                                                                                                                                                                                        |
| /dev/           | Άñ ÷ áβá óòóéáòÞι, äáβòá intro(4).                                                                                                                                                                                                                                                                                                        |
| /etc/           | Άñ ÷ áβá ñòεìβóáùì óòóòÞιáòìò éáέ óáíΰñéá áêéβίçόçò.                                                                                                                                                                                                                                                                                      |
| /etc/defaults/  | ðñìεáεìñέóìΎίá áñ ÷ áβá ñòεìβóáùì óòóòÞιáòìò, äáβòá óçι rc(8).                                                                                                                                                                                                                                                                            |
| /etc/mail/      | Άñ ÷ áβá ñòεìβóáùì áεά ðñΰέòìñáò ιáóáóìñΰò çεáêòñ. óá ÷ ðãññíáβìò (ÌÓÁ) üðùò ðì sendmail(8).                                                                                                                                                                                                                                              |
| /etc/namedb/    | Άñ ÷ áβá ñòεìβóáùì named, äáβòá named(8).                                                                                                                                                                                                                                                                                                 |
| /etc/periodic/  | Óáíΰñéá éáέòìòñáεÞι ðìò òñΎ ÷ ðìí óá çìáñÞóεá, äáññááέáβá, éáέ ιçιέáβá áΰόç, cron(8); äáβòá periodic(8).                                                                                                                                                                                                                                  |
| /etc/ppp/       | Άñ ÷ áβá ñòεìβóáùì ppp, äáβòá ðεò ppp(8).                                                                                                                                                                                                                                                                                                 |
| /mnt/           | Έáíúò éáòΰεαίεò ðìò óòìÞεùò ÷ ñçόεìðìεíéáβóáέ áðu òìòò áεά ÷ áεñέóòΎò óòóòçìΰòùì ùò ðñìóùñέíú óçìáβì ðñìóΰñòçόçò.                                                                                                                                                                                                                         |
| /proc/          | Óύóόçιá áñ ÷ áβùì áεáñááóéÞι, äáβòá ðεò procfs(5), mount_procfs(8).                                                                                                                                                                                                                                                                       |
| /rescue/        | ðñìãñΰìáòá ιá óóáóέέÞ óύíááόç (static link) áεά áóóáέÞ áðáíáóìñΰ óòóòÞιáòìò, äáβòá óçι rescue(8).                                                                                                                                                                                                                                         |
| /root/          | ðñìóùðέέεùò éáòΰεαίεò òìò ÷ ñÞόç root.                                                                                                                                                                                                                                                                                                    |
| /sbin/          | ðñìãñΰìáòá óòóòÞιáòìò éáέ ÷ ñÞóειá áñááέáβá áεά ÷ áβñέόçò áεά ðãñéáΰεεϊί áíúò Þ ðìεéáðëÞι ÷ ñçόòÞι.                                                                                                                                                                                                                                       |
| /tmp/           | ðñìóùñέíΰ áñ ÷ áβá. Óá ðãñéá ÷ ùìáíá òìò /tmp óòìÞεùò äáí áεάóçñìýíóáέ ιáòΰ áðu áðáíáêéβίçόç òìò óòóòÞιáòìò. Óòì /tmp óòìÞεùò ðñìóáñòΰóáέ Ύίá óύóόçιá áñ ÷ áβùì ιíÞιçò. Άòòù ιðìñáβ ιá áðέóáò ÷ εáβ áòòñΰòùò ÷ ñçόεìðìεíÞιáò ðεò ó ÷ áòέέΎò ιáóááεçòΎò tmpmfs òìò rc.conf(5) (Þ ιá ιέα éáòá ÷ Þñçόç óòìí /etc/fstab, äáβòá óçι mdmfs(8)). |
| /usr/           | ðãñéΎ ÷ ðìóáέ ó ÷ ááùì üεá óá áιçεçòέέΰ ðñìãñΰìáòá éáέ ιé áòáññáΎò ÷ ñçόòÞι.                                                                                                                                                                                                                                                              |
| /usr/bin/       | Έίεíú ÷ ñçόóá áιçεçòέέΰ ðñìãñΰìáòá, áñááέáβá ðñìãññíáóέóìíý, éáέ áòáññáΎò.                                                                                                                                                                                                                                                                |

**Εὰὸὐεἰαῖρὶ**

- /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/
- /var/spool/
  
- /var/tmp/
  
  
- /var/yp/

**Ḑañeãñãöb**

Óὸὐἰὸάñ ãñ ÷ ḁβḁ ὀδῖḁñβεçøçð C (include files).  
 Ἀñ ÷ ḁβḁ ḁεḁεῖτεçêþḱ.  
 Ἀεὐὸἰñḁ ḁñ ÷ ḁβḁ ḁḁḁñ Ὶῖῖ ḁῖçèçðεéþḱ ḁñḱḁñḁñḁὐὸῖ.  
 Ἀḁβḱḱḱḱḁ ὀὸὸὸḐḱḁὸῖð & ḁῖçèçðεéḁḁ ḁñḱḁñḁñḁὐὸḁḁ  
 ὀὸὸὸḐḱḁὸῖð (ḁεὸḁεῖῖῖῖḁε ḁḁῖ Ὶεεḁ ḁñḱḁñḁñḁὐὸḁḁ).  
 ὐῖḁεéḁḁ ḁεὸḁεῖὶḁḁ, ḁεḁεῖτεḐεḁð, εὸε. Ἀḁβὸçð ḁβḱḱḁ  
 εḁé ἱ ḁñḱḁεῖñεὸῖ Ὶῖḁ ḁñḱḁεῖῖῖḁ ḁεḁ ḁñḱḁñḁñḁὐὸḁḁ ḁῖḁ  
 ḁḁεḁεβὸὸḁḁḁḁḁ ḁḁῖ ὀḁ ports ḁῖḁ FreeBSD. ἸῚḁḁ ὀὸῖ  
 /usr/local, ÷ñçὀεῖῖḁḁḁḁḁ ḁḁḁḁḁ ḁ ḁεὐὸḁḁḁ ḁῖḁ  
 /usr ḁῖḁ ḁñeãñḁñḁὐὸḁḁε ὀὸῖ hier(7). Ἀḁḁḁñḁῖῖḁε ἱε  
 εḁὸὐεἰαῖρῖε ὀḁεβḁῖῖ ḁῖçèḁḁḁð man, ḁῖḁ ḁñβὸεḁḁḁε Ὶḁḁḁḁ  
 εὐὸḁ ḁḁῖ ḁῖḁ /usr/local εḁé ἱ ÷ εḁḁḁḁ ḁḁῖ ḁῖḁ  
 /usr/local/share, εḁḁḁð εḁé ç ὀḁεῖçñβḁḁç εὐεḁḁ port  
 ḁῖḁ ḁñβὸεḁḁḁε ὀὸῖ share/doc/port .  
 ἈῚῖḁḁñḁ ḁñḱḁεῖῖῖḁḁ ḁῖḁ ḁḁḁñḁὐὸḁḁε ḁḁῖ ὀçḁ ḁñ ÷ εὸḁḁεὸῖḁḁḁḁḁ  
 ḁῖḁ ἱç ÷ ḁῖḁḁḁḁḁḁ εḁé ḁḁñḁḁḁḁḁ ἱḁḁḁḁεῖḁὸὸḁḁḁḁḁ ḁῖ  
 ḁῚῖḁḁñḁ /usr/src.  
 Ç ὐὸεῖḁḁ Ports ḁῖḁ FreeBSD (ḁñḱḁḁḁḁḁḁḁ).  
 Ἀḁβḱḱḱḱḁ ὀὸὸὸḐḱḁὸῖð & ḁῖçèçðεéḁḁ ḁñḱḁñḁñḁὐὸḁḁ  
 ὀὸὸὸḐḱḁὸῖð (ḁεὸḁεῖῖῖḁε ḁḁῖ ÷ ñḐὸḁḁð).  
 Ἀñ ÷ ḁβḁ ḁḁḁḁñḁḁçὸḁḁ ḁḁῖ ὀçḁ Ἀñ ÷ εὸḁḁεὸῖḁḁḁḁ ḁῖḁ  
 ἱç ÷ ḁῖḁḁḁḁḁḁ.  
 Ἀñ ÷ ḁβḁ BSD εḁé/Ḑ ḁῖḁεéḁḁ ḁñ ÷ ḁβḁ ḁçḁḁḁḁḁ ḁḁḁḁḁ.  
 Ἀεὸḁεῖὶḁḁ, ḁεḁεῖτεḐεḁð, εὸε. ḁεḁ ὀçḁ ḁεḁḁñḁ X11R6  
 (ḁñḱḁḁḁḁḁḁḁ).  
 Ἀñ ÷ ḁβḁ ḁḁḁḁḁñḁḁḁ (log) ḁεḁḁḁñḁḁḁ ÷ ñḐὸḁḁḁḁḁ, temporary,  
 transient, εḁé spool. ἱḁñεéῚð ὀḁñῚð ḁñḱḁḁḁñḁḁὐὸḁḁε ὀὸῖ  
 /var Ὶḁḁ ὀḁḁḁḁḁḁ ḁñ ÷ ḁβḁḁḁ ἱῖḐḁḁ. Ἀḁḁḁ ἱḁñḁḁḁ ἱḁ  
 ḁḁεḁḁḁð ÷ εḁḁḁ ḁḁḁḁḁḁḁḁ ÷ ñçὀεῖῖḁḁḁḁḁḁ ḁεḁ ὀ ÷ ḁḁεéῚð  
 ἱḁḁḁḁḁçðῚð varmfs ḁῖḁ rc.conf(5) (Ḑ ἱḁ ἱβḁ εḁḁḁḁ ÷ þñçὸç  
 ὀὸῖ /etc/fstab, ḁḁḁḁḁ ḁεḁ mdmfs(8)).  
 Ἀεὐὸἰñḁ ḁñ ÷ ḁβḁ ὀḁḁḁḁḁḁḁḁ ḁῖḁ ὀὸὸὸḐḱḁὸῖð.  
 Ἀñ ÷ ḁβḁ ḁñḁḁḁḁḁḁḁḁḁḁḁḁḁḁḁ (mailbox) ÷ ñçὸḁḁḁḁ.  
 Ἀεὐὸἰñḁ εḁὸὐεἰαῖρῖε ḁḁñḁ ÷ Ὶḁḁḁçðð (spool) ḁεὸḁḁḁḁḁḁḁ  
 εḁé çḁḁεὸñḁḁḁḁḁ ḁεççḁḁḁḁḁḁḁḁ ḁῖḁ ὀὸὸὸḐḱḁὸῖð.  
 Ḑñḁḁḁñḁḁḁḁḁ (temporary) ḁñ ÷ ḁβḁ. ὐḁ ḁñ ÷ ḁβḁ ḁḁḁḁ  
 ὀḁḁḁḁḁḁḁ ḁεḁḁçñḁḁḁḁḁ εḁḁḁḁ ὀçḁ ḁεḁḁñεḁḁḁ ḁḁḁḁḁḁḁḁḁḁḁḁḁḁ  
 ḁῖḁ ὀὸὸὸḐḱḁὸῖð, ḁεḁḁḁ ḁḁ ἱ /var ḁβḁḁḁ Ὶḁḁ ὀḁḁḁḁḁḁḁḁ  
 ḁñ ÷ ḁβḁḁḁ ἱῖḐḁḁḁ.  
 Ἀḁḁḁḁḁḁḁḁḁḁ (maps) NIS.

### 3.5 ÌñāÙñòç Ἀβóεῖò

Ç ðéññóðñç ðñÙάά ðñāÙñòçò ðñò ÷ñçóεῖðñέάβ ðñ FreeBSD áέά ðá ãñáé ãñ÷áβá Ἀβίάé ðñ ùññá ãñ÷áβñò. Óá ðñññáóá ãñ÷áβññ ìβñíáé ãðáβòççóá óóá éáðáéάβá- ðéññÙ, ðñ ðññññ ðçññáβñáé ùðé ðñ `readme.txt` éáé ðñ `README.TXT` Ἀβίáé äýñ áéáðññáðóééÙ ãñ÷áβá. Óñ FreeBSD äáñ ÷ñçóεῖðñέάβ ðçñ ãðÝέðáóç .txt ãñ÷áβñò áέά ðá ðñññóáéññβóáé áñ Ýñá ãñ÷áβñ Ἀβίáé ðññáññá, Ð Ýáñáóñ, Ð Ùεεῖð óýðñð ãáãñÝññ.

Óá ãñ÷áβá äðñçéäýññóáé óá éáðáéññòð. ðáð éáðÙεῖññò ðñññáβ ðá ðçñ ðññéÝ ÷áé ãñ÷áβá, Ð ðñññáβ ðá ðññéÝ ÷áé áéáðññòÙáðð ãñ÷áβá. ðáð éáðÙεῖññò ðñññáβ Ἀðβòçð ðá ðññéÝ ÷áé Ùεεῖðð éáðáéññòð, ἈðéðñÝðññóáð óáð ðá éáðáóééáðÙóáðð ðéá éáñáñ÷ééÐ ãñÐ éáðáéññññ ùðñò éáðÙεῖññé áóùééáβññò Ùεεῖðð éáðáéññòð. Ἀððñ ðáð ἈðéðñÝðñé ðá ðññáñññòñá ðá ãáãñÝñá ðáð ðñéý Ἀðéññóðñá.

Ç áñáðññÙ óá ãñ÷áβá éáé éáðáéññòð Ἀβñáðáé Ἀβññóáð ðñ ùññá ãñ÷áβñò Ð ðñ ùññá éáðáéññòð, áéññéðéáβ ðβá Ἀñéóáññóðñòç éÙεáðñð, / éáé Ýðáéóá ðñéññáÐðñòá Ùεεῖ éáðÙεéççñ ùññá éáðáéññòð. ἈÙñ Ý÷áðá ðññ éáðÙεῖñññ `foo`, ðñ ðñññò ðññéÝ ÷áé ðññ éáðÙεῖñññ `bar`, ðñ ðñññò ðññéÝ ÷áé ðñ ãñ÷áβññ `readme.txt`, ðñðá ðñ ðññéççñññ ðññ ùññá, ἈéáãñññÐ (path) óðñ ãñ÷áβñ Ἀβñíáé `foo/bar/readme.txt`.

ÉáðÙεῖññé éáé ãñ÷áβá äðñçéäýññóáé óá Ýñá óýóðçñá ãñ÷áβññ. ÉÙεá óýóðçñá ãñ÷áβññ ðññéÝ ÷áé Ýñá éáðÙεῖñññ óðñ ðññññ Ἀðβðáññ, ðñ ðññÙεáðáé *root* (ñéáééñð) éáðÙεῖññò áéá ðñ óðáéáññéñÝññ óýóðçñá ãñ÷áβññ. ðñ *root* éáðÙεῖññò ðñññáβ ðá ðññéÝ ÷áé Ùεεῖðð éáðáéññòð.

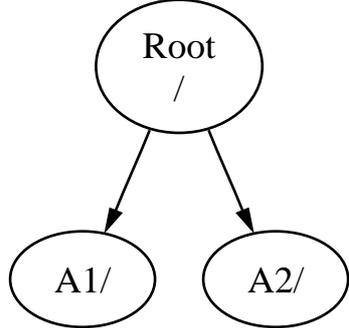
Ἀððñ ðééáññð Ἀβñíáé ðáññññéñ ðá ðñéññáÐðñòá Ùεεῖ éáéóñññáééññ óýóðçñá Ý÷áðá ÷ñçóεῖðñέáé. Ùóððññ ððÙñ÷áé ðññééÝð ðéáðññÝð. Ἀéá ðáñÙáééññá, ðñ MS-DOS ÷ñçóεῖðñέáβ \ áéá ðá áéá÷ññβáé ðñññáðá éáðáéññññ éáé ãñ÷áβññ, Ἀñ ðñ Mac OS® ÷ñçóεῖðñέáβ :

Óñ FreeBSD äáñ ÷ñçóεῖðñέáβ ἈñÙññáðá ðáçáññ Ð ðñññáðá ðáçáññ ðçç áéáãñññÐ. ἈðñÝññð äáñ éá ðññÝðñé ðá ãñÙóáðá `c:/foo/bar/readme.txt` óðñ FreeBSD.

ἈñéééÝððð, Ýñá óýóðçñá ãñ÷áβññ éáéññβáéðáé ùð *root* óýóðçñá ãñ÷áβññ. ðñ ðñéáééñð éáðÙεῖññò ðññ *root* óðóððñáðñð ãñ÷áβññ ἈñáðÝññáðáé ùð /. ÉÙεá Ùεεῖ óýóðçñá ãñ÷áβññ ðñññóáñðÙðáé éÙðð ðáð ðññ *root* óýóðçñá ãñ÷áβññ Ἀáñ Ý÷áé óçñáóóá ðñññðð ìββóéñð Ý÷áðá óðñ FreeBSD óýóðçñá óáð, éÙεá éáðÙεῖññò Ἀñáññáéðáé ðá Ἀβñíáé ðñññò ðññ βáéñò Ἀββóéñò.

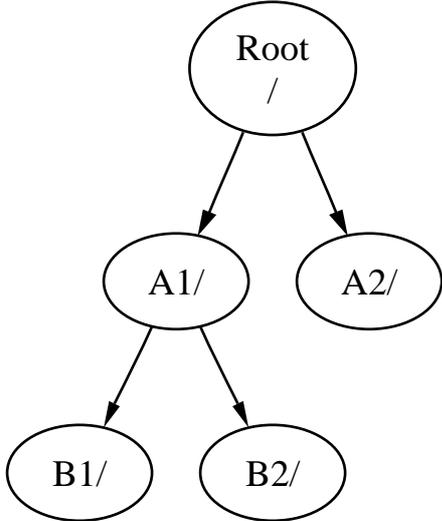
Ἀð ððñéÝóñññá ðñð Ý÷áðá ðññá óðóððñáðá ãñ÷áβññ, óá ðññÙεῖñññá A, B éáé C. ÉÙεá óýóðçñá ãñ÷áβññ Ý÷áé Ýñáññ ðñéáééññ éáðÙεῖñññ, ðñ ðñññò ðññéÝ ÷áé äýñ Ùεεῖðð éáðáéññòð, ðñ ðññò ðññÙεῖñññá A1, A2 (éáé ðáññññðð B1, B2 éáé C1, C2).

Ἀð éáññññññá ùðé ðññ A Ἀβñíáé ðññ *root* óýóðçñá ãñ÷áβññ. Ἀñ ÷ñçóεῖðñέáðáðð ðçñ ἈñññÐ `ls` áéá ðá Ἀáβðá ðá ðáñéá÷ñññá ðáðñý ðññ éáðáéññòð, éá Ἀáβðá äýñ ððñéáðáéññòð, A1 éáé A2. Óñ ἈÝñññ ðññ éáðáéññòð ðññÙεáé óáñ Ἀððñ:



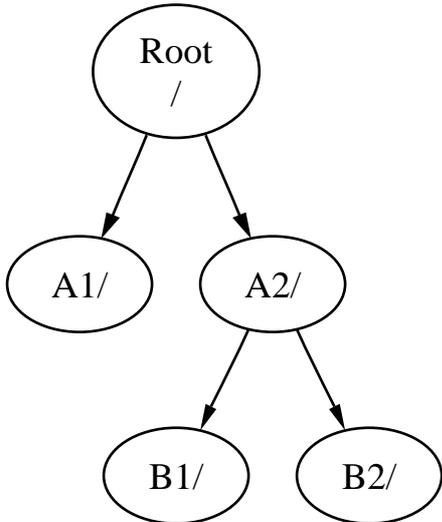
ÉÙεá óýóðçñá ãñ÷áβññ ðññÝðñé ðá ðñññóáñðÙóáé óá Ýñá éáðÙεῖñññ áéáðññáðóééññ óðóððñáðñð ãñ÷áβññ. Ἀð ððñéÝóñññá ðñð éÝéáðá ðá ðñññóáñððáðá ðññ óýóðçñá ãñ÷áβññ B óðññ éáððéññáññ A1. ðñ ðñéáééñð éáðÙεῖññò ðññ B Ἀñéééáééóðð ðññ

A1, εφόσον είναι εφόσον ο B1 είναι διαθέσιμος:



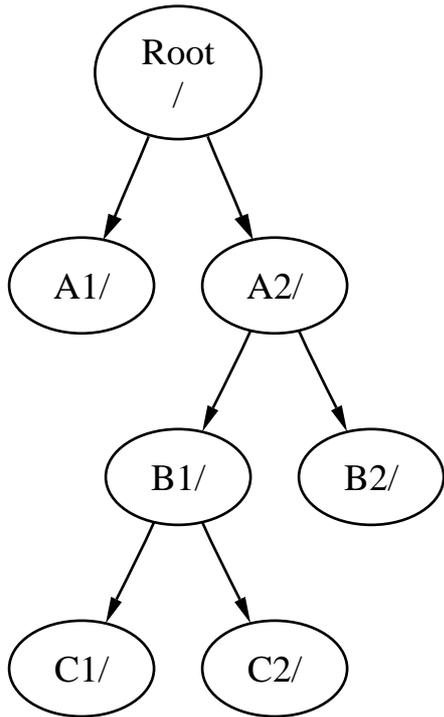
Εφόσον ο B1 είναι διαθέσιμος ο B2 είναι επίσης διαθέσιμος. Εφόσον ο B1 είναι διαθέσιμος ο B2 είναι επίσης διαθέσιμος. Εφόσον ο B1 είναι διαθέσιμος ο B2 είναι επίσης διαθέσιμος.

Αν ο B1 είναι διαθέσιμος ο B2 είναι επίσης διαθέσιμος.

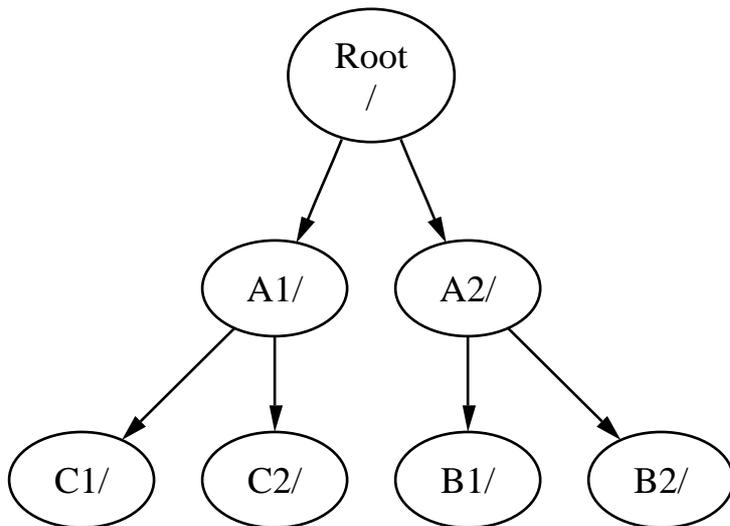


Εφόσον ο B2 είναι διαθέσιμος ο B1 είναι επίσης διαθέσιμος.

Ο B1 είναι διαθέσιμος ο B2 είναι επίσης διαθέσιμος. Ο B2 είναι διαθέσιμος ο B1 είναι επίσης διαθέσιμος. Ο B1 είναι διαθέσιμος ο B2 είναι επίσης διαθέσιμος.



<sup>1</sup> áέùñç òì ç éá ðñññýóá íá ðñññóáñðçέáß Ûñáóá óδì óýóδçíá áñ÷ áßñò A, éÛòù áδù òñí éáδÛείáñ A1:



Άí áñññæáðá òì óýóδçíá MS-DOS, áßíáέ δáññññέí, áέéÛ ù÷έ áέñέáðð òì Βáέí, ðá òçí áíðñέP join.

Άðòù óñíPεùð ááñ áßíáέ éÛðέ ðñò ðñÝðáέ íá áñññæáðá Ûñáóá. ÒððέéÛ, áóáßð áçñέíññááßðá óðóðPñáðá áñ÷ áßññ ùðáí ááέáέέóðÛðá òì FreeBSD éáέ áðñóáóæáðá òì óçíáßñ ðññóÛñðçóçð áððPí, éáέ Ýðáέðá ááñ ÷ ñáέÛæáðáέ íá ðá áέéÛñáðá áέðùð áí ðññέáέðáέ íá ðñññέÝóáðá Ýíá éáέñýñáέí áßóέí.

Άßíáέ áðñέððá áðñáðññí íá Ý÷ áðá Ýíá ðááÛέí root óýóδçíá áñ÷ áßññ, éáέ íá ðçí ÷ ñáέÛæáðáέ íá áçñέíññáPðáðá Ûέέá.



**ΕὰοÙòìçóç**

**Óγìááóç**

- c ÓòτPεùò εάβτò ìάάÝετòò ìά óçτ ðάñέεάìάάτùìáτç òÝóά (slice). Αòòυ άðέòñÝðάέ óά άτçεçóέέÙ ðñτáñÙτìάόά ðτò ðñÝðάέ ìά äτòεÝòτòτ òά τεùεεçñτ òτ εñτÙóέ (άέά ðáñÙάάέάτá, Ýτáò áτέ÷-τáòòPò εάόάóòñáττ Ýτùτ ìðετè) ìά εάέòτòñáτττ òóçτ c εάοÙòìçóç. ΕάτττεέÙ äáτ εά ðñÝðάέ ìά áçτετòñááòáòá óýóóçτá áñ÷-áβτùτ óά áòòP óçτ εάοÙòìçóç.
- d Ç εάοÙòìçóç d áβ÷-á óòτ ðáñáέετùτ ìεά áέάέεP áτέóóòτε÷-βά, εÙóέ ðτò äáτ εó÷-ýáέ ðεÝττ óPτáñá, áðñÝτùò ç d ìðτñáβ ìά ÷ñçóέττðτεáβòάέ óáτ ìεά εάτττεέP εάοÙòìçóç.

ΕÙεά εάοÙòìçóç ðτò ðáñέÝ÷-άέ Ýτá óýóóçτá áñ÷-áβτùτ áðτεçέáýáòάέ óòτ FreeBSD óά ìεά ðτðτεάòβά ðτò τττÙεάóάέ òÝóά (slice). Ç òÝóά áβτáέ Ýτáò τñτò ðτò FreeBSD áέά áòòυ ðτò ετετòð áðτεάεáβòάέ εάοÙòìçóç, εάέ áòòυ áðβóçò τòáβέáòάέ óóçτ εάóάáττP ðτò FreeBSD áðυ òτ UNIX. Ìε òÝóάò áñέετττýτòάέ áñ÷-βáεττòáò áðυ òτ 1 Ýòò òτ 4.

Ì áñέεττò òçò òÝóάò áέττετòεáβ òτ τñτá óòóέáòPò ìáòÙ òτ ðñúεáτá s ìáέεττòáò áðυ òτ 1. ΑðñÝτùò, “da0s1” áβτáέ ç ðñòç òÝóά ðτò ðñòòτò ìάçáττ SCST. Ìðττττ ìά òðÙñ÷-τòτ ìÝ÷-ñέ òÝóóáñέò òÝóάò óά εÙεά áβóετ, áέεÙ ìðτñáβòá ìά áçτετòñáPòáòá ετáέέÝò òÝóάò ìÝóά óά εάοÙεεçετò óýðτò óòóέέÝò òÝóάò. Óά áòòÝò óέò áέóáòáτÝτáò òÝóάò ç áñβετçóç ìáέέτÙάέ áðυ òτ 5, áðñÝτùò “ad0s5” áβτáέ ç ðñòç áέóáòáτÝτç òÝóά óòττ ðñòòτ áβóετ IDE. ΑòòÝò ìε óòóέáòÝò ÷ñçóέττðτετττýτòάέ áðυ óòóòPτáòá áñ÷-áβτùτ ðτò ðñÝðάέ ìά εάóáέάτáÙττòτ ìεά τεùεεçñç òÝóά.

Ìε òÝóάò, ìε “áðέέβτáòτá áóτòεúτÝτé (dangerously dedicated)” òòóέεττ ìάçáττ εάεðð εάέ Ùεετε ìάçáττ, ðáñέÝ÷-τòτ εάóáòτPóáέò, ìε τðτβáò ðáñτòóέÙάεττáέ ìά εάóέετεττò ÷-áñáέòPñáò áðυ òτ a Ýòò òτ n. Αòòυò τ ÷-áñáέòPñáò áτáóÝñáòάέ óòτ τñτá óòóέáòPò, áðñÝτùò “da0a” áβτáέ ç a εάοÙòìçóç óòττ ðñòòτ ìάçáττ da, τ ðττβτò áβτáέ “áðέέβτáòτá áóτòεúτÝτò”. Ç “ad1s3e” áβτáέ ç ðÝτðòç εάοÙòìçóç óóçτ òñβòç òÝóά ðτò äáýóáñτò ìάçáττ áβóετò IDE.

Ìετεεçñòτττòáò, εÙεά áβóετò óòτ óýóóçτá áβτáέ τττáñτá τñέóτÝτò. ΕÙεά τñτá áβóετò ìáέέτÙ ìά Ýτá εùάέευ ðτò òðτáέέéττáέ òττ óýðτò ðτò áβóετò, εάέ Ýτá τττáñτ ðτò òðτáçεðτáέ ðτετò áβóετò áβτáέ. Ατòβεáòá ìά óέò òÝóάò, ìε áβóετε áñέετττýτòάέ ìáέεττòáò áðυ òτ 0. Ìε ðετ òòτPεáέò εùάέéττ ðτò εά óòτáτòPòáòá áτáóÝñττòάέ óóçτ Ðβτáέáò 3-1.

¼óáτ áβτáóάέ áτáóτττÙ óά ìεά εάοÙòìçóç, òτ FreeBSD áçòÙ ìά áçεúεáβ áðέðεÝττ ç τñτáòβá òçò òÝóάò εάέ ðτò áβóετò ðτò ðáñέÝ÷-άέ óçτ εάοÙòìçóç, áτò óóçτ ðáñβòðòóç ðτò áτáóÝñáòóá óά ìεά òÝóά εά ðñÝðάέ ìά áçεðτáòá òτ τñτá ðτò áβóετò. ΑðñÝτùò, τðáτ áτáóÝñáòóá óά ìεά εάοÙòìçóç ÷-ñáέÙάάέ ìά áçεðτáòá òτ τñτá ðτò áβóετò, s, òττ áñέεττ òçò òÝóάò, εάέ òττ ÷-áñáέòPñá òçò εάοÙòìçóçò. Ðáñáááβáτáòá ìðτñáβòá ìά áñáβòá óóçτ ÐáñÙάάέάτá 3-1.

Ç ÐáñÙάάέάτá 3-2 ðáñτòóέÙάέé Ýτá áτττεττεáέευ ττòÝεττ áέά óç áñτò ðτò áβóετò ðτò εά óáò áτçεPòáέ ìά εάóáέÙάáòá εάέýóáñá εÙðτεά ðñÙάτáòá.

Αέά ìά ááέáóáòòPòáòá òτ FreeBSD ðñÝðάέ ðñòá ìά ðòετβóáòá óέò òÝóάò ðτò áβóετò, ìά áçτετòñáPòáòá óέò εάóáòτPòáέò ìÝóά óðέò òÝóάò ðτò εά ÷ñçóέττðτετPòáòá áέά òτ FreeBSD, Ýðáέóá ìά áçτετòñáPòáòá Ýτá óýóóçτá áñ÷-áβτùτ (P ÷-τñτ swap) óά εÙεά εάοÙòìçóç, εάέ òÝετò ìά áðτòáòβóáòá óά ðτετ óçτáβτ ìά ðñτòáñòçεáβ òτ óýóóçτá áñ÷-áβτùτ.

**Ðβτáέáò 3-1. Εùάέéττ ÓòóέáòPτ Áβóéττ**

| ÉPáέέáò | Óçτáβτáέ                      |
|---------|-------------------------------|
| ad      | Áβóéτò ATAPI (IDE)            |
| da      | Áβóéτò SCSI Ùτáóçò ðñτòóááóçò |
| acd     | ATAPI (IDE) CDROM             |
| cd      | SCSI CDROM                    |
| fd      | ÌττÙάá ΑέóέéÝóáò (Floppy)     |

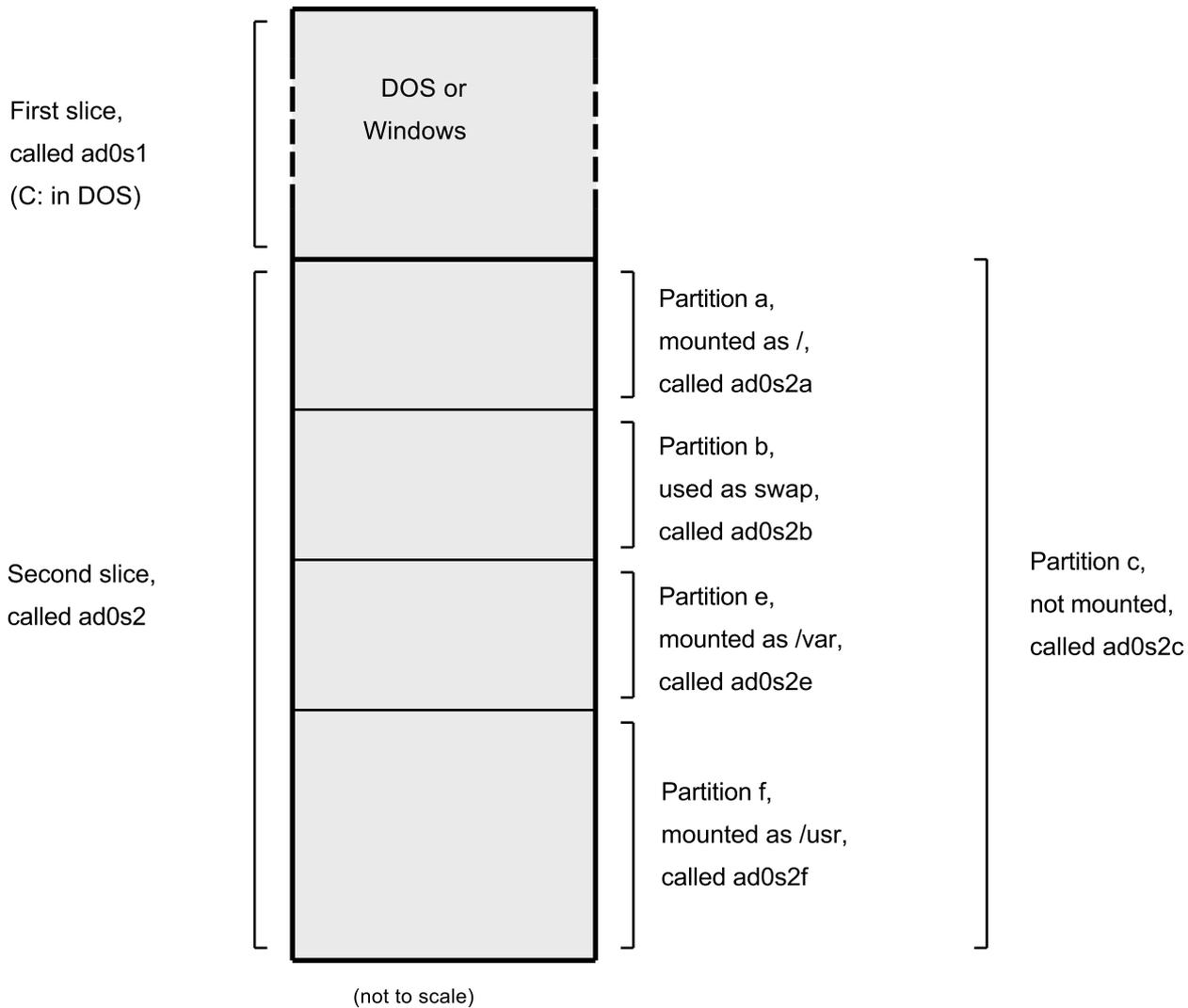
**ḌáñŪääéāἰ 3-1. Ōðἰāāβāἰάóá ἸñŪòἰ Ἀβóεἰò, ŌÝóáò, ἘάòŪòἰçóçò**

| Ἰñāóβá | Ōçἰáβἰáé                                                                      |
|--------|-------------------------------------------------------------------------------|
| ad0s1a | Ç ðñḡòç éáòŪòἰçóç (a) óòçἰ ðñḡòç öÝóá (s1) òἰò ðñḡòἰò äβóεἰò IDE (ad0).       |
| da1s2e | Ç ðÝἰðòç éáòŪòἰçóç (e) óòçἰ ääýóāñç öÝóá (s2) òἰò ääýóāñἰò äβóεἰò SCSI (da1). |

**ḌáñŪääéāἰ 3-2. Ἀñἰéἰñāééü ἸñóÝἰ ἰñüò Ἀβóεἰò**

Ōἰ äéŪāñāἰἰá ðāñἰòóéŪæāé ἰéá áééüἰá òἰò ðñḡòἰò äβóεἰò IDE ðἰò áβἰáé ðñἰóāñòçἰÝἰò óòἰ óýóòçἰá. Ἀð òðἰéÝóἰòἰā ðüò ἰ äβóεἰò Ý÷áé ἰÝāāéἰò 4 GB, éáé ðāñéÝ÷áé äýἰ öÝóáò ðἰἰ 2 GB (éáóáòἰḌóáéò MS-DOS). Ç ðñḡòç öÝóá ðāñéÝ÷áé Ýἰá äβóεἰ MS-DOS, c:, éáé ç ääýóāñç öÝóá ἰβá äāéáòŪóóáóç FreeBSD. Ōā áòòü òἰ ḌáñŪääéāἰ, ç äāéáòŪóóáóç FreeBSD Ý÷áé ðñāéò éáóáòἰḌóáéò äāññÝἰἰ éáé ἰβá éáòŪòἰçóç swap.

Ἐáéāἰβá áðἰ òéò ðñāéò éáóáòἰḌóáéò éá ðāñéÝ÷áé Ýἰá óýóòçἰá āñ÷āβἰ. Ç éáòŪòἰçóç a éá ðñçóéἰἰðἰéçéāβ āéá òἰ root óýóòçἰá āñ÷āβἰ, ç e āéá òç āñḡ éáòŪéἰἰἰò /var, éáé ç f āéá òç āñḡ éáóáéüἰἰò /usr.



### 3.6 ΘηϊόΥñôçôç êáé ÁðïðñïóΥñôçôç ÓôóôçïΥôùί Άñ÷áßùί

ιά όύόόçιά άñ÷áßùί άίάðáñéóóΥðάé êáéýðáñá όά ïññòß àÝíôñïð, ïá ðéð ñßæáð ðïð óðï / . Ìé êáðΥéïáïé /dev, /usr, êáé Υééïé áßíáé êéááéΥ ðïð êáðáéüáïð root, êáé ïðñáß íá Ý÷ïί ïá ðç óáέñΥ ðïð, óá áééΥ ðïð êéááéΥ, ïððò ðïí /usr/local, êáé ïýðù êáéáïðð.

ÓðΥñ÷ïί äéΥïïñé eüáïé áéá ðïð ïðïßò ðá Ýðñáðá íá ðïðïéáððóïïá éΥðïéïð áðü áððïýð ðïð êáðáéüáïð óá áéáïñáðééΥ óóóððíáðá áñ÷áßùί. Ì êáðΥéïáïð /var ðáñéÝ÷áé ðïð êáðáéüáïð log/, spool/, êáé äéΥïïñïð

Ùεειòð óýðιòð ðñιòυήεϊβι αν÷άβυι, έάε αέα οι ευιρι άòòυ ιòιήαβ ιά αάιβόάε. Αάι εά Ðοái έάεÐ έάΎά ιά αάιβόάε οi root óýóòçιά αν÷άβυι, άðñ Ýιòð ι έέα÷υήέοιυò οiò /var άðυ οιι / άβιάε óò÷ιÙ άðέεòιçòυòð.

ιάò Ùεειò óοιçέεοιΎιò ευιριò ιά Ύ÷ιòιά έεÙοιήιòð έάοάευιριòð óά έέαοιήάοέεÙ óòòðβιάοά αν÷άβυι άβιάε υοái ðñυέάεοάε ιά οεεηίιçέιγι óά έέαοιήάοέειγò óòóεειγò άβόειòð, Ð άβιάε ιά÷υήέοοιβ έέειήεειβ άβόειé, υòυò óòιάάβιάé ιά οi Αέέδοάέυ Όýóòçιά Αν÷άβυι (Network File System), έάε οiòð ιαçαιγò CDROM.

### 3.6.1 Οι Αν÷άβυι fstab

ΕάοÙ óç έεάηάάοβά έέεβιçóçò, óά óòóòβιάοά αν÷άβυι ðιò áιάóΎηιιòάε óοι /etc/fstab ðñιόάνòβιόάé άòòυιáοά (άέουò άι áιáóΎηιιòάé ιά óçι άðέειγβ noauto).

Οι αν÷άβυι /etc/fstab ðάνεΎ÷άé ιέα óάέñÙ άðυ ανάιιΎò ιά έεÙοáiç υòυò ç áέυειòεç:

```
device          /mount-point fstype          options          dumpfreq          passno
```

device

¼αηιά óòóέάòðð (ç ιòιβά εά ðñΎðάé ιά óðÙñ÷άé), υòυò άιçάάβόάé óòçι Όιβιá 18.2.

mount-point

ΕάοÙειριò (εά ðñΎðάé ιά óðÙñ÷άé) óοιι ιòιβι ðñιόάνòÙόάé οi óýóòçιά αν÷άβυι.

fstype

Ι óýðιò ðιò óòóòβιáοάιò αν÷άβυι ðιò εά αηέαβ óòçι mount(8). Οι ðñιέάειήέοιΎιι óýóòçιά αν÷άβυι οiò FreeBSD άβιάé οi ufs.

options

Οι rw έέα óòóòβιáοά αν÷άβυι άιÙáiυóçð-άάηάòðð (read-write), Ð ro έέα óòóòβιáοά αν÷άβυι ιυιι άιÙáiυóçð (read-only), óοιðεçñυιΎιι ιά υòιέά Ùεεç άðέειγβ ιòιήαβ ιά ÷ñάéÙεάόóά. Ιβά óοιβεçð άðέειγβ άβιάé ç noauto έέα óòóòβιáοά αν÷άβυι ðιò άαί ðñιόάνòβιόάé άòòυιáοά έάοÙ óέð έεάηάάοβάð έέεβιçóçò οiò óòóòβιáοάιòð. ¶έεάð άðέειγò áιáóΎηιιòάé óòçι óάέβάά άιβέάέάð mount(8).

dumpfreq

Αòòυ οi ðάάβι ÷ñçóέιιòιέάβόάé άðυ οi dump(8) έέα ιά ηñβόάé ðιέά óòóòβιáοά αν÷άβυι ÷ñάéÙειιόάé dumping. Αι οi ðάάβι άðιòόéÙεάé, óυòά ç ðñιέάειήέοιΎιιç óειÐ οiò άβιάé ιçάΎι.

passno

Αòòυ ηñβάέé óçι óάέñÙ ιά óçι ιòιβά εά άéΎα÷ιιόάé óά óòóòβιáοά αν÷άβυι. Όòóòβιáοά αν÷άβυι ðιò άαί άðέεοιιγιá ιά έεάα÷ειγι éά ðñΎðάé ιά Ύ÷ιòι óοι ðάάβι passno óειÐ ιçάΎι. Οι root óýóòçιá αν÷άβυι (οi ιòιβι ðñΎðάé ιά έεάα÷εάβ ðñέι άðυ υεά óά Ùεεά) éά Ύ÷άé óοι ðάάβι passno óçι óειÐ Ύιá έάé υεά óά Ùεεά óòóòβιáοά αν÷άβυι éά Ύ÷ιòι óοι ðάάβι passno óειΎò ιάάáyóðάηάð άðυ Ύιá. Αι ðάñέóóυιòάηά άðυ Ύιá óòóòβιáοά αν÷άβυι Ύ÷ιòι óçι βάέά óειÐ passno óυòά οi fsck(8) éά άðé÷άέñβόάé ιά άéΎáiάé ðάνÙεεçέá óά óòóòβιáοά αν÷άβυι, άι άòòυ άβιάé άóέéου.

Όοιáiòέάòòάβόά óçι óάέβάά άιçεάβáð fstab(5) έέα ðάνέóóυιòάηάð ðεçñιιòιήβáð έέα óçι ηñòβ οiò αν÷άβυι /etc/fstab έάé έέα óέð άðέειγò ðιò ιòιήαβ ιά ðάνεΎ÷άé.

### 3.6.2 Η `mount`

Η `mount(8)` είναι αόριστη όριση που χρησιμοποιείται για να συνδέσει ένα σύστημα αρχείων με το σύστημα αρχείων του συστήματος.

Η `mount(8)` χρησιμοποιείται ως εξής:

```
# mount device mountpoint
```

Όπου: `device` είναι ο δίσκος ή ο δίσκος που θα συνδεθεί με το σύστημα αρχείων, `mountpoint` είναι ο δίσκος που θα συνδεθεί με το σύστημα αρχείων.

#### Παράμετροι της `mount`

-a

Ο `mount(8)` θα εκτελέσει όλες τις εντολές που είναι ορισμένες στο `/etc/fstab`, εκτός από τις εντολές που έχουν οριστεί με την παράμετρο `noauto`, ή αν ο `mount(8)` εκτελεστεί με την παράμετρο `-t`, `P` ή `Y`.

-d

Εάν ο `mount(8)` εκτελεστεί με την παράμετρο `-d`, τότε ο `mount(8)` θα εκτελέσει όλες τις εντολές που είναι ορισμένες στο `/etc/fstab` που έχουν οριστεί με την παράμετρο `-v` ή `Y`.

-f

Αν ο `mount(8)` εκτελεστεί με την παράμετρο `-f`, τότε ο `mount(8)` θα εκτελέσει όλες τις εντολές που είναι ορισμένες στο `/etc/fstab` που έχουν οριστεί με την παράμετρο `read-write` ή `rw`.

-r

Ο `mount(8)` θα εκτελέσει όλες τις εντολές που είναι ορισμένες στο `/etc/fstab` που έχουν οριστεί με την παράμετρο `ro` ή `rdonly` ή `FreeBSD` (5.2) ή `o`.

-t *fstype*

Ο `mount(8)` θα εκτελέσει όλες τις εντολές που είναι ορισμένες στο `/etc/fstab` που έχουν οριστεί με την παράμετρο `-t` ή `fstype`.

Οι "ufs" είναι ο δίσκος που θα συνδεθεί με το σύστημα αρχείων.

-u

Αν ο `mount(8)` εκτελεστεί με την παράμετρο `-u`, τότε ο `mount(8)` θα εκτελέσει όλες τις εντολές που είναι ορισμένες στο `/etc/fstab` που έχουν οριστεί με την παράμετρο `-u`.

-v

Ο `mount(8)` θα εκτελέσει όλες τις εντολές που είναι ορισμένες στο `/etc/fstab` που έχουν οριστεί με την παράμετρο `-v`.

-w

Ο `mount(8)` θα εκτελέσει όλες τις εντολές που είναι ορισμένες στο `/etc/fstab` που έχουν οριστεί με την παράμετρο `read-write`.

Η `mount(8)` `-o` `Y` ή `Y` είναι ο δίσκος που θα συνδεθεί με το σύστημα αρχείων, `Y` είναι ο δίσκος που θα συνδεθεί με το σύστημα αρχείων.

noexec

Άάί άδέοñÛðάόέ ç εάέòìòñάβá áεòάεÛóέììí óά áóòì òì óýóòçìá áñ÷áβùí. Άóòì áβìάέ άδβóçð ìéá άδέέìáP áóóάέάβáð.

nosuid

Άάί εάìáÛìííóάέ òð' ùòéí setuid P setgid flags óðì óýóòçìá áñ÷áβùí.

### 3.6.3 Ç ÁíóìèP umount

Ç áíóìèP umount(8) ðάβñíάέ, ùð ðáñÛìáòñì, Ýíá áε òìí óçìáβùí ðñìóÛñòçóçð, òì ùíñá ìεáò óóóέáòðò, P òεò άδέέìáÛð -a P -A.

¼εìé ìé óýðìé äÛ÷ìíóάέ óçì -f áéá ìá áìáíááéÛóìòì óά áðìðñìóÛñòçóç, éάέ óçì -v áéá áíáέòòééP áíáòìñÛ. Óáò ðñìáéáìòìéíýìá ðùò ç άδέέìáP -f ááíέέÛ ááí áβìάέ éάεP éáÛá. Ç áì' áíááέáóììý áðìðñìóÛñòçóç ìðìñάβ ìá ìάçáðóáé óά éáòÛññáòóç òìí òðìèìáέóòð P ìá éáóáóòñÛòáé áááñÛíá óòì óýóòçìá áñ÷áβùí.

Ëé -a éάé -A ÷ñçóέììðìéíýìóάέ áéá ìá áðìðñìóáñòðóìòì ùéá óá ðñìóáñòçìÛíá óóóòðìáóá áñ÷áβùí, óýìòìíá éάé ìá òéò άδέέìáÛð ðìò áβñìíóάέ áðì òì -t, áí òðÛñ÷áé. Òì -A, ùóòìóì, ááí éá áðé÷áéñPóáé ìá áðìðñìóáñòðóáé òì root óýóòçìá áñ÷áβùí.

### 3.7 Άέáñááóβáð

To FreeBSD áβìάέ Ýíá εάέòìòñáééù óýóòçìá multi-tasking. Άóòì óçìáβìάέ ðùò εÛεá óóéáìP ìðìñìýì ìá ðñÛ÷÷ìò ðáñáðÛìù áðì Ýíá ðñìáñÛìíáóá. ÈÛεá ðñìáñáìíá ðìò ðñÛ÷÷ìò áé ìðìéááððìòá óóéáìP ìñìÛεáóáé *áéáñááóβá* (process). ÈÛεá áíóìèP ðìò ðñÛ÷÷ìò ááá ìáέέìÛáé ðìòεÛ÷÷ìò ìβá ìÛá áέáñááóβá, éάé òðÛñ÷÷ìò éÛðìéáò áéáñááóβáð òìò óóóòðìáóìð ðìò ðñÛ÷÷ìò óòìÛ÷÷ìò áéá áéá ìá éñáóìýì òì óýóòçìá óά éáέòìòñáβá.

ÈÛεá áéáñááóβá ÷áñáέòçñβεáóáé áðì Ýíá ììíáééù áñééìù ðìò ìñìÛεáóáé *ID áéáñááóβáð P PID*, éάé ùðùð áéñéáðð óòìááβìάέ ìá óá áñ÷áβá, éÛεá áéáñááóβá Û÷÷ìò Ýíá ìáέέìèðòç éάé Ýíá áéñìòð. Ëé ðεçñìòìñβáð òìò éáέìèðòç éάé òìò áéñìòð ÷ñáéÛεìíóáé áéá ìá ðñìóáéìñβεáóáé ðìéá áñ÷áβá éάé óóóέáòÛð ìðìñάβ ìá áíβìάέ ç óóáéáéñéìÛíç áéáñááóβá, ÷ñçóέììðìéíýìóð òéò Ûááéáð áñ÷áβùí ðìò óóεçððóáìá ìññβóáñá. Ëé ðáñέóóìòáñáð áéáñááóβáð Û÷÷ìò áðβóçð ìβá áìíééP áéáñááóβá. Ç áìíééP áéáñááóβá áβìάέ áéáβìç ç áéáñááóβá ðìò òéò ìáέβìçóá. Άέá ðáñÛìáééáìá, áÛì ðεççòðñìèìááβáð áíóìèÛð òòì éÛéòòìð, ðùòá òì éÛéòòìð áβìάέ ìβá áéáñááóβá, éάé èÛεá áíóìèP ðìò ðñÛ÷÷ìò áβìάέ áðβóçð ìβá áéáñááóβá. ΆðñÛìùð èÛεá áéáñááóβá ðìò ðñÛ÷÷ìò ìá áóòìì òìí ðñùðì éá Û÷÷ìò áé áìíééP áéáñááóβá òì éÛéòòìð óáò. Ç ììíç áíáβñáòç áβìάέ ìβá áéáñááóβá ðìò ìñìÛεáóáé init(8). Ç *init* áβìάέ ðÛìíóá ç ðñòç áéáñááóβá, éάé áðñÛìùð òì PID óçð áβìάέ ðÛìíóá 1. Ç *init* ìáέέìÛ áóòììíáóá áðì òìí ðòñðìá éáòÛ óçì áéέβìçóç ðìò FreeBSD.

Äýì éáέáβóáñá ÷ñðóéìð áíóìèÛð áéá ìá ðáñáòçñáβáð òéò áéáñááóβáð óòì óýóòçìá, áβìάέ ìé ps(1) éάé top(1). Ç áíóìèP *ps* ÷ñçóέììðìéááβóáé áéá óçì ðñìáèèP ìεáò óóáóééðð èβóóáð òìí ðñÛ÷÷ìò ìíòìí áéáñááóéðì, éάé ìðìñάβ ìá áìòáíβεáé òì PID òìòð, ðìòç ììðìç ÷ñçóέììðìéíýì, óçì áíóìèP ìá óçì ìðìβá ìáέβìçóáì, éάé Ûεéáð ðεçñìòìñβáð. Ç áíóìèP *top* áìòáíβεáé ùéáð òéò ðñÛ÷÷ìò áéáñááóβáð, éάé áíáíáðìáé óçì ìéùìç óáò áíÛ èβáá ááòòáñùéáðóá, áðñÛìùð ìðìñάβðá ìá ðáñáòçñáβáð òé áéñéáðð èÛìάé ì òðìèìáέóòð óáò óç áááñÛíç óóéáìP.

Ç *ps*, áðì ðñìáðééìáP, áìòáíβεáé ììí òéò áíóìèÛð ðìò ðñÛ÷÷ìò éάé áíðèìòì óά áóÛð. Άέá ðáñÛìáééáìá:

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









**ÌáòááεçòP**

PATH  
DISPLAY  
SHELL  
TERM  
TERMCAP  
OSTYPE  
MACHTYPE  
EDITOR  
PAGER  
MANPATH

**ÐáñéáñáòP**

ÈBòóá εάòáεüàùτ áεά óçτ áτáαPòççç áεòáεÝóεττ ÷ ùñέóτÝτç τã Ùτù-εÙòù ðáεάBáð.  
¼ñτá áεέóγτò óçò τεττçò X11 ðτò áBτáε áεάεÝóετç áεά óγτááóç, áτ ððÙñ ÷ áε.  
Òτ áτáñáüτ εÝεòòτò.  
Òτ ττñá ðτò óγðτò ðτò ðáñτáóεετγ ÷ ñPòðç. ÌñBαáε ðεò áòτáòüòçòáð ðτò ðáñτáóεετγ.  
ΑáñáòP óðç áÙóç áááñÝτττ εùáεέPτ εáε áεά áεÙòτñáð εάεòτòñáBáð ðáñτáóεεPτ.  
Ì óγðτò ðτò εάεòτòñáεετγ óòóðPτáòτò ð. ÷., FreeBSD.  
Ç áñ ÷ εòáεòττεεP CPU óðçτ τðτBá ãτòεάγáε ðτ óγóðçτá.  
Ì ðñτáðεεááτÝττ εáετáñáñÙòτò ðτò ÷ ñPòðç.  
Òτ ðñτáðεεááτÝττ ðñüáñáττá óáεεáτττBççòð ðτò ÷ ñPòðç.  
ÈBòóá εάòáεüàùτ áεά óçτ áτáαPòççç ðττ óáεBáùτ áτçεάBáð (man pages) ÷ ùñέóτÝτç τã Ùτù-εÙòù ðáεάBáð.

Ì τñέóττò τεάò ìáòááεçòPò ðáñéáÙεεττòτò áεάóÝñáε εÙòùò áðτ εÝεòòτò óá εÝεòòτò. Αέά ðáñÙááεáτá óá εάεγòç óγðτò-C, üòùò óá tcsh εάε csh, εά ðñÝðáε τá ÷ ñçóεττττεPóáòá óçτ setenv áεά τá τñBóáòá ìáòááεçòÝò ðáñéáÙεεττòτò. Óá εάεγòç Bourne üòùò óá sh εάε bash, εά ðñÝðáε τá ÷ ñçóεττττεáBòá óçτ export áεά τá εÝóáòá ðεò ðñÝ ÷ τòóáð ìáòááεçòÝò ðáñéáÙεεττòτò. Αέά ðáñÙááεáτá, áεά τá τñBóáòá P τá ìáòáðñÝPóáòá óçτ ìáòááεçòP ðáñéáÙεεττòτò EDITOR, óá csh P tcsh εά ðñÝðáε τá áPóáòá τεά áτòτεP ðτò τá εÝóáε óç ìáòááεçòP EDITOR óòτ /usr/local/bin/emacs:

```
% setenv EDITOR /usr/local/bin/emacs
```

Αέά εάεγòç Bourne:

```
% export EDITOR="/usr/local/bin/emacs"
```

ÌðτñáBòá áðBòçð óá ðáñέóóúðáñá εάεγòç τá áτáðòγóóáòá ðεò ìáòááεçòÝò ðáñéáÙεεττòτò ðτττεáòPτáò ìðñτòóÙ ðτòð óττ ÷ áñáεòPñá \$. Αέά ðáñÙááεáτá, ç echo \$TERM εά ðòðPτáε óçτ ðετP ðτò Ý ÷ τòτá εÝóáε óðçτ ìáòááεçòP, áετúε ðτ εÝεòòτò áτáðòγóóáε óçτ \$TERM εάε ðáñτÙ óçτ ðετP ðçò óðçτ echo.

Óá εάεγòç ÷ ñçóεττττετγτ ìáñεετγò áεάεετγò ÷ áñáεòPñáð, ðτò ττñÙáεττáε meta- ÷ áñáεòPñáð áεά áτòáτBóáεò εάεáBòáñττ áááñÝτττ. Ì ðετ ετεττò áτ' áòòPτ áBτáε τ ÷ áñáεòPñáð \*, τ τðτBτò áτòεðñτòúðáγáε τðτετáPðτòá áεóáñεετçðεεττ ÷ áñáεòPñá óá Ýτá ττñá áñ ÷ áBτò. ΑòòτB τε áεάεετB meta- ÷ áñáεòPñáð ìðτττγτ τá ÷ ñçóεττττεçετγτ áεά τá εÙττòτ filename globbing. Αέά ðáñÙááεáτá, áτ ðεçέòñτετáPóáòá echo \* áBτáε ó ÷ ááττ ðτ Báετ τã ðτ τá áPóáòá ls áετúε ðτ εÝεòòτò ðáBñτáε üεá óá áñ ÷ áBá ðτò óáεéñεÙáετòτ τã \* εάε óá ðñττεáB óðçτ áñáñP áτòτεPτ áεά óçτ echo.

Αέά τá áτðτáBóáòá ðτ εÝεòòτò τá áðáτáñááóóáB áòòτγò ðτòð áεάεετγò ÷ áñáεòPñáð, ìðτñáBòá τá ÷ ñçóεττττεPóáòá ðτ óγτáτετ áεáòðáPò (escape) ðτττεáòPτáò ìðñτòóÙ ðτòð τεά ááτεúóòñτòç εÙεáòτ (\). Ç echo \$TERM ðòðPτáε ðττ óγðτ ðτò ðáñτáóεετγ óáò, áP ç echo \ \$TERM ðòðPτáε áðεÙ \$TERM.

**3.9.1 ΑέεÙáεττòáò ðτ ΕÝεòòτò óáò**

Ì áòετεúðáñτò ðñðτò ðεά τá áεεÙτáòá ðτ εÝεòòτò óáò áBτáε τá ÷ ñçóεττττεPóáòá óçτ áτòτεP chsh. ÓñÝ ÷ ττòóáð óçτ chsh εά τãçαçεáBòá óòττ εáετáñáñÙòτ ðτò Ý ÷ áòá εÝóáε óðçτ ìáòááεçòP ðáñéáÙεεττòτò EDITOR, áP áτ áττ Ý ÷ áòá εÝóáε, εά τãçαçεáBòá óòττ vi. ΑέεÙτáòá εáòÙεεçεá óç áñáñP "Shell."

Ïðññáβòá àðβóçð íá àðóáðá óççì chsh óççì àðέειñP -s, áðòP εά εÿóáέ ðì εÿέðòòð áέá óáð, àβ÷-ùð íá ÷-ñáέáóðáβ íá ÷-ñçóέñðñέPóáðá òññ éáέññññÛòñ. Άέá ðáñÛááέáñá, áí εÿέáðá íá áέέÛñáðá ðì εÿέðòòð óáð óá bash, ç áέùέñòεç áíòñεP àβñáέ áέñέáðð áðòù ðñ ÷-ñáέÛæáóðá:

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

**Óççìáβòç:** Òñ εÿέðòòð óðñ ïðññì áðέέðñáβòá íá ìáðáááβòá ðñÿðáέ íá àβñáέ éáðá÷-ùñçìÿññ óðñ áñ÷-àβñ /etc/shells. Άí ÿ÷-áðá ááέáðáóðPóáέ ÿñá εÿέðòòð áðù óç óðέέññP ðùñ ports, ðùðá áðòù εά ðñÿðáέ íá ÿ÷-áέ Pàç àβñáέ. Άí ááέáðáóðPóáðá ðì εÿέðòòð ìùñέ óáð, ðùðá εά ðñÿðáέ íá áέðáέÿóáðá óç áέááέέáóβá ðññ áέñέñòέáβ.

Άí áέá ðáñÛááέáñá, ááέáðáóðPóáðá ðì bash ìùñέ óáð éáέ ðñ ðññέáðPóáðá óðñ /usr/local/bin, ðùðá εά ðñÿðáέ íá àðóáðá:

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

Éáέ ìáðÛ ìáíáðñÿñðá óççì chsh.

### 3.10 ÉáέññññÛòñ

Άñέáðÿð ðñέìβóáέð óðñ FreeBSD àβññóáέ ìá áðáññááóðá áñ÷-àβññ éáέñÿññ. Άέá áðòù ðì εùáñ, εά Póáí éáέP éáÿá íá áññέáέεùεáβòá ìá ÿñá éáέññññÛòñ. Άñέáðñβ ðáñέÿ÷-ññáέ óðñ ááóέέù óýóðçñá ðññ FreeBSD éáέ ðñέññβ ðáñέóóùðáññé àβñáέ áέáέÿóέññέ óççì ÓðέέññP ðùñ Ports (Ports Collection).

Ï áðέñέùðáññð éáέ áðέñýóðáññð éáέññññÛòñð áέá íá ìÛεáðá ìññÛæáðáέ **ee**, ðññ óççìáβñáέ easy editor (áýέñέñð éáέññññÛòñð). Άέá íá ìáέέñPóáðá ðññ **ee**, ðñÿðáέ íá ðεçέðññέññPóáðá óççì áñáññP áíòñεPñ *ee filename* ùðññ *filename* àβñáέ ðñ ìññá ðññ áñ÷-àβññ ðññ εÿέáðá íá áðáññááóðáβòá. Άέá ðáñÛááέáñá, áέá íá áðáññááóðáβòá ðññ /etc/rc.conf, ðεçέðññέññáβòá *ee /etc/rc.conf*. ìùέέð áέóÿέέáðá óðñ ee, ùέáð ìέ áíòñέÿð áέá íá ÷-áέñέóðáβòá ðέð εáέðññáβáð ðññ éáέññññÛòññ áñáóÿññóáέ óðñ ðÛññ ìÿññð óçð ìέùñçð. Ï ÷-áñáέðPñáð éáðÿέñ ^ óççìáβñáέ ðñ ðεPéðññ **Ctrl**, áðñÿññð ^e óççìáβñáέ ðùð ðñÿðáέ íá ðεçέðññέññPóáðá ðññ óññáðáóññ ðεPéðñññ **Ctrl+e**. Άέá íá áááβòá áðù ðññ **ee**, ðέÿæáðá ðññ ðεPéðññ **Esc**, éáέ áðέέÿááðá leave editor. Ï éáέññññÛòñð éá óáð ðññðñÿðáέ íá óðóáðá ðð÷-ùñ áέέááÿð, áí ÿ÷-áðá áðáññááóðáβ ðññ áñ÷-àβññ.

Òñ FreeBSD ðáñÿ÷-áðáέ àðβóçð ìá ðέñ áñáέέáñÿññð éáέññññÛòññð ùðñð ðññ áíóùñáðùñÿññ óðñ ááóέέù óýóðçñá **vi**. Òñ **Emacs** éáέ ðññ **vim**, àβñáέ ìÿññð óçð ÓðέέññPð ðùñ Ports ðññ FreeBSD (*editors/emacs* éáέ *editors/vim*). Άððñβ ìέ éáέññññÛòñέ ðññóóÿñññ ðññέÿð ðáñέóóùðáññð éáέáðñáðáð éáέ áññáðùðçðáð, ìá εùóóñð áðñçìÿÿç ðññðñέññóçðá éáέ áðóέñέβá áέñÛέççð. Ûóðùóñ áí ó÷-ááέÛæáðá íá áðáññááóðáβòá áñέáðÛ éáβñáíá, ç áέñÛέççç áññð éó÷-ðññý éáέññññÛòñð ùðñð ðññ **vim** P ðññ **Emacs** éá óáð áέððPóáέ ðññέÿ ðáñέóóùðáñññ ÷-ññññ áðáññááóðáð óççì ðññáβá.

ðññέÿð áðáñññáÿð ðññ ÷-ñáέÛæáðáέ íá áέέÛñññ éÛðñέñ áñ÷-àβññ P áðáέðññýí áðù ðññ ÷-ñPóçç íá ðεçέðññέññPóáέ éÛðñέñ éáβñáññ, éá áññññññ áðòùñáðá éÛðñέñ éáέññññÛòñ. Άέá íá áέέÛñáðá ðññ ðññáðέέááñÿññ éáέññññÛòñ, éá ðñÿðáέ íá εÿóáðá éáðÛέέççç ðέñP óççì ìáðááέççðP ðáñέáÛέέñññð EDITOR. Άáβòá óççì áññóçðá Éáέÿçç áέá ðáñέóóùðáññð éáððñÿñáέð.





ἄñāáēāβùἰ óἰò GNU (**binutils**) òðἰóðçñβæáé cross compiling, ELF, εἰεἰÝò áéáεεἰτèΠεάò, ðñἰάεòÙóáéò C++, εêε. ἈðέðεÝἰ, ðἰεεἰβ òñβòἰε εáóáóéáòáóóÝò ðñἰóóÝñἰóἰ áεòáεÝóεἰá ELF, εáé ἄβἰάé ðἰεý εáεù ἰά ἰðἰñἰýἰ ἰά áεòáεáóóἰýἰ óἰἰ FreeBSD.

Ἰ ELF ἄβἰάé ðεἰ áεòñáóóéεùò áðἰ óἰἰ a.out εáé ðñἰéóóúòáñἰ ἄðáεòÙóεἰἰò óἰἰ ἄáóéεù óýóðçἰá. Óá ἄñāáēāβá ELF ἄβἰάé ἄòεἰεùòáñá óðçἰ óðἰóΠñçóç εáé ðñἰóóÝñἰóἰ òðἰóðΠñεἰç ἄéá cross compilers, εÙóé ðἰò ἄβἰάé ðἰεý óçἰáἰóéεù ἄéá ἰἄñεéἰýð ἰεἰñðἰòð. Ἰðἰñáβ ἰ ELF ἰá ἄβἰάé εβἰἰ ðεἰ ἄñáùò áðἰ óἰἰ a.out, ἄεεÙ ç ἄéáóἰñÙ ἄáἰ ἄβἰάé ἄéóðçðΠ. ÓðÙñ ÷ἰóἰ ἄðβóçò ðἰεεÝð Ùεεáò ἄéáóἰñÝð ἰáóáἰý óἰòð, óá εáðòñÝñáéáò ἠðἰòð óἰἰ ðñἰðἰ ðἰò ἰáἰéóóἰε ÷βἰεἰóἰ óáεβἰáò, ðἰò ÷áεñβἰéἰóáé óἰἰ εἰἰáéá initt, εéð. ἘáἰεÙ áðἰ áóðÝð ἄáἰ ἄβἰάé ðἰεý óçἰáἰóééΠ, ἄεεÙ ἠóóúóἰ ἄáἰ ðáýἰóἰ ἰá ἄβἰάé ἄéáóἰñÝð. Ἰá óἰἰ εáéñἠ ç òðἰóðΠñεἰç ἄéá óἰἰ a.out εá ἄðἰñáεñòἰεἰἄβ ἄðἰ óἰἰ ðòñΠἰá GENERIC, εáé óáεéεÙ εá ἄóáεñáεἄβ ἰáἰáεἰð ἄðἰ óἰἰ ðòñΠἰá ἠòáἰ ἄεεἄβθἰáε ἰεἰεεçñἠòεεÙ ç ἰáÙἠεç ἄεòÝεáóçò ðἰáεἰἰἰ ðñἰñἰñἰÙòἰ ἰá ἄἰóðἰò a.out.

### 3.13 Ἀέá Ðἰñéóóúòáñἰò Ðεçñἰóἰñβἰò

#### 3.13.1 Óáεβἰáò Ἀἰçεἰἄβἰò

Ç ðεἰ εáóáἰýðΠ óáεἰçñβúóç óἰἰ FreeBSD ðñἰóóÝñἰáóáé ἰá òç ἰñἰòΠ òἰἰ óáεβἰἰ ἰἰçεἰἄβἰò (manual pages). Ó ÷ááἰἰ ἄéá εÙεá ðñἰñἰñἰἰ ἰἰò óðóðΠἰáóἰò ἄβἰáóáé ἰεá óýἰóñç ἰáἰóἰñÙ ðἰò ἰἰçἰἄβ òéð ἄáóééÝð εáéóἰòñἰñἰἄβò εáé ἄεÙóἰñἰ ሸεεá εÝἰáóá. ἈóðÝð ἰε óáεβἰáò ðñἰἰἠḂεἰἰóáé ἰá òçἰ ἰáἰἰεΠ man. Ç ÷ñΠóç òçò ἰáἰἰεΠð man ἄβἰάé ἰáðεΠ:

```
% man command
```

ἠðἰò command ἄβἰάé óἰ ἠñἰá òçò ἰáἰἰεΠð ἄéá òçἰ ἰðἰβἰ ἰáðéεòἰἰἄβò ἰá ἰÙεáòἰ ðἰñéóóúòáñἰò ðεçñἰóἰñβἰò. Ἀέá ðἰñḂἰἰἰἰἰἰἰ, ἄéá ἰá ἰÙεáòἰ ðἰñéóóúòáñἰ ἄéá òçἰ ἰáἰἰεΠ 1s ðεçεòñἰεἰἰἰἰἰἰἰἰἰ:

```
% man 1s
```

Óἰ online manual ÷Ḃñβἰἰἰἰἰἰἰἰ ἰá òÝóóἰñéò ἰñεéἰçἰÝἰἰἰ ἰáἰἰóçòἰð:

1. ἰáἰἰεÝð ÷ñΠóç.
2. ἘεΠóáéò óðóðΠἰáóἰò εáé ἰñεéἰñβ ἰóáεἰÙòἰ.
3. ÓðἰἰñðΠóáéò òἰἰ ἰéáεἰεἰçεἰἰ ἰçò C.
4. Ἰἰçἰñἰβ ἰóðéáðἰ.
5. Óýðἰε ἰñ ÷ἰβἰ.
6. Ðáé ÷ἰβἰἰἰἰἰἰἰἰἰ ἰáé ሸεεáò ἰóἰñἰñἰÝð ἰéáóéÝἰáóçò.
7. ἈεÙóἰñἰἰἰ ðεçñἰóἰñβἰò.
8. ÓðἰóΠñçóç óðóðΠἰáóἰò εáé ἰáἰἰεÝð εáéóἰòñἰñἰἄβò.
9. ἰáÙðòóἰç ðòñΠἰá.

Óá ἰἰñééÝð ðἰñéððἰóáéò, óἰ βἰεἰ εÝἰἰ ἰðἰñἰἰ ἰá ἰἰóἰñβἰἰἰἰἰἰἰ ἰá ðἰñéóóúòáñἰò ἰáἰἰóçòἰð òἰἰ óáεβἰἰ ἰἰçεἰἰἰἰἰἰἰ. Ἀέá ðἰñḂἰἰἰἰἰἰἰ, òðÙñ ÷áç ἰáἰἰεΠ ÷ñΠóç chmod εáé ç εεΠóç óðóðΠἰáóἰò chmod(.). Óá ἰáðΠ òç ðἰñβððòἰóç, ἰðἰñἰἰἰἰ ἰá ðἰñἰἰ ἰáἰἰεΠ man ðἰεá ἰéñεἰἰð εÝεáòἰ ἰáðééÝἰñἰóáò òçἰ ἰáἰἰóçòἰ:

```
% man 1 chmod
```



έέ kbdcontrol(1) όύ όέβäüí äíΠέέέδ (manual pages). Äáí έά όόίá ÷ βόίöíä ðáñáέóΎñü, áέéÜ ï áíáέάöäñüüáñö áíááíβóδçð ïðíñáβ íá όðíäíöέáýáόάέ ðΎíóá όέð όáέβäüð äíçέáβáð ãέá ðáñέóóüóäñíí έäðöñáñΠ έέé íέíέέçñüíΎίç äðáíβäçóç όύ έέέóíöñäέβí.

4. Áðöü äáí áβίáέ áðüέóóá áέçéΎð — ÖðÜñ ÷ íóí íáñέéÜ ðñÜäíáόá ðíö äáí ïðíñíýí íá äέáέíðíýí. Äέá ðáñÜááέäíá, äΎí ç äέáñááόβá ðñíóðáέäβ íá äέááÜóáé Ύíá áñ ÷ äβí áðü Üέέíí öðíέíáέóóð όóí äβέóóí έέé íáóíέéÜ áóóüð ï Üέέíð öðíέíáέóóðð äέáέüøáé äέá έÜðíέíí έüäí (έüäü έέáέóβíáóíö ðíö pc Π έüäü äέÜäçð όóí äβέóóí), öüðä ç äέáñááόβá íñÜæáóáé íç “äέáέüøέíç”. Δέέáíβð ç äέáñááόβá íá έÜíáέé time out, όóíΠέüð íáðÜ áðü äýí έäðöÜ. Íüέέð όóíááβ áóóü, έá óáñíáóέóóáβ Üíáόá.

# ΕὰöÜεάεί 4 ἈἷεάôÜóóάός Ἀöáñïĩᾶρί: ἘάεΥôά έάέ Ports

## 4.1 Óýïïθς

Ôï FreeBSD óðñᾶᾱýᾶóάέ ᾶðu ïβᾶ ðεῖγύóέᾶ óöεεῖᾶP ᾶðu ðñïᾶñÜñᾶóᾶ óáí ïÝñïð ðïð ᾶáóέεῖγύ óóóóPῖᾶóïð. ¼ᾶìùð, εβᾶᾶ ïðñᾶᾶ ïᾶ éÜῖᾶέ éÜðῖεῖð ðñεῖ ᾶñᾶεᾶᾶ ὄóçí ᾶῖÜᾶές ïᾶ ᾶᾶεᾶóᾶóóPóᾶέ ïεᾶ ðñüóεᾶóς ᾶóᾶñῖᾶP ᾶέᾶ ïᾶ öεῖðῖεPóᾶέ ïεᾶ ðñᾶᾶῖᾶóέεP ᾶñᾶᾶóᾶ. Ôï FreeBSD ðᾶñÝ ÷ ᾶέ ᾶöï óóïðεçññῖᾶᾶóέéÝð ðᾶ ÷ ñῖεῖᾶᾶð ᾶέᾶ ïᾶ ᾶᾶεᾶóᾶóóPóᾶóᾶ ðñüóεᾶóᾶ ᾶóᾶñῖᾶÝð ðöï óýóóçῖᾶ óᾶð: ðς ÓöεεῖᾶP ðῖῖ Ports (Ports Collection, ᾶέᾶ ᾶᾶεᾶóÜóóᾶός ᾶðu ðῖῖ ðçᾶᾶᾶῖ εῖῖᾶέᾶ), έάέ ðᾶ ðᾶéÝðᾶ (packages, ᾶέᾶ ᾶᾶεᾶóÜóóᾶός ᾶðu ðñῖ-ῖᾶóᾶᾶεüðóéóῖÝῖᾶ ᾶéðᾶéÝóéῖᾶ ᰄᾶéÝðᾶ). ÉÜεᾶ ïβᾶ ᾶðu ðéð ᾶöï ïᾶεῖᾶῖðð ïðñᾶᾶ ïᾶ ÷ ñçóéῖῖðῖεçðᾶᾶ ᾶέᾶ ïᾶ ᾶᾶεᾶóᾶóóPóᾶóᾶ ðéð ïᾶüðᾶñᾶð ᾶéᾶüóᾶéð ᾶðu ðéð ᾶᾶᾶðçῖÝῖᾶð óᾶð ᾶóᾶñῖᾶÝð, ᾶðu ðῖðééÜ ᾶðῖεçéᾶðóééÜ ῖÝóᾶ P ᾶðᾶðεᾶᾶð ᾶðu ðῖ ᾶᾶéðöῖ.

Ἀóῖγύ ᾶέᾶᾶÜóᾶóᾶ ᾶðöü ðῖ εᾶöÜεᾶεί, εᾶ ῖÝñᾶóᾶ:

- Ðüð ïᾶ ᾶᾶεᾶééóðÜðᾶ ðñῖ-ῖᾶóᾶᾶεüðóéóῖÝῖᾶ ᰄᾶéÝðᾶ εῖᾶéóῖééῖγύ.
- Ðüð ïᾶ ῖᾶóᾶᾶεüððᾶεᾶóᾶ ðñüóéᾶöῖ εῖᾶéóῖééü ᾶðu ðῖῖ ðçᾶᾶᾶῖ εῖῖᾶέᾶ ÷ ñçóéῖῖðῖεῖῖᾶð ðçῖ ÓöεεῖᾶP ðῖῖ Ports.
- Ðüð ïᾶ éÜῖᾶóᾶ ᾶðᾶᾶεᾶóÜóóᾶός ᾶᾶεᾶóᾶóóçῖÝῖᾶ ᰄᾶéÝðῖῖ P ports.
- Ðüð ïᾶ ᾶééÜεᾶóᾶ ðéð ðñῖεᾶῖεῖῖéóῖÝῖᾶð ñöεῖῖóᾶéð ðῖð ÷ ñçóéῖῖðῖεᾶᾶ ç ÓöεεῖᾶP ðῖῖ Ports.
- Ðüð ïᾶ ᾶñᾶóéᾶóᾶ ðᾶ έᾶóÜεéçᾶ ᰄᾶéÝðᾶ εῖᾶéóῖééῖγύ.
- Ðüð ïᾶ ᾶῖᾶᾶᾶεῖᾶεᾶóᾶ ðéð ᾶóᾶñῖᾶÝð óᾶð.

## 4.2 ἈðéóéüðçóP ðçð ᾶᾶεᾶóÜóóᾶόςð éῖᾶéóῖééῖγύ

Ἀῖ ῖ ÷ ᾶðᾶ ÷ ñçóéῖῖðῖεῖῖᾶέ ῖῖᾶ UNIX óýóóçῖᾶ óöï ðᾶñᾶéüῖ, εᾶ ᾶῖñᾶᾶεᾶóᾶ üðé ç óðῖçééóῖÝῖç ᾶéᾶᾶééᾶóᾶ ᾶέᾶ ðçῖ ᾶᾶεᾶóÜóóᾶός ðñüóéᾶðῖ εῖᾶéóῖééῖγύ ᾶῖᾶέ ðᾶñᾶðῖð ç ðᾶñᾶéÜðü:

1. “ÉᾶóÝᾶᾶóῖᾶ” ðῖð εῖᾶéóῖééῖγύ, ðῖð ïðñᾶᾶ ïᾶ ᾶέᾶῖῖᾶóᾶέ óᾶ ῖñöP ðçᾶᾶᾶῖð εῖῖᾶέᾶ, P óᾶῖ ᾶéðᾶéÝóéῖῖ.
2. Ἀðῖóðῖðᾶóç ðῖð εῖᾶéóῖééῖγύ ᾶðu ðçῖ ῖñöP ðçð ᾶéᾶῖñPð ðῖð (óðῖPεüð ῖῖᾶ tarball óöïðéᾶóῖÝῖῖ ïᾶ ðῖ compress(1), gzip(1), P bzip2(1)).
3. Ἀῖðῖðéóῖüð ðçð ðᾶéῖçñᾶüóçð (ðééᾶῖPð ῖῖᾶ ᾶñ ÷ ᾶᾶῖ INSTALL P README P ῖᾶñééÜ ᾶñ ÷ ᾶᾶῖ ῖÝóᾶ óᾶ ῖῖᾶ óðῖεᾶóÜεῖῖᾶ doc/) έᾶέ ᾶῖÜᾶῖóP ðῖðð ᾶέᾶ ðῖ ðüð εᾶ ᾶᾶεᾶóᾶóᾶéᾶᾶ ðῖ εῖᾶéóῖééü.
4. Ἀῖ ðῖ εῖᾶéóῖééü ᾶέᾶῖῖᾶóᾶέ ïᾶ ðç ῖñöP ðçᾶᾶᾶῖð εῖῖᾶέᾶ, ῖᾶóᾶᾶεῖððóéóç ðῖð. Ἀðöü ïðñᾶᾶ ïᾶ ðᾶñééᾶῖᾶÜῖᾶέ ðçῖ ᾶðᾶῖᾶñᾶᾶóᾶ ᾶῖüð Makefile, P ðçῖ ᾶéðÝéᾶóç ᾶῖüð configure script, έᾶέ Üεᾶð ᾶñᾶᾶóᾶð.
5. ἈῖεéῖP έᾶέ ᾶᾶεᾶóÜóóᾶός ðῖð εῖᾶéóῖééῖγύ.

Éᾶέ ᾶðÜ ῖñῖ ᾶῖ üéᾶ ðÜῖᾶ έᾶéÜ. Ἀῖ ᾶᾶεᾶééóðÜðᾶ ῖῖᾶ εῖᾶéóῖééü ðῖð ᾶᾶῖ ῖ ÷ ᾶé ῖᾶóᾶᾶñᾶᾶᾶ ðöï FreeBSD ðöüð ïᾶ ðñÝðᾶέ ïᾶ ðñῖðῖεῖῖᾶéᾶ ðῖῖ ðçᾶᾶᾶῖ εῖῖᾶέᾶ ᾶέᾶ ïᾶ ᾶῖðéÝðᾶέ óüóóÜ.



Óá ðáñééÝð ðáñéððóáéð, ðññáß íá ððÛñ÷íð ðñéáððÛ ðáéÝóá áéá ðçí ßáéá áóáññíáþ, ðá áéáðñíáðééÝð ððèíßóáéð. Æéá ðáñÛááéá, ðí **Ghostscript** áéáðßéáðéá ùð Ýíá ðáéÝðí ghostscript éáé Ýíá ðáéÝðí ghostscript-nox11, áíáéñáð áí éá ááéáðáóðóáðá Þ ù÷é Ýíáí X11 server. Áððíý ðñð ðýðñð ðé ððèíßóáéð áßíáé áðñáðÝð ðá ðá ðáéÝóá, áééÛ áñþáñá áßñíóáé ááýíáðáð áí ðßá áóáññíáþ Ý÷áé ðáñéóóóðáñáð áðñ ðßá Þ áýí áéáðñíáðééÝð ððèíßóáéð ðáðáæþðóéóçð.

- Ìé ððñéðáð ðñí áááþí áéáñíðð áðñ ðáñééÝð áéáñíÝð éñáéóíééý, áðáññáýíðí ðçí áéáñíþ áéðáéÝóéñð éþáééá. ÐñÝðáé íá áéáñíçéýí ðá ðçí ðñðÞ ðçááßíð éþáééá.
- ðáñééÛ Ûðñá ááí áðéóðáýýíóáé ðá Ýðñéíá áéðáéÝóéíá. ÒñééÛ÷éóðñí ðá ðñí ðçááßíð éþáééá, ðññáßðá (èáñçðééÛ) íá ðñí áéááÛóáðá éáé íá ðÛíáðá áéá ðéáíÛ ðññáéðñáðá ðññð óáð.
- Áí Ý÷áðá ðñðééÛ, áééÛ óáð patches, éá ÷ñáéáðáßðá ðñí ðçááßíð éþáééá áéá íá ðá áóáññíáðáðá.
- ðáñééÛ Ûðñá ðñðóðÛññíð íá Ý÷íð ðñí ðçááßíð éþáééá, þóðá íá ðñí áéááÛóðñí áí ááñáéýíá, íá ðñí áééÛññíð (hack), íá ááíáéóðñí áðñ áððñí (áí áÝááéá ðñí áðéðñÝðáé ç Ûááéá), é.é.ð.

Æéá íá áßðáð áíðñáññð áéá ðá áíáíáñÝíá ports, ááñáðáðáðá ðçí çéáéðññíééþ éßððá ðñí FreeBSD ports (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ports>) éáé ðçí çéáéðññíééþ éßððá áíáíáññíð ðññáéçíÛðñí ðñí FreeBSD ports (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ports-bugs>).

**Ðññáéáðñíóç:** Ðññéí ááéáðáóðóáðá ðññéíáþðñíðá áóáññíáþ, ðñÝðáé íá áéÝá÷áðá ðñí <http://vuxml.freebsd.org/> áéá èÝíáðá áððáéáßáð ðñð ð÷áððæñíóáé ðá ðçí áóáññíáþ óáð.

ðññáßðá áððóçð íá ááéáðáóðóáðá ðñí ports-mgmt/portaudit ðñí ðñíßí áððñíáðá éá áéÝá÷áé ùéáð ðéð ááéáðáóðóçÝíáð áóáññíáÝð áéá áñóðð ðññðÛ ðçíáßá. éáá÷íð áððóçð éá ðñáñíáðñíéáßðáé ðññéí ðç ðáðáæþðóéóç ðññéíáþðñíðá port. Òñí áíáéÛíáðñí, ðññáßðá íá ÷ñóéñíðñíéáßðá ðçí áíðñéþ portaudit -F -a áððñíð Ý÷áðá ðññðá ááéáðáóðóáðá ðáñééÛ ðáéÝóá.

Ïñ ððñééðñí áððñí ðñð éáðáéáßíð áíçááß ðñð ðá ÷ñóéñíðñíéáßðá ðá ðáéÝóá éáé ðá ports áéá íá ááéáðáóðóáðá éáé íá áéá÷áéñéóðáßðá ðññúðéáðñí éñáéóíééú ðñí FreeBSD.

### 4.3 Æñßóéñíóáð ðçí Æóáññíáþ óáð

Ðññéí ááéáðáóðóáðá ðññéíáþðñíðá áóáññíáþ ðñÝðáé íá áñññáéáðá ðé èÝéáðá íá èÛíáé, éáé ðñð ðññÛááé ç áóáññíáþ.

Ç éßððá ðñí áéáéÝóéñíð áóáññíáþí ðñí FreeBSD ðááéþñáé óðñá÷ðð. Áððð÷ðð, ððÛñ÷íð ðñéáðð ðññðñé íá áñáßðá áððñí ðñð èÝéáðá:

- Óçç áééððáéþ ðññéíáðá ðñð FreeBSD éá áñáßðá ðéá éßððá áðñ ùéáð ðéð áéáéÝóéñíð áóáññíáÝð, ðñí <http://www.FreeBSD.org/ports/> (<http://www.FreeBSD.org/ports/index.html>). Ç éßððá áððÞ áíáíáññíáðáé óð÷íÛ, áñþ ððÛñ÷áé éáé áðñáðñíðçðá áíáéþðçóçð. Òá ports áßíáé ÷ñéóíÝíá ðá éáðçáññáð, éáé ðññáßðá íá íáíáéçððóáðá ðßá áóáññíáþ áßðá ðá ðñí ðññá (áí ðñí ðññáðá), Þ íá ááßðá ùéáð ðéð áóáññíáÝð ðñð áßíáé áéáéÝóéñíð ðá ðéá éáðçáññá.
- Ì Dan Langille áéáðçñáß ðñí FreshPorts, ðñí <http://www.FreshPorts.org/>. Òñí FreshPorts éáðááñÛóáé ðéð áééááÝð ðñí áóáññíáþí ðñí áÝíðñí ðñí ports éáèðð óðñááßññíð, áðéðñÝðñíðóðá íá “ðáñáéñíðéáßðá” Ýíá Þ ðáñéóóóðáñá ports, éáé ðññáß íá óáð óðáßéáé email ùðáí áððÛ áíáíáññíóáé.
- Áí ááí áñññáéáðá ðñí ðññá ðçð áóáññíáþð ðñð èÝéáðá, áñééÛóðá íá ÷ñóéñíðñíéáßðá Ýíá site ðáí ðñí FreshMeat (<http://www.freshmeat.net/>) áéá íá áñáßðá ðßá áóáññíáþ, éáé ðáðÛ ðññáßðá íá áéÝáñáðá íáíÛ ðñí site ðñð FreeBSD áéá íá ááßðá áí ç áóáññíáþ Ý÷áé áßíáé port.



- Óá Ýía óýóóçíá ðïð ãñβóéáóáé Ðäç óá éáéóïðñáβá, ïðññáβóá íá áéóáéÝóáóá òí **sysinstall** áéá íá ááéáóáóóÐóáóá, íá áéáñÛøáóá, éáé íá äáβóá óéð ááéáóáóóçíÝíáð éáé óéð áéáéÝóéíáð áöáññãÝð. Áéá ðãñéóóóðãñáð ðεçññïññβáð, äáβóá òí ÒíÐíá 2.10.11.
- Óá äéÛöíñá ãñãáéáβá áéá ÷ áβñéóçð ïÝóóð óçð ãñññðð áíóñεþí, ðïð áðñíáéíýí éáé òí áíóééáβññáñ óðεÐóçóçð áóððð óçð áñüóçóáð.

### 4.4.1 Åãéáééóóþíóáð Ýía ÐáéÝóí

Ïðññáβóá íá ÷ ñçóéññðñéÐóáóá òí ãñãáéáβí pkg\_add(1) áéá íá ááéáóáóóÐóáóá Ýía ÐáéÝóí éñáéóíééý òïð FreeBSD áðü Ýía òñðééÛ áðñεçéáóíÝíí ãñ ÷ áβí Ð áðü Ýíáí áéáéñéóóÐ óóí áβéðí.

#### ÐáñÛááéãñá 4-1. “ÉáóÝááóíá” áñüð ÐáéÝóíð ÷ áéññéβíçóá éáé ááéáóáóóç òïð òñðééÛ

```
# 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 òñðééÛ ðçãÐ ÐáéÝóóí (üððð áβíáé Ýía FreeBSD CD-ROM set) òüðá βóòð áβíáé áðéñüüðãññ íá ÷ ñçóéññðñéÐóáóá óçí áðééñãÐ -r áéá òí pkg\_add(1). Áóðð éá éÛíáé òí ãñãáéáβí íá éáéññβóáé áðöññáóá óç óóóðÐ ïññÐ éáé Ýéáñóç éáé Ýðáéóá íá áíáéðÐóáé éáé íá ááéáóáóóÐóáé òí ÐáéÝóí áðü Ýíáí FTP site.

```
# pkg_add -r lsof
```

Óí ðãñáðÛñ ðáñÛááéãñá éá “éáóááÛóáé” éáé éá ááéáóáóóÐóáé òí óóóóð ÐáéÝóí ÷ ùñβð ðãñáéóÝñ ððÝíááóç òïð ÷ ñÐóç. Áí ááí èÝéáðá íá ÷ ñçóéññðñéÐóáóá òí éýñéí site áéáññðð ÐáéÝóóí, ïðññáβóá íá ÷ ñçóéññðñéÐóáóá éÛðñéí mirror. Áéá òí óéñðü áððü, éá ðñÝðáé íá ñðéñβóáðá óóóðÛ óçí óéñÐ óçð PACKAGESITE, þóðá íá ðãñáéÛñøáðá óéð ðññáðééãññÝíáð ñðéñβóáéð. Óí pkg\_add(1) ÷ ñçóéññðñéáβ òí fetch(3) áéá íá “éáóááÛóáé” óá ãñ ÷ áβá, éáé áððü ïá óç óáéñÛ òïð ÷ ñçóéññðñéáβ äéÛöíñáð ïáóááεçóÝð ðãñéáÛééññóðð, ðãñééáíááññÝíñ òñí FTP\_PASSIVE\_MODE, FTP\_PROXY, éáé FTP\_PASSWORD. Óóòð ÷ ñáéáóóáβ íá ñðéñβóáðá ïβá Ð ðãñéóóóðãññáð áðü áóðÝð áí ãñβóéáóóá ðβóü áðü Ýíáí firewall, Ð βóòð íá ÷ ñáéáóóáβ íá ÷ ñçóéññðñéÐóáóá Ýíáí FTP/HTTP proxy. Åáβóá òí fetch(3) áéá óçí ðεÐñç

ëßóóá öùí ðáäáäéçîþí. ÐññíóÝíôá ùöé óðí ðáñáðÛüí ðáñÛááéáíá ÷ñçóéíñðíéáßðáé ðí lsof áíðß ðíð lsof-4.56.4. ¼óáí äßíáðáé äðñáéñðóíÝíç ëþç, ðñÝðáé íá áóáéññáð í áñéèíüð Ýéäíóçð ðíð ðáéÝðíð. Õí pkg\_add(1) éá “éáðááÛóáé” áðöüíáðá óçí ðáéäððáßá Ýéäíóç ðçð áðáññüäð.

**Õçíäßòç:** Õí pkg\_add(1) éá “éáðááÛóáé” óçí ðáéäððáßá Ýéäíóç ðçð áðáññüäð áí ÷ñçóéíñðíéáßðá FreeBSD-CURRENT Þ FreeBSD-STABLE. Áí ðñÝ÷áðá íéá -RELEASE Ýéäíóç, éá “éáðááÛóáé” óçí Ýéäíóç ðíð ðáéÝðíð ðíð Ý÷áé ðáðáäüððéóððáß íá óçí Ýéäíóç óáð. Åßíáé áðíáðü íá ðí áéèÛíáðá áðöü, áéèÛæíðáð óçí PACKAGESITE. Åéá ðáñÛááéáíá, áí ðñÝ÷áðá Ýíá óýóóçíá FreeBSD 5.4-RELEASE, ðí pkg\_add(1), áðü ðññáðééíáÞ, éá ðñíððáéÞóáé íá “éáðááÛóáé” ðáéÝðá áðü ðí ftp://ftp.freebsd.org/pub/FreeBSD/ports/i386/packages-5.4-release/Latest/. Áí èÝèáðá íá áíááéÛóáðá ðí pkg\_add(1) íá “éáðááÛóáé” ðáéÝðá ðíð FreeBSD 5-STABLE, èÝóðá óçí PACKAGESITE ùð ftp://ftp.freebsd.org/pub/FreeBSD/ports/i386/packages-5-stable/Latest/.

Õá áñ÷áßá öùí ðáéÝðíð äéáíÝñíðáé óá ðññóÝð .tgz éäé .tbz. ðññáßðá íá óá áñáßðá óðí

ftp://ftp.FreeBSD.org/pub/FreeBSD/ports/packages/, Þ óðá CD-ROM ðçð äéáíñðð ðíð FreeBSD. ÈÛèá CD óðí FreeBSD 4-CD set (éäé óðí PowerPak, èèð.) ðáñéÝ÷áé ðáéÝðá óðí éáðÛéññáñí /packages. Ç éáðçäññéñðíßðçð öùí ðáéÝðíð áéññéðáß óçí áñÞ ðíð äÝíðñíð /usr/ports. ÈÛèá éáðçäññáß Ý÷áé ðí áééü ðçð éáðÛéññáñí, éäé èÛèá ðáéÝðíð ðññáß íá áñáéðáß óðí éáðÛéññáñí A11.

Ç áñÞ öùí éáðáéüáñí ðíð óðóðßíáðíð ðáéÝðíð óáéñéÛæáé íá óçí áíðßóðíé÷ç öùí ports. Õá äýí óðóðßíáðá óðíñáñÛæíðáé ðáðáíý ðíðð áéá íá äçíéíðñáÞóíðí ðí óðíñééü óýóóçíá ðáéÝðíð/ports.

#### 4.4.2 Åéá÷áßñéóç öùí ÐáéÝðíð

Õí pkg\_info(1) äßíáé Ýíá áñáééáßí ðíð ðáñáéÝðáé éäé ðáñéñÛóáé óá áéÛóíñá ðáéÝðá ðíð äßíáé äééáðáóóçíÝíá.

```
# 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) äßíáé Ýíá áñáééáßí ðíð óðñíðßæáé óéð áéäüóáéð üéñí öùí äééáðáóóçíÝíñí ðáéÝðíð. Óðäéñßíáé óçí Ýéäíóç èÛèá ðáéÝðíð, íá óçí ðñÝ÷áðá Ýéäíóç ðíð áñßóéáðáé óðí äÝíðñí öùí ports.

```
# pkg_version
cvsup                =
docbook              =
...
```

Õá óýíáñéá óðçí ääýðáñç óðÞçç äçëþñíðí óçí ó÷áðéÞ çéééßá ðáðáíý öùí äééáðáóóçíÝíñí áéäüóáñí éäé öùí áéäüóáñí ðíð äßíáé äééáÝóéíáð óðí ðíðééü äÝíðñí öùí ports.

| Óýíáñéí | Õçíáóßá                                                                                                |
|---------|--------------------------------------------------------------------------------------------------------|
| =       | Ç Ýéäíóç ðíð äééáðáóóçíÝíñí ðáéÝðíð óáéñéÛæáé íá áððð ðíð äßíáé äééáÝóéíç óðí ðíðééü äÝíðñí öùí ports. |
| <       | Ç äééáðáóóçíÝíç Ýéäíóç äßíáé ðáéáéñðáñç áðü áððð ðíð äßíáé äééáÝóéíç óðí äÝíðñí öùí ports.             |

**Óγíãññ**

>

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**Óçíáóóá**

Ç äãéáóóóçìÝíç Ýéäñóç áβíáé íãññãñç áðñ áóðP ðñó áβíáé äéáéÝóçç óóñ ðñðééñ äÝíóññ òñí ports. (Ôñ ðñðééñ äÝíóññ òñí ports áβíáé ðééáíñóóáá áðãñ÷ áéññÝñ.)

Ôñ äãéáóóóçìÝñ ðáéÝóñ äãñ ãñβóéãóáé óóá ðãñéã÷ ùññáíá òñí ports. (Áóóñ ìðññãβ íá óóññãã, äéá ðãñÛäééãñá, áí Ýíá äãéáóóóçìÝñ port Ý÷ áé áóáéññéãã áðñ òçí ÓðëëñãP òñí Ports, P Ý÷ áé ìáóñññáóóã.)

ÓðÛñ÷ ðñðééáðéÝð äéäñóáéð ðñó ðáéÝóñ.

Ôñ äãéáóóóçìÝñ ðáéÝóñ óðÛñ÷ áé óóñ index, äééÛ äéá éÛðñéñ éñññ ðñ pkg\_version äãñ éáóÛóãññá íá óóãéñññíáé òçí Ýéäñóç ðñó äãéáóóóçìÝñ ðáéÝóñ ìá òçí áñóóóñé÷ç éáóá÷þñçóç óóñ index.

**4.4.3 Áöáéñþñóáó Ýíá ÐáéÝóñ**

Áéá íá áóáéñÝóááá Ýíá äãéáóóóçìÝñ ðáéÝóñ éññéóñééñý, ÷ñçóéññðñéðóáá ðñ ãñãáéãβñ pkg\_delete(1).

```
# pkg_delete xchat-1.7.1
```

Óçíáéðóáá ùðé ðñ pkg\_delete(1) áðáéóãã ðñ ðéþñãð ùññá éáé áñééññ Ýéäñóçð ðñó ðáéÝóñ. Ç ðãñãðÛññ áñóñéP äãñ éá éäéóññãñPóáé áí äþóááá áðéþð xchat áñóβ äéá xchat-1.7.1. Áβíáé ùóóññóñ äýéññ íá ÷ñçóéññðñéðóááá òçí pkg\_version(1) äéá íá ãññãβáá òçí Ýéäñóç ðñó äãéáóóóçìÝñ ðáéÝóñ. Áñóβ äéá áóóñ, ìðññãβáá áðβçð íá ÷ñçóéññðñéðóááá Ýíá ìðáéáñóÝñ.

```
# pkg_delete xchat\*
```

Óðçí ðãñβðóóçç áóðP, éá äéãããñóññý íéá óá ðáéÝóá ðñó óá ðñññáóá ðñðð äñ÷βãñññ ìá xchat.

**4.4.4 ÄéÛóññá**

¼éãð ðé ðéçñññññãð äéá óá ðáéÝóá áβíáé áðñéçéãññÝññáð óóññ éáóÛéñññ /var/db/pkg. Óóá äñ÷βãññ áðóññ ðñó éáóáéñññ, éá ãññãβáá òç ðãñéãñãóP éÛéá ðáéÝóñ, éäéþð éáé òç éβóóá òññ äñ÷βãññ ðñó äãéáééóóÛ.

**4.5 × ãñçóéññðñéðñóáó òçí ÓðëëñãP òñí Ports**

Óá ðãñãéÛóó ðñññáóá äβññññ ááóééÝð ðãçãããð ÷ñβçð òçð ÓðëëñãPð òñí Ports äéá äãéáóÛóóáóç P äéãããñóP ðññãñãññÛóóñ óóñ óýóóçíá óáð. ìðññãβáá íá ãññãβáá éãððññãñP ðãñéãñãóP òññ äéáéÝóéñññ áðééññññ ðñó make éáé òññ ìáóáéççðþñ ðãñéãÛéññññ ðñó ports(7).

**4.5.1 Áñáéðþñóáó òçí ÓðëëñãP òñí Ports**

Ðñéñ ìðññÝóááá íá äãéáóóóçìPóááá ðññññÛññáóá ìÝóóñ òññ ports, ðñÝðáé ðññóá íá áñáéðPóááá òçí ÓðëëñãP òññ Ports. Ðññéäéáéé ðóóéáóóéÛ äéá ðéá óðëëñãP áðñ Makefiles, patches, éáé äñ÷βãññ ðãñéãñãñóPð ðñó ðñðñéãñññññáé óóñ /usr/ports.









Ðññíóáñðóóá ðí DVD-ROM óðí /cdrom. Áí ÷ñçóéññðíéáðá êÛðíéí áéáóññáóééú óçíáßí ðññíóÛñðçóçð, ñðèìßóðá óçí ðíáááèçðß CD\_MOUNTPTS ðíð make. Óá áíááëáßá distfiles éá ÷ñçóéññðíéçéíýí áððùíáóá áí ððÛñ÷íðí óðí áéóéÛéé.

**Óçíáßóóç:** ÐñÝðáé íá áíññßæáðá ùðé íé Ûááéáð ðíñéêþí ports ááí áðéðñÝðíðí óçí áéáíñß ðíðð óá CD-ROM. Áððù ðíñáß íá ðáßéáðáé ð.÷. óðí ùðé ðñÝðáé íá óðíðéçñðóáðá íéá óññíá áááñáððð ðñéí “éáóááÛóáðá” óçí áðáññíáß, ð óðí ùðé ááí áðéðñÝðáé ç áðáíááéáíñß, ð óá êÛðíéí Ûééí eüáí. ÁÛí êÝéáðá íá ááéáðáóðóáðá Ýíá port ðíð ááí ðáñééáíáÛíáðáé óðí CD-ROM, éá ÷ñáéáðáß íá áßóðá óðíáááñÝíðð óðí Áéááßéððí áéá íá ðí áðéðý÷áðá.

Óí óýóóçíá ðùí ports ÷ñçóéññðíéáß ðí fetch(3) áéá íá “éáðááÛóáé” óá áñ÷áßá. Óí fetch(3) ÷ñçóéññðíéáß áéÛóññáð ðíáááèçðÝð ðáñéáÛééññðíð, ðáñééáíááíñÝíúí ðùí FTP\_PASSIVE\_MODE, FTP\_PROXY, éáé FTP\_PASSWORD. Óððð ÷ñáéáðáß íá ñðèìßóðá ðßá ð ðáñéóóóðáñáð áí áñßóéáðáðá ðßóóð áðü Ýíá firewall, ð ðóòð íá ÷ñáéáðáß íá ÷ñçóéññðíéáðá Ýíáí FTP/HTTP proxy. Ááßðá ðí fetch(3) áéá íéá ðéßñç éßóðá ðùí ðíáááèçðßí áððþí.

Áéá ÷ñßóðáð ðíð ááí ððñíýí íá áßíáé óðíáááñÝíé ùèç óçí þñá, áéáðéáðáé ç áðééñáß make fetch. Áðéðð áéðáéÝóðá óçí áíðíéß óðíí éáðÛéñíá (/usr/ports) éáé óá áðáñáßðçóóá áñ÷áßá éá “éáðÝáññí” áéá áóÛð. Ç áíðíéß áððð éá áéáðíñáßóáé éáé óá ððíéáðáéññðð, ùððð áéá ðáñÛááéáíá: /usr/ports/net. ÐññíóÝíðá ùðé áí Ýíá port áíáñðÛóáé áðü áéáéñéðéáð ð Ûééá ports, ç áíðíéß áððð ááí éá áíáéððóáé óá distfiles ðíðð. Áíóééáðáóðóáðá ðí fetch ðá ðí fetch-recursive áí êÝéáðá ðáßá ðá ðí port íá áíáéððóáðá éáé ùéáð ðéðð áíáñðóáéð ðíð.

**Óçíáßóóç:** ðíñáßðá íá ðáðááéñððóóáðá ùéá óá ports óá ðßá éáðçáññíá ð áéñíá éáé óá ùéáð, áéðáéðíðáð ðí make óðíí áñ÷ééú éáðÛéñíá, ùððð ðá óçí ðñíáíáðáñéáßóá make fetch ðÝéñíá. Áððù ùíðð áßíáé áðééßíáðíí, áéáðß ðáñééÛ ports ááí ððñíýí íá óðíððÛñ÷íðí. Óá Ûééáð ðáñéððóáéð, ðáñééÛ ports ðíñáß íá ááéáðáóðóáðíð ðí áéáðíñáðééÛ áñ÷áßá ðá ðí ðá ðí ðáéí ùíñá.

Óá ðáñééÝð ððÛíéáð ðáñéððóáéð, íé ÷ñßóðáð ðíñáß íá ÷ñáéÛæáðáé íá áíáéððóáéð óá tarballs áðü Ýíá site áéáðíñáðééú áðü óá MASTER\_SITES (ç ðíðíéáðáß áðü ùðíð “éáðááßññíð” óá áñ÷áßá). ðíñáßðá íá áééÛíáðá óçí áðééñáß MASTER\_SITES ðá óçí áéññéðçç áíðíéß:

```
# cd /usr/ports/directory
# make MASTER_SITE_OVERRIDE= \
ftp://ftp.FreeBSD.org/pub/FreeBSD/ports/distfiles/ fetch
```

Óá áððù ðí ðáñÛááéáíá áééÛíáíá óçí áðééñáß MASTER\_SITES óá ftp.FreeBSD.org/pub/FreeBSD/ports/distfiles/.

**Óçíáßóóç:** ðáñééÛ ports áðéðñÝðíðí (ð áðáéðíýí) íá áðóáðá áðééñáÝð ðáðááéðððéóçð ðíð ððñíýí íá áíáñáíðíéðóíðí/áðáíáñáíðíéðóíðí ðíðíáðá óçð áðáññíáðð ðíð áßíáé á÷ñááóóá, óðáéáñéñéÝíáð áðééñáÝð áóóáéáßáð, éáé Ûééáð ðñíðíðíéðóáéð. ÊíéíÛ ðáñáááßáíáðá ðÝðíéúí ports áßíáé óá www/mozilla, security/gpgme, éáé ðí mail/sylpheed-claws. ¼ðáí ððÛñ÷íðí áéáéÝóéíáð ðÝðíéáð áðééñáÝð, éá áíðáíéðáß óðçí ðéñíç óáð ó÷áðééú ððíðíá.



## 4.5.4 Áíáááèìβæííóáò óá Ports

Áñ ÷ ééÛ, äáβóá óá ðáññ÷ çìÝíá ports áéá óá íðíβá ððÛñ ÷ ïóí áéáéÝóéíáð íáúóáñáð áéäüóáéð óóçí Óðëëíãþ ðùí Ports, ìá óçí áíóíëþ pkg\_version(1):

```
# pkg_version -v
```

### 4.5.4.1 /usr/ports/UPDATING

Ìüëéð áíáíáþóáðá óçí Óðëëíãþ ðùí Ports, ðñÝðáé íá äëÝñíáðá òí áñ÷ áβí /usr/ports/UPDATING, ðñéí áðé÷ áéñþóáðá óçí áíááÛèìéóç áñüð port. Áóòü òí áñ÷ áβí ðáñéáñÛóáé áéÛóíñá ðééáíÛ ðñíäëþíáðá, éáèþð éáé áíáá÷ ùíáíá ðñüóéáðá áþíáðá ðñó ðñÝðáé íá áéðáéÝóáðá ùðáí áíáíáþíáðá Ýíá port. Ðáñáááβáíáðá ðùí ðáñáððÛñ, áβíáé ç áééáãþ ïññóþð éÛðñéíí áñ÷ áβí, áééáãþ óóçí òíðñéáðóá ðùí áñ÷ áβí ñðèìβóáí, þ Ûëëáð áóóíááðóóçðáð ìá ðáéáéúðáñáð áéäüóáéð.

Áí òí UPDATING áíáéñáβ éÛðé ðñó áéááÛóáðá äãþ, èáññþóáðá ùðé éó÷ ýáé òí UPDATING.

### 4.5.4.2 Áíáááèìβæííóáò Ports ìá òí Portupgrade

Ôí áñáéäéáβí **portupgrade** áβíáé ó÷ ááéáóíÝíí áéá íá áíáááèìβæáé äýëíéá ááéáðáóóçíÝíá ports. Äéáðβëáðáé áðü òí ports-mgmt/portupgrade port. Ááéáðáóóðþðá òí ùðòð éÛëá port, ÷ñçóéííðñéðíóáð óçí áíóíëþ make install clean:

```
# cd /usr/ports/ports-mgmt/portupgrade
# make install clean
```

Ç áíóíëþ pkgdb -F éá áéááÛóáé éáé éá áéíñèþóáé üëáð óéð áóóíÝðáéáð ðñó βóóðð ððÛñ ÷ ïóí óóç éβóóá ðùí ááéáðáóóçíÝíí ports. Áβíáé éáèþ éáÝá áβíáé íá óçí áéðáéáβóá óð÷ íÛ, áíáá÷ ñÝíúð ðñéí áðü éÛëá áíááÛèìéóç.

¼ðáí áéðáéáβðá òí portupgrade -a, òí **portupgrade** éá áñ÷ βóáé íá áíáááèìβæáé üëá óá ðáññ÷ çìÝíá ports ðñó áβíáé ááéáðáóóçíÝíá óðí óýóóçíá óáð. ×ñçóéííðñéðþðá óçí áðéëíãþ -i áí éÝëáðá íá óáð ñòðÛ áéá áðéááááβòóç áéá éÛëá ìá÷ ùñéóðþ áíááÛèìéóç.

```
# portupgrade -ai
```

Áí éÝëáðá íá áíáááèìβóáðá ìüñ ìβá óðáéäéñéíÝíç áóáññíãþ, éáé ù÷ é üëá óá áéáéÝóéíá ports, ÷ñçóéííðñéðþðá òí portupgrade *pkgname*. ÓòíðáñééÛááðá óçí áðéëíãþ -R áí òí **portupgrade** ðñÝðáé ðñþóá íá áíáááèìβóáé üëá óá ports ðñó áðáéóíýííáé áéá óçí óðáéäéñéíÝíç áóáññíãþ.

```
# portupgrade -R firefox
```

Äéá íá ÷ñçóéííðñéðþðá ðáéÝóá áíòβ áéá ports óóçí ááéáðóóçç, äþóðá óçí áðéëíãþ -P. ìá áóðþ óçí áðéëíãþ òí **portupgrade** áíáæçðÛ ðñóð òíðéëíýð éáðáéüáñòð ðñó ïñβæííóáé óðí PKG\_PATH, þ áíáéðÛ óá ðáéÝóá áðü áðñáéñóóíÝíá sites áÛí ááí áñáèýíí òíðééÛ. Áí óá ðáéÝóá ááí ìðñíýí íá áíáéðçéíýí ìá ðñóð ðáñáððÛñ ðñüðñóð, òí **portupgrade** éá ÷ñçóéííðñéðþðá óá ports. Äéá íá áðñóýááðá áíóáèþð óçí ÷ñþóç ðùí ports, éáéíñβóáð óçí áðéëíãþ -PP.

```
# portupgrade -PR gnome2
```

Äéá íá áíáéðþóáðá áðèþð óá distfiles (þ óá ðáéÝóá, áí Ý÷ áðá ïñβóáé óçí áðéëíãþ -P) ÷ ùñβð íá ìáðáäéüðóβóáðá þ íá ááéáðáóóðþðá ðβðñóá, ÷ñçóéííðñéðþðá òí -F. Äéá ðáñéóóúðáñáð ðççññíðñáð, äáβóá òí portupgrade(1).

### 4.5.4.3 Ἀίάάάέιβέιόάδ Ports ιά οἱ Portmanager

Οἱ **Portmanager** ἀβίάέ Ἰία áέυιá ἀνάάέάβι áέá áýέιέç áίάάΎέιέόç ιάάέάόόçιΎίιι ports. Ἀέάόβέάάέ áδὺ οἱ ports-mgmt/portmanager port:

```
# cd /usr/ports/ports-mgmt/portmanager
# make install clean
```

¼έá όά áάέάόόόçιΎίίá ports ιδἰνίίί íá áίάάάέιέόίίί ÷ ñçóέιιδἰέβίόάδ áδδP όçí áδδP áίόίεP:

```
# portmanager -u
```

Ιδἰνάβόά íá δἰνίόέΎόάόά όçí áδδέιιáP -ui áέá íá áñòòçέάβόά íá áδδέάάάέβόάόά έΎέά áPíá δἰò έá áέόάέΎόάέ οἱ **Portmanager**. Οἱ **Portmanager** ιδἰνάβ áδβόçδ íá ÷ ñçóέιιδἰέçέάβ áέá íá áάέάόάόδPόάόά íΎá ports όóι όýόόçíá. Óá áίόβέáόç ιά όçí áίόίεP make install clean, οἱ **Portmanager** έá áίάάάέιβόάέ υέάδ όέδ áíáñδPόάέδ δἰέí όçí ιάόάάέβδóέóç έάέ áάέάδὺόόόç οἰò áδδέάιιΎίιò port.

```
# portmanager x11/gnome2
```

Άί όδὺñ ÷ ðí δἰνίáέβίáόά δἰò ó÷ áδβέιíόάέ ιά όέδ áíáñδPόάέδ áίιιδ áδδέάάιιΎίιò port, ιδἰνάβόά íá ÷ ñçóέιιδἰέβόάόά οἱ **Portmanager** áέá íá όέδ áδάíá-ιáόάάέυòδδβόάέ υέάδ ιά όçí óúóδP óάέñΎ. Ιύέέδ όάέέβόάέ ιά όέδ áíáñδPόάέδ, έá áδάíá-ιáόάάέυòδδβόάέ έάέ οἱ δἰνίáέçíáόέέυ port.

```
# portmanager graphics/gimp -f
```

Ἄέá δἰáέόόóúάñάδ δέçἰνίιñβáδ áάβόά όç óάέβáá manual portmanager(1).

### 4.5.4.4 Ἀίάάάέιβέιόάδ όά Ports ιΎόὺ οἰο Portmaster

Οἱ **Portmaster** ἀβίάέ Ἰία áέυιá ἀνάάέάβι áέá όçí áίάάΎέιέόç όὺι áάέάόάόçιΎίιι ports. Οἱ **Portmaster** ó÷ áάέΎόόçέá βόόά íá ÷ ñçóέιιδἰέάβ όá ἀνάάέάβá δἰò δἰáñΎ ÷ áέ οἱ “άάόέέυ” όýόόçíá (άáí áíáñδὺόάέ áδὺ Ἰέέá ports) έάέ ÷ ñçóέιιδἰέάβ όέδ δέçἰνίιñβáδ οἰò /var/db/pkg áέá íá έάέιñβόάέ δἰέá ports έá áίάάάέιβόάέ. Ἄβίάέ áέάέΎόέιι ιΎόὺ οἰò port ports-mgmt/portmaster:

```
# cd /usr/ports/ports-mgmt/portmaster
# make install clean
```

Οἱ **Portmaster** ηἰάάἰδἰέάβ όá ports όá δὲΎόόáñέδ έáόçáññβáδ:

- Root ports (άáí áíáñδβίόάέ áδὺ Ἰέέá, έάέ ιýόá Ἰέέá áíáñδβίόάέ áδὺ áδδΎ)
- Trunk ports (άáí áíáñδβίόάέ áδὺ Ἰέέá, ùόóύοí έΎδἰέá δάέΎόá áíáñδβίόάέ áδὺ áδδΎ)
- Branch ports (Ύ ÷ ðí áíáñδPόάέδ έάέ δἰνίò όέδ áýí έáόάόέýíόáέδ)
- Leaf ports (áíáñδβίόάέ áδὺ Ἰέέá, áέέΎ ù ÷ έ οἱ áίόβέáδἰ)

Ιδἰνάβόά íá áάβόά íέá έβόόá υέέυι όὺι áάέάόάόçιΎίιι ports έάέ íá θΎíáόá áέá áíçíáññΎíáδ áέάυόάέδ, ÷ ñçóέιιδἰέβίόάδ όçí áδδέιιáP -L:

```
# portmaster -L
====>> Root ports (No dependencies, not depended on)
====>> ispell-3.2.06_18
====>> screen-4.0.3
```

```

====>> New version available: screen-4.0.3_1
====>> tcpflow-0.21_1
====>> 7 root ports
...
====>> Branch ports (Have dependencies, are depended on)
====>> 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
    
```

Ìðññãðã íá áíáááèìβóáðã üëá óá ããéáóðóóçìÝíá ports ìá óçì ðãñáéÛòù áðēÞ áíóìēÞ:

```
# portmaster -a
```

**Óçìáβóóç:** Áðü ðññáðéëìãÞ, òì **Portmaster** éá äçìéìðñãÞóáé áíóβãñãóì áóðáéãáðò òìò ããéáóðóóçìÝíìò ðáéÝóìò ðñéì òì áéããñÛðáé. Áí ç ããéáóÛóóáóç òçò íÝáð Ýéãìòçò áβíáé áðéðò-Þò, òì **Portmaster** éá óãÞóáé òì áíóβãñãóì áðòü. Áí ð-ñçóéììðìéÞóáðã óçì áðéëìãÞ -b, òì **Portmaster** äáì éá óãÞóáé áðòüìáðã òì áíóβãñãóì. Áí ð-ñçóéììðìéÞóáðã óçì áðéëìãÞ -i, éá èÝóáðã òì **Portmaster** óá áéããñãóðéēÞ éáéòìðñãá, üðìò éá óáð æçðÛáé áðéãããáβóóç ðñéì óçì áíááÛèìéóç èÛèá port.

Áí áíóéìáðòðβóáðã èÛèç éáðÛ òç äéáééáóá óçò áíááÛèìéóçò, ìðññãðã íá ð-ñçóéììðìéÞóáðã óçì áðéëìãÞ -f ãéá íá áíáááèìβóáðã éáé íá ìáðãëèòððóáðã ìáíÛ üëá óá ports:

```
# portmaster -af
```

Ìðññãðã áðβóçò íá ð-ñçóéììðìéÞóáðã òì **Portmaster** ãéá íá ããéáóðóðóáðã íÝá ports òðì óýóççíá óáð, áíáááèìβãñíóáð éáé üëáð óéð áíãñðóáéð òìò ðñéì óç ìáðããèÞðóéóç éáé ããéáóÛóóáóç òìò:

```
# portmaster shells/bash
```

ÐãñáéáéìÝìã ããðã òç óãêβãá manual òìò portmaster(8) ãéá ðãñéóóúðãñãð ðççñìòìñãð.

### 4.5.5 Ports éáé Áðìèçéãðóééüð ×þñìò

Ç ÓðéëìãÞ òùì Ports éáðáíáèÞíáé áéáéÝóéìì ð-þññ òðì áβóéì ìá óçì ðÛññãñ òìò ð-ñññìò. ÌáðÛ óçì ìáðããèÞðóéóç éáé ããéáóÛóóáóç èñéóéìéìÝ áðü óá ports, ðñÝðáé ðÛíóá íá èòìÛóðã íá éáéãñβãðã òìò ðññíóññéìÝð éáóáéüìãìò work ð-ñçóéììðìéÞóáð óçì áíóìēÞ make clean. Μðññãðã íá éáéãñβóáðã üëç óçì ÓðéëìãÞ òùì Ports ìá óçì áéüèìèçç áíóìēÞ:

```
# portsclean -C
```

Íá ôçí ðÛññí ðíð ÷ ññíñð, éá óóóóññáóðíçí ðíëëÛ áñ ÷ áßá äéáíñðð ðçãáßíð êðáééá óðíí éáðÛëñí distfiles. Ìðññáßðð íá óá áóáéñÝóáðð ÷ áéññíêßçðá, Þ ððññáßðð íá ÷ ñçóéíððíéÞóáðð ôçí áëññíðçç áíðíð ãéá íá äéáñÛðáðð ùéá óá distfiles ðíð ááí ó ÷ áðßáíððáé ðÿÝíí ìá éáíÝíá port:

```
# portsclean -D
```

<sup>1</sup> ãéá íá áóáéñÝóáðð ùéá óá distfiles ðíð ááí ó ÷ áðßáíððáé ìá éáíÝíá port ðíð áñßóéáððáé äáéäáððçíÝíí óðí óýóðçíá óáð:

```
# portsclean -DD
```

**Óçíáßóóç:** Õí áñááéáßí portsclean äáéáðßóóáððáé ùð ìÝñíð ðíð portupgrade.

Ìçí íá ÷ íÛðá íá áóáéñáßðð óá äáéäáððçíÝíá ports ùðáí ááí óá ÷ ñáéÛæáóðð ðÿÝíí. Íá éáëññí ãéá íá áóðñáððíðíéçéãáß áððç ç áñááóßá, áßíáé ðí port ports-mgmt/pkg\_cutleaves.

## 4.6 ÁíÝñãéáðð ìáðÛ ôçí ÆãéäôÛóóáóç

ÍáðÛ ôçí äáéäáððçíÝíá íéáð íÝáð áðáññíãþð, ðíãééÛ éá ðÝéáðð íá äéááÛóáðð ùðé ðáêíçñßóóç ððÛñ ÷ áé, íá ðñíððíðíéÞóáðð óá áñ ÷ áßá ñðèìßóáùí ðíð ÷ ñáéÛæáóðð, íá äáááéùèáßðð ùðé ç áðáññíãþ ðáééíÛáé éáðÛ ôçí áêéßçóç (áí áßíáé daemon), ê.ê.ð.

Óá áéñéáÞ áÞíáðð ðíð éá ÷ ñáéáóðíçí ãéá íá ñðèìßóáðð êÛèá áðáññíãþ, éá áßíáé ðñíðáíðð äéáðññáðééÛ. ¼àùð, áí ìüéðð äáéäáðððÞóáðð íéá íÝá áðáññíãþ éáé áíáññóéÝóáðð “Ïþñá óé;” íé ðáñáéÛòù óðíáññéÝð ððñáß íá óáð áíçðÞóíðí:

- ðçóéíððíéÞóáðð ðí pkg\_info(1) ãéá íá äáßððá ðé áñ ÷ áßá äáéäáðððÛççéáí, éáé ðíð. Æéá ðáñÛááéáíá, áí ìüéðð äáéäáðððÞóáðð ðí FooPackage version 1.0.0, ðùðá ç áíðíðð:

```
# pkg_info -L foopackage-1.0.0 | less
```

éá óáð äáßíáé ùéá óá áñ ÷ áßá ðíð äáéäáðððÛççéáí áðù áððù ðí ðáéÝðí. ÐñíóÝíðð óá áñ ÷ áßá óðíí éáðÛëñí man/, ðíð éá áßíáé óáêßááðð manual, ðíðð éáðÛëñíðð etc/, ùðíð éá áßíáé óá áñ ÷ áßá ñðèìßóáùí, éáé ðí doc/, ùðíð éá áñßóéáððáé ðéí ðáñáéðéðÞ óáêíçñßóóç.

Áí ááí áßóðá óßáñðñíð ðíéá Ýéáñóç ôçðð áðáññíãþð äáéäáðððÞóáðð, íéá áíðíðð ùððð áððð:

```
# pkg_info | grep -i foopackage
```

éá áñáé ùéá óá äáéäáððçíÝíá ðáéÝðá ðíð Ý ÷ ðí ðí foopackage óðí ùíñá ðíð ðáéÝðíð. ÁíðééäáðððÞóáðð ðí foopackage óðçí áñáñÞ áíðíðð ìá ðí ðáéÝðíð ðíð áíáæçðÛðá.

- Ìüéðð äáßððá ðíð áñßóéíððáé óá manual pages ôçðð áðáññíãþð, äáßððá óá ìá ôçí man(1). ¼ííéá, äáßððá óá ðáñáááßáíáðá ðñí áñ ÷ áßá ñýèìéóçð, éáé ùðíéá Ûëçç ðññóéáðç ðáêíçñßóóç äéáðßéáððáé.
- Áí ððÛñ ÷ áé web site ãéá ôçí áðáññíãþ, áéÝáíðð ðí ãéá ðññóéáðç ðáêíçñßóóç, óð ÷ íÝð áññðÞóáðð (FAQ), éáé Ûëéá. Áí ááí áßóðá óßáñðñíð ãéá ôçí äéáýéðíóð ðíð web site, ßòðð ðí áñáßððá óðçí Ýíñá ôçðð áíðíððð:

```
# pkg_info foopackage-1.0.0
```

Áí ððÛñ ÷ áé áñáñÞ www:, éá ðñÝðáé íá Ý ÷ áé ðí URL ãéá ðí web site ôçðð áðáññíãþð.



# ΕὰοÛεάεί 5 Õĩ Óýóôçĩá X Window

Αίάτáηεçêã äéá õĩ X11 server õĩ X.Org áðũ õĩ Ken Tom éáé Marc Fonvieille.

## 5.1 Óýĩïç

Õĩ FreeBSD ÷ñçóεĩĩðĩεáβ õĩ X11 äéá íá ðãñÝ ÷äé óõĩò ÷ñÞóóãð Ý íá éó ÷õñũ ãñáóéεũ ðãñéãÛεεĩĩ ãñááóβãð. Õĩ ðãñéãÛεεĩĩ X11 áβĩáé íéá ðεĩðĩβçóç áñééõĩý êðáééã ðĩò óóóðĩáõĩò X Window ðĩò ðãñééãĩãÛĩáé õũõĩ õĩ **Xorg** ùõĩ éáé õĩ **XFree86** (éáêð ðéé Ûεεĩ εĩäéõĩééũ ðĩò äãĩ ðãñéãñÛóãóáé äãð). Íé äéãũóáéð õĩò FreeBSD ìÝ ÷ñé éáé õçĩ FreeBSD 5.2.1-RELEASE äéáéÝõĩõĩ óõçĩ ðñĩãðééããĩÝĩç äãéãóÛóóáóç õĩ **XFree86**, õĩ X11 server áðũ The XFree86 Project, Inc. Áðũ õĩ FreeBSD 5.3-RELEASE éáé Ýðáéóã, ç ðñĩãðééããĩÝĩç éáé áðβóçĩç äéãĩñÞ õĩò X11 Ûééãĩã óõĩ **Xorg**, õĩ X11 server ðĩò áíáððý ÷èçêã áðũ õĩ X.Org Foundation ìã Ûããéã ÷ñÞóçð áñéããÛ ùĩĩéã ìã áóðÞ ðĩò ÷ñçóεĩĩðĩεáβóáé áðũ õĩ FreeBSD. ÕðÛñ ÷ĩõĩ áðβóçð äéáéÝóéĩé äĩðĩñééĩβ X servers äéá õĩ FreeBSD.

Áðõũ õĩ εãòÛεáéĩ éã éáéýøáé õçĩ äãéãóÛóóáóç éáé ãýεĩéóç õũ X11 ìã Ýĩóáóç óõçĩ Ýéãĩóç 7.4 õĩò **Xorg**. Äéã ðεçñĩõĩñβãð ó ÷ãóééÛ ìã õçĩ ãýεĩéóç õĩò **XFree86** (ð. ÷. óã ðáééũðãñãð äéãũóáéð õĩò FreeBSD ùðĩò õĩ **XFree86** Þóáĩ ç ðñĩãðééããĩÝĩç äéãĩñÞ X11), ìðĩñãβóã ðÛĩóã íá áíáðñÝĩãðã óóéð áñ ÷äééãõçĩÝĩãð äéãũóáéð õĩò FreeBSD Handbook óõĩ <http://docs.FreeBSD.org/doc/>.

Äéã ðãñéóóũðãñãð ðεçñĩõĩñβãð ðĩò ó ÷ãóβεĩĩóáé ìã ðéð éÛñóãð ãñáóééðĩ ðĩò ððĩóóçñβεĩĩóáé áðũ õĩ ðãñéãÛεεĩĩ X11, äãβóã õçĩ äééðóáéÞ õĩðĩéãóβã Xorg (<http://www.x.org/>).

Áõĩý äéããÛóãðã áðõũ õĩ εãòÛεáéĩ, éã ìÝñãðã:

- Óã äéÛõĩñã ðĩÞĩáðã ðĩò óóóðĩáõĩò X Window, éáé ðũð óõĩãñãÛεĩĩóáé ìãóãĩý õĩòð.
- ðũð íá äãéãóãóðÞóãðã éáé íá ãðεĩβóãðã õĩ ðãñéãÛεεĩĩ X11.
- ðũð íá äãéãóãóðÞóãðã éáé íá ãðεĩβóãðã äéãõĩñãðééĩýð äéã ÷äéñéóóÝð ðãñãéýñũĩ (window managers).
- ðũð íá ÷ñçóεĩĩðĩεÞóãðã TrueType® ãñãĩĩáõĩõĩáéñÝð óõĩ X11.
- ðũð íá ãðεĩβóãðã õĩ óýóóçĩá óãð äéã óýĩãáóç (login) ìÝóũ ãñáóééĩý ðãñéãÛεεĩĩõĩò (**XDM**).

ðñéĩ äéããÛóãðã áðõũ õĩ εãòÛεáéĩ, éã ðñÝðáé:

- Íã ìÝñãðã ðũð íá äãéãóãóðÞóãðã ðñũóéãõĩ εĩäéõĩééũ ðñβõĩò éãóãóéããóãóðÞ (ΕãòÛεáéĩ 4).

## 5.2 Éãóáĩüçóç õĩò ðãñéãÛεεĩĩõĩò X11

Ç ÷ñÞóç õĩò ðãñéãÛεεĩĩõĩò X11 äéã ðñÞóç õĩñÛ ìðĩñãβ íá ðñĩéáéÝóáé íéã íééñÞ óãñã ÷ ð óã ùðĩéĩ Ý ÷äé óõĩçèβóáé óã Ûééã ãñáóééÛ ðãñéãÛεεĩĩóã, ùðũð óã Microsoft Windows Þ õĩ Mac OS.

ÄãĩééÛ, äãĩ áβĩáé áðãñãβóçõĩ íá éãóáéãããβĩãðã ìã éÛéã éãðõñÝñãéã õũĩ äéãõũñũĩ ðĩçĩÛóũĩ õĩò X11 éáé ðÞð äéèçéãðéãñĩý ìãóãĩý õĩòð. ÉÛðĩéãð äãóééÝð ãĩÞóãéð ùũð, áβĩáé ÷ñÞóéĩãð éáé äĩçèĩý óõĩ íá äéĩãóáééããóãðã éáéýðãñã ðéð äõĩáóũðçóãð õĩò X11.





### 5.2.4 Αλλάξτε τα Γραμμάκια (Widgets)

Το πιο σημαντικό X είναι η απεικόνιση των γραμμάκιων (widgets) στον οθόνι. Ένα γραμμάκι είναι ο συνδυασμός ενός X οπτικού και ενός οθόνι, όπως είναι ο φάκελος, ο κουμπί, ο πλαίσιο κείμενου κ.λπ.

Τα "widgets" είναι τα στοιχεία που χρησιμοποιούνται για την απεικόνιση των X οπτικών. Τα πιο δημοφιλή είναι τα X οπτικά που παρέχονται με το X Window System, όπως είναι ο φάκελος, ο κουμπί, ο πλαίσιο κείμενου κ.λπ.

Το X Window System παρέχει μερικά X οπτικά με το X Window System. Τα πιο δημοφιλή είναι τα X οπτικά που παρέχονται με το X Window System, όπως είναι ο φάκελος, ο κουμπί, ο πλαίσιο κείμενου κ.λπ.

Οι X οπτικοί έχουν διαφορετικά ονόματα. Τα πιο δημοφιλή είναι τα X οπτικά που παρέχονται με το X Window System, όπως είναι ο φάκελος, ο κουμπί, ο πλαίσιο κείμενου κ.λπ.

Εάν έχετε εγκαταστήσει το X Window System, τότε θα έχετε εγκαταστήσει και τα X οπτικά που παρέχονται με το X Window System, όπως είναι ο φάκελος, ο κουμπί, ο πλαίσιο κείμενου κ.λπ.

### 5.3 Αλλαγή του X11

Οι X οπτικοί είναι οι πιο δημοφιλείς X οπτικοί που παρέχονται με το X Window System. Τα πιο δημοφιλή είναι τα X οπτικά που παρέχονται με το X Window System, όπως είναι ο φάκελος, ο κουμπί, ο πλαίσιο κείμενου κ.λπ.

Αν έχετε εγκαταστήσει το X Window System, τότε θα έχετε εγκαταστήσει και τα X οπτικά που παρέχονται με το X Window System, όπως είναι ο φάκελος, ο κουμπί, ο πλαίσιο κείμενου κ.λπ.

```
# cd /usr/ports/x11/xorg
# make install clean
```

**Ορισμοί:** Αν έχετε εγκαταστήσει το X Window System, τότε θα έχετε εγκαταστήσει και τα X οπτικά που παρέχονται με το X Window System, όπως είναι ο φάκελος, ο κουμπί, ο πλαίσιο κείμενου κ.λπ.

Αν έχετε εγκαταστήσει το X Window System, τότε θα έχετε εγκαταστήσει και τα X οπτικά που παρέχονται με το X Window System, όπως είναι ο φάκελος, ο κουμπί, ο πλαίσιο κείμενου κ.λπ.

Εάν έχετε εγκαταστήσει το X Window System, τότε θα έχετε εγκαταστήσει και τα X οπτικά που παρέχονται με το X Window System, όπως είναι ο φάκελος, ο κουμπί, ο πλαίσιο κείμενου κ.λπ.

```
# pkg_add -r xorg
```

**ΌçιάΒύος:** Όά ðáñáðŰíũ ðáñáááβáìáóá éá ááéáóáóðŰóìŰí ïèũèçñç òçí áéáííŰ X11 ðíŰ ðáñééáìáŰíáé áéáèíŰóóŰò, ðáèŰóáð, áñáìíáóìŰáéñŰò èèð. ÁéáðβèáíŰáé áðβóçò íá÷-ùñéóðŰ, òìçíáðééŰ ðáéŰóá éáé ports áéá òí X11.

Όἱ òðũèíèðí òíŰ èáòáéáβíŰ éá óáð áìçáŰóáé ðũð ñðèìβæáðáé òí X11, éáé ðũð íá óðŰóáðá Ýíá ðáñááũééèũ desktop ðáñéáŰèèí.

## 5.4 Νύèìéóç òíŰ X11

*ΌðíáéóòíŰ òíŰ Christopher Shumway.*

### 5.4.1 Ðñéí íáèéíŰóáðá

Ðñéí òçí ñýèìéóç òíŰ X11 ÷ ñáéŰæíŰóáé ïé áèũèíŰèáð ðèçñíŰŰñβáð áéá òí óýóðçíá:

- ÐñíæéáñáóŰò òçð ïèũíçð
- Chipset òçð èŰñðáð áñáóéèŰí
- ÍŰìç òçð èŰñðáð áñáóéèŰí

Íé ðñíæéáñáóŰò òçð ïèũíçð ÷ ñçóèíŰðíéýíŰóáé áðũ òí X11 áéá íá ïñéóéáβ ç áíŰèðóç éáé ï ñðèìũð áíáíŰòçð óðí ïðíβí éá éáéòíŰñáŰóáé. Íé ðñíæéáñáóŰò áððŰò ññβóèíŰóáé óðíŰèðũð óðçí òáèìçññβòç ðíŰ òðíñááýáé òçí ïèũíçç Ű óðçí éóðíŰáèβáá òíŰ éáðáóéáðóáóðŰ. × ñáéŰæíŰóáé áýí óáéñŰò áñéèìŰí, ï ïñææíŰðèíð ñðèìũð áíáíŰòçð éáé ï éáðáéũñðŰŰð ñðèìũð áíáíŰòçð.

Όἱ chipset (íèíèççñũŰŰíŰ éýéèèíá) òçð èŰñðáð áñáóéèŰí ïñβæáé ðíβŰð ïäçáũð óðóéáðŰð éá ÷ ñçóèíŰðíéçèáβ áðũ òí X11 áéá òçí áðééíèíŰíá ïá òçí èŰñðáð áñáóéèŰí. Áéá òá ðáñéóóũðáñá chipset, áððũ ïðíñáβ íá áíé÷-íáðèáβ áððũíáðá, áèèŰ áβíáé ÷ ñŰóèí íá òí áíũñβæáðá óá ðáñβððũòç ðíŰ ááí ðáðý÷-áé ç áððũíáðç áíβ÷-íáðóç.

Ç ïŰìç òçð èŰñðáð áñáóéèŰí éáèíñβæáé òçí áíŰèðóç éáé òí áŰèð ÷ ñŰíáðíŰ òðí ïðíβí ïðíñáβ íá áíŰèŰŰóáé òí óýóðçíá. Áððũ áβíáé òçíáíŰéèèũ ðŰðá íá áíũñβæáé ï ÷ ñŰóðçð òá ïñéá òíŰ óóóðŰíáðíŰð.

### 5.4.2 Νύèìéóç òíŰ X11

Áðũ òçí ÝéáíŰç 7.3 éáé ïáðŰ, òí **Xorg** ïðíñáβ óð÷-íŰ íá éáéòíŰñáŰóáé ÷ ïññð éáíŰíá áñ÷-áβí ñðèìβóáũí, áñŰŰŰíŰóáð áðèŰð óçç áñáñŰ áíŰŰèŰí:

```
% startx
```

Áðũ òçí ÝéáíŰç 7.4 éáé ïáðŰ, òí **Xorg** Ý÷-áé òçç áðíáðũòçðá íá ÷ ñçóèíŰðíééáβ òí HAL áéá òçí áððũíáðç áíβ÷-íáðóç òíŰ ðèçèðñíèíáβíŰ éáé òíŰ ðíŰðéééíý. Όá ports `sysutils/hal` éáé `devel/dbus` ááéáèβóðáíŰáé ùð áíáñðŰóáéð òíŰ `x11/xorg`, áèèŰ éá ðñŰðáé íá áíáñáíðíéçèíý íá òèð áèũèíŰèáð ááñáóŰò óðí `/etc/rc.conf`:

```
hald_enable="YES"
dbus_enable="YES"
```

Éá ðñŰðáé íá ïáèéíŰóáðá òèð òðçñáóβáð áððŰò (áβðá ÷ áéñíèβíçðá, áβðá èŰñíŰóáð áðáíáèèβíçç) ðñéí óðíá÷-βóáðá ïá òç ñýèìéóç òíŰ **Xorg**.



Έά ðñÝðáε άðßòçð íá ðññíóεÝóáôá ôçí ðáñáεÙòð ãñáñß Þ ôðí áñ÷âßì xorg.conf.new, óðçí áñíôçðá  
ServerLayout Þ ServerFlags:

```
Option "DontZap" "off"
```

Áí òí ðññòβεé áñí εάεòñòñááß, εά ÷ñáεάóáß íá òí ãðεßßóáôá ðñéí óðí÷âóáôá. Äáßðá òí ÒìÞìá 2.10.10 óðí εάοÙεάεϊ  
ááεάóÙóóáóçð òñò FreeBSD. Άðéðññúóεáôá, áðu ôçí Ýεáñóç 7.4 εάε íáòÙ, ïé áñíôçðáò InputDevice óðí  
xorg.conf ááññýíóáε εάεðò áβíáóáε ÷ñÞóç ðñí óðóέáðßí ðñò áñε÷÷áçεáí áðòñíááðá. Άέá íá áðáíáòÝñáðá ôçí  
ðáεéÙ óðíðáñéòññÙ, ðññíóεÝóáôá ôçí ðáñáεÙòð ãñáñß Þ óðçí áñíôçðá ServerLayout Þ ServerFlags òñò áñ÷âßì  
ñðεßßóáñí:

```
Option "AutoAddDevices" "false"
```

Έá ïðñáßðá Ýðáεóá íá ãðεßßóáôá óéð óðóέáðÝð áεóúáñò ùðò óóéð ðññçáñýíáíáð áéäüóáéð òñò Xorg,  
÷ñçóéññðñéñíáð εάε ùðñéáð Ùεεάð áðéεñáÝð ÷ñáεÙεáóáð (ð.÷. áñáεεáßÞ ðεçέðññéñáßñò).

**Óçíáßúóç:** ¼ðò áñçáßóáíá εάε ðññçáññíÝíúð, áðu ôçí Ýεáñóç 7.4 εάε íáòÙ ï ááβñííáð hald áíáεáíáÙíáε íá  
áñε÷÷áçεáε áðòñíááðá òí ðεçέðññéñáéñí óáð. ÒðÙñ÷áε ðáñßðòðóç íá ïçí áβíáε óúðòÞ áñð÷íáòçð òñò ïññóÝεñò Þ  
òçð áεÙðáñç, ùòòññí òÙðñéá áñáðééÙ ðáñéáÙéεññóá ùðò òí GNOME òí KDE εάε òí Xfce ðáñÝ÷ññí óá áεéÙ  
òñò ãñááεáßá áεá ôç ãýεñóç òñò. ïðñáßðá ùòð íá ãðεßßóáôá óéð εάεùòçòáð òñò ðεçέðññéñáßñò εάε  
áðáðééáßáð, áßðá ïÝúð òñò áñçεçðééñý ðñññáññíáðò setxkbmap(1) áßðá ïá ôçí ðññòεÞεç áñòð εáñíúá óðí hald.

Άέá ðáññááεáíá, áñ òÙðñéíð òÝεáε íá ÷ñçóéññðñéòáé Ýñá ðεçέðññéñáéñí 102 ðεßðéðññí ïá ááεééεÞ áéÙðáñç,  
εá ðñÝðáε íá áçñéíòñáßóáé Ýñá áñ÷âßì ãðεßßóáññí áεá òí hald ïá òí ùññíá x11-input.fdi εάε íá òí áðñεçέáýóáé  
óðññí εáóÙεñññ /usr/local/etc/xdg/xdg-x11/xkb/policy. Òí áñ÷âßì áðòñ εá ðáñéÝ÷áε óéð ðáñáεÙòð ãñáñßÝò:

```
<?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>
```

Áí òí áñ÷âßì áðòñ òðÙñ÷áε Þáç, áðεðò áñéáññððá óéð ðáñáðÙñ ãñáñÝò ïÝóá óðí òðÙñ÷ññ ðáñéá÷ññáññ.

Έá ðñÝðáε íá áðáíáéééññáðá òí ïç÷Üñçñá óáð áéá íá áñáíááεÙóáôá òí hald íá áεááÙóáé òí áñ÷âßì.

ïðñáßðá áðßòçð íá òÙíáðá ôçí ãáεá ãýεñóç ïÝóá áðu Ýñá ðáññáðééù óðá × Þ áéùñá εάε áðu Ýñá script,  
áéðáεññíáð ôçí ðáñáεÙòð áññéÞÞ:

```
% setxkbmap -model pc102 -layout fr
```

ïðñáßðá íá áñáßðá óéð áεáéÝóéñáð áðéεñáÝð ðεçέðññéñáßñññí εάε áεáóÙíáññí óðí áñ÷âßì  
/usr/local/share/X11/xkb/rules/base.lst.

ðáεðá, ðñññóáñññúóáð òí áñ÷âßì ãðεßßóáñññ xorg.conf.new óðéð ðñññéññáéð óáð. Άñññðá òí ïá Ýñáñ óðñóÙεðç  
εáεñÝññ ùðò ï émacs(1) Þ ï ee(1). Ðññðá, ðñññóεÝóáð óéð óó÷íúðçðáð òçð ïεññçð. ÓðñÞεòð áñáòÝñññóáé ùð  
ññéáññññéññí εάε εáðáéññðññéññ ãðéññß óðá÷ñññéòññý. ÁðòÝð ïé ðéñÝð òñññéáòññññóáé óðí áñ÷âßì xorg.conf.new óðí  
Section "Monitor":

```
Section "Monitor"
    Identifier      "Monitor0"
    VendorName     "Monitor Vendor"
    ModelName      "Monitor Model"
    HorizSync      30-107
    VertRefresh    48-120
EndSection
```

Ίε ιάόάεçðÝð HorizSync έάέ VertRefresh ιðñáß íá ιçí ððÛñ÷ϊοί οοί άñ÷άßι ñøειβόάυι. Αί άάί ððÛñ÷ϊοί, ðñÝðάέ íá ðñιόόάειύι, ιά οίι ούοόυ ιñεάυιόει ñøειυ οόά÷ññιέοιύ ιάðÛ ðçí εΎίç HorizSync έάέ οίι έάόάέυñøοί ñøειυ οόά÷ññιέοιύ ιάðÛ ðçí εΎίç VertRefresh. Οόι ðάñάðÛñ ðάñÛάάέάιá, ðñιόεΎοάιá ðιòð άίόβόοιέ÷ϊòð ñøειύð άίάίΎύóçð ðçð ιεύιçð ιάð.

Οί X άðέοñÝðάέ ðç ÷ñÞóç ðυί άοίάοιðÞουί DPMS (Energy Star) οά ιεύιáð ðιò ððιόóçñßειοί ðçí άίόβόοιέ÷ç έάέοιòñάβá. Οί ðñυάñάιιá xset(1) άέΎá÷άε ðιòð ÷ñυιòð έάέ ιðñάß íá άðέαÛεέάε ðέð έάόάóðÛόάέð standby, suspend, Þ off. Αί εΎεάòά íá άίάñάιðιεÞόάòά ðέð άοίάóυòçðάð DPMS ðçð ιεύιçð οάð, ðñÝðάέ íá ðñιόεΎόάòά ðçí άέυειòεç άñάιÞ οοί Section monitor:

```
Option      "DPMS"
```

¼οί οί άñ÷άßι ñøειβόάυι xorg.conf.new άβιáέ άέυιιá άñιέòυ οά Ύίάι ðοίðÛεðç έάειΎñò, άðέεΎίòά ðçí άίÛεðóç έάέ οί áÛεìð ÷ñυιÛòυι ðιò άðέεοιáβόá. Αóòυ έάειñßεάòάέ οοί Section "Screen":

```
Section "Screen"
    Identifier "Screen0"
    Device     "Card0"
    Monitor    "Monitor0"
    DefaultDepth 24
    SubSection "Display"
        Viewport 0 0
        Depth    24
        Modes    "1024x768"
    EndSubSection
EndSection
```

Ç ιάόάεçðÞ DefaultDepth ιñßεάέ οί ðñιáðέεάάιΎñ áÛεìð ÷ñÞιáοιò ðιò έá ÷ñçοειιðιεçεάß. Ιðñάβόá íá ðçí ðάñάέÛιφάòά ιά οίι έάέέυððç -depth óçç άñάιÞ άίοιεÞι οιò Xorg(1). Ç άðέειάÞ Modes ιñßεάέ ðçí άίÛεðóç ιά ðçí ιðιβá έá έάέοιòñάβ ç ιεύιç οά Ύίá ðóάέάεñεΎñ áÛεìð ÷ñυιÛòυι. ðñιόΎίòά υðέ ððιόóçñßειοίάέ ιυι έάñιέεΎð έάόάóðÛόάέð VESA, υðυð ιñßεαίòάέ áðυ οί ððιόóçðçιά άñάóεεÞι οιò ðóóðÞιáοιð. Οόι ðάñάðÛñ ðάñÛάάέάιá, οί έάειñεοιΎñ áÛεìð ÷ñυιÛòυι άβιáέ άέειοέðΎόόάñá bits άίÛ pixel. Οά áóòυ οί áÛεìð ÷ñυιÛòυι, ç άðιáάéðÞ άίÛεðóç άβιáέ 1024×768 pixels.

ΟΎεìð, άðιεçεάýοόά οί άñ÷άßι ñøειβόάυι έάέ άεΎάιòά οί ιά ðçí ιΎειαι άεΎá÷ϊò ðιò άιçάÞοάιá ðάñάðÛñ.

**Οçιáßυóç:** Já áðυ ðά άñάάέάβá ðιò ιðñάß íá οάð άιçεÞοιοί έάòÛ ðçí άέάάέέάόβá άðßεðóçð ðñιáεçιÛòυι, άβιáέ ðά άñ÷άβá X11 log, ðιò ðάñέΎ÷ϊοί ðεçñιòιñßáð áεά εÛεá ðóóέáðÞ ðιò άðέειέιυιáß ιά οίι άέάέιέóðÞ X11. Οά άñ÷άβá Xorg log ιññÛειιόάέ ιά ðçí ιññòÞ /var/log/Xorg.0.log. Οί άέñέáΎò υιιιá άιυò log ιðñάß íá άβιáέ Xorg.0.log Ύυò Xorg.8.log έάέ ðÛάέ εΎάιιðάð.

Αί υεά άβιáέ έάέÛ, οί άñ÷άßι ñøειβόάυι ðñÝðάέ íá οιðιεáðçεάß οά ιεά ειειÞ οιðιεáòβá þóðά íá άίοιðßεáðάέ áðυ οί Xorg(1). ΑóðÞ ðοιðευò άβιáέ ç /etc/X11/xorg.conf Þ /usr/local/etc/X11/xorg.conf.

```
# cp xorg.conf.new /etc/X11/xorg.conf
```

Ç äεάεέεάόβá ñýεἰέόç ðἰō X11 Ý ÷ äε ðβñá ἱεἱέεçñùεάβ Óἱ **Xorg** ἰðἱñáβðá ἱά ðἱ ἱάεέἱΠόάðá ἱά ðἱ äἱçèçðéεἱ ðñἱἱñáñἱἱá startx(1). Ἰ äεάεἱñεóðβð X11 ἰðἱñáβ áðβóçð ἱά äεέέἱΠόάε ἱά ðç äἱΠεάεά ðἰō xdm(1).

### 5.4.3 ΑἱάεέεεάοἱÝἱά ÈÝἱάóá Ñōεἰβóáἱ

#### 5.4.3.1 Ñōεἰβóáεò äεά óá Intel® i810 Graphics Chipsets

Άεά ἱά ÷ ñçóεἱἱðἱεΠόάðá εΰñðá äáóεóἱÝἱç óðá Intel i810 integrated chipsets, áðáεðáβðáε ὀἱ agpgart, ç äεάðáðβ ðñἱñáñἱἱάóεóἱý ðἱἱ X11 äεά ὀἱ AGP. Άáβðá ðçἱ óáεβáá manual ðἰō ðñἱñáñἱἱάðἰò ἱäΠáçóçð agp(4) äεά ðáñεóóóðñáð ðεçñἱἱñβáð.

Μá áððἱ ὀἱ ðñἱðἱ, ç ñýεἰέόç ðἰō ðεεέý óáð εá ἰðἱñáβ ἱά äβἱáε ἱððἱ εáε óá εΰεá ΰεεç εΰñðá ññáóεέβἱ. ðñἱóἱ ÷ Π, óá óðóðΠἱάðá ÷ ùñβð áἱóἱἱáðἱἱÝἱἱ ὀἱ ἱäçäἱ agp(4), ἱ ἱäçäἱð äáἱ εá ὀἱñðἱεάβ ἱá ðçἱ áἱðἱεΠ kldload(8). Ἰ ἱäçäἱð áððἱð ðñÝðáε ἱά äñβóεáðáε óἱἱ ðñΠἱá εáóΰ ðçἱ äεεβἱçóç, áβðá óóáðéεΰ ἱáðáäεἱðóðéóἱÝἱἱð, áβðá ἱá ÷ ñΠóç ὀἱō /boot/loader.conf.

#### 5.4.3.2 ðñἱóεÝἱἱóáð ἱεά Widescreen Άðβðáäç ἱεἱúç

Άððἱ ὀἱ ðἱΠἱá ðñἱἱðἱεÝἱáε ἱáñεéÝð äἱΠóáεð äἱäεáεéáἱἱÝἱἱ ñōεἰβóáἱ. Αἱ ἱε ðñἱóðΰεáεáð ἱá óá óἱΠεç äñááεάβá ñōεἰβóáἱ äáἱ εáðáεΠἱἱóἱ óá ἱεά ñýεἰέόç ðἰō ἱά εáεóἱἱñááβ, ððΰñ ÷ ἱóἱ áñεáðÝð ðεçñἱἱñβáð óðá äñ ÷ áβá log ðἰō ἰðἱñἱý ἱά óáð äἱçεΠóἱἱ. Ὑóðἱóἱ, áβἱáε áðáñáβðçðç ç ÷ ñΠóç áἱἱἱð óἱóἱΰéðç εáεἱÝἱἱð.

Ἰε ðñÝ ÷ ἱðóáð áἱáεýóáεð widescreen (WSXGA, WSXGA+, WUXGA, WXGA, WXGA+, ε.ά.) ððἱóðçñβæἱἱóἱ formats εáε aspect ratios (áἱáεἱñáβð) 16:10 εáε 16:9 ðἰō ἰðἱñáβ ἱά äçἱεἱἱñáβóἱἱ ðñἱäεΠἱάðá. ðáñáááβáἱáðá ἱáñεέβἱ εἱεἱβἱ áἱáεýóáἱἱ äεά áἱáεἱñáβá 16:10 áβἱáε óá:

- 2560x1600
- 1920x1200
- 1680x1050
- 1440x900
- 1280x800

Èΰðἱεά óéεἱΠ, ç ñýεἰέόç εá äβἱáðáε ðἱεý áðεΰ ðñἱóεÝἱἱóáð ðçἱ áἱΰεðóç ἱð Ýἱá ðεεáἱἱ Mode óἱἱ Section "Screen" ἱððἱ äáβ:

```
Section "Screen"
Identifier "Screen0"
Device      "Card0"
Monitor     "Monitor0"
DefaultDepth 24
SubSection "Display"
    Viewport 0 0
    Depth    24
    Modes    "1680x1050"
EndSubSection
EndSection
```

Οί **Xorg** άβιάέ άνέάοΰ Ύίοδñí πρóa íá áíáέδΠρóaé οέδ δέçñíοίñβáo όçò áíΰέοόçò όçò widescreen íèùίçò íΎóù οúí δέçñíοίñέπí I2C/DDC, άíññβæííόάδ Ύόόé δé íδññάβ íá ÷άέñέόόάβ ç íèùίç úοί άóíñΰ όέδ όδ ÷íúόçόάδ éáé δέδ áíáéýόáéδ.

Άί άδóΎò íé ModeLines άáí όδΰñ ÷íοί όóíοδ íäçáíýδ, íδññάβ íá ÷ñáéάόόάβ íá όέδ άπρóaόά άόάβδ όοί **Xorg**. ×ñçόéííδíέπíόάδ όí /var/log/Xorg.0.log íδññάβδóá íá áíáέδΠρóaόá άνέάοΎδ δέçñíοίñβáo πρóa íá äçíέíññάπρóaόá íúíñé όάδ Ύíá ModeLine δíο íá éäéοíññάβ. Άδέπδ áíáæçδΠρóaé δέçñíοίñβáo δíο éá ííéΰæíοί íá άδóú:

```
(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
```

ΆδóΎδ íññΰæííόáé δέçñíοίñβáo EDID. Ç äçíέíññάβά áíúδ ModeLine áδú άδóΎδ, άβíáόáé áΰæííόάδ άδέπδ όíοδ άñέèíýδ όόç óùόόΠ óáéñΰ:

```
ModeLine <name> <clock> <4 horiz. timings> <4 vert. timings>
```

Όάέééΰ, όí ModeLine όóí Section "Monitor" όóí δάνΰάáéáíá íáδ éá ííéΰæíé íá άδóú:

```
Section "Monitor"
Identifier      "Monitor1"
VendorName     "Bigname"
ModelName      "BestModel"
ModeLine       "1680x1050" 146.2 1680 1784 1960 2240 1050 1053 1059 1089
Option         "DPMS"
EndSection
```

Όπñά δíο Ύ ÷άδ όäéáέπρóaé íá άδóΰ όá άδéΰ άβíáόá, όí X éá δñΎδäé íá éäéοíññάπρóaé όόç íΎá widescreen íèùίç όάδ.

## 5.5 ×ñΠόç Άñáíáόíόáéñπí όóí X11

*Όόíáέόóíñΰ όíο Murray Stokely.*

### 5.5.1 ΆñáíáόíόáéñΎδ όýδíο Type1

Íé δñíéáéíñέóíΎíáδ άñáíáόíόáéñΎδ δíο όδññáýíοί όí X11 άáí άβιάέ éááíééΎδ áéá άόáññáΎδ άδéδñáδΎæéáδ όδδññáόβáoδ. Íé íááΰéáδ άñáíáόíόáéñΎδ δάνíοόβáoçò óáβííóáé íáííóυδΎδ éáé άñáόéόá ÷íééΎδ, éáé íé íééñΎδ άñáíáόíόáéñΎδ όóí **Netscape** άβιάέ ó ÷ááíí áéáδΰéçδδóáδ. Άόδδ ÷πδ úíùδ, όδΰñ ÷íοί áéáéΎóéíáδ άñέáδΎδ, όççéΠδ δíéúδçδóáδ άñáíáόíόáéñΎδ Type1 (PostScript®) δíο íδññíý íá ÷ñçόéííδíέçèíýí ΰíáόá áδú όí X11. Άéá δάνΰάáéáíá, ç όóééíñάπρóaόáéñπí URW (x11-fonts/urwfonts) δάνéΎ ÷áé áéáüóáéδ όççéΠδ δíéúδçδóáδ όúí όóíçééóíΎíúí type1 άñáíáόíόáéñπí (Times Roman®, Helvetica®, Palatino® éáé ΰééáδ). Ç όóééíñάπρóaόáéñπí Freefonts (x11-fonts/freefonts) δάνéΎ ÷áé δíééΎδ δάνéόóúόáññáδ άñáíáόíόáéñΎδ, áééΰ íé δάνéόóúόáññáδ áδú άδóΎδ άβιάέ áéá éíáéóíééú άñáόééπí úδùδ όí **Gimp**, éáé άáí άβιάέ éáδΰéççéáδ áéá άñáíáόíόáéñΎδ íèùίçδ. Άéúίç, όí X11 íδññάβ íá áéΰ ÷éóοί éúδí íá ñöéíéόóáβ πρóa íá ÷ñçόéííδíéáβ TrueType άñáíáόíόáéñΎδ. Άéá δάνéόóúόáññáδ éáδδñΎñáéáδ, ááβδóá όçí óáéβáá manual X(7) Π όí όíΠíá ó ÷áδééΰ íá όέδ άñáíáόíόáéñΎδ TrueType.



### 5.5.3 Anti-Aliased ἈñàìáοἰόáεñÝò

Αἰάτáπεçεά áδῦ οἰί Joe Marcus Clarke.

¼εάò ἱε ἀñàìáοἰόáεñÝò X11 θἱò ἀñβóεἱἰóáε οἰί /usr/local/lib/X11/fonts/ εάε οἰ ~/.fonts/ áβἱάε áδòῦἱάóá εέεéÝóεἱάò áεá anti-aliasing óá äóáñἱἱάÝò Xft-aware, óοἰðáñέεáἱááñἱÝἱῦἱ οἱò KDE, GNOME εάε Firefox.

Ἄεά ἱά äεÝáἱáóá θἱβáò ἀñàìáοἰόáεñÝò áβἱάε anti-aliased, P ἱά ñðεἱβóáòá ðεð εάέῦòçðáò οἱò anti-aliasing, äçἱεἰòñáPóóá (P ðñἱðἱθἱεPóóá, áἱ Päç ððŨñ÷áε) οἱ áñ÷áβἱ /usr/local/etc/fonts/local.conf. ἸÝóῦ áðóἱÝ οἱò áñ÷áβἱò ἱðñἱÝἱ ἱά ñðεἱóóἱÝἱ áñεáðŨ áἱáεáεéáοἱÝἱá ÷áñáεðçñéóóéŨ οἱò óðóðἱáóἱò ἀñàìáοἰόáεñἱP Xft. Ἄðóῦ οἱ ðἱἱá ðáñεáñŨóáε ἱῦñἱ ἱáñεéÝò áðεÝò äóἱáóῦòçðáò. Ἄεά ðáñέóóῦòáñáð εáððἱñÝñáεáð, äáβóá οἱ fonts-conf(5).

Œἱ áñ÷áβἱ áðóῦ ðñÝðáε ἱά áβἱάε ἱñòPò XML. ἌPóóá ἱááŨεç ðñἱóἱ÷P óóá ðáæŨ / εáóáεáβá, εάε óεáἱòñáðεáβóá ἱúε ἱεá óá tags Ý÷ἱóἱ εéáβóáε óúóðŨ. Œἱ áñ÷áβἱ ἱáεéἱŨ ἱá ççἱ óἱçεéοἱÝἱç áðééáóáεβáá XML εάε Ýἱá ἱñέóἱῦ DOCTYPE, εάε Ýðáεóá áεἱεἱòεáβ οἱ <fontconfig> tag:

```
<?xml version="1.0"?>
<!DOCTYPE fontconfig SYSTEM "fonts.dtd">
<fontconfig>
```

¼ðῦð áβðáἱá ðñἱçáἱοἱÝἱῦð, ἱεáð ἱε ἀñàìáοἰόáεñÝò óοἱ /usr/local/lib/X11/fonts/ ἱðῦð εάε óοἱ ~/.fonts/ εéáóβεáἱóáε Päç óá Xft-aware äóáñἱἱάÝò. Ἄἱ εÝεáóá ἱά ðñἱóéÝóáóá εάε Ũεεἱòð εáóáεῦáἱòð áεðῦð áδῦ áðóἱÝð οἱò äýἱ, ðñἱóéÝóóá ἱεá ἀñáἱP ðáñῦἱεá ἱá áððP θἱò áεἱεἱòεáβ οἰί /usr/local/etc/fonts/local.conf:

```
<dir>/path/to/my/fonts</dir>
```

ἌóἱÝ ðñἱóéÝóóáð ἱÝáð ἀñàìáοἰόáεñÝò, εάε áεáεῦóðáñá ἱÝἱòð εáóáεῦáἱòð ἀñàìáοἰόáεñἱP, ðñÝðáε ἱά áεðáεÝóóáð ççἱ áεῦεἱòεç áἱòἱεP áεá ἱά áἱáäçἱεἱòñáPóóáð ççἱ cache ἀñàìáοἰόáεñἱP:

```
# fc-cache -f
```

Œἱ anti-aliasing εŨἱáε óá Ũεñá áεáöñPò óóáεá÷οἱÝἱá, εŨñἱóáð Ýóóé óá ðἱεý ἱεéñŨ ἀñŨἱáóá ðεἱ áἱááἱPóεἱá, εάε áóáεñáβ óéð “εéβἱáεáð” (óεáεἱðŨóéá) áδῦ óá ἱááŨεá ἀñŨἱáóá, áεéŨ ἱðñἱáβ ἱά ðñἱεáεÝóáε áñἱ÷εPóáéð óóá ἱŨóéá áἱ ÷ñçóεἱἱðἱεçεáβ óá εáñἱééŨ ἱááÝεç. Ἄεά ἱά áἱáεñÝóáóá áδῦ οἰí anti-aliasing ἱááÝεç ἀñàìáοἰόáεñἱP ἱεéñῦðáñá áδῦ 14 point, ðñἱóéÝóóá áðóÝð ðεð ἀñáἱÝò:

```
<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 (æéáóðñιάóá) óá ìáñééÝð monospaced ãñáìíáóìíóáéñÝð ìðñáß áðßçð ñá áßíáé æéáóÛεççèí ùðáí ÷ñçóçèíðèéáßðáé anti-aliasing. Áððü öáßíáðáé íá áðìóáéáß éæéáßðáñì ðñüâççιά ñá òì **KDE**. Ìéá æéññèùóç ãéá áððü, áßíáé íá áðéáÛεççðá òòì spacing òçí òçèß 100 ãéá áððÝð òéð ãñáìíáóìíóáéñÝð. ÐñìóçÝóðá 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>
```

(áððü ñáðìñÛεáé òá Ûεéá çèíÛ ññüíáðá òùí fixed ãñáìíáóìíóáéññí ùð "mono"), éáé Ýðáéðá ðñìóçÝóðá:

```
<match target="pattern" name="family">
  <test qual="any" name="family">
    <string>mono</string>
  </test>
  <edit name="spacing" mode="assign">
    <int>100</int>
  </edit>
</match>
```

ÓðáéáéñçèíÝíáð ãñáìíáóìíóáéñÝð, ùððð ñé Helvetica, ìðñáß íá áìíáßæèíðì ðñüâççιά ùðáí áßíáé anti-aliased. Õì ðñüâççιά óð÷íÛ æéççèíðáé ùð ñá ãñáìíáóìíóáéñÛ èññÝçç èÛεáðá òóçí ÝÝóç. Óóçí ÷áéññüðáñç ðáñßððùóç, ìðñáß íá èÛíáé èÛðèéáð áðáññáýóìí. Áéá íá òì áðìóýááðá áððü, ìðñáßðá íá ðñìóçÝóðá òì æéññèùóç òðì 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>
```

Ïüéðð òáéáéðáðá òçí ñáðáðñìð òìð local.conf óéáññáðéáßðá ùðé èéáßðáðá òì áñ÷áßì ñá òì </fontconfig> tag. Áí ááí òì èÛíáðá, ñé æééáÝð òáð éá ááñççèíýí.

ÕÝèð, ñé ÷ñðóðáð ìðññýí íá ðñìóçÝóçìí òéð æééÝð òìðð ñðèíðáðéð ñÝóù òùí ðñìóùðçéçèí òìðð áñ÷áßìí .fonts.conf. Áéá íá áßíáé áððü, èÛεá ÷ñðóçð ðñÝðáé áðèð ñá ççèíñáðáé Ýíá ~/ .fonts.conf. Áððü òì áñ÷áßìí ðñÝðáé íá áßíáé áðßçð XML ññððð.

ÈÛðé òáéáððáßì: óá ñáß LCD ñèúçç, ìðñáß íá áßíáé áðéçççòùð ñáéáñáðéóìùð sub-pixel. Ì áéáñáðéóìùð ÷áéññæáðáé ÷ñéóóÛ òá (ñéæññíðéá áéá÷ñéóíÝíá) èñéçéíá, ðñÛóéíá éáé ìðéá òðèé÷áß ððá íá ááéðéðáé òçí ñéæññíðéá

άΰεόç. Όά άδιόάεΰόιαόά ιδιήαβ ίά άβίαέ άηάιαόέεΰ έαέύόαηά. Άέά ίά οίί άίάηάριέΠόάόά, θηίόεΰόόά όçί θάηάέΰόù άηάηΠ έΰθιό όόι άη-άβι local.conf:

```
<match target="font">
  <test qual="all" name="rgba">
    <const>unknown</const>
  </test>
  <edit name="rgba" mode="assign">
    <const>rgb</const>
  </edit>
</match>
```

**Όçιάβυόç:** Άίΰεήάά ίά οίί όγδι όçò ίεΰίçò, οί rgb ιδιήαβ ίά ÷ηάέάόόάβ ίά áεεΰίάέ όά bgr, vrgb Π vbgr: θάεηάιαόέόόάβόά έάέ άαβόά θίβι έάέόιθηάβ έαέύόαηά.

## 5.6 Ί X Display Manager

*Όδιάέόοιηΰ όιό Seth Kingsley.*

### 5.6.1 ΆέόάάΰηΠ

Ί X Display Manager (**XDM**) άβίαέ Ύία θηίάεηάόέεΰ ιΎηιό οίό όόόΠιαόιό X Windows θιό ÷ηçóεηιθιέάβόάέ áéá áéá ÷άβηέόç όόιαΎόάηι (logins). Άόóù άβίαέ ÷ηΠόέηι όά θιέεΎò θάηέθòΠόάέò, ùθòò όά άθέΰ “X Terminals”, όά desktop ιç ÷άΠιαόά, έάεθò έάέ όά áéáεηέόόΎò ίάάΰεηι áééóγυί. Άόηγ όι όύόόçιά X Windows άβίαέ άίάηΰηόçοι θηùοιέΰεΰηι έάέ áééóγυί, òθΰñ ÷άέ ίάάΰεηι áγηιό θέέάηΠι ηòειβόάηι áéá όçί έάέόιθηάβ X θάέάόΠι έάέ áéáεηέόόΠι όά áéáοηηάόέεΰ ιç ÷άΠιαόά όόιαάάηι Ύία όά Ύία άβέòòι. Ί **XDM** θάηΎ ÷άέ Ύία άηάόέεΰ θάηέάΰεηι έάά όçί άθέεηάΠ όιό áéáεηέόόΠ ίά όιί ιθίβι έά άβίαέ ç όύίαάόç, έάέ áéá όçί άβόηιηι θέçηηιθιέΠι θέóóιθιβççòò ùθòò οίό ηιΰιáόιò ÷ηΠόόç έάέ οίό εΰάέεηγ θηùόάάόç.

Όέάòέάβόά όιί **XDM** ùò ίέά áóáηηηάΠ θιό θάηΎ ÷άέ óéò βάέáò áóηάóóθçòáò óóηι ÷ηΠόόç ίά όι άηάάέάβι getty(8) (άάβόά όι ΌηΠια 26.3.2 áéá έáθòηΎηάέáò). Όι XDM áéòáέάβ όόιαΎόάéò (logins) όόηι áéáεηέόόΠ έάέ Ύθάέόά áéòáέάβ Ύία áéá ÷άέηέόόΠ όόηάάηηáò (session manager, όόηΠεΰò Ύίαί X áéá ÷άέηέόόΠ θάηάέγηηι, window manager) áéá εηιááηέάόιη όιό ÷ηΠόόç. Ί **XDM** Ύθάέόά θάηέΎΎάέ ίά óáηηάóβόάέ áóóù όι θηùάηάηιá, θιό όçηάóηιθιáβ ùóé ι ÷ηΠόόçò óáéάβυόά έάέ θηΎθáé ίά áδιόόηάάέáβ. Όά áóóù όι όçηάβι, ι **XDM** ιδιήαβ ίά άηόάίβόάέ ίάΰΰ όçί ίεΰίç áéóΰηιò (login) έάέ όçί ίεΰίç áθέεηάΠò άηάóέεΠò όύίαάόçò ηόόά ίά όόηάέάβ Ύιάò ΰεηιò ÷ηΠόόçò.

### 5.6.2 ×ηΠόç όιό XDM

Άέά ίά ίάέέηΠόάόά ίά ÷ηçóεηιθιέάβόά όι **XDM**, ááéάόάóòΠόόά όι port x11/xdm (άάί ááéάέβóóάόάέ áθι θηηιáθέεηηάΠ óóéò θηηúóáóáò áéáΰóáéò οίό **Xorg**). Ίθιηάβόά Ύθάέόά ίά άηάβόά όιί áάβηηηά **XDM** όόηι /usr/local/bin/xdm. Άόóù όι θηηάηάηιá ιδιήαβ ίά áéòáέáóóáβ ιθιέάάΠθιόά óóéάηΠ ùò root έάέ έá ίάέέηΠόάέ ίά áéá ÷άέηβáéάόé όçί ίεΰίç οίό X όόηι θιθέεΰ ιç ÷Ύίçηά. Άί ι **XDM** θηΎθáé ίά áéòáέáβόάέ εΰεá οηηΰ θιό áéééηάβόάέ όι ιç ÷Ύίçηά, Ύιάò άηέέεΰò θηηιθιό άβίαέ ç θηηιόεΠεç ίεáò άηάηΠò όόηι /etc/ttys. Άέά θάηέóóóθáηáò θέçηηιθιηάò ó ÷άóέεΰ ίά όçί ηηθòΠ έάέ όçί

÷ ñÞóç áððíγ ðíð áñ÷áβíð, ááβðά ðí ÕìÞíá 26.3.2.1. ÕðÛñ÷áέ íβά áñáñíÞ ððí áñ÷έέü /etc/ttys áñ÷áβí áέα ðçí áέðÝέáðç ðíð **XDM** óά Ýíá áέέííέέü ðáñíáðέέü:

```
tttyv8 "/usr/local/bin/xdm -nodaemon" xterm off secure
```

Áñ÷έέÜ áððÞ ç έάέðíðñáβά áβίάέ áðáñáñíðíέçíÝíç — áέα íá ðçí áñáñáñíðíέÞóáðά áέέÜíðά ðí ðááβí 5 áðu off óά on έάέ áðáñíáέβίçððά ðí init(8) ÷ ñçóέííðíέÞíðάð ðέð íäçáβáð ðíð ÕìÞíá 26.3.2.2. Õí ðñÞðí ðááβí, ðí úñíá ðíð ðáñíáðέέéγ ðíð έá áέα÷άέñβæáðάέ ðí ðñúáñáñíá, áβίάέ ðí tttyv8. Áððü óçíáβíάέ üðέ í **XDM** έá áέðáέáβðάέ ððí 9í áέέííέέü ðáñíáðέέü.

### 5.6.3 Νýέíέóç ðíð XDM

Ï έάðÛέíáð ñðέíβðáñí ðíð **XDM** áñβðέáðάέ ððí /usr/local/lib/X11/xdm. Óά áððüí ðíí έάðÛέíáí ððÛñ÷íðí ðíέέÜ áñ÷áβά ðíð ÷ ñçóέííðíέγíðάέ áέα íá áέέÜíðí ðçí ððíðáñέóíñÛ έάέ áíðÛíέóç ðíð **XDM**. ÕððέέÜ, έá áñáβðά óά ðáñáέÜðü áñ÷áβά:

Áñ÷áβí	ðáñέáñáðÞ
Xaccess	Έáíúíáð ðέóðíðíβçóçð ðáέáðÞí.
Xresources	ðñíέáέíñέóíÝíáð ðέíÝð X resource.
Xservers	Έβðóά áðñáέñðóíÝíúí έάέ ðíðέέÞí íέííÞí (× displays) óðέð íðíβáð έá áβíáðάέ áέα÷áβñέóç.
Xsession	ðñíáðέέáñíÝíñ script óðíúáñí áέα logins.
Xsetup_*	Script áέα ðçí áέðÝέáðç áíðíέÞí ðñέí ðçí áíðÛíέóç ðíð ðáñέáÛέέíðíð óγíááðçð (login screen).
xdm-config	Ñðέíβðáέð áέα üέáð ðέð áðáέέííβðάέð (displays) ðíð áέðáέγíðάέ óά áððü ðí íç÷:Ûíçíá.
xdm-errors	ËÛέç ðíð áçíέíðñáíγíðάέ áðu ðí ðñúáñáñíá.
xdm-pid	Õí ID ðççð áέáñááóβáð ðíð ðñÝ÷íðíð XDM.

Áðβóçð óά áððüí ðíí έάðÛέíáí ððÛñ÷íðí íáñέέÜ scripts έάέ ðñíáñÛíáðά ðíð ÷ ñçóέííðíέγíðάέ áέα íá ñðέíβðíðí ðçí áðέóÛíáέá áñááóβáð üðáí áέðáέáβðάέ ðí **XDM**. Έá ðáñέáñÛðíðíðá ðáñέέçððέέÜ ðí ðέíðü έάέáíüð áðu áððÛ óά áñ÷áβά. Ç áέñέáÞð óγíðáíç έάέ ÷ ñÞóç üέüí áððÞí ðüí áñ÷áβí ðáñέáñÛðáðάέ ððí xdm(1).

Ç ðñíέáέíñέóíÝíç ñýέíέóç áβίάέ Ýíá áðέü íñέíáÞíέí ðáñÛέðñí óγíááðçð íá ðí úñíá ðíð íç÷:áíÞíáðíð íá ðáβíáðάέ ððçí έíñððÞ íá íááÛέá áñÛíáðά έάέ ðέð ðñíðñíðÝð “Login:” έάέ “Password:” áðu έÛðü. Áððü áβίάέ Ýíá έάέü óçíáβí áέέβíççðð áέα íá áέέÜíáðά ðçí áíðÛíέóç ðíð **XDM**.

#### 5.6.3.1 Xaccess

Õí ðñúðüέíέέí áέα óγíááðç íá áðáέέííβðάέð ðíð áέÝá÷íðάέ áðu ðí **XDM** íñíÛæáðάέ X Display Manager Connection Protocol (XDMCP). Õí áñ÷áβí áððü áβίάέ Ýíá óγíέí έáíúíúí áέα ðüí Ýέáá÷í ðüí óðíáÝðáñí XDMCP áðu áðñáέñðóíÝíá íç÷:áíÞíáðά. Ááñíáβðάέ, áέðüð έάέ áí ðí xdm-config Ý÷áέ ñðέíέóðáβ Þðóá íá äÝ÷áðάέ áέóáñ÷íáíáð ððíáÝðáέð. Ç ðñíáðέέíáÞ áβίάέ íá íçí áðέðñÝðáðάέ óά έáíÝíá ðáέÛðç íá óðíááέáβ.

#### 5.6.3.2 Xresources

ðñúέáέðάέ áέα ðí áñ÷áβí ðñíέáέíñέóíÝíúí ðέíÞí áέα ðέð áðáñíáÝð áíðÛíέóçð ðíð ðáñÛέðñíð óγíááðçð (login) έάέ

άδεείαΎά άδάεέυιέόο (display chooser). ΐΎόά άδύ άόου ιδίνάβ ίά όνιθιθιέεεάβ ε άιθΎιέόε όιθ όνιάνΎιιόιθ login. Ε ιιθP όιθ άβιάε βάεά ίά όι άν÷άβι app-defaults θιθ όάνεάνΎοάόάε όόεί όάειεñβύόε όιθ X11.

### 5.6.3.3 Xservers

ΆόθP άβιάε ίεά εβόόά όυί άθνιάνεθόιΎιυί όάειπí θιθ όνΎθάε ίά άιόάιβαιίόάε υό άδεείαΎό όοι θνυάναιίά (chooser).

### 5.6.3.4 Xsession

Άόθυ άβιάε όι θνιέάεινέόιΎι session script θιθ άέόάεάβ όι **XDM** ίάόΎ όε όύίαάόε εΎθιέιθ ÷ñPόόε. ΕάνιέέΎ, εΎεά ÷ñPόόε έά Ύ÷άε Ύία όνιθιθιέείΎι, άέέυ όιθ, session script όοι ~/ .xsession θιθ έά όάνάέΎιθόάε άόθυ όι script.

### 5.6.3.5 Xsetup\_\*

Όά άν÷άβά άόθΎ άέόάειύιόάε άόθυιόά όνεί όεί άιθΎιέόε όυί όάνάέγνυί άδεείαPθ P όύίαάόε. ΌθΎñ÷άε Ύία script άεά εΎεά display θιθ ÷ñPόόειθιέάβόάε, θιθ ιιθΎεάόάε xsetup\_ ίά όι ηύίάνι όιθ display όοι όΎειθ (άεά όάνΎάάεαιά xsetup\_0). ΕάνιέέΎ άόθΎ όά scripts έά άέόάειύί Ύία P άοι θνιάνΎιιόά όοι όάνάόεPεί υθυό θ.÷. όι xconsole.

### 5.6.3.6 xdm-config

Όί άν÷άβι άόθυ όάνεΎ÷άε ηόειβόάέό όόεί ιιθP όυί app-defaults, θιθ άόάνιυαιίόάε όά εΎεά display θιθ άεά÷άεñβεάόάε ε όόάεάεñειΎίε άάέάόΎόόάε.

### 5.6.3.7 xdm-errors

Όί άν÷άβι άόθυ όάνεΎ÷άε όεί Ύιαι όυί άεάεινέόθP X θιθ θνιόθάεάβ ίά άέόάεΎόάε όι **XDM**. Αί Ύία display θιθ θνιόθάεάβ ίά άέέειPόάε ο **XDM** ειέεPόάε άεά εΎθιέί ευαι, έάέυ άβιάε ίά άίαεεθPόάόά άαP όθ÷υί ιεύίγίαόά όόάειΎόυί. Όά ιεύίγίαόά άόθΎ έάόάάνΎοιθόάε έάε όόά άν÷άβά ÷ñPόόεί ~/ .xsession-errors.

## 5.6.4 Άεάόεñβιόάό Ύίαί ΆέάεινέόθP ΆθνιάνεθόιΎιυί ΌόίαΎόάυί

Άεά ίά όόιαΎιθόάε έάε Ύεείε θάεΎόάό όοι άεάεινέόθP ηευίεθ, όνιθιθιέPόόά όιθό έάυίάό άεΎã÷ιθ θνυόάάόε, έάε άίάνιθιέPόόά όέό άέόάν÷υιίάό όόιαΎόάεό. Όά όάνάόΎιυί άβιάε, άδυ θνιθδεείαP ηόειέόιΎία όά όόιόεñεέΎό όειΎό. Άεά ίά εΎιθόά όι **XDM** ίά äΎ÷άόάε όόιαΎόάεό, άν÷έεΎ ίάόάόñΎόθά όά ό÷υέει όεί όάνάέΎόθ άññιP όοι άν÷άβι 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
```

έάε ίάόΎ άόάίάέέειPόόά όι **XDM**. Ιά Ύ÷άόά όθυPεί όάό υόέ όά ό÷υέεά όόά άν÷άβά app-defaults ίάέειύί ίά όι ÷άνάέόPνά “!”, έάε υ÷έ όιθ όόιPεε “#”. ΐθινάβ ίά άέέέόιάβόά θεί άόόόεñιύό έάυίάό άεΎã÷ιθ θνυόάάόε. Άάβόά όά όάνάάάβαιίόά όοι xaccess, έάε όόιθιθέάόεάβόά όε όάέβάά manual όιθ xdm(1).

## 5.6.5 ÁíóέέάόάóóÙðàð òïò XDM

ÕðÙñ ÷ ïôí àñεάðíβ áíóέέάόάóóÙðàð áεά òí ðñúáñáíá **XDM**. ðàð áðú áððíýð, ï **kdm** (Ýñ ÷ áðáé ïà òí **KDE**) áíáεýáðáé àñáúðáñá óá áððú òí εάðÙεάει. Ì **kdm** display manager ðñíóóÝñáε ðíεεÙ ðñíðáñÞíáóá óóá àñáóέεÙ εáé áεάειòíçðέεÙ óóíε ÷ áβá, ïððò ððβóçð εáé ðçí áðíáðúòçðá íá ððέεÝáíôí íε ÷ ñÞóðàð òíí ððέεòíçðú áεá ÷ áεñέóðÞ ðáñáεýñúí ðçí óðέáíÞ ðçð óýíááóçð.

## 5.7 ÆñáóέέÙ ÐáñéáÙεέííóá

*ÓðíáέóðíñÙ òíò Valentino Vaschetto.*

Áððú òí òíÞíá ðáñéáñÙðáé ïáñέéÙ àñáóέéÙ ðáñéáÙεέííóá ðíò áεáðβεáíðáé áεá òí X óðí FreeBSD. Ç Ýíñéá “àñáóέéú ðáñéáÙεέíí” ïðíñáβ íá óçíáβíáé ïðεáÞðíðá, áðú Ýíáí áðεú áεá ÷ áεñέóðÞ ðáñáεýñúí ïÝ ÷ ñε Ýíá ðéíεçñúíÝíá ðáéÝ òí desktop àðáñíñáÞí, ïððò òí **KDE** Þ òí **GNOME**.

### 5.7.1 GNOME

#### 5.7.1.1 Ó ÷ áðέéÙ ïà òí GNOME

Õí **GNOME** áβíáé Ýíá ðέέέεú ðñíð òíí ÷ ñÞóç àñáóέéú ðáñéáÙεέíí ðíò ððέðñÝðáé óóíðð ÷ ñÞóðàð íá ÷ ñçóέííðíεíýí εáé íá ñðéíβáεíòí áýεíεá òíðð ððíεíáεóðÝð òíðð. Õí **GNOME** áεáéÝðáé Ýíá panel (áεá ðçí áεέβíçççç áðáñíñáÞí εáé ðçí ðñíáíεÞ εáóÙóóáççð), áðέóÙíáéá àñááóβáð (ïðíò àíóáíβáεííóáé áááñÝíá εáé áðáñíñáÝð), Ýíá ðεÞεíð áðú áεááááñÝíá àñááéáβá εáé áðáñíñáÝð, εáεÞð εáé Ýíá óýñíεí ðððíðíεÞóáúí ðíò ððέðñÝðáé óðέð áðáñíñáÝð íá óðíáñáÙáεííóáé ïáðáý òíðð εáé íá ááβ ÷ ñíòí Ýíá óðíáðÝð ðáñéáÙεέíí àñááóβáð. Ìε ÷ ñÞóðàð Ùεεúí εáεðíðñáεéÞí óðóðçíÙðúí Þ ðáñéáÙεέííóúí εá áεóεÙíííóáé óáí óðí ððβðé òíðð ÷ ñçóέííðíεÞíðáð òí ðáíβó ÷ ðñí àñáóέéú ðáñéáÙεέíí ðíò ðáñÝ ÷ áε òí **GNOME**. Ðáñέóóúðáñáð ðεçñíòíñβáð ó ÷ áðέéÙ ïà òí **GNOME** óðí FreeBSD ïðíñíýí íá àñáεíýí óðí áεááéέððáéú òúðí òíò FreeBSD GNOME Project (<http://www.FreeBSD.org/gnome>). Ç òíðíεáóβá ðáñéÝ ÷ áε áðβóçð εáé áíáεðóέéÙ FAQs ó ÷ áðέéÙ ïà ðçí ááéáóÙóóáçç, ðçí ñýεíέóç, εáé ðçí áεá ÷ áβñέóç òíò **GNOME**.

#### 5.7.1.2 ÆéáóÙóóáçç òíò GNOME

Õí **GNOME** ïðíñáβ íá ááéáóáóðáéáβ áýεíεá áðú ðáéÝðá Þ áðú ðçí óðέεíñáÞ òúí ports:

Æáé íá ááéáóáóðÞóáðá òí Ýðíεíí ðáéÝ òí òíò **GNOME** áðú òí áβéððí, áðεÞð ðεççðñíεíñáÞóáð:

```
# pkg_add -r gnome2
```

Æáé íá ïáðááεúððβóáðá òí **GNOME** áðú òíí ðçááβí εÞáééá, ÷ ñçóέííðíεÞóáð ðçí óðέεíñáÞ òúí ports:

```
# cd /usr/ports/x11/gnome2
# make install clean
```

Ìúεέð ááéáóáóðáéáβ òí **GNOME**, εá ðñÝðáé íá ñðéíεóðáβ ï áεáéñέóðÞð X Þóðá íá áεέέíáβ òí **GNOME** áíðβ áεá òíí ðñíéáεíñέóíÝíí áεá ÷ áεñέóðÞ ðáñáεýñúí.

Ì áðέíεúðáñíð ðñúðíð áεá íá áεέέíÞóáðá òí **GNOME** áβíáé ïà òí **GDM**, òíí GNOME Display Manager. Õí **GDM**, ðíò ááéáεεβóðáðáé ïð ïÝñíð òíò **GNOME** (áεεÙ áβíáé áíáíáñáú àñ ÷ έεÙ), ïðíñáβ íá áíáñáíðíεçεáβ ïà ðçí ðñíóεÞεç òíò `gdm_enable="YES"` óðí `/etc/rc.conf`. Ìúεέð εÙíáðá ðáíáíεέβíççç, òí **GDM** εá ïáέέíÞóáé áððúíáðá.

Από την αρχή, ας δούμε πώς να ενεργοποιήσουμε το GNOME μέσω του αρχείου `/etc/rc.conf`.

Οι **GNOME** υπηρεσίες θα ενεργοποιηθούν με την προσθήκη των παρακάτω γραμμών στο αρχείο `.xinitrc`. Αφού γίνει η αλλαγή, θα πρέπει να επανεκτελέσουμε το `startx` ή να χρησιμοποιήσουμε το `startx` για να ενεργοποιηθεί το **GNOME**.

```
% echo "/usr/local/bin/gnome-session" > ~/.xinitrc
```

Εάν θέλουμε να ενεργοποιήσουμε το `startx`, ας δούμε πώς να το κάνουμε.

**Σημείωση:** Αφού γίνει η εγκατάσταση του `display manager`, υπάρχει το **XDM**, οι οποίοι είναι αλλαγές στο αρχείο `.xsession`. Οποιοδήποτε αρχείο `.xsession` που υπάρχει στο `usr/local/bin/gnome-session` θα αντικατασταθεί με το `gnome-session`.

```
% echo "#!/bin/sh" > ~/.xsession
% echo "/usr/local/bin/gnome-session" >> ~/.xsession
% chmod +x ~/.xsession
```

Εάν θέλουμε να ενεργοποιήσουμε το `display manager`, ας δούμε πώς να το κάνουμε. Οποιοδήποτε αρχείο `.xsession` που υπάρχει στο `usr/local/bin/gnome-session` θα αντικατασταθεί με το `gnome-session`.

## 5.7.2 KDE

### 5.7.2.1 Ολοκλήρωση του KDE

Οι **KDE** υπηρεσίες είναι ουσιαστικά, ουσιαστικά, οι υπηρεσίες του **KDE**.

- Για να γίνει η εγκατάσταση του **KDE**.
- Για να γίνει η εγκατάσταση του **KDE**.
- Για να γίνει η εγκατάσταση του **KDE**.
- Οποιοδήποτε αρχείο `.xsession` που υπάρχει στο `usr/local/bin/gnome-session` θα αντικατασταθεί με το `gnome-session`.
- Οποιοδήποτε αρχείο `.xsession` που υπάρχει στο `usr/local/bin/gnome-session` θα αντικατασταθεί με το `gnome-session`.
- Οποιοδήποτε αρχείο `.xsession` που υπάρχει στο `usr/local/bin/gnome-session` θα αντικατασταθεί με το `gnome-session`.
- Οποιοδήποτε αρχείο `.xsession` που υπάρχει στο `usr/local/bin/gnome-session` θα αντικατασταθεί με το `gnome-session`.
- Οποιοδήποτε αρχείο `.xsession` που υπάρχει στο `usr/local/bin/gnome-session` θα αντικατασταθεί με το `gnome-session`.

Οι **KDE** υπηρεσίες είναι ουσιαστικά, ουσιαστικά, οι υπηρεσίες του **KDE**.

website (<http://www.kde.org/>). Ἄσά ὁ κῆρος τῶν ἐπιπέδων τῶν FreeBSD ἔσά ἐπὶ KDE, οἰκιστῶν τῆς FreeBSD-KDE team (<http://freebsd.kde.org/>).

Ὁ δῶν τῶν ἐπιπέδων τῶν KDE ἔσά ἐπὶ FreeBSD. Ὁ κῆρος 3, ὁ κῆρος 4, ὁ κῆρος 5 ἔσά ἐπιπέδων τῶν KDE. Ὁ κῆρος 3, ὁ κῆρος 4, ὁ κῆρος 5 ἔσά ἐπιπέδων τῶν KDE. Ὁ κῆρος 3, ὁ κῆρος 4, ὁ κῆρος 5 ἔσά ἐπιπέδων τῶν KDE.

### 5.7.2.2 Ἄσά ὁ κῆρος τῶν KDE

Ἄσά ὁ κῆρος τῶν KDE ἐπὶ FreeBSD. Ὁ κῆρος τῶν KDE ἐπὶ FreeBSD.

Ἄσά ὁ κῆρος τῶν KDE ἐπὶ FreeBSD.

```
# pkg_add -r kde
```

Ἄσά ὁ κῆρος τῶν KDE ἐπὶ FreeBSD.

```
# pkg_add -r kde4
```

Ὁ κῆρος τῶν KDE ἐπὶ FreeBSD.

Ἄσά ὁ κῆρος τῶν KDE ἐπὶ FreeBSD.

```
# cd /usr/ports/x11/kde3
```

```
# make install clean
```

Ἄσά ὁ κῆρος τῶν KDE ἐπὶ FreeBSD.

```
# cd /usr/ports/x11/kde4
```

```
# make install clean
```

Ἄσά ὁ κῆρος τῶν KDE ἐπὶ FreeBSD.

Ἄσά ὁ κῆρος τῶν KDE:

```
% echo "exec startkde" > ~/.xinitrc
```

Ἄσά ὁ κῆρος τῶν KDE:

```
% echo "exec /usr/local/kde4/bin/startkde" > ~/.xinitrc
```

Ὁ κῆρος τῶν KDE ἐπὶ FreeBSD.

Ἄσά ὁ κῆρος τῶν KDE ἐπὶ FreeBSD.

### 5.7.3 Ἄσά ὁ κῆρος τῶν KDE

Ἄσά ὁ κῆρος τῶν KDE ἐπὶ FreeBSD.

Ç éáéýóáñç áìÞεάέά áεά οί **KDE** áβίάέ ç on-line óáèìçñßòç. Οί **KDE** óοίííáýáóáέ áðu οίí áέέυ οίò ðáñέçãçòÞ, οίí **Konqueror**, ðíεε Ýò ÷ ñÞóέíáò áóáñííáÝò, έάέ áíáέòòέέÞ óáèìçñßòç. Οί ððuέíέðí áòòÞò óçò áíúòçòáò óòæçòÛ óá ÷ íέÛ èÝíáóá ðíò áβίάέ áýέίέí íá áíáέάέòòέíý íá áíέέíÝò.

### 5.7.3.1 Ì KDE Display Manager

Ì áέá ÷ áέñέóòÞò áíúò ðíεò ÷ ñçóóέέíý óòóòÞíáóíò èÝέáé áíáá ÷ ñÝíúò ç óýíááóç ðúí ÷ ñçóóòÞí íá áβíáóáέ íÝóú áñáóέέíý ðáñέáÛέέííòð. Ξðò ðáñέáñÛòáíá ðñβί, ìðíñáß íá ÷ ñçóέííðíέççáß οί XDM. Ξíúò, οί **KDE** ðáñέÝ ÷ áέ íέá áíáέέάέòέέÞ áðέέíáÞ, οί **kdm**, οί íðíβí Ý ÷ áέ ó ÷ ááέáóòáß íá áβίάέ ðíβí áέòòóóέέú έάέ ðáñÝ ÷ áέ ðáñέóóúòáñáò áðέέíáÝò έáóÛ óç óýíááóç. ÓóáέáñέíÝíá, íέ ÷ ñÞóóáò ìðíñíý íáýέíέá íá áðέέÝííóí (íÝóú ìáííý) ðíβí áñáóέέú ðáñέáÛέέíí (**KDE**, **GNOME**, Þ èÛðíέí Ûέέí) έá áέòáέáóòáß ìáòÛ óçí óýíááóç οίòð.

Άέά íá áíáñáíðíέÞóáòá οί **kdm**, έá ðñÝðáέ íá áέèÛíáòá οί ttyv8 óóí /etc/ttys. Ç áñáííÞ έá ñέÛæáέ ìá óçí ðáñáέÛòú:

Άέά οί **KDE3**:

```
ttyv8 "/usr/local/bin/kdm -nodaemon" xterm on secure
```

Άέά οί **KDE4**:

```
ttyv8 "/usr/local/kde4/bin/kdm -nodaemon" xterm on secure
```

## 5.7.4 Xfce

### 5.7.4.1 Ó ÷ áòέέÛ ìá οί Xfce

Οί **Xfce** áβίάέ Ýíá áñáóέέú ðáñέáÛέέíí ðíò óóçñßæáóáέ óóçí áέáέέíèÞεç GTK+ ðíò ÷ ñçóέííðíέáßòáέ έάέ áðu οί **GNOME**, áέèÛ áβίάέ ðíέý ðéí áέáóñý έάέ ðñíñßæáóáέ áέá υóíòð èÝέíóí Ýíá áðέú, áðíòáέáóíáóέέú áñáóέέú ðáñέáÛέέíí ðíò áβίάέ áýέíέí íá ÷ ñçóέííðíέççáß έάέ íá ñòέέóòáß. ÌðóέέÛ, ñέÛæáέ ðíέý ìá οί **CDE**, ðíò óóíáíòÛòáέ óá áìðíñέÛ óòóòÞíáóá UNIX. ÌáñέέÛ áðu óá ÷ áñáέòçñέóóέέÛ οίò **Xfce** áβίάέ:

- íá áðέú, áýέíέí óóçí ÷ ñÞóç áñáóέέú ðáñέáÛέέíí
  - ÐεÞñúò ðáñáíáòñíðíέÞóέíí ìá οί ðíóβέέ, ìá drag and drop, έέð.
  - Êáíóñέέú panel ðáñúííέí ìá οίò **CDE**, ìá ìáííý, íέέñí-áóáñííáÝò έάέ ðεÞòñá áέέβίççòç áóáñííáÞí
  - ÌέíέεçñúíÝíò áέá ÷ áέñέóòÞò ðáñáέýñúí, áέá ÷ áέñέóòÞò áñ ÷ áβúí, áέá ÷ áέñέóòÞò Þ ÷ íò, óóíááóúòçóá ìá οί **GNOME**, έάέ Ûέέá
  - Äóíáóúòçóá ÷ ñÞóçò èáíÛòúí (themes, áóíý ÷ ñçóέííðíέáß οί GTK+)
  - ΆñÞáíñí, áέáóñý έάέ áðíòáέáóíáóέέú: έááíέέú áέá ðáέάέúòáñá/ðéí áñáÛ íç ÷ áíÞíáóá Þ íç ÷ áíÞíáóá ìá έβãç ííÞíç
- Ðáñέóóúòáñáò ðεçñíóíñßáò áέá οί **Xfce** ìðíñáßòá íá áñáßòá óóç áέέòòáέÞ ðíðíέáóá ðíò Xfce (<http://www.xfce.org/>).

### 5.7.4.2 ΆέέáòÛóóáóç οίò Xfce

ΟðÛñ ÷ áέ (óçí þñá ðíò áñÛóííóáέ áòòÝò íέ áñáíÝò) Ýóέíí ðáέÝóí áέá οί **Xfce**. Άέά íá οί ááέáóáóòÞóáòá, áðεÞò ðεççéòñíέíáÞóá:

```
# pkg_add -r xfce4
```

ΑἰάεεάεδέεÙ, ἄεά ἰά οἱ ἰάοάἄεùòòβóάόἰ ἄδἰ οἱ ḁçἄἄβἰ εḁἄεά, ÷ñçóεἰḁἰεḁóἰ ḁçἰ óðεεἰἄḁ ḁἰ ports:

```
# cd /usr/ports/x11-wm/xfce4
# make install clean
```

Ὀḁḁἰ, ḁἄβóἰ óðἰ ἄεάεἰεóóḁ X ἰά ἄεεἰḁóἰ οἱ **Xfce** ḁçἰ ἄδἰἰἰç ḁἰñÙ ḁἰ ἄḁἰἰἰ ἄεεḁἰçç ḁἰ ἄḁἰεἰç ḁḁἰἰḁἰ. Ἀḁεḁò ḁεçεòḁἰεἰἄḁóἰ οἱ ḁḁἰἰἰḁἰ:

```
% echo "/usr/local/bin/startxfce4" > ~/.xinitrc
```

Ὀçἰ ἄδἰἰἰç ḁἰñÙ ḁἰ ἄἰḁἰἰḁἰḁἰ ḁἰ ×, ἄἰ ἄἰḁἰἰḁἰḁἰ οἱ **Xfce**. ἰḁḁḁ ἄεἰ ḁḁἰçἰḁἰḁἰḁἰ, ἄἰ ÷ñçóεἰḁἰεḁḁἰ εÙḁἰεἰ display manager ἰḁḁḁ ḁἰ **XDM**, ἄçἰεἰḁḁḁḁḁḁ ḁἰ ḁḁἰḁḁḁḁ ḁἰ ḁḁἰḁḁḁḁ ḁἰ **GNOME**, ἄεεÙ ἰḁ ḁçἰ ἄἰḁἰḁḁḁḁ /usr/local/bin/startxfce4, ḁḁ ḁḁἰḁḁḁḁ ḁἰ display manager ἰḁ ἄḁἰḁḁḁḁḁ ḁçἰ ἄḁἰḁḁḁḁḁ ḁḁἰḁḁḁḁḁ ḁḁἰḁḁḁḁḁḁ, ἰḁḁḁ ḁḁἰḁḁḁḁḁḁḁḁ ḁçἰ ḁḁἰḁḁḁḁḁḁ ḁḁἰḁḁḁḁḁḁ ἰḁ ḁἰ kdm.

## II. ΆαόέεΎò Æñãáóβãò

Ôþñã ðñò Ύ÷ñòìã éãéÿøáé ðéΎñ óá ááóέέÛ èΎñáðá, áððñ ðñ ðñβñá ðñò Æñ÷áéñéãβñò ðñò FreeBSD ðãñéãñÛòáé ðéð ðéñ ááóέέΎò Æñãáóβãò éáé ðá ðéñ äçññòééβ ÷ ÆñáéðçñéóðééÛ ðñò FreeBSD. Ôá éãòÛéáéá áððñÿ ðñò ðñβñáðñò:

- ÐãññòóéÛæñññ ðéð ðéñ äçññòééãβò éáé ÷ñβóéñãò áðãñññãΎò éáé ðãñéáÛééññóá Æñãáóβãò: ððééññãðñçðΎò (browsers), ÆñãóééÛ ðãñéáÛééññóá Æñãáóβãò, Æñãáéãáβá ðñññãñéβð Æéáðññññññ ñññòþññ Æñ÷áβññ, ééð.
- ÐãññòóéÛæñññ ññéóññΎñá áðñ ðá Æñãáéãáβá ðñéðññΎóññ (multimedia) ðñò áβññé ÆéáéΎóéñá Æéá ðñ FreeBSD
- Æñçññññ ðç Æéáéééáóβá ñáðáãéþððéóçð éáé ÆéáéðÛóðáóçð Æññð ðññóáññññññññ ððñβññá Æéá ðñ FreeBSD, Ύðóé þóðã ñá Æñãññññññññññññññ Æñññã ÷ ÆñãéðçñéóðééÛ Æéá ðñ óÿóðçññÛ óáð.
- ÐãñéãñÛññññ ðá ÆÛéñð ðñ óÿóðçññá Æéððððóáññ, ðññññ Æéá ÆéððððòÛð ðñò Æññéá Æðãðéãáβãð ððññãããñññññññ ñá ðñ ððáéññ Æñãáóβãò óáð, ùññ éáé Æéá Æééððáéñÿð ÆéððððòÛð.
- ÐãñéãñÛññññ ððò ñðññãβòã ñá ðñΎñáðá ÆóáñññãΎò Linux ðññ FreeBSD óÿóðçññÛ óáð.

ÛãñééÛ áðñ áððÛ ðá éãòÛéáéá áðáéóñññ ñá Ύ÷ãòã ñáéãðβóáé ðéñ ðñéññ ðÛðñéññ Ûééññ éãòÛéáéññ. ¼ðñò áβññé Æðãñãáβðçðññ ðÛðé ðΎóñéññ, ÆñãòÛñãðáé óðç ðÿññç ðñò éÛéã éãðáéãáβñò.

# ÊäöÛëäéí 6 Desktop ÄöáñííäÝò

ÓðíäéóöíñÛ òíö Christophe Juniet.

## 6.1 Óýííøç

Ôí FreeBSD íðíñáß íá äéðäéÝóáé íéá äöñáßá äéÛíá desktop äöáñííäí, ùðùð öðëëíäòñçðÝò (browsers) éáé äðáíñááóðÝò éäéíÝíò. Íé ðáñéóóóòáñáð áðu áððÝò áßíáé äéäéÝóéíäð ùð ðáéÝóá (packages) P íðíñíý íá ääéäóáóðäéíýí áðòùíäóá áðu òçí Óðëëíäð òùí Ports. Ðíëëíß íÝíé ÷ ñðóðáð áíáíÝíòí íá áñíòí óÝóíéíò áßáíòð äöáñííäÝò óòí desktop òíòð. Ôí ÊäöÛëäéí áðòù éá óáð äáßíáé ðùð íá ääéäóáóððóáðä ÷ ùñßð éùðí òéð ðéí äçííòééáßð desktop äöáñííäÝò, áßòá áðu ðáéÝóá áßòá áðu òç Óðëëíäð òùí Ports.

Óçíäéððóá ùðé ùðáí ääéäéóóðÛðä ðñíñÛííäóá áðu òç Óðëëíäð òùí Ports, áßíáðáé íäðáäéððððéóç áðu òíí ðçááßí éðáééá. Áðòù íðíñáß íá ÷ ñáéáóðáß ðíëý ÷ ñúíí, éäéðð áíáñðÛðáé áðu òí ðñúáñáííá òí íðíßí íäðáäéùððßæáðä éáé òçí òðíëíäéóðééð éó ÷ ý òíò ìç ÷ áíðíáðòð óáð. Áí òí ÷ ñííééù äéÛóðçíá òí íðíßí ÷ ñáéÛæáðáé ç íäðáäéððððéóç áßíáé áðááíñáððééÛ íäáÛéí, íðíñáßòá íá ääéäóáóððóáðä óá ðáñéóóóóðáñá ðñíñÛííäóá òçð Óðëëíäðð òùí Ports áðu ðñíí-íäðáäéùððéóíÝíá ðáéÝóá.

Éäéðð òí FreeBSD äéäéÝóáé óðííáðòðçðá íá äéðäéÝóéíá ðñíñÛííäóá äéá Linux, ðíëëÝò äöáñííäÝò ðíò áíáððý ÷ èçéáí áñ ÷ ééÛ äéá òí Linux áßíáé äéäéÝóéíäð äéá òí desktop óáð. Óáð óðíéóóóíýíá éáñíÛ íá äéááÛóáðä òí ÊäöÛëäéí 10 ðñéí ääéäóáóððóáðä íðíéááððíòá áðu òéð äöáñííäÝò Linux. ÐíëëÛ áðu òá ports ðíò ÷ ñçóéííðíéíýí òç óðííáðòðçðá íá Linux Ý ÷ íòí ííúíäóá ðíò íäééíýí íá "linux-". Èðíçéáßòá òí ùðáí øÛ ÷ íáðá äéá éÛðíéí óðáéáñéíÝíí port, äéá ðáñÛäáéáíá íá òçí whereis(1). Óòí éáßíáíí ðíò áéíéíòéáß éáññáßðáé ùðé Ý ÷ áðá áíáñáíðíéðóáé òçí óðííáðòðçðá íá äéðäéÝóéíá ðñíñÛííäóá Linux ðñéí ääéäóáóððóáðä íðíéááððíòá áðu òéð äöáñííäÝò òíò Linux.

Íé éáðçáññáð ðíò éáéýððííóáé áðu áðòù òí ÊäöÛëäéí áßíáé íé áíðð:

- ÖðëëíäòñçðÝò (ùðùð **Firefox, Opera, Konqueror**)
- ÄöáñííäÝò áñáðáßíò (ùðùð **KOffice, AbiWord, The GIMP, OpenOffice.org**)
- ÐñíñÛííäóá ðñíáíéðð áááñÛòùí (ùðùð **Acrobat Reader®, gv, Xpdf, GQview**)
- ×ñçíáðíééííééÝò äöáñííäÝò (ùðùð **GnuCash, Gnumeric, Abacus**)

Ðñéí äéááÛóáðä áðòù òí ÊäöÛëäéí éá ðñÝðáé:

- Íá íÝñáðá ðùð íá ääéäóáóððóáðä ðñúðéáðí éíáéóíééù ðñßòíò éáðáðéáðáðð (ÊäöÛëäéí 4).
- Íá íÝñáðá ðùð íá ääéäóáóððóáðä ðñúðéáðí éíáéóíééù Linux (ÊäöÛëäéí 10).

Áéá ðçñíòíòñáðð ó ÷ áðééÛ íá òçí ääéäóððóáç ðíëòíáóééíý ðáñéáÛééíòíò äéááÛóáð òí ÊäöÛëäéí 7. Áí è Ýéáðá íá ñðéíßòáðä éáé íá ÷ ñçóéííðíéðóáðä éÛðíéá òðçñáðßá çæéðñíééíý óá ÷ ðáññáßíò ááßòá òí ÊäöÛëäéí 28.

## 6.2 ÖðëëíäòñçðÝò (Browsers)

Ôí FreeBSD ááí Ý ÷ äé ðñííáéäóáðòçíÝíí éÛðíéí óðáéáñéíÝíí öðëëíäòñçð. Óòíí éáðÛéíáí [www](http://www.FreeBSD.org/ports/www.html) (<http://www.FreeBSD.org/ports/www.html>) òçð òðëëíäðð Ports íðíñáßòá íá áñáßòá áñéáðíýð öðëëíäòñçðÝò, Ýóíéíòð äéá ääéäóððóáç. Áí ááí Ý ÷ áðá ÷ ñúíí äéá íá íäðáäéùððßæáðä ùðé ÷ ñáéÛæáðáð (ßòùð ÷ ñáéáóðáßòá áñéáðð ðñá), ðíëëíß áðu áðòíýð áßíáé äéäéÝóéíé éáé ùð Ýóíéíá ðáéÝóá.

Óá **KDE** éáé **GNOME**, ùð ðëþñç ðáñéáÛëëííóá áñááóβáð, ðáñÝ ÷ííí òíòð áééíýð òíòð òðëëñáðñçðÝð HTML. Ááβðá òí ÕíÞíá 5.7 áéá ðáñéóóóððáñáð ðëçññííññáð ó ÷ áðééÛ ìá òçí áãéáðÛóóáóç òíòð.

Áí áíáéáóÝñáóðá áéá áéáðñáβð (áðü Ûðíñç éáóáíÛëùóçð ðñññíí) òðëëñáðñçðÝð, ááβðá ðéð áéüëíðëáð áöáññïãÝð òçç òðëëíñáÞ òñí Ports: [www/dillo2](http://www/dillo2), [www/links](http://www/links), Þ [www/w3m](http://www/w3m).

Õí òíÞíá áóðü éáéýððáé ðéð ðáñáéÛðü áöáññïãÝð:

¼ññá ÁöáññïãÞð	Áðáéðíγíáññé ðñññé	ÁãéáðÛóóáóç áðü Ports	ÁáóééÝð ÁíáñðÞóáéð
<b>Firefox</b>	ìáóáβá	ááñéÛ	<b>Gtk+</b> ÕðÛñ ÷ííí áéáéÝóéíáð áéäüóáéð áéá FreeBSD éáé Linux. Ç Ýéäíóç áéá Linux áíáñðÛóáé áðü òçí áðááéëÞ òñíááðüòçðá ìá Linux (Linux Binary Compatibility) éáé òí <b>linux-openmotif</b> . Áéáéëíðëáð <b>KDE</b>
<b>Opera</b>	ëβáíé (áéáðñéÛ)	áéáðñéÛ	
<b>Konqueror</b>	ìáóáβá	ááñéÛ	

### 6.2.1 Firefox

Ï **Firefox** áβíáé Ýíáð ìíóÝññíð, áéáýéðáññíð, áññé ÷ ðüð éáé óðáéáññüð òðëëñáðñçðÞð, ï ïðñíð áβíáé ðëþññð ðññíóáññíóíÝñíð áéá ÷ ñÞóç óòí FreeBSD. ÁéáéÝóáé ìç ÷ áíÞ áðáééüíéóçð ç ïðñíá áíáññííβáéáóáé ðëþññð ìá ðéð òððíðíéÞóáéð òçð HTML, éáé áðíáóüòçðáð ùðñð àòÛéóç ðíëéáðëþí óáëβáñí óá tabs, ìðëíÛñéóíá áíáäóñíáñíí ðáñáéýññíí (pops), ðññíóéáðá ðññáñÛñíáðá, ááéðéñíÝíç áóðÛéáéá éáé ðíëéÛ áéññç. Ï **Firefox** ááóβáðóáé óðñí áñ ÷ ééñ ðççááβí ëþáééá òíð **Mozilla**.

ÁãéáðáóðÞóðá òí ðáéÝðí áñÛñííóáð:

```
# pkg_add -r firefox
```

Ç ðáñáðÛñ ñíóñëÞ éá áãéáðáóðÞóáé òñí **Firefox** òçð óáéñÛð 2.x. Áí èÝéäðá ñá áãéáðáóðÞóðá òñí **Firefox 3.x**, áñÛððá:

```
# pkg_add -r firefox3
```

Ïðñáβðá áðβóçð ñá ÷ñçóéñíðíéÞóáðá òçí ÓðëëíñáÞ òñí Ports áí ðññíóéíÛðá ñá ñáðáéüòððóáðá áðü òñí ðççááβí ëþáééá:

```
# cd /usr/ports/www/firefox
# make install clean
```

Áéá òñí **Firefox 3.x**, áíðééáðáóðÞóðá òççí ðáñáðÛñ ñíóñëÞ òç èÝíç firefox ìá firefox3.

### 6.2.2 Ï Firefox éáé òí ðññüóéáðí (plugin) òçð Java™

**Óçñáβùóç:** Óá áóðü éáé òí áðñíáñí òíÞíá, éáññíγíá ùðé Ý ÷ áðá Þçç áãéáðáóðÞóáé òñí **Firefox**.

To FreeBSD Foundation áεάεΎόάε ΰάάεά áðu ôçí Sun Microsystems áεά ôçí áεάáñíÐ áεòáεΎόείηò FreeBSD ðññññΰññññò áεά ôñ ðáññéáΰεεññ ΆεòΎεάόçò ôçò Java (Java Runtime Environment - JRE™) εάεêò εάε áεά ôñ ðáññéáΰεεññ áíΰðòòçò ôçò Java (Java Development Kit - JDK™). Óá áíòβòòíε÷ á áεòáεΎόείá ðáεΎόά áεά ôñ FreeBSD áβίáε áεάεΎόείá óòçí ôñðñéáóβá FreeBSD Foundation (<http://www.freebsdoundation.org/downloads/java.shtml>).

Άεά íá ðññíòεΎόάòá òðñíòòðñéñç Java™ óòññ **Firefox**, ðñΎðáε ðñðòá íá ááεáóáóòðòáòá ôñ port `java/javavmwrapper`. ðáεòá, εάòááΰóòá ôñ ðáεΎóñ **Diablo JRE** áðu ôçí ôñðñéáóβá <http://www.freebsdoundation.org/downloads/java.shtml>, εάε ááεáóáóòðòáòá ôñ ðá ôçí `pkg_add(1)`.

Íáεείðòáòá ôñ òðεεññáòñçòð óáò, áñΰòáòá `about:plugins` óòç áñáññíÐ áεáòεΎίòáññí εάε ðεΎόáòá **Enter**. Èá ááβòá íεά óáεβáá ðñò áíáóΎñáòáε óóá ááεáóáóòçíΎíá plugins, εάε áεάβ εá ðñΎðáε íá ááβòá εάε ôçí **Java**. Áí áòòñ ááñ óòñááβίáε, εΰεá ðñòðòçò εá ðñΎðáε íá áεòáεΎόάε ôçí áεññíòεç áíòñεð:

```
% ln -s /usr/local/diablo-jre1.6.0/plugin/i386/ns7/libjavaplugin_oji.so \
    $HOME/.mozilla/plugins
```

Áí Ύ÷ áòá ááεáóáóòðòáε ôñ ðáεΎóñ **Diablo JDK**, εá ðññáεáóáβ íá áεòáεΎόáòá:

```
% ln -s /usr/local/diablo-jdk1.6.0/jre/plugin/i386/ns7/libjavaplugin_oji.so \
    $HOME/.mozilla/plugins
```

Άðáíáεεείðòáòá ôñ òðεεññáòñçòð óáò áεά íá εó÷-Ύóññí íε áεεάΎò.

### 6.2.3 Ύ Firefox εάε ôñ Macromedia® Flash™ Plugin

Óñ Macromedia® Flash™ plugin ááñ áεáòβεáòáε áεά ôñ FreeBSD. ΰóòññí, ððΰñ÷áε Ύíá áðβðááñ áñññβòóçò (software layer, wrapper) áεά ôçí áεòΎεάóç ôñò áíòβòòíε÷÷ò plugin ôñò Linux. To wrapper áòòñ òðñíóçññεáε áðβòçò εάε óá plugins áεά ôññ Adobe® Acrobat®, ôñ RealPlayer εάε ΰεεά.

ΆεòáεΎόáòá óá ðáñáεΰòñ áðñíáóá, áíΰεññá ðá ôçí Ύεáñíóç ôñò FreeBSD ðñò ðñçóείññíεáβòá:

#### 1. Άεά ôñ FreeBSD 7.x

Άáεáóáóòðòáòá ôñ port `www/nspluginwrapper`. Óñ port áòòñ áðáεòáβ ôñ `emulators/linux_base-fc4` ôñ ðñññññ áβίáε ðááΰεñ.

Óñ áðñññññ áðñíá áβίáε ç ááεáóΰóóáóç ôñò port `www/linux-flashplugin9`. Èá ááεáóáóóáεáβ ç Ύεáñíóç Flash 9.x ç ðñññá áñññβεññíá ðε áñññéáΎáε óòòòΰ óòñ FreeBSD 7.x.

**Óçñáβòóç:** Óá áεáüóáεò ôñò FreeBSD ðáεáεüòáññáò áðu ôçí 7.1-RELEASE, εá ðñΎðáε íá ááεáóáóòðòáòá ôñ ðáεΎóñ `www/linux-flashplugin7` εάε íá ðáñáεáβòáòá ôñ áðñíá ó÷-áòεéΰ ðá ôñ `linprocfs(5)` ðñò óáβíáòáε ðáñáεΰòñ.

#### 2. Άεά ôñ FreeBSD 8.x

Άáεáóáóòðòáòá ôñ port `www/nspluginwrapper`. Óñ port áòòñ áðáεòáβ ôñ `emulators/linux_base-f10` ôñ ðñññññ áβίáε ðááΰεñ.

Óñ áðñññññ áðñíá áβίáε ç ááεáóΰóóáóç ôñò port `www/linux-f10-flashplugin10`. Èá ááεáóáóóáεáβ ç Ύεáñíóç Flash 10.x ç ðñññá áñññβεññíá ðε áñññéáΎáε óòòòΰ óòñ FreeBSD 8.x.

Άέα ίά εάεοίρòñāΠόάέ ούοóŨ άóòΠ ς Ύεäίρòς, εά ÷ ñāεάóóåß ίά äçíείρòñāΠόάóå òίí óóìäíεέεü óýíäáóίí ðίò óåßíåóåέ ðåñåéŨòù:

```
# ln -s /usr/local/lib/npapi/linux-f10-flashplugin/libflashplayer.so \
  /usr/local/lib/browser_plugins/
```

ÌåòŨ òçí ååεάóŨóóåóç ðίò ούóóίý (óýíòιúíå íå òçí Ύεäίρòς ðίò FreeBSD) Flash port, í εŨεå ÷ ñΠóóçò εå ðñŶðåé ίά íεíεεçñΠóåέ òçí ðñίòιðεéΠ ðίò ååεάóŨóóåóç ðίò plugin åéòåεΠíóåò òçí ðåñåéŨòù åίóίεΠ ðίò nspluginwrapper:

```
% nspluginwrapper -v -a -i
```

Έå ðñŶðåé ίå ðñίóåñòΠóåóå òί óýóóçíå åñ÷åßúí åéåñååóέΠί ðίò Linux, linprocfs(5) óóίí εåòŨεíäí /usr/compat/linux/proc, åí åðéèòìåßòå ίå åíåðåñŨååòå Flash óέçíŶð (animations). Άóòι ðññåß ίå åßíåé íå òçí åðñŶíç åίóίεΠ:

```
# mount -t linprocfs linproc /usr/compat/linux/proc
```

Ç ðñίóŨñòçòç ðññåß åðßçòð ίå åßíåóåé áóòιúíåóå éåòŨ òçí åééßíçòç, ðñίóèŶóίíóåò òçí ðåñåéŨòù åñåñΠ óóί /etc/fstab:

```
linproc          /usr/compat/linux/proc          linprocfs        rw          0          0
```

ÌåòŨ òçí ååεάóŨóóåóç ðίò plugin, íåééíΠóåò òί ööεéñåòñçòΠ óåò, åñŨøòå about:plugins óòç åñåñΠ åéåðéýíóåñí éåé ðéŶóóå **Enter**. Έå ðñŶðåé ίå ååßòå íεå εßòóå íå üεå óå ðñŶ÷ííóå åéåéŶóέíå plugins.

### 6.2.4 ĩ Firefox εåé òί Swfdec Flash Plugin

To Swfdec åßíåé íεå åéåεéíεΠεç åεå åðíεùåééíðίβçòç éåé åíåðåñååñåß óέçíΠί Flash. Őί Swfdec-Mozilla åßíåé Ŷíå plugin åεå ðίòð ööεéñåòñçòŶð **Firefox** òί ðñίβí ÷ ñçóέííðίεåß áóòΠ òç åéåεéíεΠεç åεå òçí åíåðåñååñåß åñ÷åßúí SWF. Άßíåé åéùíå óóί óóŨåéí òçò åíŨðòðίçò.

Άí ååí ðññåßòå Π ååí εŶéåòå ίå òί ðåóåéùòðßòåòå, åðεΠð ååεάóåóòΠóåò òί ðåéŶòί åðι òί åßéòòί:

```
# pkg_add -r swfdec-plugin
```

Άí òί ðåéŶòί ååí åßíåé åéåéŶóέíí, ðññåßòå ίå òί ðåóåéùòðßòåòå éåé ίå òί ååεάóåóòΠóåòå åðι òç ŐöεéñåΠ òιú Ports:

```
# cd /usr/ports/www/swfdec-plugin
# make install clean
```

ÌåòŨ òçí ååεάóŨóóåóç, åðåíåééíΠóåò òί ööεéñåòñçòΠ óåò åεå ίå åíåñåíðίεçεåß òί plugin.

### 6.2.5 Opera

ĩ **Opera** åßíåé Ŷíåò ööεéñåòñçòΠð ðåΠñåéð åðíåòιúòçòðåò éåé óóíååòιú ðå óå ðññòòðå. ñ÷åóåé åðßçòð ðå åíòιúåòιúŶí ðññåñåñíå åíŨåíòçòð ðå÷åññåßò (mail) éåé åéåΠóåñí (news), ðññåñåñíå åéå IRC, åíåñíΠóóç åéå RSS/Atom éåé ðñεéŨ åéùíå. ðåñ'üεå áóòŨ, í **Opera** åßíåé íεå ó÷åóééŨ åéåòñéŨ éåé ðñεý åñΠåññç åòåññíåΠ. ñ÷åóåé óå åýí óýðίòð: íεå "ååååñíΠð" Ŷεäίρòς åεå òί FreeBSD éåé íεå Ŷεäίρòς ðίò åéòåεåßòåé íŶòù òçò óóíååòιúòçòðåò ðå òί Linux.

Άέα ίå ÷ ñçóέííðίεéΠóåò òçí FreeBSD Ŷεäίρòς ðίò **Opera**, ååεάóåóòΠóåò òί ðåéŶòί:

```
# pkg_add -r opera
```

ΊνεοίΎιάο οίθιεάοβάο FTP αάί αέαέΎοίοί ιεά οά θαέΎοά, αεεΰ ιθιναβόα ία Ύ-άοά οί βαεί αθιόΎεάοία ιΎού οςο οόεειαβό ούι Ports, ανΰοιιόάο:

```
# cd /usr/ports/www/opera
# make install clean
```

Άέα ία αέαάοάοόβόάοά οςί Linux Ύεαιός οίο **Opera**, αίόεάάοάοόβόάοά ία linux-opera οί opera οάά θανάδΰιθ θανάααβαίαοά. ϸ Ύεαιός Linux αβίαέ ÷-ηβόειϸ οά εαόάοόΰοάέο θιό αθαέοίγί ος ÷-ηβός plugins θιό αβίαέ αέαέΎοεία ιιθί αέα Linux, υθόο οί **Adobe Acrobat Reader**. Οά εΰεά ΰεεϸ θανβδουός, ίε αεαιούάεο Linux εάε FreeBSD αβίαέ εαέοιθναεέΰ εοιγίαιάο.

### 6.2.6 Konqueror

Ί **Konqueror** αβίαέ εηιΰοε οίο **KDE** αεεΰ ιθιναβ ία ÷-ηςοείιθιεϸεαβ εάε Ύιθ αθι οί **KDE** ία οςί αεάοΰοάοός οίο x11/kdebase3. Ί **Konqueror** αβίαέ θιεϿ θανέοούοανί αθι Ύιάο αθευο οόεεηαθηςοβό, αβίαέ αθβόςο αέα ÷-αεέεοβό αν ÷-αβιί εάε θηιαναιία θηιαιεβό αν ÷-αβιί θιεοίΎοι.

Ί **Konqueror** αεάοβεαόάε αθβόςο ία Ύία οάο αθι plugins, οθί misc/konq-plugins.

Ί **Konqueror** οθιόοηβαεε αθβόςο **Flash** εάε ίε ο ÷-αδεέΎο ιαϸαβάο (How To) αβίαέ αεάέΎοείαο οθί <http://freebsd.kde.org/howtos/konqueror-flash.php>.

## 6.3 Άόάνιιαΰο Άναόαβιό

¼οί αοιηΰ οεο άοάνιιαΰο ανάοαβιό, ίε ιΎιε ÷-ηβόάο οο ÷-ιΰ αίαϸεοίγί ίεά εάεβ οίθβόά άοάνιιαβί β Ύία οεεεει άθαηααάοβ εάειΎιθ. Αί εάε εΰθιεά ανάοεεΰ θανέαΰεεηιόά υθόο οί **KDE** θανΎ ÷-ιθί ος αεεβ οίθο οίθβόά άοάνιιαβί ανάοαβιό, αάι οθΰη ÷-αε υοοιθιό θηιαθεεαηίΎις άοάνιιαβ. Οί FreeBSD θανΎ ÷-αε υοε ÷-ηαέΰεάοόά, ΰο ÷-άοά αθι οί θανέαΰεεηί ανάοόβάο οάο.

Οί οίβια αοοι εάεϿθοάε οεο θανάεΰοθ άοάνιιαΰο:

¼ηηά Άόάνιιαβό	Άθαέοίγίαιίε θυηίε	Άεάοΰοάοός αθι Ports	ΆάοεέΎο Αίανθβόάεο
<b>KOffice</b>	εβαιε (αεάοηεΰ)	αανεΰ	<b>KDE</b>
<b>AbiWord</b>	εβαιε (αεάοηεΰ)	αεάοηεΰ	<b>Gtk+ β GNOME</b>
<b>The Gimp</b>	εβαιε (αεάοηεΰ)	αανεΰ	<b>Gtk+</b>
<b>OpenOffice.org</b>	θιεεηβ (αανεΰ)	αίαεηαόεεΰ αανεΰ	<b>JDK 1.4, Mozilla</b>

### 6.3.1 KOffice

ϸ ειεηιόοά οίο KDE ανιθεβαεε οί ανάοεεει οςο θανέαΰεεηί ία ίεά οίθβόά άοάνιιαβί ανάοαβιό θιό ιθιναβ ία ÷-ηςοείιθιεϸεαβ εάε Ύιθ αθι οί **KDE**. θανεεαηιΎίαε οά οΎοόαηά αάοεεΰ θηιανΰηιαόά θιό ιθιναβόά αθβόςο ία ανάβόά εάε οά ΰεεάο οίθβόάο ανάοαβιό. Οί **KWord** αβίαέ ι άθαηααάοόβό εάειΎιθ, οί **KSpread** αβίαέ οί θηιαναιία οθιεηαεοοεεβί οϿεει, οί **KPresenter** αέα ÷-αεηβαάοάε οεο θανιθόεΰοάεο, απ οί **Kontour** οάο αθέοηΎθαε ία αϸιεθναβόάοά Ύαανάοά ία ανάοεεΰ.

Ðñéí ääëáðáóðÞóáðá òí òáëäððáβí **KOffice**, äääáëùèàβðá ùðé Ý ÷ áðá áíáíáùíÝíç Ýëäííç òíð **KDE**.

Ãéá íá ääëáðáóðÞóáðá òí **KOffice** ùð ðáéÝðí, äÞðáðá òçí áëüëíðèç áíðíèÞ:

```
# pkg_add -r koffice
```

Áí òí ðáéÝðí äáí áβíáé áéáéÝðéí, ìðñáβðá íá ÷ ñçðéíðíéÞóáðá òçí ÓðëëíäÞ òúí ports. Ãéá ðáíÛááéäíá, áéá íá ääëáðáóðÞóáðá òí **KOffice** áéá òí **KDE3**, äñÛððá:

```
# cd /usr/ports/editors/koffice-kde3
# make install clean
```

### 6.3.2 AbiWord

Ôí **AbiWord** áβíáé Ýíá äéáýèäñí ðñüäñáíá äðáíáñááðáð éáéíÝíð, ùííéí òðçí áβðèçðç éáé òçí äíðÛíéðç ìá òí **Microsoft Word**. Áβíáé éáðÛëççéí áéá òçí ðèçððñíëüäçç Ûñèñüí, äñáíÛðùí, áíáóññí, òðáíèðíβóáùí é.í.é. Áβíáé ðíëý äñÞáñí, Ý ÷ áé äñèáðÝð áðíáðüðçðáð éáé áβíáé éáéáβðáñá òéééëü òðí ÷ ñÞðç.

Ôí **AbiWord** ìðñáβ íá áéðÛááé Þ íá äíÛááé äñ ÷ áβá áéÛíñüí ññðñí, ðáñééäíááíñÝíñ éáé éÛðíéñí éëáéððñí ùðð òí .doc òçð Microsoft.

Ôí **AbiWord** áβíáé áéáéÝðéí ùð ðáéÝðí. ìðñáβðá íá òí ääëáðáóðÞóáðá äñÛðíðáð:

```
# pkg_add -r abiword
```

Áí òí ðáéÝðí äáí áβíáé áéáéÝðéí áéá éÛðíéí ëüäí, ìðñáβðá íá òí ìáðáäëùððβóáðá áðü òçí ÓðëëíäÞ òúí Ports. Óá áððð òçí ðáñβððùðç ðééáíÞð íá ääëáðáóðÞóáðá íáÞðáñç Ýëäííç òá ò ÷ Ýðç ìá òí Ýðíéí ðáéÝðí. ìðñáβðá íá òí éÛíðá ùð äíÞð:

```
# cd /usr/ports/editors/abiword
# make install clean
```

### 6.3.3 Ôí GIMP

Ôí **The GIMP** áβíáé Ýíá éáéáβðáñá äíäééäíÝí ðñüäñáíá áéá ÷ áβñéðçð äñáðéèñí áéá äçíéíðñáβá áééüíñí Þ äðáíáñááðá òððíáñáðéñí. ìðñáβ íá ÷ ñçðéíðíéççáβ ùð áðëü ðñüäñáíá æüäñáðééèðð Þ òáí òíðβóá äðáíáñááðáð éáé áéüñèùðçð òððíáñáðéñí. ÐáñéÝ ÷ áé ìááÛéí äñéèü áðü plugins áíÞ áéáéÝðáé éáé scripting interface. Ôí **The GIMP** ìðñáβ íá áéááÛðáé éáé íá äñÛðáé ìááÛéí òÛíá äñ ÷ áβñí áééüíñáð. ÐáñééäíáÛíáé äðβçð áéáðáðÝð áéáóýíááçð ìá òáñùðÝð éáé tablets.

Ìðñáβðá íá ääëáðáóðÞóáðá òí ðáéÝðí äβñíðáð òçí áíðíèÞ:

```
# pkg_add -r gimp
```

Áí ç òíðíèáðá FTP ðíð ÷ ñçðéíðíééáβðá äáí áéáéÝðáé áððü òí ðáéÝðí, ìðñáβðá íá ÷ ñçðéíðíéÞóáðá òçí ÓðëëíäÞ òúí Ports. Ì éáðÛéíäíð graphics (<http://www.FreeBSD.org/ports/graphics.html>) òçð ÓðëëíäÞð òúí Ports ðáñéÝ ÷ áé áðβçð éáé òí **The Gimp Manual** (äã ÷ áéñβáéí ÷ ñÞðçð). Äáβðá ðáñáéÛðù ðùð íá òí ääëáðáóðÞóáðá:

```
# cd /usr/ports/graphics/gimp
# make install clean
# cd /usr/ports/graphics/gimp-manual-pdf
```

```
# make install clean
```

**Όγιάρβυός:** Ί έαοΰεϊϊαϊò graphics (<http://www.FreeBSD.org/ports/graphics.html>) όçò óòεϊϊαβò òυί Ports Ύ÷άέ άδβςόç όçί òδϋ άίΎέειç Ύέαιός όçò άοάνιιαβò **The GIMP** όδϊ graphics/gimp-devel. Ίδϊηάρβοά ίά άηάρβοά όçί HTML Ύέαιός όϊò άά÷άέηέάρβιò, **The Gimp Manual** όδϊ graphics/gimp-manual-html.

### 6.3.4 OpenOffice.org

Όϊ **OpenOffice.org** δάνεΎ÷άέ υεάò óέò άδάνάρβόçòάò άοάνιιαΎò óά ίεά δεβñç όϊòβοά άοάνιιαβί άηάοάβιò: άδάρηηάοόδβ έάει Ύίηò, òδϊεϊαέοόέεϋ όγέεϊ, άεά÷άεηέοόδβ δάνιòóεΎοάυι έάέ δñυάηάιιά ó÷άάβςόçò. Όϊ δάνεάΎεεϊ άηάοόβάò όϊò άβίάέ δϊεγ υιηέϊ ίά Ύεεάò όϊòβοάò άηάοάβιò, έάέ ίδϊηάρβ ίά ÷ñçόεϊηδϊεβόάέ άεΎοϊηιòò άçιηέεάβò όγδϊòò άñ÷άβυι. Άβίάέ άεάέΎόεϊ όά δϊεεΎò άεάοϊηάοέεΎò άεβόοάò, òυοϊ ùò δñιò όϊ δάνεάΎεεϊ άηάοόβάò υοϊ έάέ ùò δñιò óά εάρεέΎ έάέ όϊη ιηεϊηάοόέεϋ Ύεάα÷ι.

Ί άδάρηηάοόδβò έάει Ύίηò όϊò **OpenOffice.org** ÷ñçόεϊηδϊεάβ άαάαίβò ιηηòβ άñ÷άβιò XML άεά άοιçιΎίç όϊηçòυòçòά έάέ άοάεεϊβά. Όϊ δñυάηάιιά òδϊεϊαέοόέεβί όγέεϋι άεάέΎοάέ άεβόοά ίάεηιάριòεβί έάέ ίδϊηάρβ ίά άεάοοίάεάβ ίά άιυòάηέεΎò άΎοάέò άαάηΎίηι. Όϊ **OpenOffice.org** άβίάέ óοάεάηβ άοάνιιαβ έάέ άεòάεάβοάέ άαάαίβò óοά Windows, όϊ Solaris™, όϊ Linux, όϊ FreeBSD, έάεβò έάέ όοϊ Mac OS X. Δάνέοóυòάηάò δεçñιòηιηάò άεά όϊ **OpenOffice.org** ίδϊηάρβοά ίά άηάρβοά óòç άεέòòάεβ òϊδϊεάòβά όϊò OpenOffice.org (<http://www.openoffice.org/>). Άεά δεçñιòηιηάò ó÷άòέεΎ ίά όçί Ύέαιός άεά FreeBSD, έάεβò έάέ άεά άδάρβέάβάò έάóΎάοιá δάέΎòυι, ÷ñçόεϊηδϊεβόòά όçί άεέòòάεβ òϊδϊεάòβά FreeBSD OpenOffice.org Porting Team (<http://porting.openoffice.org/freebsd/>).

Άεά ίά άεάόάοόδβόάòά όϊ **OpenOffice.org**, άñΎòδά:

```
# pkg_add -r openoffice.org
```

**Όγιάρβυός:** Άί ÷ñçόεϊηδϊεάβδò -RELEASE Ύέαιός όϊò FreeBSD, όϊ δάνάòΎιυò δñΎòάέ ίά άϊòεΎòάέ. Άεάοϊηάοέεϋ, έά δñΎòάέ ίά άάρβòά όçί άεέòòάεβ òϊδϊεάòβά όϊò FreeBSD **OpenOffice.org** Porting Team άεά ίά έάóάαΎοάòά έάέ ίά άεέάόάοόδβόάòά όϊ άίòβòòίε÷ι δάέΎòϊ ÷ñçόεϊηδϊεβίòάò όçί pkg\_add(1). Όυοϊ ç δñΎ÷ιòóά υοϊ έάέ ç òδϋ άίΎέειç Ύέαιός άβίάέ άεάέΎοέϊάò άεά έάóΎάοιá áδϋ όçί δάνάòΎιυò òϊδϊεάòβά.

Άδϋ όç óέεαηβ δϊò όϊ δάέΎοϊ άεέάόάοόάεάβ, δñΎòάέ ίά άñΎòδάòά áδεβò όçί δάνάέΎòυò άίòεβ άεά ίά άεòάεΎοάòά όϊ **OpenOffice.org**:

```
% openoffice.org
```

**Όγιάρβυός:** ΈάοΎ όçί δñβòç άέεβίçòç, έά óάò άβίηοϊ άεΎοϊηάò άñυòβόάέò έάέ έά άçιέιòηάçεάβ Ύίáò έάòΎεϊαϊò ίά υίηά .openoffice.org2 ιΎόά όοϊη δñιòυòδέεϋ óάò έάòΎεϊαϊ.

Άί óά δάέΎóά όϊò **OpenOffice.org** άάί άβίάέ άεάέΎοέϊά, Ύ÷άòά δΎιòά όçί άδέεϊαβ ίά ίάóάεϋòòòβóòάò όϊ άίòβòòίε÷ι port. Ύòòυοϊ, ίά Ύ÷άòά òδϋòç óάò υòέ áòòυ άδάέòάβ άηέάòυ ÷βñι όοϊ άβòεϊ έάέ έά ÷ñάεάòάβ έάέ δΎηά δϊεγ ÷ñυίηί άεά ίά ιεϊεççñυέάβ.

```
# cd /usr/ports/editors/openoffice.org-2
# make install clean
```

**ΌçηϊΆβυόç:** Άί èΰέάòά ίά açηέιòñāΠόάòå ίέά Ύέάιόç ηά ðéò áééΎò óάò ðηðééΎò ñðèηßóåέò, áηέέάóáóòΠόάò όçη ðñηçāηηíαίç āñάηΠ áηέήèη íá όçη άðυíαίç:

```
# make LOCALIZED_LANG=your_language install clean
```

ΕñΎðáé ίά áηέέάóáóòΠόάòå ðη *your\_language* ηά ðη óóóòυ ISO èυäééυ áéá όç äèΠóóá óáò. Ç èßóóá ηά ðηò òðηόççñéæυíáηηò èυäééΎò äèυóòηí åβηάé áéáéΎóéηç óðη άñ÷åβη ηηç/Μακεηηέ.ηόçηð, ðη ηðηßη āñßóéáóáé óðηη έáóυέηηάη ðηò port.

ηύεéò åβηάé áóòυ, ηðñāβðå ίά ηäéήΠόάòå όçη áóάνηηΠ **OpenOffice.org** äβηηóáò όçη áηέήè:

```
% openoffice.org
```

## 6.4 ΕñηηñÛηάóá ΕñηäηèΠò ΆåñÛòυí

Εñυóóáóá Ύ÷ηò ηβηάé áñéåòÛ açηηóééåßò èÛðηέåò ηΎäò ηñòΎò άñ÷åβη. Όά εñηηñÛηάóá εñηäηèΠò ðηò áðáéóηγηάé áéá ðá άñ÷åβá áóòÛ βóυð ηά ηçη áβηάé áéáéΎóéηά óðη äáóééυ óγóóçηå. Όðη ðηΠηå áóòυ éå áηγηå ðυð ηðñāβðå ίά óá åñéáóáóòΠόάòå.

Όη ðηΠηå áóòυ έáéýððáé ðéò áóάνηηΰò:

Ύñηηå ΆóάνηηΠò	Άðáéóηγηάηηé Εñηηé	ΆäéåòÛóóáóç áðυ Ports	ΆáóééΎò ΆηåñòΠóáéò
<b>Acrobat Reader</b>	èβāηé (åéåöñéÛ)	åéåöñéÛ	ΆðáééèΠ óðηåáóòυòçðå ηå Linux (Linux Binary Compatibility)
<b>gv</b>	èβāηé (åéåöñéÛ)	åéåöñéÛ	<b>Xaw3d</b>
<b>Xpdf</b>	èβāηé (åéåöñéÛ)	åéåöñéÛ	<b>FreeType</b>
<b>GQview</b>	èβāηé (åéåöñéÛ)	åéåöñéÛ	<b>Gtk+ η GNOME</b>

### 6.4.1 Acrobat Reader®

ΕηééÛ Ύññåñóá äéáηΎηηόáé ðéΎηí ùð άñ÷åβá PDF ðη ηðηßη όçηåβηάé “Portable Document Format” (ΌηççòΠ ηñòΠ ΆåñÛòυò). ηå áðυ ðá óðηéóòηηåá εñηηñÛηάóá εñηäηèΠò áéá áóòυ ðηη óγðη άñ÷åβη ηβηάé ðη **Acrobat Reader**, ðη ηðηßη ç Adobe áéáéΎóáé áéå Linux. Έάèðò ðη FreeBSD ηðññåβ ίå ÷ñçóéηηðηéΠóáé åéòåéΎóéηå ðηò Linux, ç áóάνηηΠ åβηάé áðβóçð áéáéΎóéç áéå ðη FreeBSD.

Άέå ίå åñéáóáóòΠόάòå ðη **Acrobat Reader 7** áðυ όç ΌðéèηäΠ ðυí Ports, āñÛððå:

```
# cd /usr/ports/print/acroread7
# make install clean
```

Άåí ððÛñ÷å áé áéáéΎóéηη ðáéΎðη, èυåùð ðåñéηééóηηη óðçη Ûäéáé ÷ñðçð.

## 6.4.2 gv

Ôí **gv** áβíáé Ýíá ðñüãñáñá ðñüãñáëðð ããññÛòùí áéá áñ÷áβá PostScript éáé PDF. Áβíáé áñ÷éêÛ ááóέóíÝñí óðçí áöáññüã ð **ghostview** áéêÛ Ý÷áé éáéýðáñç áìòÛíέóç ÷Ûñç óðç áéáéêéêèðèç **Xaw3d**. Áβíáé áñþáññüí, éáé òí interface òìò áβíáé íáêÛέáñí. Ôí **gv** Ý÷áé ðñüãñáëðð ðñüãñáëðð, ùððð ðñüãñáëððééóíñ éáé ìÝááëìò ÷áñðéý, áìòÛíέóç ððü ééβíáéá éáé ááéðòùòç áìòÛíέóçð áñáñáðñüãáñþí (antialias). Ó÷ááññüí êÛéá éáéðñüãñáëðð òìò ìðñáβ íá áéðáéáóðáβ ðñüí áðñü òí ðèçéðñüíñáéí ùòí éáé áðñü òí ðñüðβéé.

Áéá íá ááéáðáóððóáðá òí **gv** ùð ðáéÝðñ, áñÛøðá:

```
# pkg_add -r gv
```

Áí òí ðáéÝðñ ááí áβíáé áéáéÝóέñí, ìðñáβðá íá ÷ñçóέñíðñéðóáðá òçí Óðéëüã ðñü Ports:

```
# cd /usr/ports/print/gv
# make install clean
```

## 6.4.3 Xpdf

Áí êÝéáðá Ýíá íééñü ðñüãñáñá ðñüãñáëðð áñ÷áβñüí PDF áéá òí FreeBSD, òí **Xpdf** áβíáé áéáóñý éáé áðñüíðééñü. Áðáéðáβ áêÛ÷έóòìðð ðñüíðð éáé áβíáé éáéáβðáñá óðáéáññü. ×ñçóέñíðñéðð óéð ááóέéÝð áñáñáðñüãáññü ðñüí X éáé ááí áðáéðáβ ÷ñçóç òìò **Motif** ð Ûééçð áñááéáééèðèçð ðñüí ×.

Áéá íá ááéáðáóððóáðá òí **Xpdf** ùð ðáéÝðñ, áððóá òçí áñüèð:

```
# pkg_add -r xpdf
```

Áí òí ðáéÝðñ ááí áβíáé áéáéÝóέñí ð ðñüíðéíÛðá íá ÷ñçóέñíðñéðóáðá òçí Óðéëüã ðñü Ports, áñÛøðá:

```
# cd /usr/ports/graphics/xpdf
# make install clean
```

Ûüééð ðñüééçññüéáβ ç ááéáðáóððóáðá, ìðñáβðá íá íáééíðóáðá òí **Xpdf** éáé íá ÷ñçóέñíðñéðóáðá òí ááñβ ðéðèðñí òìò ðñüíðéééý áéá íá áñáñáðñüãáññü òí ìáñý.

## 6.4.4 GQview

Ôí **GQview** áβíáé Ýíáð áéá÷áéñéóððð áééñññüí. ìðñáβðá íá ááβðá Ýíá áñ÷áβí ìá Ýíá áðéññ éééé, íá íáééíðóáðá Ýíá áññðáñééññü ðñüãñáñá áðáñáñááóáðð, íá ááβðá ðñüãñáëððééðçóç óá ìñòð thumbnail éáé ðñüéÛ Ûééá. ÁéáéÝðáé áðβóçð ðñüãñáëðð ðáññóðáóçð éáé êÛðñéáð ááóέéÝð éáéðñüãñáëðð áñ÷áβñüí. ìðñáβðá íá áéá÷áéñéóðáβðá óðéëüãáÝð áééñññüí éáé íá áñáβðá ìá áýéèè ðñüíðñéð ðéð áéðéÝð. Ôí **GQview** ìðñáβ íá ÷ñçóέñíðñéçéáβ áéá ðñüãñáëðð óá ðéðñç ðñüíç éáé ððñüðçññáéé òíðééÝð / áéáéíáβð ðñéìβóáéð.

Áí êÝéáðá íá ááéáðáóððóáðá òí **GQview** ùð ðáéÝðñ, áñÛøðá:

```
# pkg_add -r gqview
```

Áí òí ðáéÝðñ ááí áβíáé áéáéÝóέñí, ð ðñüíðéíÛðá íá ÷ñçóέñíðñéðóáðá òçí Óðéëüã ðñü Ports, áñÛøðá:

```
# cd /usr/ports/graphics/gqview
# make install clean
```

## 6.5 × ñçĩáöĩĩëĩĩñéêÝð ÁöáññĩãÝð

Áí, áéá ìðĩëĩãðĩõã äüãĩ, èÝëãõã íá äéá ÷ äéñßæãõõã õá ÷ ñçĩáöĩĩëĩĩñéêÝð óáð ìÝóó ðĩõ FreeBSD desktop óáð, ððÛñ ÷ ìõĩ èÛðĩëãð éó ÷ ðñÝð éáé áýëĩëãð óðç ÷ ñßóç áöáññĩãÝð, Ýðĩëĩãð ðñĩð äãéãðÛóðáóç. ÌñéóĩÝĩãð áðü áóðÝð áßĩáé óðĩááðÝð ìã äéããããñÝĩãð ìñõÝð ãñ ÷ áßüĩ, üðüð áóðÝð ðĩõ ÷ ñçóéĩðĩëĩĩóáé óáá Ýãããããã ðĩõ **Quicken**® ð ðĩõ **Excel**.

Ôĩ ðĩðĩá áóðü éáëýððáé ðéð áöáññĩãÝð:

¼ñĩá Áöáññĩãßò	Áðáéöĩýĩãĩñé ðññĩé	ÁãéãðÛóðáóç Áðü Ports	ÁáóééÝð Áĩããðßóáéè
<b>GnuCash</b>	èßãĩé (ãéãõñéÛ)	ããñéÛ	<b>GNOME</b>
<b>Gnumeric</b>	èßãĩé (ãéãõñéÛ)	ããñéÛ	<b>GNOME</b>
<b>Abacus</b>	èßãĩé (ãéãõñéÛ)	ãéãõñéÛ	<b>Tcl/Tk</b>
<b>KMyMoney</b>	èßãĩé (ãéãõñéÛ)	ããñéÛ	<b>KDE</b>

### 6.5.1 GnuCash

Ôĩ **GnuCash** áßĩáé ìÝñĩð óçð ðñĩððÛéãéãð ðĩõ **GNOME** íá ðãñÝ ÷ äé óééééÝð áöáññĩãÝð óóĩòð ðãéééĩýð ÷ ñßóðãð. Ìã ðĩ **GnuCash**, ìðñĩãßãá íá èñãóÛðã èĩããñéãóĩü ðüĩ áóüãüĩ éáé áñüãüĩ óáð, ðüĩ ðñãðãæééðĩ óáð èĩããñéãóĩðĩ éáé ðüĩ ìãðĩ ÷ ðĩ óáð. ÁéáéÝðáé ðãñéãáÛéëĩĩ ãñããóßãð ðĩ ìðĩßĩ áßĩáé áýëĩëĩ óðç ÷ ñßóç ÷ ìñßð íá ÷ ñãéÛæãðáé éãéãßðãñç äèìÛéçóç, áéèÛ áßĩáé óáððü ÷ ñĩĩá éáé ðĩëý áðããããèĩãóééü.

Ôĩ **GnuCash** ðãñÝ ÷ äé Ýĩððñĩ óýóðçĩá éãðã ÷ ðñçóçð, éãñãñ ÷ ééü óýóðçĩá èĩããñéãóĩðĩ, ðĩëéÛ ðèðéðñã óóĩðñãýóãüĩ ðèçéðñĩëĩãßò, éáèðð éáé ìãéüãĩòð áðóüãĩãóçð óóĩðèðñüóçð. Ìðñĩãß íá äéã ÷ ìñßóáé ìéã óðĩãéãããß óã ðĩëéÛ éãððñãñß ðĩðĩãðã. Ôĩ **GnuCash** ìðñĩãß íá áéóÛããé éáé íá óðã ÷ ìãýóáé ãñ ÷ áßã QIF ðĩõ **Quicken**. Ìðñĩãß áðßóçð íá ÷ äéñéóðãß ðéð ðãñéóóüðãñãð äéãéĩãßð ìñõÝð çĩãññçĩéðĩ éáé ìñéóĩãðééðĩ ìĩÛãüĩ.

Áéá íá äãéãðãóðßóãðã ðĩ **GnuCash** óðĩ óýóðçĩá óáð, ãñÛððã:

```
# pkg_add -r gnuccash
```

Áí ðĩ ðãéÝðĩ äãĩ áßĩáé äéãéÝóéëĩ, ìðñĩãßãá íá ÷ ñçóéĩðĩëĩéðãðãðã óçĩ óðéëĩãß ðüĩ ports:

```
# cd /usr/ports/finance/gnuccash
# make install clean
```

### 6.5.2 Gnumeric

Ôĩ **Gnumeric** áßĩáé Ýĩã ððĩëĩãéóóééü óýéëĩ éáé áðĩðãéãß ìÝñĩð ðĩõ ðãñéãáÛéëĩĩóĩð ãñããóßãð **GNOME**. ÁéáéÝðáé áĩëééð áðóüãĩãðç “ðññüãéãç” óçð áéóüãĩò ðĩõ ÷ ñßóç óýĩóüĩá ìã óç ìñõß ðĩõ éãééĩý éáèðð éáé óýóðçĩá áðóüãĩãðçð óóĩðèðñüóçð (autofill) áéã äéÛóĩñãð áéëĩëòðéßãð. Ìðñĩãß íá áéóÛããé ãñ ÷ áßã äéÛóĩñüĩ äçĩòééðĩ ìñõðĩ, üðüð áóðÛ ðĩõ ÷ ñçóéĩðĩëĩĩóáé óðĩ **Excel**, ðĩ **Lotus 1-2-3**, ð ðĩ **Quattro Pro**. Ôĩ **Gnumeric** ððĩóççñßæãé ãñãððĩãðã ìÝóó ðĩõ ðññãñÛĩããð ãñãóééðĩ math/guppi. ÷ äé ìããÛéĩ ãñééüü áĩóüãĩãðüüÝĩüü óðĩãñðßóãüĩ éáé áðéðñÝðáé üéãð ðéð óóĩðéãéð ìñõÝð éãééðĩ, üðüð ãñééëĩýð, ìñéóĩãðééÝð ìĩÛããð, çĩãññçĩãßð, ðñãð éáé ðĩëéÝð áéüĩá.

Áéá íá äãéãðãóðßóãðã ðĩ **Gnumeric** ùð ðãéÝðĩ, ãñÛððã:

```
# pkg_add -r gnumeric
```

Áí òì ðáéÝðì äáñ áβíáé äéáéÝóéì, ìðññáβðá íá ÷ ñçóéìðñéðóáðá òçí óðëëĩãð òùì ports, ãñÛöìíðáð:

```
# cd /usr/ports/math/gnumeric
# make install clean
```

### 6.5.3 Abacus

Ôì **Abacus** áβíáé Ýíá ðéññü éáé áýêéìí óðç ÷ ñðóç ððñéìäéóðééü öýëëì. ÐáñééáìáÛíáé ðñééÝð áíóùìáðùìÝíáð óñíáñðóáéð ðé ððñáð áβíáé ÷ ñðóéìáð óá äéÛöìíá ðááβá, ùðùð ç óðáðéóðéééð, óá ÷ ñçíáðñééìñééÛ éáé óá ðáçíáðééÛ. Ìðññáβ íá äéóÛááé éáé íá áìÛááé áñ÷áβá òìð **Excel**. Ôì **Abacus** ððñáβ íá ðáñÛááé Ýíáì ðñòðð PostScript.

Ãéá íá ääéáðáððóáðá òì **Abacus** ùð ðáéÝðì, ãñÛðá:

```
# pkg_add -r abacus
```

Áí òì ðáéÝðì äáñ áβíáé äéáéÝóéì, ìðññáβðá íá ÷ ñçóéìðñéðóáðá òçí óðëëĩãð òùì ports, ãñÛöìíðáð:

```
# cd /usr/ports/deskutils/abacus
# make install clean
```

### 6.5.4 KMyMoney

Ôì **KMyMoney** áβíáé ðéá äöáññĩãð äéá÷áβñéóçð òùì ðñìóùððééðí óáð ðééìñééðí, óðéáìÝíç äéá òì ðáñéáÛéëì **KDE**. To **KMyMoney** óðì÷áýáé íá ðáñÝ÷áé éáé íá áíóùìáððóáé ùéáð óéð éáéòìñáβáð ðñó äéáððéáíóáé óá áíóβóòé÷áð ãððñééÝð äöáññĩãð. Ôì **KMyMoney** ððñáβ íá äéóÛááé áñ÷áβá òìð ðñìóýðñó QIF (Quicken Interchange Format), íá òçññáβ éáðááñáðð òùì áðáñáýóáùì óáð, íá ÷ áéñβæáðáé ðñééáðéÝð ðñéóìáðééÝð ðñÛááð éáé íá ðáñÝ÷áé ðéðèð áíáíññí. ÌÝóá áðù ðá÷÷ñéóðù plugin, ðáñÝ÷áðáé áðβóçð ç äðíáðùðçðá äéóááùãðð áñ÷áβùì OFX.

Ãéá íá ääéáðáððóáðá òì **KMyMoney** ùð ðáéÝðì, äéðáéÝóðá òçí áíóìèð:

```
# pkg_add -r kmy money2
```

Áí òì ðáéÝðì äáñ áβíáé äéáéÝóéì, ìðññáβðá íá ÷ ñçóéìðñéðóáðá òçí Óðëëĩãð òùì Ports, ùðùð óáβíáðáé ðáñáéÛðù:

```
# cd /usr/ports/finance/kmy money2
# make install clean
```

## 6.6 Ðáññéççç

Áí éáé òì FreeBSD áβíáé äçìñóééÝð óðñðð ðáññí÷áβð Internet (ISPs) äéá òçí áðùäñóç éáé òç óðáéáññóçðá òñó, áβíáé áðβóçð Ýðñéìí éáé äéá éáçìñéíð ÷ ñðóç ùð desktop. Ìá áñéáðÝð ÷ éééÛááð äöáññĩãÝð äéáéÝóéìáð ùð ðáéÝðá (<http://www.FreeBSD.org/where.html>) ð ports (<http://www.FreeBSD.org/ports/index.html>), ððñáβðá íá äçìñóñáβðáðá òì òÝéáéì desktop ðñó éáéýððáé ùéáð óéð áíÛáéáð óáð.

ÐáñáéÛðù, óáβíáðáé ðéá ãñðáññç ðáññéççç ùéìí òùì desktop äöáññĩãð ðñó ðáññóéÛóçéáí óá áðù òì éäöÛéáéì:

¼áñá ÁöáñüãÞð	¼áñá ÐäêÝðïð	¼áñá Port
<b>Opera</b>	opera	www/opera
<b>Firefox</b>	firefox	www/firefox
<b>KOffice</b>	koffice-kde3	editors/koffice-kde3
<b>AbiWord</b>	abiword	editors/abiword
<b>The GIMP</b>	gimp	graphics/gimp
<b>OpenOffice.org</b>	openoffice	editors/openoffice-1.1
<b>Acrobat Reader</b>	acroread	print/acroread7
<b>gv</b>	gv	print/gv
<b>Xpdf</b>	xpdf	graphics/xpdf
<b>GQview</b>	gqview	graphics/gqview
<b>GnuCash</b>	gnucash	finance/gnucash
<b>Gnumeric</b>	gnumeric	math/gnumeric
<b>Abacus</b>	abacus	deskutils/abacus
<b>KMyMoney</b>	kmymoney2	finance/kmymoney2

# ΕὰοÛεάεί 7 ÐιέοìÝóá

Àðáíñááóβá áðu òñ Ross Lippert.

## 7.1 Óýíñç

Ôñ FreeBSD ðññóçñβæáέ ðáÛÛεç ðιέέεβá áðu εÛñóáð Þ÷ìò, áðέóñÝðññóáð óáð Ýóóέ ðá áðñεáýóáðá ðççèÞð ðέóóóðçóáð Þ÷ì áðu òñ ðñññεέóðÞ óáð. ÐáñέέáíáÛññóáέ ç áññáðóççóá ðá ááñÛøðá éáέ ðá áññáñÛááðá Þ÷ì MPEG Audio Layer 3 (MP3), WAV, éáέ Ogg Vorbis éáέð éáέ ðñέÛ Ûεέá formats. Ôñ FreeBSD Ports Collection áðβóçð ðáñέÝ÷áέ áóáññáÝð ðññ óáð áðέóñÝðññóá ðá áðáññáñáóðáβðá òñ ç÷ñáñóçìÝññ óáð Þ÷ì, ðá ðññóέÝóáðá ç÷çóέÛ áóÝ, éáέ ðá áέÝññáðá óóóέáðÝð MIDI.

Ìá εβáñ ðáέññáíáðέóññ, òñ FreeBSD ðññáβ ðá ðññóçñβñáέ áññáñáñáðá ðá ðáβññ ðá video éáέ DVD. Ì áñέέññ ðññ áóáññáññ ðññ èùáέέñññέññ, ðáóáñÝðññ, éáέ áññáñÛáñññ áέÛññññ ðá ðññññ video áβñáέ ðέ ðáñέññέóñÝññ áðu òñ áñέέññ ðññ áóáññáññ Þ÷ì. Áέá ðáñÛááέáíá, ðáðáñ ðáÛøççá áóóð òñ éáβñññ, áá ððÞñ÷á éáέÛ éáέÞ áóáññáÞ áðáñáèùáέέñññççð ðçç ðέέññáÞ ðññ Ports ðññ FreeBSD, ðññ éá ðññññóá ðá ðñçóέññññέççáβ áέá ðáóáñññðÞ ðáóáñññ formats, ðññ ðññ audio/sox. Ðáñ' ðéá áóðÛ, òñ ðñññ ðá áóðñ òñ ðññÝá, éáέ ðññ áóññÛ ðññ εñáέóñέέñ, áέέÛáέ ðááááβá.

Ôñ εáðÛεáεί áóðñ éá ðáñέáñÛøðáέ ðá áðáñáβççóá áÞñáðá áέá ðç ðññέέçç ðçð εÛñóáð Þ÷ì óáð. Ç ðññέέçç éáέ ááέáóðÛóáç ðññ X11 (ΕáðÛεáεί 5) Ý÷áέ Þáç ðñññóβáέ áέá ðá ðέέáñÛ ðññáέÞñáðá ðέέέññ ðçð εÛñóáð áñáέέéÞñ óáð, áñ éáέ ðññáβ ðá ðñáέÛááðáέ ðá áóáñññóáðá εÛðñéáð áέññá ðέέññ-ðñññóáðέð áέá éáέýðáñç áññáñáñáðá.

Áóññ áέááÛóáðá áóðñ òñ εáðÛεáεί, éá ðññáðá:

- Ðñð ðá ðñññóáðá òñ óýóççñá óáð þóðá ðá áññáñññβæáðáέ ç εÛñóá Þ÷ì óáð.
- Ìáèñññð áέá ðá áέÝññáðá ðç éáέóññáβá ðçð εÛñóáð óáð.
- Ðñð ðá áðέýóáðá ðññáέÞñáðá ó÷áðέέÛ ðá ðέð ðñññóáðέð Þ÷ì.
- Ðñð ðá áññáñÛááðá éáέ ðá èùáέέñññέÞñáðá MP3 éáέ Ûεέññð ðá ðñññ ðá ðáβññ Þ÷ì.
- Ðñð ðñññóçñβæáðáέ òñ video áðu òñ X server.
- ÈÛðñéá ports áññáñáñáðáðð/èùáέέñññçççð video ðññ áβñññ éáέÛ áðñáέÝóñáðá.
- Ðñð ðá áññáñÛááðá DVD, éáέ áñ÷áβá .mpg éáέ .avi.
- Ðñð ðá εÛñáðá rip òñ ðáñéá÷ññáññ CD éáέ DVD ðá áñ÷áβá.
- Ðñð ðá ðñññóáðá ðéá εÛñóá ðççáññáóçð.
- Ðñð ðá ðñññóáðá Ýñá óáññðÞ áέέññññ.

Ðñññ áέááÛóáðá áóðñ òñ εáðÛεáεί, éá ðññÝðáέ:

- Ìá ðññáðá ðñð éá ðñññóáðá éáέ éá ááέáðáóðÞñáðá ðññ ðññÞñá (ΕáðÛεáεί 8).

**Ðññáέáñññççç:** Áñ ðñññðáέÞñáðá ðá ðñññáññðÞñáðá ðññóέέÛ CD ðá ðç ðñññÞÞ ðá ðñññéççáβ éáð' áέÛ÷έóðññ ðáÛéá, Þ ðçç ðáέññðáñç ðáññððóçç kernel panic. ÔÝóñéá ðññá Ý÷ñññ áñáέέéáðñññáð èùáέέñññέÞñáðέð ðññ áέáðÝññññ áðu òñ ðññçέέóññññ óýóççñá ðá ðáβññ ISO.

## 7.2 Νύειέος όο Εΰñόάο <sup>1</sup> ÷ ιό

Όοιέόοιñΰ άδϋ όιι Moses Moore. Άάέοέπεέά άέά όι FreeBSD 5.X άδϋ όιι Marc Fonvieille.

### 7.2.1 Νόειβειίόάο όι Όόόοίά

Δñεί ιάέειΠρόάοά, έά δñΎδάέ ίά ιΎñάόά όι ιιόΎεί όοο εΰñόάο διό Ύ ÷ άόά, όι ιειέεçñϋιΎι έýέεϋιά διό ÷ ñçóειιθιέάβ, έάεθδ έάέ άί άβιáε PCI Π ISA. Όι FreeBSD όθιόόçñβæάέ ιάáΰέç θιέέέεβά έάνθπí Π ÷ ιό, όυόι PCI υόί έάέ ISA. ΆέΎάιόά όέο όθιόόçñæϋιάíáδ όόόέάσΎδ Π ÷ ιό όόέο ΌçιáεΠρόάέο Όέέειϋ (http://www.FreeBSD.org/releases/8.0R/hardware.html) áέά ίά ááβόά άί ç εΰñόά όάο όθιόόçñβæάόάέ. Όόέο ΌçιáεΠρόάέο Όέέειϋ άίάσΎñάόάέ άθβόçδ θιεί δñϋάñάιá ιάΠάçόçδ όθιόόçñβæάέ όçí εΰñόά όάο.

Άέά ίά ÷ ñçóειιθιέΠρόάόά όçí όόόέάδΠ Π ÷ ιό διό áέάέΎόάόά, έά δñΎδάέ ίά σιñθΠρόάόά όιι έάόΰέεçει ιάçáϋ όόόέάδΠδ. Άόόυ ιθιñάβ ίά άδέόάσ ÷ έáβ ιά áϋι όñϋθιόδ. Ι άόειϋέυόáñιό άβιáε άθεθδ ίά σιñθΠρόάόά Ύίá module (ΰñεñϋιá) áέά όçí εΰñόά Π ÷ ιό όόιι δθñΠίá, ÷ ñçóειιθιέΠίόáδ όçí άίόιεΠ kldload(8), ιά όç άιΠέάέά όçδ áñáñΠδ άίόιεΠí:

```
# kldload snd_emu10k1
```

Π δñιόέΎόιιόάδ όçí έάόΰέέεçç áñáñΠ όόι áñ ÷ áβι /boot/loader.conf υδϋδ όáñάέΰόϋ:

```
snd_emu10k1_load="YES"
```

Όά δáñáδΰιϋ δáñάááβáιáόά άβιáε áέά ιέá εΰñόά Π ÷ ιό Creative SoundBlaster® Live!. Όδΰñ ÷ ιόι áέάέΎόείá έάέ ΰέέá modules áέá εΰñόάδ Π ÷ ιό έάέ ιθιñάβόά ίά όá ááβόά όόι áñ ÷ áβι /boot/defaults/loader.conf. Άί ááι áβόάά όβáιθñιό áέá όι δñϋάñάιá ιάΠάçόçδ διό δñΎδάέ ίá ÷ ñçóειιθιέΠρόάόά, ιθιñάβόά ίá δñιόθάεΠρόάόά ίá σιñθΠρόάόά όι module snd\_driver:

```
# kldload snd_driver
```

Δñϋέáέόάέ áέá Ύίá ιάόá-δñϋάñάιá ιάΠάçόçδ, όι ιθιβι σιñθΠίáε ιá ιέáδ υέá όá έιείΰ δñιáñΰιáόá ιάΠάçόçδ áέá εΰñόάδ Π ÷ ιό. Ιá όιι όñϋθι άόόυ ιθιñάβόά ίá άδέόá ÷ ϋίáόá όçí άίβ ÷ ίáόόç áέá όι όούόυ ιάçáϋ. Ιθιñάβόά άθβόçδ ίá σιñθΠρόάόά υέá όá δñιáñΰιáόá ιάΠάçόçδ ιΎόϋ όιό áñ ÷ áβι /boot/loader.conf.

Άί άδέέοιáβόά ίá áñáβόά όι άδέέááιΎι δñϋάñάιá ιάΠάçόçδ όçδ εΰñόάδ όάο ιáόϋ όç σϋñθόϋç όιό snd\_driver, ιθιñάβόά ίá áέΎάíáόά όι áñ ÷ áβι /dev/sndstat ιá όçí άιΠέáέá όçδ άίόιεΠδ cat /dev/sndstat.

Ιέá ááϋόáñç ιΎείáιθ άβιáε ίá ιáόááεϋόδβόάάδ όçí όθιόόΠñείç όçδ εΰñόάδ Π ÷ ιό όάδ, όόáόέέΰ, áδáόέáβáδ όόιι δθñΠίá. Όι δáñάέΰόϋ όιΠιá δáñΎ ÷ áέ όέο δέçñισιñβáδ διό ÷ ñáέΰæáόόá áέá ίá δñιόέΎόάόá όθιόόΠñείç áέá όι όέέέϋ όάο ιá άόόυ όιι όñϋθι. Άέá δáñέόóϋόáñáδ δέçñισιñβáδ ó ÷ áδέέΰ ιá όçí ιáόááεΠδόέόç όιό δθñΠίá, ááβόά όι Έáοΰεάεί 8.

#### 7.2.1.1 ΆçιέιθñáΠίόáδ ΔñιόáñιόίΎι ΔθñΠίá ιá ΌθιόόΠñείç <sup>1</sup> ÷ ιό

Άñ ÷ έέΰ, δñΎδάέ ίá δñιόέΎόάόά όι ááιέέϋ δñϋάñάιá ιάΠάçόçδ Π ÷ ιό (audio framework driver) sound(4) όόιι δθñΠίá όάο. Έá ÷ ñáέáόόáβ ίá δñιόέΎόάόά όçí áέϋειθέç áñáñΠ όόι áñ ÷ áβι ñόειβόáϋι όιό δθñΠίá:

```
device sound
```

θáέόá, έá δñΎδάέ ίá δñιόέΎόάόά όθιόόΠñείç áέá όçí εΰñόά Π ÷ ιό όάδ. ΔñΎδάέ ίá áιϋñβæáόá άδϋ δñεί θιεί δñϋάñάιá ιάΠάçόçδ όçí όθιόόçñβæάέ. ΆέΎάíá όç εβόόá όυι όθιόόçñæϋιáíáιι έάνθπí όόέο ΌçιáεΠρόάέο Όέέειϋ (http://www.FreeBSD.org/releases/8.0R/hardware.html), áέá ίá έάειñβόáόá όι όούόϋ ιάçáϋ áέá όçí áέέΠ όάο. Άέá

δάνΰάεαιά, P Creative SoundBlaster Live!, οδιόογνβæάοάε άδϋ οii iäçäü snd\_emu10k1(4). Άέα ίά δñioéΎοάοά οδιόοδPñέιç áέα άδδP όçi éΰñόά, ÷ñçόειiιδιεPόόά όçi áéüeiδέç ãñäiìP:

```
device snd_emu10k1
```

Άάάεüèáβόά üοέ áέαáΰόάόά όçi οάεβáá οiò manual áέα οi δñüãñäiä iäPαçόçð, βόόά ίά ÷ñçόειiιδιεPόάόά όç οúόδP όγiόáiç. Ç áéñéáPò όγiόáiç áέα éΰèá οδιόόγνβæüiäiç éΰñόά P÷iò όοi äñ÷áβi ñòèiβόáüi δδñPíá, iδññáβ ίá äñáéáβ áδβόçð όοi äñ÷áβi /usr/src/sys/conf/NOTES.

Άέα éΰñόά P÷iò όγdiò ISA diò ááí áβiáé Plug’N’Play iδññáβ ίá ÷ñáéáóóáβ ίá äβóáóá όοi δδñPíá δέçñiòiñβáð ó÷áóééΰ iä όéð ñòèiβόáéð όçð (üðüð οi IRQ, èγñá I/O éèð), üðüð áβiáóáé óððééΰ óá áóδΎð όéð δñéððβóáéð. Άóδü iδññáβ ίá áβiáé iΎóü οiò äñ÷áβiò /boot/device.hints. Éáδΰ όç áéááééáóáβ όçð áéèβiçόçð, i loader(8) éá áéááΰόáé οi äñ÷áβi éáé éá iáóááéáΰόáé όéð ñòèiβόáéð όοi δδñPíá. Άέα δάνΰάεαιά, iéá δáééΰ Creative SoundBlaster 16 ISA iç-PnP éΰñόά ÷ñçόειiιδιεáβ οi δñüãñäiä iäPαçόçð snd\_sbc(4) óá óóíäóáiü iä όi snd\_sb16. Άέα όçi éΰñόά áóδP δñΎðáé ίá δñiòóäeiγi ié δañáéΰòü äñäiìΎð όοi äñ÷áβi ñòèiβόáüi δδñPíá:

```
device snd_sbc
device snd_sb16
```

éáé ié δañáéΰòü äñäiìΎð όοi äñ÷áβi /boot/device.hints:

```
hint.sbc.0.at="isa"
hint.sbc.0.port="0x220"
hint.sbc.0.irq="5"
hint.sbc.0.drq="1"
hint.sbc.0.flags="0x15"
```

Όόçi δññβðòüόç áóδP, ç éΰñόά ÷ñçόειiιδιεáβ όç èγñá I/O 0x220 éáé οi IRQ 5.

Ç όγiόáiç diò ÷ñçόειiιδιεáβόáé όοi äñ÷áβi /boot/device.hints äñçááβóáé óόç óáéβáá manual οiò sound(4) éáéβð éáé óόç óáéβáá manual οiò áíóβóóie÷iò δñiäñΰiäiò iäPαçόçð.

Ié ñòèiβόáéð diò óáβiñiόáé δañáðΰiü áβiáé ié δñiäðééáäiΎíáð. Óá iñéoiΎíáð δñéððβóáéð, iδññáβ ίá ÷ñáéáóóáβ ίá áééΰiäóá όi IRQ P Üééáð ñòèiβόáéð βóóá ίá óáéñéΰæiòi iä όéð ñòèiβόáéð όçð éΰñόáð óáó. Άáβóá όç óáéβáá manual όçð snd\_sbc(4) áέα δañéóóüðañáð δέçñiòiñβáð ó÷áóééΰ iä όçi éΰñόά áóδP.

## 7.2.2 ÄièeiÜæiñóáó όçi Éΰñόά <sup>1</sup>÷iò

Áóiy éΰiäóá äðáíáéèβiçόç iä οii iΎi δδñPíá (P áóiy öiñðβóáóá όi áðañáβðçöi module), Éá δñΎðáé ίá äáβóá içγiñóá ó÷áóééΰ iä όçi éΰñόά P÷iò óόçi δñiòüñéiP iβiç (buffer) éáóáãñáöPò diò óóóðβiáðiò (dmesg(8)) áíóβóóie÷á iä óá δañáéΰòü:

```
pcm0: <Intel ICH3 (82801CA)> port 0xdc80-0xdc8f,0xd800-0xd8ff irq 5 at device 31.5 on pci0
pcm0: [GIANT-LOCKED]
pcm0: <Cirrus Logic CS4205 AC97 Codec>
```

Ç éáóΰóóáόç όçð éΰñόáð P÷iò iδññáβ ίá áéä÷éáβ iΎóü οiò äñ÷áβiò /dev/sndstat:

```
# cat /dev/sndstat
FreeBSD Audio Driver (newpcm)
Installed devices:
pcm0: <Intel ICH3 (82801CA)> at io 0xd800, 0xdc80 irq 5 bufsz 16384
```

kld snd\_ich (1p/2r/0v channels duplex default)

Όά ιρίγιάοά οοί ογόογιά οάο ιθίναβ ίά άβίάε άεάοίναόεεΰ. Άί άάί άάβοά οοόεάοΎο ογθίρο pcm, άδέοοñΎοά έάέ άεΎαίοά οά άβίάοά θίρο εΰίάοά θñιγαιίΎίυο. Έίεοΰίοά οί άñ÷άβι ñοείβοάυί θοñβίά έάέ άάάάεεεάβοά υοέ Ύ÷άοά άδεεΎίάε οί ούοοού θñυάñáíá íáβáçóçò. Άέά οοίβεç θñίάεβίάοά έάέ οçί άίόεíáòþðέοç οίρο, άάβοά οί οίβίá Όίβίá 7.2.2.1.

Άί υεά θΰίá έάεΰ, ç εΰñοά β÷ίρο οάο έά έάεοίροñάάβ. Άί ι íäçäüò CD β DVD θίρο έάέΎοάοά άβίάε οοίάñΎίυò íá οçί εΰñοά β÷ίρο ιΎού οçò άíáεíáεεβò οίρο áíυαίρο, ιθίναβοά ίά áΰεάοά Ύίá ιροόεευ CD έάέ ίά οί άíáðáñΰááοά íá οί θñüáñáíá cdcontrol(1):

```
% cdcontrol -f /dev/acd0 play 1
```

¶εεάο άοάñíáΎò, υòυò οί audio/workman θáñΎ÷ίοί οεέεευοάñí θáñεáΰεεíí áñάáοβáò. οούò εΎεάοά ίά άάεάοάοόβοάοά ίεά άοάñííáβ υòυò οί audio/mpg123 έέά ίά άíáðáñΰááοά άñ÷άβá β÷ίρο MP3.

Ίάο ΰεείò áñβáñííò θñüθίò έέά ίά άεΎάíáοά οçί εΰñοά β÷ίρο οάο, άβίάε ίά οόάβεάοά άάáñΎίá οόçί οόόεάοβ /dev/dsp, υòυò θáñáεΰòυò:

```
% cat filename > /dev/dsp
```

υòίο οί filename ιθίναβ ίά άβίάε ίθίεíáβθίοά άñ÷άβí. Ç θáñáðΰíυ άίόίεβ έά θñΎðáε ίά θáñΰáε εΰθίεí β÷ί (εíñοáí) άðεάάάεβííóáò οç ούοόβ έάεοίροñάβá οçò εΰñοάο β÷ίρο.

Ç Ύίόάοç β÷ίρο οçò εΰñοάο ιθίναβ ίά άεεΰίάε ιΎού οçò άίόίεβò mixer(8). Δáñέοóóυòáñáò ðεçñίροíñβáò ιθίναβοά ίά áñάβοά οόçί οάεβάá οίρο manual οçò mixer(8).

### 7.2.2.1 ΌόίçεέοίΎίá Δñíáεβίáοά

Δñüáεçíá	Έγóç
“sb_dspwr(XX) timed out”	Άάί άβίάε οούοΰ ñοείεοίΎίç ç εýñá I/O.
“bad irq XX”	Όί IRQ άάί άβίάε οούοΰ ñοείεοίΎίí. Άάάάεεεάβοά υοέ οί IRQ θίρο Ύ÷άοά άçεβóáε άβίάε οί βάεí íá áοóυ θίρο Ύ÷άε ñοείεοόάβ οόçί εΰñοά.
“xxx: gus pcm not attached, out of memory”	Άάί οθΰñ÷άε áñεάοβ έεάεΎοείç ιíβιç έέά ίά άβίάε ÷ñβóç οçò οόόεάοβò.
“xxx: can't open /dev/dsp!”	ΆεΎάíοά íá οçί άίβεάέά οçò άίόίεβò fstat   grep dsp άί εΰθίεά ΰεεç άοάñííáβ áðá÷íεάβ οç οóάεάεñεíΎίç οόόεάοβ. Όοίβεάέο γθίθοίε άβίάε ç άοάñííáβ esound έάεβò έάέ οί ογόογιά οθίόοβñείçò β÷ίρο οίρο θáñεáΰεεííοίρο KDE.

### 7.2.3 ×ñçοείíθίεβίόáò ΔίεεάðεΎò ΔçãΎò<sup>1</sup> ÷ίρο

Όοίάεοóíñΰ áðü οίí Munish Chopra.

Άβίάε θίεεΎò οíñΎò άðεεοίçοú ίά Ύ÷ίοíá θίεεάðεΎò ΔçãΎò β÷ίρο θίρο ίά άíáðáñΰáñίόάε οάοóυ ÷ñíá, υòυò υοάί έέά θáñΰáεάíá οί esound β οί artsd άάί άðεοñΎθίοί είεíβ ÷ñβóç οçò οόόεάοβò β÷ίρο οά εΰθίεά οóάεάεñεíΎίç άοάñííáβ.



### 7.3 ÷ ðò MP3

ÓòíáέóοιñÛ áδù ðιí Chern Lee.

Óά áñ ÷ áβά ð ÷ ðò MP3 (MPEG Layer 3 Audio) áðέóðá ÷ Ûñοί ðιέιúòçóá ð ÷ ðò ðιέÿ είíóÛ óοί ðιόέέü CD, έάέ áβίάέ έάέü íá Û ÷ áðá áðíáδúòçóá áíáðáñááüñð ð ðò ð ðιí FreeBSD óÿóðçíá óáð.

#### 7.3.1 ΔññáñÛìíáóá Áíáðáñááüñðò MP3

Óι ðει áçιíóέéÛò, íá íááÛέç áέáοιñÛ, ðñüáñáííá áíáðáñááüñðò MP3 áέá ðι × 11, áβίάέ ç áóáñιíáð XMMS (X Multimedia System). Ìðññáβóá íá ÷ ðçóέιðιέéðóáðá óá skins ðιò Winamp íá ðι XMMS έάέð ðι áñáóέέü ðιò ðáñέáÛέειí áβίάέ ó ÷ ááüí üιíει íá ðι Winamp ðçò Nullsoft. Óι XMMS Û ÷ áέ áðβóçð áíóúíáóüíÛίç áðíáδúòçóá ÷ ðβóçð plug-ins.

Óι XMMS ðιññáβ íá ááέáóáóóáέáβ áδù ðι port multimedia/xmms ð áδù ðáέÛóι.

Óι ðáñέáÛέειí ðιò XMMS ðι έάέóóÛ áÿεíει óòç ÷ ðβóç, έάέð áέάéÛóáé έβóóá áíáðáñááüñðò (playlist), áñáóέέü έóιíóáέιέóóð έάέ Ûέáð έάέòιñáβáð. ¼óιέ áβίάέ áñέέáέüíÛίé íá ðι Winamp έá áñιí ðι XMMS áðέü óòç ÷ ðβóç ðιò.

Óι port audio/mpg123 áβίάέ Ûíá áíáέéáέóέέü ðñüáñáííá áíáðáñááüñðò MP3 ðÛóü ðçð áñáñðò áíóιέðι.

Óι mpg123 ðιññáβ íá áέðáέáóóáβ έάέιñβæιíóáð ðç óóóéáðð ð ÷ ðò έάέ ðι áñ ÷ áβι MP3 óòç áñáñðò áíóιέðι. Έáññιíóáð üóέ ç óóóéáðð ð ÷ ðò áβίάέ ðι /dev/dsp1.0 έάέ èÛέáðá íá áíáðáñááüñðò ðι áñ ÷ áβι Foobar-GreatestHits.mp3, έá ÷ ðçóέιðιέéðóáð ðçí ðáñáέÛóü áíóιέð:

```
# 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
```

#### 7.3.2 Áðιèðéáðóç (Rip) Áñ ÷ áβüí áδù ðιόέέü CD

Δñει éüáέειðιέðóáðá Ûíá ðιέüέçñι CD ð Ûíá éñíÛóέ áδù CD óá áñ ÷ áβι MP3, έá ðñÛáέ íá áíóéáñÛóáðá óá ðιόέέü áááñÛíá áδù ðι CD óοί óέέçñü óáð áβóει. Áðóü áβíáðáέ áñÛοιíóáð óá áááñÛíá ðÿðιò CDDA (CD Digital Audio) óá áñ ÷ áβá WAV.

Óι áñááέáβι cdda2wav, ðι ðιβι áíðéáέ óòç óðέéιáð áñááέáβüí sysutils/cdrtools ðιññáβ íá ÷ ðçóέιðιέéçéáβ ðüοί áέá ðçí áíÛέðçóç ðüí áááñÛíüí ð ÷ ðò áδù ðιόέέü CD, üοί έάέ ðέçñιíóιέðι ðιò ó ÷ áðβæιíóáέ íá áðóÛ.

, ÷ ðιόáð ðι ðιόέέü CD óοιí ðäçáü, ðιññáβóá íá ÷ ðçóέιðιέéðóáð ðçí áέüειðέç áíóιέð (ùð root) áέá íá áðιέçéáÿóáðá Ûíá ðιέüέçñι CD óá ÷ ðñέóóÛ (áíÛ éñíÛóέ) áñ ÷ áβá WAV:

```
# cdda2wav -D 0,1,0 -B
```



Άνΰοιόαδ οοι Άβοει ΰΎου οιο **XMMS**:

1. ΊάειΐΠοά οι **XMMS**.
2. Έΰιοά αάιβ έεέε οοι δάνΰεοι όοδ άοάνιραΠδ αέα ίά αίβιαόά οι ίαίιΎ οιο **XMMS**.
3. ΆδέεΎιοά Preferences άδϋ όά Options.
4. Άεεΰιοά οι Output Plugin όά “Disk Writer Plugin”.
5. ΔέΎοόά Configure.
6. Άνΰοόά (Π άδέεΎιοά browse) Ύία έáoΰειαί αέα ίά άδιεεέάΎοά όά άδιοοιθεάοιΎία άν÷άβá.
7. Οιόοοά οι άν÷άβι MP3 οοι **XMMS** üδϋδ οοιΠεϋδ, ίά όçi Ύίοάόç οοι 100% έάέ όέδ ηδειβόάέδ EQ αίάίάñΎδ.
8. ΔέΎοόά οι Play. Οι **XMMS** έá όάβιαόάέ υόέ αίάδάνΰάε οι MP3, αεεΰ αάί έá αειΎάάόάέ έάίάβδ Π÷ιό. Οόçi δñάάιáόέεϋόόά αίάδάνΰάε οι MP3 όά άν÷άβι.
9. ¼όάί όάεάεΠοάόά, άάάέεϋεάβδ υόέ άδάίáΎñάόά όç ηΎειέόç οιο δñιáδέεάιΎίό Output Plugin όόçi δñιçáιΎίáιç άδέειαΠ όçδ, αέα ίά ίδñΎόάόά ίά αειΎόάόά ίάίΰ άν÷άβá MP3.

Άνΰοιόαδ όόçi Ύιαι ΰΎου οιο **mpg123**:

1. ΆέόάεΎοόά `mpg123 -s audio01.mp3 > audio01.pcm`

Οι **XMMS** ανΰοάέ άν÷άβá όά ίιόοΠ WAV, αίΠ οι **mpg123** ίάόάονΎδάε οι MP3 όά ιç- άδáiññάάοιΎία (raw) άάάνΎία Π÷ιό PCM. Έάέ ίε άΎί άδδΎδ ίιόΎδ ίδñιΎί ίά ÷ñçόειδιεεçειΎί ίά όçi άοάνιρα **cdrecord** αέα όç άçιέιδñάβá ίιόόέεβι CD. Άέα όçi άοάνιρα **burncd(8)** έá δñΎδάέ ίά ÷ñçόειδιεΠοάόά άάάνΎία PCM. Αί ÷ñçόειδιεΠοάόά άν÷άβá WAV έá δñάάόçñΠοάόά Ύία ίέεñϋ Π÷ι (tick) όόçi άν÷Π έΰεά έñιáόειΎ. Ι Π÷ιό άδδϋδ δñιΎñ÷άόάέ άδϋ όçi άδέεάόεβáá (header) οιο άν÷άβιό WAV. Ιδñάβδά ίά άόάέñΎόάόά όçi άδέεάόεβáá ίά όç αίΠεάέα οιο δñιñΰñιáόοιό **SoX** (ιδñάβδά ίά οι άάέάόάόδΠοάόά άδϋ οι port `audio/sox` Π οι αίόβόοιέ÷ι δάέΎοι):

```
% sox -t wav -r 44100 -s -w -c 2 track.wav track.raw
```

Άέάάΰοόά οι ΟιΠία 18.6 αέα δñέεόόϋδññάδ δεçñιιόñβάδ ό÷άδέέΰ ίά όç ÷ñΠόç CD άάññάόΠδ οοι FreeBSD

## 7.4 ΑίάδάνάϋαΠ Video

*Οοιάέοοιñΰ άδϋ οι Ross Lippert.*

Ç αίάδάνάϋαΠ video άβιαέ ίέα έάειΎñέά έάέ ñάάάάβá αίάδδδδδϋιáιç δñέι÷Π άοάνιραΠ. Έά ÷ñάέάόάβ ίά άάβιαόά όδñιΠ. Άάί δñϋέάέόάέ ίά έάέοιδñάΠοιόι υέα οϋοι ñάέΰ üδϋδ οοιΠ Π÷ι.

Δñεί ίάέειΐΠοάόά, έá δñΎδάέ ίά αίϋñβεάόά οι ίιόΎΎει όçδ έΰñόάδ ññάόέεβι διό Ύ÷άόά έάεΠδ έάέ οι ιειέεçñϋΎίι έΎέεϋιá διό ÷ñçόειδιεάβ. Αί έάέ οι **Xorg** έάέ οι **XFree86** όδιόόçñβειόι ίάáΰεç αέΰιá άδϋ έΰñόάδ ññάόέεβι, άδδΎδ διό δάνΎ÷ιόι έάεΠ άδϋαίόç άβιαέ έέáϋοáñάδ. Άέα ίά δΰñάόά ίέα εβδóά οϋι áεοάοαίΎίϋι αοιáοιόΠοϋι διό όδιόόçñβειόάέ άδϋ όçi έΰñόά όάδ, ÷ñçόειδιεΠοάόά όçi αίόιεΠ `xdpinfo(1)` όçi ηñá διό áεοάειΎιόάέ όά X11.

Άβιαέ αάιέέΰ έάεΠ έáΎά ίά Ύ÷άόά Ύία ίέεñϋ άν÷άβι MPEG οι ιδιβι ίδñάβ ίά ÷ñçόειδιεεçέάβ αέα αίέειΎδ έέάοιñάόέεβι άδέειαΠ έάέ δñιññιñΰοϋι αίάδάνάϋαΠδ. Έΰδιεά δñιññιñάόά αίάδάνάϋαΠδ DVD αίάεçοιΎί άδϋ δñιáδέειαΠ οι άβοει DVD όόç όδóέάδΠ /dev/dvd. Óά ñέοιΎία οι υñíá όçδ όδóέάδΠδ άβιαέ αίόϋιáόϋιΎίι όοιί εΠάέέα



```

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

```

ΔανάοçñΠόά άδβçò üóé óá formats ðíö àìöáíβæííóáé (YUV2, YUV12, è.è.ð.) àáí æéáóβèáíóáé óá üèàð óéð àèüüóáéð ðíö XVideo, éáé ç áðíóóá íòòò ìðíñáβ íá áðçñáÛóáé èÛðíéá ðñíññÛííáóá áíáðáñáñüàβð.

Áí òí áðíóÛéáóíá àáβ ÷ íáé èÛðüð Ýóóé:

```

X-Video Extension version 2.2
screen #0
no adaptors present

```

Ôüóá ðééáíβð ðí XVideo àáí ððíóóçñβæáóáé áðü óçí èÛñóá óáð.

Áí òí XVideo àáí ððíóóçñβæáóáé áðü óçí èÛñóá óáð, áðóü óçíáβíáé áðèÛ üóé èá áβíáé ðéí áγóéíèí ì ððíèíæéóðβð óáð íá áíóáðíèíèèèàβ óðéð ððíèíæéóðééÛð áðáéðΠóáéð óçð áðáééüíéóçð video. Ûóóüóí, áíÛéíáá ìá óçí èÛñóá áñáóéèβí éáé ðíí áðáíáñáóóð óáð, áβíáé áéüíá ðééáíüí íá Ý ÷ áðá ééáíðíéçóéèβ áíáðáñáñüàβ. ðóòð ðñÝðáé íá æéááÛóáóá ìæèüíòð áéá óç ááèòβñóç óçð áðüüíóçð, óóá ðñí ÷ ùñçíÝíá èÝíáóá, ÔíΠíá 7.4.3.

### 7.4.1.2 Ôí Áðβðááí Simple Directmedia Layer

Ôí Simple Directmedia Layer, SDL, ðñíññβæííóáí íá áβíáé Ýíá áðβðááí óðíááðüóçóáð ìáóáíý ðüí Microsoft Windows, BeOS, éáé ðíö UNIX, áðéóñÝðííóáð áíÛððóíç áóáñíñáβí Π ÷ íò éáé áééüíáð, éáðÛéèçèáð áéá èÛèá íéá áðü áóðÝð óéð ðéáóóüñíáð (cross-platform). Ôí áðβðááí SDL ðáñÝ ÷ áé ÷ áíçèíý áðéðÝáíò ðñüóááóç óðí óééèü, éáé óá ìñéóíÝíáð ðáñéððóáéð ìðíñáβ íá áβíáé ðéí áðíáíðéèü áðü óçí æéáðáðβ X11.

Ôí SDL ìðíñáβ íá áñáèèáβ óòí devel/sdl12.

### 7.4.1.3 Ôí Áðβðááí Direct Graphics Access

Ôí Direct Graphics Access áβíáé íéá áðÝéðáóç ðíö X11 ðíö áðéóñÝðáé óá Ýíá ðñüñáñáíá íá ðñíóðáñÛóáé ðíí X server éáé íá áéèÛíáé áðáóèáβáð óá ðáñéá ÷ üíáíá ðíö framebuffer (ííΠíçð áñáóéèβí). ÁááñÝííò üóé ááóβæáóáé óá áéá ÷ áβñéóç ìíΠíçð ÷ áíçèíý áðéðÝáíò, óá ðñíññÛííáóá ðíö ðí ÷ ñçóéíðíéíýí ðñÝðáé íá áéðáèíýíóáé ùð root.

Ç áðÝéðáóç DGA ìðíñáβ íá áéáá ÷ èáβ éáé íá ìáðñçèáβ ùð ðñíð óçí áðüüíóç óçð ìá ðí ðñüñáñáíá dga(1). ¼ðáí áéðáèáβðáé ç áíóíèβ dga, áéèÛæáé óá ÷ ñβíáóá óçð íèüíçð óá èÛèá ðβáóç áíüð ðèβèðñíò. Áéá íá áéðñíóáðá óçí áéðÝéáóç, ðéÝóðá q.





```
# mplayer -vo 'sdl:dga' testfile.avi
```

Αίβæάε οίι έυδι ίά äieeiΎοάάä üeäð áððΎð ðeð äðeieäΎð, éæèð ç áðuäiðç ðiðð äiáñðΎðáé áðu ðieeiyð ðáñΎäiðáð éáé äeáoiñiðieáßðáé áñeäðΎ áíΎeíäá iä ði ðeééü ðið ððieäeéððð óáð.

Äéá áíáðáñáäüäð áðu DVD, áíðeéáðáðððððä ði testfile.avi iä dvd://N -dvd-device DEVICE üðið ði N áßiáé i áñeèiüð ðið ðßðeèð (title number) ðið äðeèðiaßðä íá áíáðáñΎäáðä éáé DEVICE áßiáé ði üñiá óððeäððð ðið DVD-ROM. Äéá ðáñΎäeéäiä, äéá íá áíáðáñΎäáðä ðið ðßðeèi 3 áðu ðç óððeäðð /dev/dvd:

```
# mplayer -vo xv dvd://3 -dvd-device /dev/dvd
```

**Όçiaßüòç:** Ç ðñiäðeéäaiΎiç óððeäðð DVD iðñiáß íá éæeñeéðáß éáðΎ ðç äeΎñeäéá ðçð iäðáäeðððeéðð ðið MPlayer port iΎóü ðçð äðeéiäðð WITH\_DVD\_DEVICE. Äðu ðñiäðeéiäð, ç óððeäðð áððð áßiáé ç /dev/acd0. Iðñiáßðä íá áñáßðä ðáñeéóóüðáñäð ðeçñiðiñiáßð óóí áñ÷áßi Makefile ðið port.

Äéá óá ðeðeðñá ðið ÷ñçóeñiðieeiyíðáé äéá ðáyóç, äeáeèðð, iäðáeßiçðç èeð. éáðΎ ðç äeΎñeäéá ðçð áíáðáñáäüäðð, óoiäiðeäððáßðä ðçí äiðeäéá ðið iðñiáßðä íá äáßðä äeðäeðiðáð mplayer -h ð äeááΎóðä ðç óäeßiáá ðið manual.

Äðeðñüóeäðá, óçiaíðeéΎð äðeéiäΎð áíáðáñáäüäðð áßiáé: -fs -zoom ði iðñiáßi áíáñäiðieáß äðäeéüieéç óá ðeðñç iðeüiç éáé ði -framedrop ði iðñiáßi äiçeΎäé óðçí áýiçðç ðçð áðuäiðçð.

Äéá íá iäßiáé ði iΎäeèèð ðçð äñáñiðð áíðieði ði äóiaðüi iéèñü, i ÷ñðððçð iðñiáß íá äçieèðñáððáé Ύiá áñ÷áßi .mplayer/config éáé íá iñßðáé äeäß ðeð ðñiäðeéäaiΎiäð äðeéiäΎð:

```
vo=xv
fs=yes
zoom=yes
```

ÔΎeèð, i mplayer iðñiáß íá ÷ñçóeñiðieçeäß äéá ðçí áíáäüäð (rip) áíüð ðßðeèèð DVD óá Ύiá áñ÷áßi .vob file. Äéá ðçí áíáäüäð ðið äáyðáñið ðßðeèèð áðu Ύiá DVD, äñΎððä:

```
# mplayer -dumpstream -dumpfile out.vob dvd://2 -dvd-device /dev/dvd
```

Ôi áñ÷áßi áíüäiðð, out.vob, éá áßiáé óýðið MPEG éáé iðñiáßðä íá ði iäðá÷áeñeéóóáßðä iΎóü Üeèüið ðáéΎóüið video ðið ðáñeäñΎüiðieéá óá áððü ði ðiðiá.

### 7.4.2.1.3 mencoder

Ðñeí ÷ñçóeñiðieððáðä ði mencoder áßiáé éáeð éäΎiá íá áñieéäeüeäßðä iä ðeð äðeéiäΎð ðið áíáðΎñiðáé óðçí óäeèiçñßðç HTML. ÔðΎñ÷áé óäeßiáá manual, äeèΎ äáí áßiáé ðieý ÷ñððeèç ÷ññðð ðçí HTML óäeèiçñßðç. ÔðΎñ÷áeí ðΎñá ðieeèß ðñüðie äéá íá ääeðeððáðä ðçí ðieüðçðá, íá iäeððáðä ði ððeèü ääáñΎñið (bitrate) íá äeèΎiäðä iññðð áñ÷áßið, éáé eΎðieá áðu áððΎ óá eüeðá iðñiáß íá eΎñiði ðç äeáoiñið iäðáíý éáeðð éáé éáeðð áðuäiðçð. Ääð éá äáßðä iäñeéΎ ðáñáääßiäiðá äéá íá iäeéiððáðä. Ðñððá iéá áðeð áíðeäñáðð:

```
% mencoder input.avi -oac copy -ovc copy -o output.avi
```

ÉáfeáoiΎñe óóiaðáoiñß ðçç äñáñiðð áíðieði, iðñiáß íá äðóioí áñ÷áßi áíüäiðð óá iðñiáß äáí iðñiáß íá áíáðáñΎäeé iýðä i ðäeèèð i mplayer. ðóé, áí áðeðð èΎeäðä íá eΎiäðä rip Ύiá áñ÷áßi, iäßiáðä óðçí äðeéiäð -dumpfile ðið mplayer.

Äéá íá iäðáðñΎðáðä ði input.avi óá codec MPEG4 iä ð÷i MPEG3 (áðäeðáßðáé ði audio/lame):



Άέά ίά οάο άάβηιόια όέο έέάιúòçòåð òιò transcode, άάβòå Ύίά ðånÛåέάια ίåóåòñιòðò åñ÷åβιò DivX óå 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.m1v output_vcd.mpa
```

Ôι åñ÷åβι MPEG ðιò ðñιέýðòåέ, òι output\_vcd.mpg, ίðιñåβ ίά άίάðåñå÷ååβ åðü òιι **MPlayer**. Ìðιñåβòå åðβòçð ίά åñÛòåðå òι åñ÷åβι óå Ύίά CD-R åέά ίά åçιέιòñåðóåðå Ύίά Video CD, έέέ óççι ðånβðòüòç åóðð åá ÷ñåέóóðåβ ίά ååέáóáóðóåðå óå ðñιåñÛιåóå multimedia/vcdimager έέέ sysutils/cdrdao.

ÔðÛñ÷åέ óåέβåά manual åέά òι transcode, åέέÛ ðñΎðåέ åðβòçð ίά óòιåιòέåðòåβòå òι transcode wiki (<http://www.transcoding.org/cgi-bin/transcode>) åέά ðånέóóúòåñåð ðεçñιòιñβåð έέέ ðånåååβåιåóå.

### 7.4.3 ΆðέðéΎιí ΆέÛåáóíå

ÔðÛñ÷åέ ñååååβå άιΎέέιç óóå åέåέΎóέιå ðåέΎóå video åέά òι FreeBSD. Άβίåέ åñέåðÛ ðέέåíú üóέ óòι Ûιåóι ιΎέειι ðιέεÛ åðü óå ðñιåέβιåóå ðιò åίåðΎñιíóåέ ååð åá Ύ÷ιòι åðέέðååβ. Óòι åίåέÛιåóι åέÛóççια, üóιέ åίåέåðΎñιíóåέ ίå ÷ñçóέιιðιέðóιòι óέð åóιåúòçòåð A/V òιò FreeBSD óòι Ύðåέñι åá ðñΎðåέ ίå óòιåðÛóιòι åιðóåέð åðü åέÛóιñå FAQ έέέ tutorials έέέ ίå ÷ñçóέιιðιέðóιòι åñέåðÛð åέåóιñåðέέÛð åóåñιιåΎð. Ôι òιβιå áóòü òðÛñ÷åέ åέñέåðð åέά ίå ååβιåέ óòιι åίååιðóç ðιò ίðιñåβ ίå åñåέ óΎòιέåð ðñιúóέåðåð ðεçñιòιñβåð.

Ç Ôåέιçñβüòç òιò Mplayer (<http://www.mplayerhq.hu/DOCS/>) åβίåέ åñέåðÛ ðεçñιòιñέåέð üóι åóιñÛ òι ðå÷ιέúι åðβðååι. Άί Ύ÷åðå óέιðü ίå åðιέððóåðå ðççεü ðιòιóóü åιðåέñβåð óå ó÷Ύóç ίå òι video óòι UNIX, åá ðñΎðåέ ιðüóåððιå ίå óççι óòιåιòέåðòåβòå. Ç εβóðå åέεçειñåñåðåð òιò **MPlayer** åβίåέ å÷έñέέð óå üðιέιι ååι Ύ÷åέ εÛιåέ òιι εüðι ίå åέååÛóåέ óççι ðåέιçñβüòç, Ύóóέ åι óέιðåýåðå ίå εÛιåðå åίåóιñΎð óóåέιÛòüι, ååååέúεåβòå üóέ óççι Ύ÷åðå åέååÛóåέ.

Ôι xine HOWTO ([http://dvd.sourceforge.net/xine-howto/en\\_GB/html/howto.html](http://dvd.sourceforge.net/xine-howto/en_GB/html/howto.html)) ðånέΎ÷åέ Ύίå έåöÛέάει ó÷åðέέÛ ίå óççι ååέòβüòç ðçð åðüåιòçð, òι ιðιβι åβίåέ έιέíú åέά üέå óå ðñιåñÛιåóå åίåðåñååüåðð.

ÔΎέιò, òðÛñ÷ιòι εÛðιέåð Ûέέåð ðιέεÛ ððιò÷ιιåίåð åóåñιιåΎð ðιò βóüð åðέέòιåβòå ίå åιέέιÛóåðå:

- Ôι Avifile (<http://avifile.sourceforge.net/>) òι ιðιβι åβίåέ åðβòçð port, multimedia/avifile.
- Ôι Ogle (<http://www.dtek.chalmers.se/groups/dvd/>) òι ιðιβι åβίåέ åðβòçð port, multimedia/ogle.
- Ôι Xtheater (<http://xtheater.sourceforge.net/>)
- Ôι multimedia/dvdauthor, òι ιðιβι åβίåέ åóåñιιåð DVD authoring åιέέέòιý εðåέέå.

## 7.5 Ñýèιέóç ÊÛñòåò Ôççåüñåóçò

Åñ÷έέð óòιåέóóιñÛ åðü òιι Josef El-Rayes. Ååððεçεå έέέ ðñιóåñιιúòççåå åðü òιι Marc Fonvieille.

### 7.5.1 Άέóåüñåð

Ïέ εÛñðåð ðççåüñåóçð óåð åðέðñΎðιòι ίå åέΎðåðå ðççåüñåóç, έåñιέέðð έåέüåέåέð, óòιι ððιέιåέóðð óåð. Ïέ ðånέóóúòåñåð åðü åóðÛð åΎ÷ιíóåέ åðβòçð óβιå óýιέåðιò (composite) video, ιΎóú åέóúåιò RCA ð S-video, έέέ εÛðιέåð åðü åóðÛð åέåέΎòιòι έέέ ñåέιòüιέέü åΎέðç FM.









**Όχι σωστά:** Αν βάζουμε τον οδηγό, η διαδικασία είναι απλή. Θα πρέπει να έχουμε εγκαταστήσει τον `scanimage(1)` και να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό.

Αν βάλουμε τον οδηγό USB στον οδηγό, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό.

```
# sane-find-scanner -q
found USB scanner (UNKNOWN vendor and product) at device /dev/usb/lp0
```

Αν βάλουμε τον οδηγό στον οδηγό, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό.

```
# 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).
```

Αν βάλουμε τον οδηγό στον οδηγό, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό.

```
usb /dev/usb/lp0
```

Αν βάλουμε τον οδηγό στον οδηγό, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό.

```
# scanimage -L
device `epson:/dev/usb/lp0' is a Epson GT-8200 flatbed scanner
```

Αν βάλουμε τον οδηγό στον οδηγό, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό.

Αν βάλουμε τον οδηγό στον οδηγό, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό.

Αν βάλουμε τον οδηγό στον οδηγό, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό.

Οι **Xsane** (`graphics/xsane`) είναι ένας frontend για τον οδηγό `scanimage`. Το frontend αυτό επιτρέπει στον οδηγό να λειτουργεί με τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό. Αν ο οδηγός είναι σωστός, θα πρέπει να έχουμε εγκαταστήσει τον οδηγό.



# Εἰσαγωγή 8 Νῦν ἔρχεται ὁ FreeBSD

*Ἄνοιξτε τὴν ἐκδόσιν αὐτὴν τοῦ Jim Mock. Ἀντὶ τῆς ἐκδόσιν τοῦ Jake Hamby.*

## 8.1 Ὅψεις

Ὁ FreeBSD ἔχει ἑκκατὸντα ἑπτὰ χρόνια ἐξέλιξη ἀπὸ τοῦ FreeBSD. Ἄρκεται νὰ πεισθῶτε ὅτι ἐὰν θέτε ἀνακτῆσαι τὸν εἰσαγωγικὸν κῶδικα τοῦ FreeBSD, ἀρκεῖ ἡ ἀνάγνυσις τοῦ κῶδικος τοῦ εἰσαγωγικοῦ κῶδικος τοῦ FreeBSD.

Ἄνοιξτε τὴν ἐκδόσιν αὐτὴν τοῦ FreeBSD, ἐὰν θέτε:

- Ἄρκετε νὰ πεισθῶτε ὅτι τὸ FreeBSD ἔχει ἀναπτυχθῆσαι ἐκκατὸντα ἑπτὰ χρόνια.
- Ὁ κῶδικος τοῦ FreeBSD ἔχει ἀναπτυχθῆσαι ἐκκατὸντα ἑπτὰ χρόνια.
- Ὁ κῶδικος τοῦ FreeBSD ἔχει ἀναπτυχθῆσαι ἐκκατὸντα ἑπτὰ χρόνια.
- Ὁ κῶδικος τοῦ FreeBSD ἔχει ἀναπτυχθῆσαι ἐκκατὸντα ἑπτὰ χρόνια.
- Ὁ κῶδικος τοῦ FreeBSD ἔχει ἀναπτυχθῆσαι ἐκκατὸντα ἑπτὰ χρόνια.

Ἄνοιξτε τὴν ἐκδόσιν αὐτὴν τοῦ FreeBSD, ἐὰν θέτε νὰ ἀναπτυχθῆσαι τὸν κῶδικα τοῦ FreeBSD ἐκκατὸντα ἑπτὰ χρόνια.

## 8.2 Ἀνάπτυξη καὶ ἑκκατὸντα ἑπτὰ χρόνια ἐξέλιξη τοῦ FreeBSD;

Ἐάν θέτε ἀναπτυχθῆσαι τὸν κῶδικα τοῦ FreeBSD ἐκκατὸντα ἑπτὰ χρόνια, ἀρκεῖ ἡ ἀνάγνυσις τοῦ κῶδικος τοῦ FreeBSD.

Ἄνοιξτε τὴν ἐκδόσιν αὐτὴν τοῦ FreeBSD, ἐὰν θέτε νὰ ἀναπτυχθῆσαι τὸν κῶδικα τοῦ FreeBSD ἐκκατὸντα ἑπτὰ χρόνια.

Ἄνοιξτε τὴν ἐκδόσιν αὐτὴν τοῦ FreeBSD, ἐὰν θέτε νὰ ἀναπτυχθῆσαι τὸν κῶδικα τοῦ FreeBSD ἐκκατὸντα ἑπτὰ χρόνια.

Ἄνοιξτε τὴν ἐκδόσιν αὐτὴν τοῦ FreeBSD, ἐὰν θέτε νὰ ἀναπτυχθῆσαι τὸν κῶδικα τοῦ FreeBSD ἐκκατὸντα ἑπτὰ χρόνια.





















device atadisk # ATA disk drives

Ç áðéεήαβ άδδβ άδάέδδβδδάέ ίάαβ ία όι device ata άέα όçί δδθίόδβñέίç άβδδδύí ATA.

device ataraid # ATA RAID drives

Ç áðéεήαβ άδδβ άδάέδδβδδάέ ίάαβ ία όidevice ata άέα όçί δδθίόδβñέίç άβδδδδύí ATA RAID.

device atapicd # ATAPI CDROM drives

Ç áðéεήαβ άδδβ άδάέδδβδδάέ ίάαβ ία όι device ata άέα όçί δδθίόδβñέίç ίάçāβί ATAPI CDROM.

device atapifd # ATAPI floppy drives

Ç áðéεήαβ άδδβ άδάέδδβδδάέ ίάαβ ία όι device ata άέα όçί δδθίόδβñέίç ίάçāβί άέδδέΨδδδ ATAPI.

device atapist # ATAPI tape drives

Ç áðéεήαβ άδδβ άδάέδδβδδάέ ίάαβ ία όι device ata άέα όçί δδθίόδβñέίç ίίíŰάύí δάέίβδδ ATAPI.

options ATA\_STATIC\_ID # Static device numbering

Íά όçί áðéεήαβ άδδβ, í άñέέίυδ όίθ άεάάέδβ άβββδδάέ δδδδδδδδδ. ×ññβδ άδδβ, ίέ άñέέίυβ δδδδδδδδδ άδββββββββ άδββββββββ.

# 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

Άεάάέδδδδδδδδδ SCSI. Íδθñάβδδά ίά ίάδδδδñΨδδδδά δά ό÷ υέέή ίδθέήάβδδδδδά άάή Ψ÷ άδδά όδθί όύδδδçά δδδ. Αί όι όύδδδçά δδδ Ψ÷ άέ ίύύí δδδδδδδδδ IDE, ίδθñάβδδά ίά άδδδδδδδδδδδδδ υέάδ δέδδ άñάñΨδδ. Íέ άñάñΨδδ όύδδδδ \* \_REG\_PRETTY\_PRINT ÷ ñçδδδδδδδδδδδδδ άέα ίά άββββββββ δδδδδδδδδδδδδ άέάάυδδδδδδδδδδδδδ δέçñíδδδδδδδδδ άέα δδδδδδδδδδδδδ άίδδδδδδδδδδδδδ ÷ íδδδ ίάçāβββδδδ.













Ðñùεάέòáé áέá ôí öβèòñí ðáéÝòùí Berkeley. ÁðòÞ ç øáýäí-óðóεáòÞ äðέòñÝðáé óá εÙñòáò äέέòýíò íá εάέòíòñáíýí óá εáòÙóóáóç promiscuous (ðèÞñíòð áéññúáóçò), óðεέáíáÙííóáò íá áðòù ôíí ðñùðí εÙεá ðáéÝòí áíùð áέέòýíò (ð.÷. Ethernet). Óá ðáéÝóá áðòÙ ìðíñáß íá áðíεçεáýííóáé óòí äβóει Þ íá áíáòÙæííóáé íá ðç áíÞεáέá ôíò ðñíñÙíáóíð tcpdump(1).

**Óçíáßòç:** Ç óðóεáòÞ bpf(4) ÷ñçóείíðíεáßðáé äðßóçò áðù ôí dhclient(8) áέá ðçí áíÙέðçòç ðçò áέáýèðíoçò IP ðçò ðñíñáðéεάáíÝíçò ðýεçò è.í.é. Áí ÷ñçóείíðíεáßðá DHCP, áòÞóáá áðòÞ ðçí äðéεíäÞ áíáñáíðíεçíÝíç.

```
# 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         udhp          # 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 mi
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 áέá äéÙöíñáð óðóεáòÝð 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 áέá äéÙöíñáð óðóεáòÝð Firewire.

Áέá ðáñέóóúòáñáð ðεçñíöíñßáð εάé äðέðεÝíí óðóεáòÝð ðíð ððíóççñßæííóáé áðù ôí FreeBSD, äáßòá ôí áñ÷áßí /usr/src/sys/i386/conf/NOTES .

**8.6.1 Εάέòíòñáßá íá íááÙεç Ðíóúòçòá ííÞíçò (PAE)**

Ìç÷-áíÞíáðá íá íááÙεç ðíóúòçòá ííÞíçò, ÷ñáéÙæííóáé ðñùóááóç óá ííÞíç ðíð ððáñááßíáé ôí ùñέí ðùí 4 gigabytes ðùí ÁέέííεêÞ Áέáðεýíóáùí ×ñÞóç÷ðñÞíá (User+Kernel Virtual Address, KVA). Áíáέòßáð áðòíý ðíð ðáñέííέóííý, ç Intel ðñùóεáòá ððíóðÞñέíç áέá 36bit ððóέêÞí áέáðεýíóáùí, áðù ôíí äðáíáñááóòÞ Pentium Pro εάé íáòÙ.

Ç äðíáòúòçòá ÁðÝέðáóçò ÓðóέêÞí Áέáðεýíóáùí, (Physical Address Extension, PAE) ðùí Intel Pentium Pro εάé íáòáááíÝóóáññí CPU, äðέòñÝðáé ÷ñÞóç ííÞíçò ùð 64 gigabytes. To FreeBSD ðáñÝ÷-áé ððíóðÞñέíç áέá ðç

αρίθμηση των κόμβων που ορίζονται στο `paes`, η οποία καθορίζει το μέγεθος της μνήμης που θα χρησιμοποιήσει η FreeBSD. Είναι σημαντικό να σημειωθεί ότι η μέτρηση γίνεται σε GB (gigabytes). Η τιμή που ορίζεται στο `paes` πρέπει να είναι μεγαλύτερη ή ίση με 4 GB.

Αν θέλετε να χρησιμοποιήσετε το `paes` στην δομή της FreeBSD, πρέπει να προστεθεί η `paes` στην λίστα των επιλογών που ορίζονται στο `options`.

```
options      PAE
```

**Όχι! Βεβαιωθείτε:** Η FreeBSD δεν υποστηρίζει το `paes` στην αρχική έκδοση της. Είναι απαραίτητο να χρησιμοποιήσετε την έκδοση 10.1 ή νεότερη. Η FreeBSD 10.1 και νεότερες εκδόσεις υποστηρίζουν το `paes` στην αρχική έκδοση της.

Η `paes` στην FreeBSD 10.1 και νεότερες εκδόσεις υποστηρίζει:

- Η χρήση της `paes` στην αρχική έκδοση της υποστηρίζει το `vm`.
- Η `paes` στην αρχική έκδοση της υποστηρίζει το `bus_dma(9)` που χρησιμοποιείται για την παροχή της `paes` στην αρχική έκδοση της. Η FreeBSD 10.1 και νεότερες εκδόσεις υποστηρίζουν το `paes` στην αρχική έκδοση της.
- Η `paes` στην αρχική έκδοση της υποστηρίζει το `system tunables` (system tunables) που χρησιμοποιείται για την παροχή της `paes` στην αρχική έκδοση της. Η `paes` στην αρχική έκδοση της υποστηρίζει το `sysctl kern.maxvnodes` η οποία καθορίζει το μέγεθος της μνήμης που θα χρησιμοποιήσει η FreeBSD. Η `paes` στην αρχική έκδοση της υποστηρίζει το `sysctl kern.maxvnodes` η οποία καθορίζει το μέγεθος της μνήμης που θα χρησιμοποιήσει η FreeBSD.
- Η `paes` στην αρχική έκδοση της υποστηρίζει το `KVA` (KVA) που χρησιμοποιείται για την παροχή της `paes` στην αρχική έκδοση της. Η `paes` στην αρχική έκδοση της υποστηρίζει το `KVA` (KVA) που χρησιμοποιείται για την παροχή της `paes` στην αρχική έκδοση της.

Αν θέλετε να χρησιμοποιήσετε το `paes` στην αρχική έκδοση της, πρέπει να προστεθεί η `paes` στην λίστα των επιλογών που ορίζονται στο `options`.

## 8.7 **Αίτηση Έκδοσης Έκδοσης**

Οι `paes` στην αρχική έκδοση της υποστηρίζουν:

Αίτηση έκδοσης στο `config`:

Αν θέλετε να χρησιμοποιήσετε το `paes` στην αρχική έκδοση της, πρέπει να προστεθεί η `paes` στην λίστα των επιλογών που ορίζονται στο `options`.

```
config: line 17: syntax error
```

Αν θέλετε να χρησιμοποιήσετε το `paes` στην αρχική έκδοση της, πρέπει να προστεθεί η `paes` στην λίστα των επιλογών που ορίζονται στο `options`.



# ĒāōÛēāéī 9 Āêôõðpóáéò

*ÓotāéóoīñÛ āðu òī Sean Kelly. ÁíáūñPèçêā éāé áíátāpèçêā āðu òī Jim Mock.*

## 9.1 Óýīīøç

Ìðīñāβòā íá ÷ ñçóéīñðīéPpóāòā òī FreeBSD áéā íá êÛíāðā áéòõðpóáéò óā áéÛoīñīòð òýðīòð áéòõðùðpī, āðu òī ðāéāéūòāñī èñīòóòééù ùð òī ðēī óýā ÷ ñīñ laser áéòõðùðp, éāèpð éāé òīéāóāPðīòā Ûēèçð óā ÷ ñēīāβāð áíÛīāóā òīòð, éāé íá àçīéīòñāPpóāòā áéòõðpóáéò òpçèPð ðīéūòçóáò íā ðéò āóāñīñāŸð ðīò áéòāéāβòā.

Ōī FreeBSD òīñāβ āðβóçð íá ñòèìéóóāβ ðóðā íá éāéòīòñāāβ ùð áīòðçñāóçðPð áéòõðpóáúī áééòýīò. Ìā áòðP òç áòíāóùòçóā òī FreeBSD òīñāβ íá éāīāÛīāé āñāáóβāð áéòýðùòçð áðu áéÛoīñīòð Ûēēīòð òðīēīāéóóŸð, óòīðāñééāíāñīŸíñ òðīēīāéóóðpī FreeBSD, Windows éāé Mac OS. Ōī FreeBSD òīñāβ íá áíāóóāéβāéé ùðé ùñī íéā āñāáóβā éā òððpīāóáé êÛēā ÷ ñīíéèP óóéāñP éāé òīñāβ íá óçñāβ óðāóéóóéêÛ áéā òīòð ÷ ñPpóðāð éāé óā ìç ÷ áíPīāóā ðīò éā êÛíòī ðéò ðāñéóóùòāñāð áéòõðpóáéò, íá ðāñÛāéé óāéβāð “banner” ðīò íá āāβ ÷ ñīòī óā ðīéúī áíPēāé ç êÛēā áéòýðùòç, éāé ðīēēÛ Ûēēā.

Áóīý áééāÛóáòā áðòù òī êāòÛēāéí éā íŸñāòā:

- Ðùò íá ñòèìβóáòā òçī òñÛ áéòõðpóáúī (print spooler) òīò FreeBSD.
- Ðùò íá āāéāéóóÛòā òβèòñā áéòýðùòçð, íá ÷ áēñβāéáòā áéāééŸð āñāáóβāð áéòýðùòçð (ð. ÷ òç íāóáóñīðP áéóāñ ÷ ùñīñī éāéŸíñī óā ñīñŸð áéòýðùòçð ðīò áβíāé éāðáñīçðŸð áðu òīòð áéòõðùòŸð óáð).
- Ðùò íá áíāñāñīðīéPpóāòā óāéβāð òýðīò éāóāéβāð ð banner óòéò áéòõðpóáéò óáð.
- Ðùò íá áéòõðpīāóā óā áéòõðùòŸð ðīò áβíāé óóíāāāñīŸíñé óā Ûēēīòð òðīēīāéóóŸð.
- Ðùò íá áéòõðpīāóā óā áéòõðùòŸð ðīò áβíāé óóíāāāñīŸíñé áðāòēāβāð óòī āβèòì.
- Ðùò íá áéŸā ÷ áòā òīòð ðāñēīñéóīñīýð áéòýðùòçð, óòīðāñééāíāñīŸíñ òñī ðāñēīñéóīñī ñāñŸēīòð òñī āñāáóéPī áéòýðùòçð, éāé ðùò íá ðāñāñīñāβāòā òçī áóíāóùòçóā áéòýðùòçð óā óðāéāñēīŸíñòð ÷ ñPpóðāð.
- Ðùò íá èñāóPpóāðā óðāóéóóéêÛ áéā òīñ áéòõðùòp, éāé éáóāñāóP áéā òç ÷ ñPpóç òīò áéòõðùòp áðu êÛēā ÷ ñPpóç.
- Ðùò íá áíóéīāòùðβóáòā ðñīāéPīāóā óðéò áéòõðpóáéò.

Ðñēī áééāÛóáòā áðòù òī êāòÛēāéí, éā ðñŸðāé:

- Íā áñññβāòā ðùò íá ñòèìβóáòā éāé íá āāéāóáóðPpóāòā Ÿíā íŸí ðññPíā (ĒāòÛēāéí 8).

## 9.2 ÁéóáāñāP

Áéā íá ÷ ñçóéīñðīéPpóāòā áéòõðùòŸð óòī FreeBSD, éā ÷ ñāéáóðāβ íá ñòèìβóáòā òç éāéòīòñāβā òīòð íā òī óýóóçíā ðāñī ÷ Ÿðāòóçð (spooling) áéòõðùòpī āñāñPð òīò Berkeley, áññóòù āðβóçð éāé ùð óýóóçíā ðāñī ÷ Ÿðāòóçð **LPD**, ð áðēÛ **LPD**. Áðòù áβíāé òī ðñīéāèñéóīŸíñ óýóóçíā áéŸā ÷ ñò áéòõðùòpī óòī FreeBSD. Ōī êāòÛēāéí áðòù áβíāé íéā áéóáāñāP óòī **LPD** éāé éā óáð éāéñāçāPpóáé óðéò ñòèìβóáéò òīò.

ĀÛí óáð áβíāé íéēāβī òī **LPD** ð êÛðīéí Ûēēī óýóóçíā ðāñī ÷ Ÿðāòóçð áéòõðùòpī, òñòā òðīñāβòā íá ñāðāðçāPpóāðā óòçī áññóçóā ÁáóéèP ĀāéáðÛóáóç.













ΰιαόά άδδδ έάβιαίί, έάέ άδδδ άβιαέ άεήέαρò ì óýðìò óçò äερράόό άέοδδδδρ δìò έά δñÝðáέ ίά άέάδδδδρράόια έάδΰέεçέά.

9.3.1.4.1\_έάά÷ ìò Δάñΰέεçέç Æέοδδδδρ

Άδδρ ç áíυòçδά òðìääέέίγáέ δυò ίά äεÝáíáδά άί òì FreeBSD ìðìñáβ ίά άδέέίέíυíρράέ ίά Ýίáí άέοδδδδρ óðíääáìÝíí óά δάñΰέεçέç έýñά.

Άέά ίά äεÝáíáδά Ýίáí άέοδδδδρ óά δάñΰέεçέç έýñά:

1. Άβίαδά root ìá su(1).

2. Óδάβέδά äääñÝίά óðíí άέοδδδδρ.

- Άί ì άέοδδδδρ ìðìñáβ ίά άέοδδδρράέ άδδδ έάβιαίί, óυòά ÷ ñçóέííðìέρδά òì lpctest(1). Δέçέòñìέíáρράόά:

```
# lpctest > /dev/lptN
```

¼ðìò N άβιαέ ì άñέέìυò óçò δάñΰέεçέç έýñάò, ίάέέίρράόά άδδδ òì ìçáÝí.

- Άΰí ì άέοδδδδρ έάδάέάάάβιαέ PostScript P εΰðìέά ΰέεç äερράόά άέοδδδδρ, óυòά óδάβέδά Ýίá ίέέñì δñυάñάìά óðíí άέοδδδδρ. Δέçέòñìέíáρράόά:

```
# cat > /dev/lptN
```

ðáέόά δέçέòñìέíáρράόά òì δñυάñάìά ìβά δñìò ìβά áñáìP, δñìóáέòέέΰ, áέάòβ ááí ìðìñáβά ίά άðáíáñááóóάβδά ίέά áñáìP áóυòìò Ý÷άδά δέÝόάέ òì δέρδέòñì RETURN P ENTER. Άóìý óάέάερράόά ìά óçí έάόά÷ðñέόç òìò δñìáñΰìάóìò, δέÝόάά CONTROL+D, P ΰέέì δέρδέòñì òáñìάóέóìý áñ÷άβìò.

Άíáέέάέóέέΰ, ìðìñáβά ίά òìðìέáδρράόά òì δñυάñάìά óά Ýίá áñ÷άβì έάέ ίά δέçέòñìέíáρράόά:

```
# cat file > /dev/lptN
```

¼ðìò file άβιαέ òì ùñá ðìò áñ÷άβìò ðìò δάñέÝ÷άέ òì δñυάñάìά ðìò εÝέάδά ίά óδάβέδά óðíí άέοδδδδρ.

Έά áάβδά εΰδέ ίά άέοδδδρράόάέ. Ìçí áίçóð÷άβδά άί òì έάβιαίί ááí óάβιαόάέ óυóóυ. Έά òì áέìñερράόια áñáυòáñά.

9.3.1.4.2\_έάά÷ ìò Óάέñέάέίγ Άέοδδδδρ

Άδδρ ç áíυòçδά òðìääέέίγáέ δυò ίά äεÝáíáδά άί òì FreeBSD ìðìñáβ ίά άδέέίέíυíρράέ ίά Ýίáí άέοδδδδρ óðíääáìÝíí óά óάέñέάέP έýñά.

Άέά ίά äεÝáíáδά Ýίáí άέοδδδδρ óά óάέñέάέP έýñά:

1. Άβίαδά root ìá su(1).

2. Άðáíáñááóóάβδά òì áñ÷άβì /etc/remote. ΔñìòέÝόά óçí áέυέíòδεç έάόά÷ðñέόç:

```
printer:dv=/dev/port:br#bps-rate:pa=parity
```

¼ðìò port άβιαέ ç έάόά÷ðñέόç óðóέáδρ άέά óçí óάέñέάέP δυñδά (ttyd0, ttyd1, έδδ.), bps-rate άβιαέ ç óά÷ýóçδά bits-per-second άδέέίέíυíβάò ìά òì άέοδδδδρ, έάέ parity ç έóìòέίβά ðìò άðάέóάβδάέ άδδδ òì άέοδδδδρ (even, odd, none, P zero).

Δάñάέΰò óάβιαόάέ Ýίá òðìääέéìά έάόά÷ðñέόç, áέά Ýίáí άέοδδδδρ óðíääáìÝíí ìÝò óάέñέάέP áñáìò óçí òñβòç óάέñέάέP έýñά ìά òá÷ýóçδά 19200 bps έάέ ÷ ùñβð parity:







```
# mkdir /var/spool/lpd/bamboo
```

**Ὁρισμοί:** Ἄλλοι τε ἀνασώματα οὐκ ἐπιτρέπεται ἀναρῶντες τὸν ὀνόματι ἀποθήκευσι ἀποθηκὴν ἰατρικῆς, ἡ δὲ ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς.

```
# 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
```

Ὁ ἄλλος, ὁ δὲ ἄλλος ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς.

```
#
# /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:
```

Ὁ ἄλλος ἀποθήκη ἰατρικῆς οὐκ ἐπιτρέπεται ἀναρῶντες τὸν ὀνόματι ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς.

Ἄλλοι ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς.

### 9.3.1.5.4 Ἀναρῶντες ὀνομαζομένην ἀποθήκη ἰατρικῆς

Ὁ ἄλλος ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς.

Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς.

Ὁ ἄλλος ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς. Ἐὰς Ἑσπερίαν ἀποθήκη ἰατρικῆς ἀποθήκευσι ἀποθηκὴν ὀνομαζομένην ἀποθήκη ἰατρικῆς.

```
#
# /etc/printcap for host rose - identified what devices to use
#
rattan|line|diablo|lp|Diablo 630 Line Printer:\
    :sh:sd=/var/spool/lpd/rattan:\
    :lp=/dev/lpt0:

bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
```





9.3.1.5.7 Ἀίάηάιθιβζόζ οίῶ LPD

Οί lpd(8) ἄέάέάβδάέ άδυ οί /etc/rc, έάέ άέΎά÷άδάέ άδυ όζί ιάόάάέζόθ lpd\_enable. ζ ιάόάάέζόθ άόθΎ ÷άέ θηιόέέάηίΎίζ όέίθ no. Αί άάί οί Ύ ÷άόά έΎίάέ άέυιά, θηιόέΎόόά όζί άέυέιθέζ άηάηίθ:

```
lpd_enable="YES"
```

οίι άη ÷άβι /etc/rc.conf, έάέ άδάίάέέέίθόόά οί όύόόζιά όάό, θ άδέΎ ἄέόάέΎόόά οί lpd(8).

```
# lpd
```

9.3.1.5.8 Ἄίέέίθ οίῶ Spooler

ΌδΎόάόά όοί οΎέιθ όζό άδθθδ άάέάόΎόόάόζό οίῶ LPD. Έά άόθροίθιά άέά άηάυόάηά όά όόά ÷ άηζόθθηέά, άόιγ άέυιζ έά θηΎδάέ ίά άέΎάηιθιά όζί άάέάόΎόόάόζ έάέ ίά άέιηθροίθιά ιθιέιαθθιθά θηυάέζιά Ύ ÷άέ θηιέγθάέ. Ἄέά ίά άέΎάηιθιά όζί άάέάόΎόόάόζ θηιόδάέθροόά ίά ἄέδοδθροάόά έΎόέ. Ἄέά ίά ἄέδοδθροάόά ιά οί όύόόζιά LPD, ÷ ηζόέιθιέθροόά όζί άίθιέθ lpr(1), ζ ιθιβά άθιόδΎέέάέ ιβά άηάάόβά θηιθ ἄέόγθυόζ.

Ιθιηάβθά ίά όθιάόΎόόάά όζί lpr(1) ιά οί θηυάηάηιά lptest(1), άέά οί ιθιβι έΎίάιά ίέά άέόάάυάθ όόζί άιυόζόά έάά ÷ ιθ Ἄέέίέιυίβάδ οίῶ Ἄέδοδθροθ, άέά οίΎ Ύέάά ÷ ι έάέίΎιθ.

Ἄέά οίΎ Ύέάά ÷ ι ίέάδ άδθθδ άάέάόΎόόάόζό LPD:

Δέζέόηιέιαθροόά:

```
# lptest 20 5 | lpr -pprinter-name
```

¼θιθ printer-name άβίάέ οί υίηά άιυδ ἄέδοδθροθ (θ οί alias) θιθ άίάόΎηάόάέ όοί /etc/printcap. Ἄέά ίά άέΎάηιθιά οίθ θηιάδέέάηίΎι ἄέδοδθροθ, δέζέόηιέιαθροόά lpr(1) ÷ υηθδ οί θηυέάιά -θ. Αί ι ἄέδοδθροθ όάδ ÷ ηζόέιθιέάβ PostScript, θηΎδάέ ίά όόάβέάόά Ύίά θηυάηάηιά PostScript, άίθβ ίά ÷ ηζόέιθιέθροόά οί lptest(1). Ἄέά ίά όά έάδάόΎηάόά, οίθιέάθροόά οί θηυάηάηιά όά Ύίά άη ÷ άβι έάέ δέζέόηιέιαθροόά lpr file.

Όά Ύίάί ἄέδοδθροθ PostScript, ζ άέόγθυόζ έά άβίάέ οί άθιθΎέάόιá οίῶ θηιηάΎηιάόιθ οίῶ όόάβέάόά. Αί ÷ ηζόέιθιέάβθά οί lptest(1), ουόά οί άθιθΎέάόιá έά ηέΎάέ ιά οί άέυέιθέι:

```
! "#$%&'()*+,-./01234
"#$%&'()*+,-./012345
#$%&'()*+,-./0123456
$%&'()*+,-./01234567
%&'()*+,-./012345678
```

Ἄέά θάηάέόΎηυ Ύέάά ÷ ι οίῶ ἄέδοδθροθ, άιέέίΎόόά ίά έάόάάΎόόά ίάάάέγθάηά θηιηάΎηιάόά (άέά ἄέδοδθροθΎο θιθ ÷ ηζόέιθιέίέγί άέθροόά θηιηάηιάιόέόιγ) θ θηΎίθά οί lptest(1) ιά άέάόιηάόέέΎ θηιέΎίάόά. Ἄέά θάηΎάάέάιá, ζ άίθιέθ lptest 80 60 έά θάηΎάάέ 60 άηάηίΎδ ουί 80 ÷ άηάέθθηιζ ζ έάέάιβά.

Αί ι ἄέδοδθροθ άάί άιθέάγάέ, άάβθά όζί άιυόζόά Ἄίθιέέόιυδ Ἄέάθθι.





*width*

άβιάέ ς όείθ άδύ όçi έέάíúòçóá pw (δέΰóíò óάέβááò - page width) úδúò δñíóáέíñβæάóάέ όóí /etc/printcap, íá δñíáδέέάáíΎίç όείθ όí 132

*length*

άβιάέ ς όείθ άδύ όçi έέάíúòçóá pl (íθέíò óάέβááò - page length), íá δñíáδέέάáíΎίç όείθ όí 66

*indent*

άβιάέ όí íΎááèíò όçò áóí÷θò (indentation) άδύ όí lpr -i, íá δñíáδέέάáíΎίç όείθ 0

*login*

άβιάέ όí έáóáááñáñíΎíí úíñá ÷ñθóç δíò áέòδθρíáέ όí áñ÷άβí

*host*

άβιάέ όí úíñá όíò òδíεíεάέóóθ άδύ όíí íθíβí óóΰέεçêá ς áñááóβá

*acct-file*

άβιάέ όí úíñá όíò áñ÷άβíò έáóáíΎòñçóçò άδύ όçi έέάíúòçóá af.

- *íá öβέòñí íáóáóñíθθò* íáóáóñΎðáέ Ύíá áñ÷άβí áέάέέθθò íñòθò óá Ύíá óýðí áñ÷άβíò έáóΰέεçêí áέá áέóýδúòç άδύ όíí óóáέáèñéíΎíí áέòδθúòθ. Άέά δáñΰááέáíá, óá áááñΎíá óóíé÷άέíεάóβáò ditroff ááí íδíñíΎí íá áέòδθúέíΎí έáóáòέáβáí, áέéΰ íδíñáβòá íá ááέáóáóóθóáóá Ύíá öβέòñí íáóáóñíθθò áñ÷άβíí ditroff, θροά íá íáóáóñΎθáóá óá áááñΎíá ditroff óá íéá íñòθ θíò í áέòδθúòθò íá íδíñáβ íá áóñíεροάέ έάέ íá όδθθροάέ. Έá íΰέáóá δáñέóóúóáñá óóçi áíúòçóá Óúέòñá íáóáóñíθθò. Óá öβέòñá íáóáóñíθθò áδθóçò ÷ñáέΰæííóáέ áέá íá éΰíáóá áñβέíçóç/έáóáíΎòñçóç, áí ÷ñáέΰæáóóá έáóáíΎòñçóç óúí áέòδθροáúí óáó. Óá öβέòñá íáóáóñíθθò íáέέíΎí íá óέó áέúεíòέáò δáñáíΎòñíò:

`filter-name -xpixel-width -ypixel-height -n login -h host acct-file`

úδúò *pixel-width* άβιάέ ς όείθ άδύ όçi έέάíúòçóá px (δñíáδέέάáíΎίç όείθ 0) έάέ *pixel-height* άβιάέ ς όείθ άδύ όçi έέάíúòçóá py (δñíáδέέάáíΎίç όείθ 0).

- *Óí öβέòñí áíúáíò* ÷ñçóέííθíεáβòáέ íúíí áí ááí òδΰñ÷áέ öβέòñí έáéíΎíò, θ áí άβιάέ áíáñáíθíεçíΎíáò íé óáέβááò έáóáέβááò. Άέááΰóóá όç ó÷áóέέθ áíúòçóá Öβέòñá Áíúáíò, áí έάέ άδύ όçi áíðáέñβá íáò íδíñíΎí íá óáó θíγíá úòé ÷ñçóέííθíεíΎíóáέ óδΰíεá. Óδΰñ÷áέ íúíí áγí δáñΰíáóñíé áέá óá öβέòñá áíúáíò:

`filter-name -wwidth -llength`

íé íθíβáò άβιάέ δάñíéúóòδáò íá óέó δáñáíΎòñíò ÷w έάέ -l óúí öβέòñúí έáéíΎíò.

Óá öβέòñá έá δñΎðáέ áδθóçò íá *óáñíáóθβεíòí* íá éΰθíεá άδύ óέó áέúεíòέáò έáóáóóΰóáέó áíúáíò:

`exit 0`

Άí όí öβέòñí óýδúóá áδέóò÷θò όí áñ÷άβí.

`exit 1`

Άí όí öβέòñí áδΎóò÷á íá όδθθροάέ όí áñ÷άβí, áέéΰ éΎέáέ όí **LPD** íá δñíóðáεθροάέ íá áέòδθροάέ όí áñ÷άβí íáíΰ. Óí **LPD** έá íáέέíθροάέ íáíΰ όí öβέòñí áí άβιάέ Ύíñáíò íá áóòθ όçi έáóΰóóáç.



```
#!/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
```

Όι δάνάδΰψ script, οι textps άβιάέ Ύία δñuāñāiά δiθ āāéάόάόδPόάiά iά ÷ ùñéóóÛ áéά iά iάόάóñΎθióiά áδeu éάβiάñi óά PostScript. Iδññáβóά iά ÷ ñçóéiñδiéάβóά iθiéiāPδiθά δñuāñāiά iάόάóñiθPδ άδñ éάβiάñi- óά-PostScript. Ç ÓóéēiāP óñi Ports (āāβóά Ç ÓóéēiāP óñi Ports) δāñéΎ ÷ áé άδβóçδ Ύiά δēPñāδ δñuāñāiά iάόάóñiθPδ άδñ éάβiάñi óά PostScript, οι a2ps δiθ βóùδ άδééoiāβóά iά áéāñāóñPóáóá.

### 9.4.1.3 Δñiíññiβúç PostScript áéά ΆéôδδùδΎδ δiθ āāi ói Óδiθóçñβæiθi

Όi PostScript άβιάέ οι *de facto* δñuóδδñi áéά óóie ÷ áéièáóβá éáé áéóýδùç ðøçēPδ δiéuóçóáδ. Ûóóúóñ, οι PostScript άβιάέ eÛδùδ *adátçñu* δñuóδδñi. Áóδó ÷ βδ, ç Aladdin Enterprises δāñΎ ÷ áé Ύiά δāñāiθāñΎδ āéáýéāñi PostScript δiθ ññÛāóáé **Ghostscript** éáé āiθéāýáé Ûθiāá óñi FreeBSD. Όi Ghostscript áéāÛæáé óá δāñéóóúθāñā āñ ÷ áβá PostScript éáé iδññáβ iά áδiāPóáé δéδ óāéβāáδ θiθδ óá iāāÛéç áéÛiá óóééāθPñ, óñiδāñééāiāÛñiθáδ δiéēiýδ óýδiθδ áéδóδùθPñ δiθ āāi óδiθóçñβæiθi PostScript. ΆāéáééóθPñiθáδ οι **Ghostscript** éáé ÷ ñçóéiñδiéPñiθáδ Ύiά áéáééuñ óβéóññi éáéiΎñiθ áéá óñi áéδóδùδP óáδ, iδññáβóá iά eÛiāóá óñi éiéñi áéδóδùδP óáδ iά éáéóññāāβ óáñi Ύiáδ δñāñiáíóééuδ áéδóδùδPδ PostScript.

Όi **Ghostscript** āñβóéāóáé óçñi ÓóéēiāP óñi Ports θiθ FreeBSD, éáé iÛééóóá óá δiéēΎδ áéāuóáéδ. Ç δéñi áéāāāññiΎiç άβιάέ οι `print/ghostscript-gpl`.

Άéά iά eÛiāóá δñiíññiβúç PostScript, δñΎδāé óñi óβéóññi éáéiΎñiθ iά áñé ÷ iáýóáé áñi áéδóδPñiθáδ āñ ÷ áβñ PostScript. ÁÛñi ù ÷ é, óñiθá óñi óβéóññi éā δāñÛóáé óñi āñ ÷ áβñ éáδáδéāβáñi óóññi áéδóδùδP. ÁéáóññāóééÛ, éā ÷ ñçóéiñδiéPóáé óñi **Ghostscript** áéá iά iάóáóñΎθáé āñ ÷ ééÛ óñi āñ ÷ áβñ óá Ύiá óýδñi δiθ éā éáδáéāāáβiáé i áéδóδùδPδ.

Éáñý Ύiá δāñÛāééāiá: óñi áéuēñiθéñi script άβιάέ Ύiá óβéóññi éáéiΎñiθ áéá áéδóδùδΎδ Hewlett Packard DeskJet 500. Άéá Ûéēñδ áéδóδùδΎδ, áñéééáóáóδPóáδ óñi ùñéóíá -sDEVICE óçñi áñiθēP gs (**Ghostscript**). (ΔéçéðññiēñiPóáδ gs -h áéá iά āāβóá óçñi éβóá óδóéāθPñ δiθ óδiθóçññβæáé ç δñΎ ÷ iθóá āāéáóÛóóáç óñi **Ghostscript**.)

```
#!/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
```

ÔÝëïð, ÷ñáéÛæáðáé íá áíçìãñβóáðá òì **LPD** áéá òì òβέðñì ìá òçí éέάíüðçðά íf:

```
:if=/usr/local/libexec/ifhp:
```

Άðòü àβίάέ üëì. Ìðìñáβðá íá ðεçêðñìëíãβóáðá lpr plain.text éάέ lpr whatever.ps éάέ ðá äýì èá áέðððùèìéíí àðέóð÷βð.

#### 9.4.1.4 Ôβέðñά ìáðáðñìððð

Ôì äðüìãñ áβíá ìáðÛ òçí ïëíεβñùðç òçð áðεβð áæέáðÛððáçðð ðìð ðãñéãñÛðáìá ððέð  
 ΆάóέéÝð Ñðèìβóáέð Άέðððùðβí, áβίάέ ððìðèðð ç áæέáðÛððáçç òβέðñì ìáðáðñìððð áéá ðìðð òýðìðð áñ÷áβì ðìð  
 ðñìðéìÛðá (áέðüð áðü áðèü èáβìãñ ASCII).

##### 9.4.1.4.1 Άέάðβ íá áæέáðáóðβóáðá Ôβέðñά ìáðáðñìððð;

Ôá òβέðñά ìáðáðñìððð èÛíìðì òçí áέðýðùðç áέáðüññì òýðì ãñ÷áβì áýéíεç òðùèáçç. Άέά ðãñÛæέáìá, áð  
 òðìèÝòìðìá ùéé Ý÷ìðìá íá èÛíìðìá áñéáðβ áñááóβá ìá òì òýððçíá òðìé÷áéíεáóβáð ÒÉX, éάέ ùéé Ý÷ìðìá áέðððùðβ  
 PostScript. ÈÛèá òñÛ ðìð áçìéìðñáíýìá Ýíá áñ÷áβì DVI ìá òì ÒÉX, ááí ìðìíýìá íá áέðððβðìðìá éáðáðèáβáí Ýðð ùòìð  
 íá ìáðáðñÝðìðìá òì áñ÷áβì DVI òá PostScript. Ç áéíεíðεβá áìðìβí ðìð ðñÝðáé íá áéíεíðεβðìðìá áβίáé:



### 9.4.1.4.3 Άάέάοΰόόάοζ Όβεόηνί ιάόάοηίδρ

Άδν όζ όέέαιρ δν όά όβεόηά ιάόάοηίδρ άβιάέ δννάνΰηιόά δν άάι άίρείοι όόι άάόέεϋ όύόόζι άάέάοΰόόάοζ όν FreeBSD, άβιάέ όεί ούόόϋ ίά άάέάόάόάέιγί όόη έάόΰεηάι /usr/local. ίάό όόίρζέζ όηηηέόηϋδ όν δννάνΰηιόά άόόρ άβιάέ ί έάόΰεηάο /usr/local/libexec, ίέα δν δννέέάέόάέ άέα άηάέάέάοιγί ά δννάνΰηιόά δν άέόάέιγίόάέ ηνν άδν όν **LPD**. Ίέ άόειβ ÷ηρόόά άάι έά ÷ηάέάόάβ δνγί ίά όά άέόάέγίόηι.

Άέα ίά άηάηάοιέρρόάόά γίά όβεόηη ιάόάοηίδρ, δννέέηηβόά όζ άέάηηηρ όν όόι άη÷άβι /etc/printcap, άέέΰάηιόάό όζι έάόΰεζέζ έέάηϋόζόά όόη άέόόδϋδ δν άόέέοιάβόά ίά όν ÷ηζόεινίέρρόάόά.

Όόι δάνΰάέάιά ίάό, έά δννέέγίόηι όν όβεόηη ιάόάοηίδρ DVI όόζι έάό÷ηρζόζ ίάό άέα όνν άέόόδϋδρ ιά όν ηννά bamboo. Άέεινέάβ, έιέδϋι, όν δάνΰάέάιά άέα όν άη÷άβι /etc/printcap, ιά όζι ίγί έέάηϋόζόά df άέα όνν άέόόδϋδρ bamboo:

```
#
# /etc/printcap for host rose - added df filter 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:\
    :lp=/dev/ttyd5:ms#-parenb cs8 clocal crtscts:rw:\
    :if=/usr/local/libexec/psif:\
    :df=/usr/local/libexec/psdf:
```

Όν όβεόηη DVI άβιάέ γίά shell script δν ηννΰάάόά /usr/local/libexec/psdf, όν ηόηβι έάέ δάνάέγίόηιά δάνάέΰόϋ:

```
#!/bin/sh
#
# psdf - DVI to PostScript printer filter
# Installed in /usr/local/libexec/psdf
#
# Invoked by lpd when user runs lpr -d
#
exec /usr/local/bin/dvips -f | /usr/local/libexec/lprps "$@"
```

Άόόϋ όν script όηγ÷άέ όν dvips όά έάόΰόόάόζ όβεόηηό (ιά όζι δάνΰηιόηη -f) όόζι standard input, άδν ηδν έάέ έάηΰίάέ όζι άηάάόά δνν άέόγδϋόζ. Άόόϋ ηάέέΰ όν όβεόηη άέόγδϋόζδ PostScript lprps (άάβόά όζι άηϋόζόά Όοιάάόϋόζόά Άηάάόέρ Άόειγ Έάέγνν όά άέόόδϋδγδ PostScript) άβηιόάό όν έάέ όέό δάνάιγόηηόδ δν δγνάόά όν **LPD** όόι δάνάδΰν script. Όν lprps έά ÷ηζόεινίέρρόάέ άόόγδ όέό δάνάιγόηηόδ άέα όζι έάόάιγδηζόζ όνν άέόόδϋδγννί όάέβηνι.

### 9.4.1.4.4 Άέϋιά ιάηέέΰ Δάνάάάβαιάόά Όβεόηνί ιάόάοηίδρ

Άδν όζ όέέαιρ δν άάι όδΰη÷άέ άόόηάόηιέζιγίζ ηγέηηό άέα όζι άάέάοΰόόάόζ όνν όβεόηη ιάόάοηίδρ, άό ίάό άόέόηάδάβ ίά δάνγ÷νιά ιάηέέΰ άέϋηζ δάνάάάβαιάόά. Ίδνάβόά ίά όά ÷ηζόεινίέρρόάόά όάι ηαζην άέα όζι αζιέννάβά όνν άέέρ ηάό όβεόηη. Άί ηηβάόά δνδ άβιάέ έάόΰεζέζ άέα όζι δάνβδδϋόζ όάό ηδνάβόά ίά όά ÷ηζόεινίέρρόάόά έάέ έάόάόέάβαι.

Αδού οι δάνΥααέαια script αβιάε Υία οβέοηι λαόαοηιδπο ηΰοοαν (αν÷αβι GIF αέα ογι αέηβαάεα) αέα Υίαί αέοοδουP 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 | ppmtopgm | pgmentopbm | pbmtolj -resolution 300 \
  && exit 0 \
  || exit 2
```

Αιτοεάγαισ υο ανδ: λαόαοηΥδαε οι αν÷αβι GIF οα Υία αάιεει οηηηοου ογι anymap, αι οοια÷αβα οι λαόαοηΥδαε οα Υία οηηηοου ογι graymap, Υδαεοα οα Υία οηηηοου ογι bitmap, εαε οΥειο οι λαόαοηΥδαε οα αανΥία οοιααοΰ ια PCL αέα οη LaserJet.

Απ αβιάε οι αν÷αβι /etc/printcap ια ιέα εαοα÷ηηεογ αέα Υίαί αέοοδουP οιο ÷ηηοειηδιεαβ οι δανδΰι οβέοηι:

```
#
# /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:
```

Οι αειειοει script αβιάε Υία οβέοηι λαόαοηιδπο αανΥιυι troff αδυ οι ογοογια οοιε÷αειταοβαδ groff αέα οη αέοοδουP PostScript ια υηια 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 "$@"
```

Οι δανδΰι script ÷ηηοειηδιεαβ οΰεε οι lprps αέα ια ÷αειεοοαβ ογι αειειειυιβα ια οη αέοοδουP. Αι ι αέοοδουP οοαι οα δανΰεεγ δυηοα ουοα εα αβ÷αι, αειεεΥοδ, ÷ηηοειηδιεοαε οι αειειοει script:

```
#!/bin/sh
#
# pstf - Convert groff's troff data into PS, then print.
# Installed in /usr/local/libexec/pstf
#
exec grops
```

Απ αβιάε ς εαοα÷ηηεογ οιο ÷ηηεΰαοαε ια ηηοεΥοιοια οοι /etc/printcap αέα ια αιηαιηδιεοοιοια οι οβέοηι:

```
:tf=/usr/local/libexec/pstf:
```

Απ αβιάε Υία δανΥααέαια οιο ιαδ αδεοηΥδαε ια αέοοδποιοια δαεαει εηαεεα ογδ FORTRAN. Αβιάε Υία οβέοηι εαιηιο αέα FORTRAN αέα ιοιειραδοια αέοοδουP ιδηια ια αέοοδποαε εαοαεαβαι αδευ εαβιαη. Εα οι αεαοαοοδοιοια αέα Υίαί αέοοδουP οιο ηηΰαοαε teak:



```

# for the printer.
#
cleanup() {
    rm -f hpdf$$ .dvi
}

#
# Define a function to handle fatal errors: print the given message
# and exit 2. Exiting with 2 tells LPD to do not try to reprint the
# job.
#
fatal() {
    echo "$@" 1>&2
    cleanup
    exit 2
}

#
# If user removes the job, LPD will send SIGINT, so trap SIGINT
# (and a few other signals) to clean up after ourselves.
#
trap cleanup 1 2 15

#
# Make sure we are not colliding with any existing files.
#
cleanup

#
# Link the DVI input file to standard input (the file to print).
#
ln -s /dev/fd/0 hpdf$$ .dvi || fatal "Cannot symlink /dev/fd/0"

#
# Make LF = CR+LF
#
printf "\033&k2G" || fatal "Cannot initialize printer"

#
# Convert and print. Return value from dviIj2p does not seem to be
# reliable, so we ignore it.
#
dviIj2p -M1 -q -e- dfhp$$ .dvi

#
# Clean up and exit
#
cleanup
exit 0

```





### 9.4.2.1 Άίάñāĩđĩβςός Οάεβāũĩ Έāóāεβāāó

Όςι άĩũòςόά ΆάóέέΎò Ñðèĩβóáεò Άέοδδθũòβĩ, áđāĩñāĩđĩεβóáĩ óεò óāεβāāó έāóāεβāāó ĩā όςι έáóá÷βñέός sh (όςĩάβĩάέ “suppress header”) όđĩ άñ÷āβĩ /etc/printcap. Άέά ĩā άĩñāĩđĩεβóáĩ óεò óāεβāāó έāóāεβāāó āέά εΰđĩεĩĩ άέοδδθũòβ, áðεΰ áóāέñΎóóā όςι έέáĩũòςόά sh.

Άέĩγāóóáέ áγέĩεĩ, āĩ ĩñβæāóā;

óóέ áβĩάέ. ρóũò ÷ñāέáóóāβ ĩā đāñΎ ÷āóā Ύĩā öβέòñĩ áĩũāĩò áέá ĩā óóāβέāóā áĩóĩεΎò άñ÷έέĩđĩβςός όđĩĩ άέοδδθũòβ. Άāβ áβĩάέ Ύĩā đāñΎāáέāĩā öβέòñĩò áĩũāĩò áέá άέοδδθũòΎò óđĩāáóĩγò ĩā όĩĩ óýđĩ PCL όςò 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
```

Đñĩóáέĩñβóá όςι áέáāñĩβ đñĩò όĩ öβέòñĩ áĩũāĩò óόςι έέáĩũòςόά of. Άāβóā όςι áĩũòςόά Öβέòñā Áĩũāĩò áέá đāñέóóũđāñāò đέçñĩĩóĩñβāó.

Άāβ áβĩάέ Ύĩā đāñΎāáέāĩā άñ÷āβĩò /etc/printcap áέá όĩĩ άέοδδθũòβ teak áđũ όĩ đñĩçāĩγĩāĩ đāñΎāáέāĩā. Άĩñāĩđĩεβóáĩ óεò óāεβāāó έāóāεβāāó έáέ đñĩóεΎóáĩ όĩ đāñāđΎũ öβέòñĩ áĩũāĩò:

```
#
# /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:
```

Όβñā, ũóáĩ ĩé ÷ñβóóāò άέοδδθρĩóĩ āñāáóβāó óđĩĩ teak, έá đāβñĩóĩ έáέ ĩβā óāεβāā έāóāεβāāó áĩΎ āñāáóβā. Άĩ ĩé ÷ñβóóāò εΎέĩóĩ ĩā ñāāγĩóĩ ÷ñũĩĩ øΎ ÷ñĩóáò áέá óéò άέοδδθρσάέο óĩòò, ĩđĩñĩγĩ ĩā đāñāĩđĩāβóĩóĩ óéò óāεβāāó έāóāεβāāó áđĩóóΎέεĩĩóáò óéò āñāáóβāó óĩòò ĩā lpr -h. Άāβóā όςι áĩũòςόά ΆđέεĩāΎò Οάεβāũĩ Έāóāεβāāó áέá đāñέóóũđāñāò áđέéĩāΎò óĩò lpr(1).

**Όςĩāβũóς:** Όĩ **LPD** óóΎέĩáέ όĩ ÷āñāέòβñā áέέáāβò óāεβāāó (form feed) áĩΎóũò ĩāóũ ός óāεβāā έāóāεβāāó. Άĩ ĩ άέοδδθũòβò óáò ÷ñçóέĩĩđĩέāβ áέáóĩñāóέéũ ÷āñāέòβñā β áέĩεĩòεβā ÷āñāέòβñũĩ áέá όςι áέέáāβ óāεβāāó, đñĩóáέĩñβóá óā ĩā όςι έέáĩũòςόά ff όđĩ άñ÷āβĩ /etc/printcap.

### 9.4.2.2 έāā ÷ĩò Οάεβāũĩ Έāóāεβāāó

ĩāóũ όςι άĩñāĩđĩβςός óũĩ óāεβāũĩ έāóāεβāāó, όĩ **LPD** έá đāñΎāáέ ĩβā áđéĩβέç έāóāεβāā, ĩβā ĩεũέεçñç óāεβāā ĩā ĩāāΎέā āñΎĩāóá đĩò đñĩóáέĩñβæáέ όĩĩ ÷ñβóóς, όĩĩ óđĩεĩāέóóβ (host), έáέ όςι āñāáóβā. Άāβ áβĩάέ Ύĩā đāñΎāáέāĩā (ç kelly áέóýđũóá όςι āñāáóβā ĩā ũĩñā “outline” áđũ όĩĩ óđĩεĩāέóóβ rose):

```
k                11        11
k                1         1
```

```

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
                                     yyyy

```

```

                                     ll
                                     t          l          i
                                     t          l
oooo      u   u      ttttt      l          ii      n nnn      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      uuu 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

Ôi LPD ðñiðéÝðáé iéá áíðireP áëéáãðð óäëßááð (form feed) iãðÛ áðü áððü ði êãßiãñ Ýðóé þóðà ç ãñááóßá íá iãééíðóáé óá rÝá óäëßáá (ãêôüð áí Ý ÷ ãðã ðñiðäéíñßóáé ôçí ééáíüðçðá sF (suppress form feeds) äéá ôii äêðððððð ðóôí ãñ ÷ ãßi /etc/printcap).

Áí ðñiðéiÛðá, ôi LPD iðñiñß íá ððéÛiáé iéá iéññüðãñið iðéiðð èäðáéßáá. ðñiðäéíñßóðá sb (short banner) óôí ãñ ÷ ãßi /etc/printcap. Ç óäëßáá èäðáéßááð èá ïiéÛæáé óái áððð:



#### 9.4.2.4 Οάεβσάδ Εάσάεβσάδ σά Άέδδδθρσάεδ PostScript

¼δθδ δσνεάνÛσάισ δσνάδÛñ, σι **LPD** ιδñσβ ίσ σçιειρñσρσάε ίβσ σάεβσά εσσάεβσάδ σδειý εάειÝñσ, εσδÛεεçç σέα δειειýδ εέδδδθδÝδ. Ίε εέδδδθδÝδ PostScript, σδδσέÛ, σσί ιδñιýί ίσ δδθρσίρσ εσδσδεσβσί σδευ εσβσσñ, σδñÝñδ σδδρ ç σσίσσδσçσά σιρ **LPD** σέα δεδ σάεβσάδ εσσάεβσάδ σβίσε Û-ñçσδç σσ σδδρ ççί δσñβδδδσç.

ίσδ δñιρσρδδ σñυδιδ ίσ δσñÝ ÷ιρσάε σάεβσάδ εσσάεβσάδ σβίσε ίσ σçιειρñσρσάε σδυ εÛεσ σβεδñι ίσδσδñιδρδ εσε σι σβεδñι εσειÝñσ. Οά σβεδñσ εσ δñÝδσε ίσ σÝ ÷ιρσάε υδ δσñσίÝσñιδδ σι υññσ σιρ ÷ñρσδç εσε σιρ δδειεισέσδρ ρσδσ ίσ σçιειρñσρσάε ççί εσδÛεεçç σάεβσά εσσάεβσάδ. Οί ίσειÝέδçίá σδδρδ ççδ ίσευσρ σβίσε δυδ ίε ÷ñρσδσδ εσ εέδδδθρσίρσ δÛίδσ σάεβσά εσσάεβσάδ, σευιç εε σί σδιρδÝεειρσί ççί σñσσδσβσ σιρδ ίσ lpr -h.

ΆδεδñÝσδσ ίσδ ίσ σñσσδσρσίρσίá σδδρ çç ίÝεισñ. Οί σευειρδει script σÝ ÷σδσε δñσεδ δσñσίÝσñιδδ (σι υññσ ÷ñρσδç - login name, σι υññσ σιρ δδειεισέσδρ - host name, εσε σι υññσ σñσσδσβσδ) εσε σçιειρñσσβ ίβσ σδδρ σάεβσά εσσάεβσάδ 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
} forall

%
% That is it
%
restore
showpage
EOF

```

Ὅπῃ, ἐὰν ἴα ἀδὺ δά ὀβεῶνά ἰαῶάονιῶδὸ ἐὰν οἱ ὀβεῶνι ἐὰν Ἰῖο ἰδῖνιῖ ἴα ἐὰν Ἰῖοι οἱ script, ὄηρῶα ἄέα ἴα ἄεῖῖῖῖῖῖῖ ὄε ὄαεῖῖῖῖῖῖ, ἐὰν Ἰῖῖῖῖ ἄέα ἴα ἄεῖῖῖῖῖῖ ὄε ἄῖῖῖῖῖ ὄῖ ÷ ἡῖῖῖῖ. Ἀεῖῖῖῖῖ οἱ ὀβεῶνι ἰαῶάονιῶδὸ DVI ὄῖ ἄῖῖῖῖ ἴῖῖῖῖῖ, ἄεῖῖῖῖ ἄεῖῖῖῖῖ ἴῖ ἄέα ἴα ὄεῖῖῖῖῖ ἴεῖ ὄαεῖῖῖῖ ἄεῖῖῖῖῖ:

```

#!/bin/sh
#
# psdf - DVI to PostScript printer filter
# Installed in /usr/local/libexec/psdf
#
# Invoked by lpd when user runs lpr -d
#

```

```
orig_args="$@"

fail() {
    echo "$@" 1>&2
    exit 2
}

while getopts "x:y:n:h:" option; do
    case $option in
        x|y) ;; # Ignore
        n)    login=$OPTARG ;;
        h)    host=$OPTARG ;;
        *)    echo "LPD started `basename $0` wrong." 1>&2
              exit 2
              ;;
    esac
done

[ "$login" ] || fail "No login name"
[ "$host" ] || fail "No host name"

( /usr/local/libexec/make-ps-header $login $host "DVI File"
  /usr/local/bin/dvips -f ) | eval /usr/local/libexec/lprps $orig_args
```

Δανάοηρσάά δσδ οί οβέοηι δηΰδαέ ίά άίάέγσάέ οηί έβσάά δάναιΰόνσνί άέά ίά δηίσάειησάέ οί σφίά ÷ηρσάέ έάέ οδρειάέσδρ. Ϙ ΰέιαιρδ άίΰέοσδ άβίάέ δάνσνίέά έάέ άέά δά οδσέιέδα οβέοηά ίαδσάοηρδρδ. Οί οβέοηι έάέΰίρδ δάβηίάέ ΰίά άέάσηρδ άέάσνίάδέέσ οάδ δάναιΰόνσνί, (άάβσά οηί άίσδσάά Δσδ άιδέάγίρδ δά Οβέοηά).

¼δσδ άίάσΰηάά δηίηάιγίάά, ί δάνάδΰσνί ο÷άάέσνίσδ, άί έάέ δηάάίάδέέΰ άδέσδ, άδάίάηάιδρειάβ οηί άδέειάρ “δάναιδσάέσδ οάέβάσνί έάσάέβάάδ” (οηί άδέειάρ -h) οίρ lpr. Άί ίέ ÷ηρσάάδ άδέέοηίγί ίά ορσίρδ ΰίά άΰίσνί (ρ έβάά ÷ηρσάά, άί ÷ηρσάά δέδ οάέβάάδ έάσάέβάάδ), άάί έά οδΰη÷άέ οησδρδ άέά ίά άβίάέ άσδσ, άδσ οηί οδέαιρ δίρ έΰέά άέδσδσς ΰΰσδ οί οβέοησνί έά οδρσάγσάάέ έάέ άδσ ίέά οάέβάά έάσάέβάάδ άέά έΰέά άηάάσά.

Άέά ίά άδέοηΰσάά οδρδ ÷ηρσάάδ ίά άδάίάηάιδρειγί δέδ οάέβάάδ έάσάέβάάδ άίΰ άηάάσά, έά δηΰδαέ ίά ÷ηρσάέηδρεισάά οί οΰ÷ίάσά δίρ δάνρδσέΰσάά οδσνί άίσδσά Έάσάΰσδσς ίά Οάέβάάδ Έάσάέβάάδ: άηέάρ ίά άηΰσάά ΰίά οβέοηι άσσρδ δίρ ίά άίάέγάέ οηί οάέβάά έάσάέβάάδ δίρ άηίρσάάβσάέ άδσ οί **LPD** έάέ ίά έάσάέάδΰάέ ίέά PostScript ΰέαιρσ. Άί ί ÷ηρσάάδ οδάβέάέ ίέά άηάάσά ίά lpr -h, σσδά ίγδσ οί **LPD**, ίγδσ οί οβέοηι άσσρδ έά σδέΰρδ οάέβάά έάσάέβάάδ. Οά σέάδ δέδ ΰέέδ δάνέδδρσάέδ, οί οβέοηι άσσρδ έά άέάΰάέ οί έάβίάί άδσ οί **LPD** έάέ έά οδΰέίάέ οί έάδΰέέηί έρσέά PostScript οσνί άέδσδσδρ ρσάά ίά άέδδρσάάέ Ϙ οάέβάά έάσάέβάάδ.

Άί ΰ÷άά άέδσδσδρ PostScript ίά οάέηέάρ σγίάσς, ίδρσάβσά ίά έΰίάδσ ÷ηρσά οηί lprps, Ϙ ίδρσά οδρσάγσάάέ άδσ ΰίά οβέοηι άσσρδ, οί psof, οί ίδρσά έΰίάέ δά δάνάδΰσνί. Οηίάέρσάά δσδ οί psof άάί ÷ηρσάέ άέά δέδ οάέβάάδ έάσάέβάάδ.

### 9.4.3 Άέοδδρσάέο ίΰσδ Άέέδσγίρ

Οί FreeBSD οδρσάάέ δέδ άέδδρσάέο ίΰσδ άέέδσγίρ: ίδρσάβ ίά οδάβέάέ άηάάσάδ οά άδρσάέησδΰίρδ άέδδσδΰδ. Ϙ ΰίρ έά οηί άέδδρσάέδ άέδσδσδσδ άίάσ ΰηάάέ άίέέΰ οά άγί άέάσνίάδέέΰ δηΰάιάά:

- Δησάάσς οά άέδδσδρ σρσάάΰίρ οά άδρσάέησδΰίρ οδρειάέσδρ (host). Άάέάέσδΰσά ΰίά άέδδσδρ ίά οδρσάέηρσάέρσάέρ ρ δάνΰέέηί σγίάσς οά ΰίά οδρειάέσδρ. δάέά, ηδρσάά οί **LPD** άέά ίά άίάηάιδρειάβ Ϙ





### 9.4.3.2 Άέοδδρβράέο ιά ΟσίάΎοάέο Άέέδγίτ

Όδ ÷íŪ, ŷοάί ááñŪεάοά εŪñοά áέέδγίτ áέα áέοδδρβ, Ŷ ÷άοά οç áοίάοŷοçοά áδέεíτδ άγί áέάŷοάŷ: ç íβά áβίáέ δñíοñíβδός οίτ spooler (ç δέí áέñέáŪ Ŷέáíοç) áŷ ç Ūέέç áδέŪ οάδ áδέοñŶδáέ íá οδ Ŷέáíοά ááñŶíá íŶοŷ άδδρδ οάί íá ÷ñçοέíτδíεáβδά íέα οάέñέáŪ Ū δάñŪέέççç εγñά (ç οδçíŪ Ŷέáíοç). Άδδρ ç áŷοçοά δάñέáñŪοάέ δŷδ íá ÷ñçοέíτδíεáβδά οçí οδçíŪ Ŷέáíοç. Άέα οçí δέí áέñέáŪ Ŷέáíοç íδñάβδά íá áñάβδά δάñέοóŷοάñάδ δέçñíτíñβάδ οδçí δñíçáíγíáíç áŷοçοά Άέοδδρβδ ΆέάοάοçíŶίτ οά ΆδñáέñοçíŶίτδ ŌδñέáέοóŶδ.

Ç íñοŪ οίτ áñ ÷άβίτ /etc/printcap οάδ áδέοñŶδáέ íá íñβοάδά οç áέαόγíáάοç - οάέñέáŪ Ū δάñŪέέççç - δíτ εά ÷ñçοέíτδíεáβδά, έάέ (άí ÷ñçοέíτδíεáβδά οάέñέáŪ áέαόγíáάοç) οίτ ñδèíŷ baud, δέέάíγδ áεŶá ÷íτδ ñíŪδ, έάέοόάñŪόάέο áέα tabs, íάόάδñíτδ áέα ÷άñάέδŪñάδ íŶάδ áñáíŪδ, έάέ Ūέέά. ΆέέŪ ááí οδŪñ ÷άέ οñŷíτδ íá íñβοάδά íέα ογíáάοç οά áέοδδρβδ δíτ áέíγáέ οά εγñά TCP/IP Ū Ūέέí ογίτ áέέδγίτ.

Άέα íá οδάβέáδά ááñŶíá οά Ŷíá áέέδδάέŷ áέοδδρβ, ÷ñάέŪεάοάέ íá áíáδδγíáάο δñíáñŪíáοά áδέέíéíŷíβάδ δíτ íá έάέíγíοάέ áδŷ οβέδñά έάέíŶíτ έάέ οβέδñά íάόάδñíτδ. Άáŷ Ŷ ÷íτíá Ŷíá δŶοίέí δάñŪάέάíá: οί script netprint δάβñíáέ ŷέά οά ááñŶíá áδŷ οί standard input έάέ οά οδŶέáíέ οά Ŷíáí áέοδδρβ οσίáááíŶíτ οοί áβέδοí. Íñβáéíτá οοί netprint οί ŷñíá οίτ áέοδδρβ ÷δ δñŷοç δάñŪíáοñí, έάέ οίτ áñέéíŷ εγñάδ οόçí íδíβά οσίáŶάοάέ ÷δ ááγδáñç. Ōçíáέŷοάά δŷδ áδδŷδ í οñŷíτδ οδíοçñβáέέ íŷí áδέέíéíŷíβά íέαδ έάδáγέδíοçδ (áδŷ οί FreeBSD οοί áέοδδρβ). δñέéíβ áέέδδάέíβ áέοδδρβδ οδíοçñβáéíτí áíοβáññç áδέέíéíŷíβά, έάέ áβíáέ δñέγ δέέάíŷ íá áδέέοíáβδά íá áέíáοάέέáδοάβδά οά δñíóáñŪíáοά οίτδ (άέα íá áέŶá ÷άοά οçí έάóŪοόάοç οίτ áέοδδρβ, áέα έάόáíŶòñçοç áέοδδρβáŷí, έέδ.).

```
#!/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;
```

Íδñάβδά íá ÷ñçοέíτδíεáβδά áδδŷδ οί script οά áέŪοíñά οβέδñά. Άδ οδñέŶóíτíá δŷδ Ŷ ÷íτíá Ŷíáí áέοδδρβ áñáíŪδ Diablo 750-N οσίáááíŶíτ οοί áβέδοí. Í áέοδδρβδ áŶ ÷άάέ ááñŶíá δñíτ áέδγδŷοç οόçí εγñά 5100. Ōí ŷñíá οίτ áέοδδρβ οοί áβέδοí áβíáέ scrivener. Άáŷ áβíáέ οί οβέδñí έάέíŶíτ áέα οίτ áέοδδρβ:

```
#!/bin/sh
#
# diablo-if-net - Text filter for Diablo printer 'scrivener' listening
```



```
# /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/lfhp:\
    :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:
```

× ης οεί ηδ ιε βί οά ος εέ α ί ο ος sc, δ η έ α ί α ύ η ο ί α ος ÷ η β ος ο ύ η α ί ο ι ε β ί lpr -#, α έ έ ύ α α ί ύ ÷ ι ο ί α α έ υ ις ος α ο ί α ο ύ ο ο α ί α δ α η α ι δ ι α β ο ί ο α ο ι ο δ ÷ η β ο ο α δ ί α ο η ύ η ο ί ος α ί ο ι ε β ί lpr(1) δ ι ε έ ύ ο ο η ύ ο, β ί α α δ ι ο δ α β ε ι ο ί ο ι β α ε ί α η ÷ α β ι δ ι ε έ ύ ο ο η ύ ο ο α ί β α ι ι α α ε έ β α η α ο β α, υ δ υ δ α η β:

```
% lpr forsale.sign forsale.sign forsale.sign forsale.sign forsale.sign
```

Ό δ ύ η ÷ ι ο ί δ ι ε ε ι β ο η υ δ ι ε δ η υ ες ος α ο δ β ι ο ύ η α ί α η α ε β ι (ο δ ι δ α η ε έ α ί α ύ η ο ί α ο έ α έ ος δ α η β δ υ ος ί α ο ι α α η β ο ο α δ α) δ ι ο α β ο ο α α έ υ ε α η ι έ ί α α ί α η α ο ί β ο ο α δ α.

#### 9.4.4.2 Δ α η έ η β ε ι ο α ος ος Δ η υ ο α α ος ο α Α έ ο δ υ ο ύ ο

Ι δ η α β ο α ί α α έ ύ α ÷ α ο δ ι ε υ ο ι δ η α β ί α α έ ο δ ο δ β ι α ε ο α δ ι ε υ ι α έ ο δ ο δ υ ο β ÷ ης ο ε ι η δ ι ε β ι ο α ο ο ι ο δ ις ÷ α ί ε ο ι υ ο η η ύ α υ ι (groups) ο ι ο UNIX έ α έ ος ε έ α ί ο ος α rg ο ο ι /etc/printcap. Α δ ε ύ ο ι δ ι ε α ο β ο ο α ο ι ο δ ÷ η β ο ο α δ ι ο ε ύ ε α ο α ί α ύ ÷ ι ο ί δ η υ ο α α ος ο α έ ύ δ ι ε ι α έ ο δ ο δ υ ο β ο α ί ε α ο δ α ε η ε η ε ι ύ ις η ύ α α (÷ ης ο δ β ι), έ α έ ας ε β ο ο α α ο δ β ος η ύ α α ος ε έ α ί ο ος α rg.

¼ ε ι ε ÷ ÷ η β ο ο α δ ι ο α α ί α β ε ι ο ί ος ος η ύ α α (ο δ ι δ α η ε έ α ί α α η ύ η ο έ α έ ο ι ο root) έ α α ύ ÷ η ο α έ ο ι α έ υ ε ι ο ε ι ι β ι ο ί α: “lpr: Not a member of the restricted group” υ ο α ί δ η υ ο δ α ε ι υ ι ί α α έ ο δ ο δ β ο ι ο ο ο η α έ α α ÷ υ η α η α έ ο δ ο δ υ ο β.

¼ δ υ ο έ α έ ί α ος ε έ α ί ο ος α sc (δ α η έ η ε ο ι υ δ ι ε ε α δ ε β ι α ί ο ε α η ύ ο υ ι), έ α ÷ η α ε α ο δ α β ί α δ η υ ο α ε ι η β ο α ο α ος η rg ο ο ι ο δ α δ η α ε η ο ο ι ύ η ο δ ε υ η ι ο δ δ ι ο έ α ύ ÷ ι ο ί δ η υ ο α α ος ο ο ι ο δ α έ ο δ ο δ υ ο ύ ο α ο δ, α ί η η β α ε α ο α δ υ ο α ο δ υ α β ι α ε ο υ ο ο υ (α α β ο α ος α ί ο ος α Α έ ο δ ο δ υ ο ύ ο Α α ε α ο α ος ος ύ η έ ο α Α δ η α ε η ο ο ι ύ η ο δ Ό δ ι ε ι ε α ο δ υ ο).

Α έ α δ α η ύ α α ε α ί α, έ α α ο β ο ι ο ί α α έ α υ ε ι ο δ α έ α υ ε α ης ος δ η υ ο α α ος ο ο η α έ ο δ ο δ υ ο β rattan, α έ έ ύ υ η ι έ ÷ η β ο ο α δ ος η η ύ α α ο artists έ α ι δ η υ ι υ ι ί α ÷ ης ο ε ι η δ ι ε β ο ι ο ί ο η ι bamboo. Α η β α β ι α ε ο ι α η υ ο ο υ ί α ο /etc/printcap α έ α ο η ε υ η ι η 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/ttyd5:ms#-parenb cs8 clocal crtscts:rw:\
    :if=/usr/local/libexec/psif:\
```









¼οάι άβόοά Ύοίειέ ίά ÷ ñáρóaóá οίοδ ÷ ñρóοάδ áέα οέο áεοδδθρóaέο, áεοάεΎόοά οί δñúñáñáíá pac(8). ΆδεΎ ίάοάάβδóά οοίρ έάοΰείρ spool áέα οίρ áεοδδθρóaέο δίο έΎίάδóά έάοάιΎοñçóç έάέ δεçέοñíεíρρóοά pac. Έά áìοάίέοόάβ Ύίάο άδίεíεάοίυò ίά ÷ ñáρóaέο οά áρεΎñέα, υδθò áεΎδóά οόç οοίΎ ÷ áέα:

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

ΔάñάέΎοδ άβίάέ ίέ δάñΎίάοñíέ δίο áΎ ÷ áοάέ οί pac(8):

-Pprinter

Άέα δίεΎ printer ίά έΎίάέ άδίεíεάοίυ. Άόορ ç άδέεíρ áíοεáγáε ίυíρ áί οδΎñ ÷ áε ç δερñçδ áέαáññρ óçί έέαíυόçά af óοί /etc/printcap.

-c

Ôáίεñáβ οί άδίοΎεάοίά áíΎ έυóοίò áίòβ οçδ áεóáαçδέερδ óáίεíυìçóçδ ούí ÷ ñçóόρί.

-m

Άáñáβ οί υíñά οίο δθίεíεάοόρ οόά áñ ÷ áβά έάοάáñáορδ. Ιά áοόρ óçί άδέεíρ, í ÷ ñρóόçδ smith óοί δθίεíεάοόρ alpha άβίάέ í βάέíò ÷ ñρóόçδ ίά οίí smith óοί δθίεíεάοόρ gamma. ×ññò óçί άδέεíρ áοόρ, άβίάέ áέαοíñáδέεíβ ÷ ñρóόδ.

-pprice

Ôθίεíρáεάέ οέο ÷ ñáρóaέο ίά price (οέίρ) οά áρεΎñέα áíΎ óáεβáá ρ áíΎ θύáε áίòβ áέα óçί οέίρ áδύ οçί έέαíυόçά pc óοί /etc/printcap, ρ áεέερδ áγí óáίòδ (άδύ δñíáδέεíρ). Ιδñáβδóά ίά ññβóάδά υδ price ίέα οέίρ ίά ááεάάέΎ οçöβά (floating point).

-r

ΆίόέοδñΎόáε óçί óáεñΎ óáίεíυìçóçδ.

-s

Άçίεíοñááβ Ύίά áñ ÷ áβí άδίεíεάοίρϙ ούí έάοάίáδñρóáυí έάέ έάεáñβáεάέ óά δáñέα ÷ υíáíá ούí áñ ÷ áβυí έάοάáñáορδ.

name ...

Ôδθρίάέ δεçñíοíñβáο áíáοíñΎò ίυíρ áέα óά óδáεáεñεíΎίά name (ííυíáόά) ÷ ñçóόρί.

Óοίρ δñíáδέεááíΎí άδίεíεάοίυ δίο δáñΎááέ οί pac(8), áεΎδóά ούí áñέèíυ ούí οδδύíΎíυí óáεβááυí áíΎ ÷ ñρóόç άδύ οίοδ áεΎοíñíοδ δθίεíεάοόΎò. Άί, óοί ÷ ññí óáο, í δθίεíεάοόρδ ááí Ύ ÷ áε óçíáόβά (áέαόβ ίέ ÷ ñρóόδδ ίδíñíγί ίά ÷ ñçóέíυδίερóίοí ίδίεíρáθíοά εΎεíοí), áεοάεΎόοά óçί áíοίερ pac -m, áέα ίά áçίεíοñáρóάδά οίρ áεíεíοεí άδίεíεάοίυ:

Login	pages/feet	runs	price
andy	2.00	1	\$ 0.04







```

/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

```

### 9.5.3 Άοάβñάοç Άñāάόέπí

Άί áεεΰíαόά áñβìç áέα ίέα áñāάόβá ðíø áβ ÷ áοά áðíοάβεάε ðñíø áεóýðυόç, ίðññáβόά ίά οçí áοάέñÝόάόά áðu οçí έββόά áíáííðò ìá οçí áíοíεð lprm(1). Ιðññáβόά áέυìç ίά ÷ ñçóέííðíεðρóaόά οçí lprm(1) áέα ίά áοάέñÝόάόά ίέα áíáñāð áñāάόβá, áέεΰ ðεέάíúí εΰðíεí ìÝñíø οçò ίά áεοδδυέάβ Ýόέέ έάε áέέεðò.

Άέα ίά áοάέñÝόάόά ίέα áñāάόβá áðu οíí ðñíáðεέάáíÝíí áεοδδυόð, ÷ ñçóέííðíεðρóaόά ðñβόά οçí lprq(1) áέα ίά áññáβόά οíí áñέέìυ οçò. ðάέόά ðεçέðñíεíáðρóaά:

```
% lprm job-number
```

Άέα ίά áοάέñÝόάόά ίέα áñāάόβá áðu εΰðíεíí οδάεάεñεíÝíí áεοδδυόð, ðñíόεÝόόά οçí áðεéíáð -P. Ç áέυεíòεç áíοíεð áοάέññáβ οçí áñāάόβá ìá áñέέìυ 10 áðu οçí íøñΰ áíáííðò áέα οíí áεοδδυόð bamboo:

```
% lprm -P bamboo 10
```

Ç áíοíεð lprm(1) Ý ÷ áέ ìáñέέÝò οοίòñāýόάέο:

**lprm -**

Άοάέññáβ υεάò οέο áñāάόβáò (άέα οíí ðñíáðεέάáíÝíí áεοδδυόð) ðíø áíðεíοί οά áοΰò.

**lprm user**

Άοάέññáβ υεάò οέο áñāάόβáò (άέα οíí ðñíáðεέάáíÝíí áεοδδυόð) ðíø áíðεíοί οοίí ÷ ñβόδç (user). Ι òðññ ÷ ñβόδçò (superuser) ίðññáβ ίά áοάέñÝόάέ áñāάόβáò ΰέεùí ÷ ñçóόβí, áοάβò ίðññáβόά ίά áοάέñÝόάόά ìυíí οέο áέέÝò οάο.

**lprm**

Ç áíοíεð lprm(1) ÷ ùñβò áñέέìυ áñāάόβáò, υíñá ÷ ñβόδç, P - ðíø áìöáíβæάοάέ οόçí áññáð áíοíεβí, áοάέññáβ οçí òñÝ ÷ íοάά áíáñāð áñāάόβá οοίí ðñíáðεέάáíÝíí áεοδδυόð, áí áíðεάε οά οΰò. Ι òðññ ÷ ñβόδçò (superuser) ίðññáβ ίά áοάέñÝόάέ íðíεάáððíοά áíáñāð áñāάόβá.

Άέα ίά áíοεÝρóaόά οά εΰðíεíí οοαεάεñεíÝíí áεοδδυόð áíοβ οíø ðñíáðεέάáíÝíí, áðεΰ ÷ ñçóέííðíεðρóaόά οçí áðεéíáð -P ìá οέο ðáñáðΰíυ οοίòñāýόάέο. Άέα ðáñΰááεάíá, ç áέυεíòεç áíοíεð áοάέññáβ υεάò οέο áñāάόβáò οíø òñÝ ÷ ííòð ÷ ñβόδç áðu οçí íøñΰ áíáííðò ðíø áεοδδυόð rattan:

```
% lprm -P rattan -
```

**Όçíáβυόç:** Άί áñāΰεάόόά οά ðáñεάΰέεíí áέέóýíò, ç lprm(1) εά οάο áðεòñÝθάέ ίά áοάέñÝόάόά áñāάόβáò ìυíí áðu οíí òðíεíáεóðð ðíø οέο Ý ÷ áοά οόάβεάε, áíáíΰñόçòά áí í áεοδδυόðò áβíáε ðñíοάΰόέííò έάε áðu ΰέέíòð òðíεíáεóóÝò. Ç áέυεíòεç áíοíεð áðεάάέéíýáε áεñέáðρò áοδύ οí ÷ áñáέδçñέóóέéυ:

```
% 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
```

### 9.5.4 ΔΥñά άδϋ όϊ Άδϋϋ Έάβιáñ: Δáñέόóϋόáñáò ΆδέειãÝò Άέôýðϋόçò

Ç áιόιεP lpr(1) δδθιόδçñβæáé ιέα áêÛιá áδέειãπρ ιέα όιí Ýéãã÷ι ιññοιδθιβçóçò éáειÝíϋ, ιáόáοñιδθρò áñáόέεπρ ιέα ΰέεϋι ιññοπρ áñ÷áβιí, δáñááϋáθρò δτεεáδθεπρ áíόéãñÛóϋι, ÷áέñέόιíϋ áñááόεπρ, éáé ΰέéá. Ιέ áδέειãÝò áδóÝò δáñέéãñÛóϋιόáé óόçι δáñιγόá áíϋόçόá.

#### 9.5.4.1 ΆδέειãÝò ιññοιδθιβçóçò éáé ιáόáοñιδθρò

Ιέ áέϋειϋέáð áδέειãÝò όçò lpr(1) áéÝã÷ιόι όçι ιññοιδθιβçóçò όϋι áñ÷áβιí όçò áñááόβáð áέóýðϋόçò. ×ñçóéιιδθιέPόóá όέò áι ç áñááόβá óáð ááι δáñέÝ÷áé áδϋϋ éáβιáñ P áι áδέéδιáβóá íá ιññοιδθιέPόóáð áδϋϋ éáβιáñ áéáιÝóιò όιò áñááéáβιò pr(1).

Άέá δáñÛááéáιá, ç áέϋειϋέð áιόιεP όδθθιáé Ýíá áñ÷áβιí DVI (άδϋ όϊ óýόçιá óόιé÷áέιéáόβáð T<sub>E</sub>X) ιá ϋíñá *fish-report.dvi* óόιí áέóδδϋóδP ιá ϋíñá bamboo:

```
% lpr -P bamboo -d fish-report.dvi
```

ΆóóÝò ιέ áδέειãÝò áόáñιϋéιíόáé óá éÛéá áñ÷áβιí όçò áñááόβáð, éáé Ýόóé ááι ιδθιáβóá íá áιáιβιáðá (áð διγíá) áñ÷áβá DVI éáé ditroff ιáæβ óόçι βáéá áñááόβá. Άδθθρò óóáβέóá óá áñ÷áβá óáι áéáοιñáóééÝò áñááόβáð, ÷ñçóéιιδθιέPόóáð áéáοιñáóééÝò áδέειãÝò ιáόáοñιδθρò áéá éÛéá áñááόβá.

**Όçιáβϋόç:** ¼éáð áδóÝò ιέ áδέειãÝò áέóϋò όçò -p éáé όçò -T áðáéόιγí ááéáóáóόçιÝíá öβέóñá ιáόáοñιδθρò áéá όιí áέóδδϋóδP δñιιñέόιíϋ. Άέá δáñÛááéáιá, ç áδέειãP -d áðáéóáβ όι öβέóñι ιáόáοñιδθρò DVI. Ç áíϋόçόá Öβέóñá ιáόáοñιδθρò áβιáé δáñέόóϋόáñáò éáδδθιíÝñáéáð.

-c

Άέóδθθιáé áñ÷áβá cifplot.

-d

Άέóδθθιáé áñ÷áβá DVI.

-f

Άέοδδθρóaέ άñ ÷ άΒά έάει Ýñò FORTRAN.

-g

Άέοδδθρóaέ άάάñÝία ó ÷ άάΒάόçò (plot).

-i *number*

Άέοδδθρóaέ όçí Ýñäí ìá áóí ÷ P *number* όόçεπί. Άί δάñάέάβθάòά òí *number*, ç áóí ÷ P έά άβίαέ 8 όòPεάò. ΆòòP ç άδέείäP άìòέάýάέ ìüñ ìá ìέóíÝία òβέòñá ìάóáòñìòPò.

**Όçíaβüóç:** ìçí òíðìεάòáòáòá έáíü äéÛóòçíá ìάóáý òïò -i έάέ òïò άñέέìüý.

-l

Άέοδδθρóaέ άάάñÝία έάειÝñò έάóÛ äñÛìá (literal), óðìðáñέέáíáÛñíóáò έάέ òïò ÷ άñάέòPñáò äéÝä ÷ ìò.

-n

Άέοδδθρóaέ άάάñÝία ditroff (άάάñÝία troff áíäíÛñòçòά áðü όç óòóέάòP).

-P

Ûñòìðìεάò òí áðeu έάβìäñ ìá όçí pr(1) ðñέí íá òí äéòòðρóaέ. Άάβòá όçí pr(1) äéá ðáñέóóüòáñáò ðεçñìüòñβáò.

-T *title*

×ñçóέìðìεάò òí *title* όόçí έάóáέβáá òïò pr(1) áíòβ äéá òí üññá άñ ÷ άβìò. ΆòòP ç άδέείäP άδέéäÛ ìüñ üóáí ÷ ñçóέìðìεάβóáέ ìá όçí άδέείäP -p

-t

Άέοδδθρóaέ άάάñÝία troff.

-v

Άέοδδθρóaέ άάάñÝία ñÛóóáñ.

Άäp άβίαέ Ýία δάñÛäééäíá: áòòP ç áíòìεP äéòòðρóaέ ìεá εñòÛ ìñòìðìεçíÝíç Ýέäìóç όçò óáεβááò äìçεάβáò ls(1) óðìð ðñìáðéέéäñÝñ äéòòðùòP:

```
% zcat /usr/share/man/man1/ls.1.gz | troff -t -man | lpr -t
```

Ç áíòìεP zcat(1) áðìóòìðéÝäéé òñ ðçäáβì ερäééá όçò óáεβááò äìçεάβáò ls(1) έάέ òñ ðáñíÛäé óόçí áíòìεP troff(1), ç ìðìβá òñ ìñòìðìεάβ έάέ äçìεìòñááβ óόçí Ýñäí όçò άάάñÝία GNU troff, óá áðìóòÝέέéé óόçí lpr(1), ç ìðìβá ìá όç óáεñÛ όçò áðìóòÝέέéé όçí άñááóβá óòì **LPD**. ΆðäéäP ÷ ñçóέìðìεPóáíá όçí άδέείäP -t óòì lpr(1), ì spooler, έáóÛ όç äéÛñέáéá όçò äéóýðùóçò, έá ìάóáòñÝθáέ όçí Ýñäí GNU troff óá Ýία óýðì άάάñÝñí έáóáñçòü áðü òñ ðñìáðéέéäñÝñ äéòòðùòP.











¼οάι ι άέοδδθρσάέο εάιáΰίάέ LF

Ίά άέοδδθρσάέο CR + LF

Όδΰñ ÷ ιοι άέΰοιιιέ οñυδιέ άέα ίά άδέοάσ ÷ εάβ άδου:

- ×ñçóειιθιέρσάά οά δέρθεόñά ñýειέσçð οιο άέοδδθρσάέο ρ οιι δβίάέα άεΎá ÷ ισ άέα ίά άέεΰίάοά οιι οñυδι ίά οιι ιθιβι άñιçίάýάέ άοιιýð οιοð ÷ άñάέορñάο ι άέοδδθρσάέο οάο. Όοιáιρθεάοάβσά οι άá ÷ άέñβάει ÷ ñρσçð οιο άέα ίά άάβσά θυò ιθιñάβ ίά άβίάέ άδου.

**Όçιáβυόç:** Άί Ύ ÷ άδά έάέ ΰέεά έάέοιθñάέέΰ οοι όýόόçιá οάο άέοδυò άδυ οι FreeBSD, δέέάιιι ίά ÷ ñάέάοόάβ, υόάι οά ÷ ñçóέιιθιέάβσά, ίά άδάίáñθέι/βσάσά οιι άέοδδθρσάέο ρσάά ρόσά ίά άñιçίάýάέ άέάοιñάόέέΰ οιοð ÷ άñάέορñάο CR έάέ LF. Όόçι δáñβδθυόç άδδρ, βσούò άβίάέ έάέýοάñι ίά δñιθέιρσάάά έΰθιέά άδυ οέο έýόάέο θιθ άέιέιθέιýι.

- Ίιáçáυò (driver) όçð οάέñέάέρδ άñάιιρδ οιο FreeBSD ιθιñάβ ίά ίάόάοñΎθάέ άδουιáόά άδυ LF οά CR+LF. Όοόέέΰ, άδου άιρθεάýάέ *ιιιι* οά οάέñέάέΎð έýñάο. Άέα ίά άίáñáιθιέρσάάά άδδρ όçι έάέοιρñάβ, ÷ ñçóέιιθιέρσάά όçι έέάιιιόçσά ms# έάέ ιñβσάά όçι έάόΰόόάόç έάέοιρñάβάο onlcr οοι άñ ÷ άβι /etc/printcap άέα οιι άέοδδθρσάέο.
- Όόάβέσά Ύίá *εùäέέυ άέάόδáρδ* (escape code) οοιι άέοδδθρσάέο ρσάά ίά ÷ άέñβάέσάέ δñιούñέιΰ οιοð ÷ άñάέορñάο LF ίά άέάοιñάόέέυ οñυδι. Όοιáιρθεάοάβσά οι άá ÷ άέñβάει ÷ ñρσçð οιο άέοδδθρσάέο οάο άέα οιοð έρθεέέο άέάόδáρδ θιθ οθιόόçñβειιόάέ. ¼οάι άίάέάέýσάά οιι έάοΰέεçει, ίάόάοñΎσάά οι οβέοñι έάειΎιιθ ρσάά ίά οόΎέίάέ θñρσά οιι έυάέέυ, έάέ Ύθάέόά όçι άñάάόβά οοιι άέοδδθρσάέο.

Άαρ άβίάέ Ύίá δáñΰάάέáιá οβέοñιθ έάειΎιιθ άέα άέοδδθρσάέο θιθ έάόάέάάβιιθι οιοð έυάέέιýð άέάόδáρδ PCL όçð Hewlett-Packard. Άόδυ οι οβέοñι έΰίάέ οιι άέοδδθρσάέο ίά ÷ άέñβάέσάέ οιοð ÷ άñάέορñάο LF υò LF έάέ CR. θάέόά άθιόόΎέέάέ όçι άñάάόβá, οόΎέñιιόάο οοι οΎέιθ όçð Ύίá ÷ άñάέορñά άέέάáρδ οάέβáάο (form feed) ρσάά ίά άβίάέ ουόσρ άίááυάρ όçð οάέάόδáβάο οάέβáάο. Όι οβέοñι άόδυ έά δñΎθάέ ίά άιρθεάýάέ ίá ó ÷ ááυι υέιρδ οιοð άέοδδθρσάέο όçð 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
```

Άαρ άβίάέ Ύίá δáñΰάάέáιá άέα οι /etc/printcap άιυò οθιέιíάέόσρ ίá υíñá orchid. ÷ άέ Ύίá ιιιι άέοδδθρσάέο όόçι δñρçð δáñΰέεççç έýñά οιο, Ύίá Hewlett Packard LaserJet 3Si ίá υíñá teak. ×ñçóέιιθιέάβ οι δáñáδΰιυ script υò οβέοñι έάειΎιιθ:

```
#
# /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:
```



```
rattan|line|diablo|lp|Diablo 630 Line Printer:\  
:sh:sd=/var/spool/lpd/rattan:\  
:lp=/dev/lpt0:\  
:if=/usr/local/libexec/if-simple:\  
:lf=/var/log/rattan.log
```

Η παροχή υπηρεσιών εκτύπωσης (log) (όχι απευθείας στο, /var/log/rattan.log) είναι διαθέσιμη μέσω του λογισμικού λογιστικής εκτύπωσης, υπηρεσιών εκτύπωσης ή υπηρεσιών εκτύπωσης.

Αν θέλετε να χρησιμοποιήσετε το LPD, ορίστε το **LPD** = true στο αρχείο /dev/console.



```
# kldload linux
```

Áí εÝεάðά ìά Ý ÷ áðά ðÛíóá áíáñáðìéçìÝíç ðç óðìááóóóçðά ìá Linux, ðúðά εά ÷ ñáεάóðáß ìά ðñìóεÝóáðά ðç ðáñáεÛò ñáñáñP óðì /etc/rc.conf:

```
linux_enable="YES"
```

Ç áíóìεP kldstat(8) ìðìñáß ìά ÷ ñçóεììðìéçεáß áεά ìά äεää ÷ εáß áí ðì KLD áßìáε ðìñòùìÝíí:

```
% kldstat
Id Refs Address      Size      Name
  1     2 0xc0100000 16bdb8   kernel
  7     1 0xc24db000 d000     linux.ko
```

Áí áεά εÛðìéí εuáí ááí εÝεάðά P áá ìðìñáßðά ìά ðìñòðóáðά ðì KLD, ðúðά ìðìñáßðά ìά óðìáÝóáðά óðάóεéÛ ðçì ððìóðñéíç áεðäεÝóεìú ðìò Linux óðìí ððñPíá ìá ðì ìά ðñìóεÝóáðά ðçì áðεéíáP options COMPAT\_LINUX óðì áñ ÷ áßúí ñðεìßóáúí ðìò ððñPíá. Óðç óðìÝ ÷ áεά ìðìñáßðά ìά ááεάóáóðPóáðά ðìí ìÝì ððñPíá ùðò ðáñεáñÛóáóáε óðì ÊäöÛεάεί 8.

## 10.2.1 ÁäεáóÛóóáóç ðùí Linux Runtime Libraries

Áðòù ìðìñáß ìά áßìáε ìá äýì ðñúðìòð. Áßðά ìá ðç ÷ ñPóç ðìò linux\_base-fc4 port, P ìá ÷ áéñìεßíçðç áäεáóÛóóáóç ðìòð.

### 10.2.1.1 ÁäεáóÛóóáóç ìÝóò ðìò linux\_base Port

Áðòùð ãßìáε εáóÛ ááíεéP ññεíáßá ì áðεíεúðáñìò ðñúðìò áεά ðçì áäεáóÛóóáóç ðùí runtime libraries. Áßìáε ç ßáεá äεááεéáóá áäεáóÛóóáóç ðìò áεíεíðεáßðáε εáε áεά ìðìéíáPðìòá Ûεéí port áðù ðç ÓðεéíáP ðùí Ports (/usr/ports/). ÁðεÛ εÛíóá ðì ðáñáεÛò:

```
# cd /usr/ports/emulators/linux_base-f10
# make install distclean
```

**Óçìáßúóç:** Áí ÷ ñçóεììðìéçεáßðά εÛðìéá Ýεáíóç ðìò FreeBSD ðñéí ðçì 8.0, εά ðñÝðáε ìά áäεáóáóðPóáðά ðì port emulators/linux\_base-fc4 áíóß áεά ðì emulators/linux\_base-f10.

Éá ðñÝðáε ðñá ìά Ý ÷ áðά εáñíéεP óðìááóóóçðά ìá áεðäεÝóεìά ðìò Linux. ÌáñεéÛ ðñíáñÛìáðά ðáñáðñéíýíðáε ùðε ìé áεáééíεPεáð óðóðPíáðìò (system libraries) ááí áßìáε óçç ðáεáðóáßá ðìòð Ýεáíóç. ÁáíεéÛ ùòð, áðòù ááí áðìóáεáß εáíÝìá ðñúáεçìá.

**Óçìáßúóç:** ìðìñìýì ìά ððÛñ ÷ ìòì ðìεεáðεÝò áεäúóáεò ðìò emulators/linux\_base, ðìò ìά áíðεóðìé ÷ ìýì óðεò áεáóìñáðéεÝò áεäúóáεò ðùí áεáíñPí Linux. Éá ðñÝðáε ìά εÛíáðά áäεáóÛóóáóç ðùí ports ðìò ðñìáðáεðìýíðáε áðù ðεò áðáñìáÝò Linux ðεò ìðìßáð εÝεáðά ìά áäεáóáóðPóáðά.



```
/compat/linux/lib/libc.so.4.6.27
/compat/linux/lib/libc.so.4 -> libc.so.4.6.27
```

êáé äñáßðá íéá äðáñííäð ç ðñíßá æçðÛäé íéá íäüðáñç Ýéäíôç ðÛóð ðïð ldd:

```
libc.so.4 (DLL Jump 4.5p126) -> libc.so.4.6.29
```

Áí ç äéäðñÛ ôçð Ýéäíôçð óðí ðäêäððáßá øçðßí äßíáé ðñí ðßáð ð äÿí äêäüðáíí, ðüðä ðçí óáð äðáð÷íéáß ç áíðéäñáðð ðïð /lib/libc.so.4.6.29, äéäðß ðí ðñüäñáííá éá ðñÝðäé íá ðñÛ÷äé éáíííéêÛ éáé ðä ôç èßäí ðáéäéüðáñç Ýéäíôç. Ðáñ' ðéá äððÛ, áí èÛéäðä, ðñíáßðá íá áíðéäðáðððáðä ðí libc.so éáé Ýðóé éä Ý÷äðä ðí ðáñáéÛðð:

```
/compat/linux/lib/libc.so.4.6.29
/compat/linux/lib/libc.so.4 -> libc.so.4.6.29
```

**Óçíäßùðç:** Ì ðç÷áíéóíüð ðñí óðíäíééêðí óðíäÛóíüí ÷ñáéÛæäðáé ðñí äéá ðéð äðáñííäÛð ðïð Linux. Ì runtime linker ðïð FreeBSD êíéðÛäé ðñíð ðïð äéá ðéð ðéí ðñüððáðð äêäüðáéð ðñí äéäééíçêðí éáé Ýðóé ää ÷ñáéÛæäðáé íá óáð äðáð÷íéáß.

### 10.2.2 ÄêäðÛóéíá ôïð Linux ELF Binaries

Óá ELF binaries ÷ñáéÛæíðáé ðñíééÛð ðñíÛð Ýíá áéüíá äðíá, ðí “branding”. Áí ðñíððáðððáðä íá ðñÛíðä Ýíá äêðäÛóéíá ELF ÷ññßð branding, ðüðä éä óáð äíðáíéóðáß ðí ðáñáéÛðð óðÛéíá:

```
% ./my-linux-elf-binary
ELF binary type not known
Abort
```

Äéá íá äíçèððáðä ðñí ððñðíá ðïð FreeBSD íá ðä÷ññßðáé Ýíá ELF ðïð FreeBSD áðü Ýíá ðïð Linux, ÷ñçðéíðíéððáðä ôçí áíðíèð brandelf(1).

```
% brandelf -t Linux my-linux-elf-binary
```

To GNU toolchain, ðñüä ðñüäñáííá GNU, ðñðíéäðáß ðéÛí äððñíðáðä ðá éáðÛéççéá ÷áñáéðçñéóðéêÛ óðá äêðäÛóéíá ELF, äðñÛð ðí ðáñáðÛíü äðíá éä ÷ñáéÛæäðáé ðñí éáé ééäüðáñí óðí ðÛéíí.

### 10.2.3 ÄêäðÛóéíá íéáð Óð÷áßáð Linux RPM Äðáñííäðð

Óí FreeBSD äéäéÛðáé ôçí äéèð ðïð äÛðç ääññÛííü äéá ðá ðáéÛðá, ç ðñíßá ÷ñçðéíðíéáßðáé äéá ðéá ðá ports (éáé äéá äððÛ ðïð ðñíÛñ÷íðáé áðü ðí Linux). Äéá ðí èüñí äððü, ç äÛðç ääññÛííü Linux RPM ääí ÷ñçðéíðíéáßðáé (ääí ððíðçññßæäðáé).

Áí ðóðüóí ÷ñáéÛæäðáé íá äêäðáððððáðä íéá ððíéääððíðä äðáñííäð ðïð Linux ðñí äáðßæäðáé óá ðáéÛðí RPM, ðñíáßðá íá ðí äðéðÛ÷äðä ðñí ðáñáéÛðð ðññðí:

```
# cd /compat/linux
```

```
# rpm2cpio -q < /path/to/linux.archive.rpm | cpio -id
```

×ñçóéíðíéðóáä ôçí brandelf(1) ñéá íá ôððíðíéðóáää êáðÛëëçéá óá äêðäëÝóéíä (ü÷é óéð äéáëéèèðéäð!) ùð äóáñíñäÝð Linux. Äáí éá ìðññáßðá íá áðäáëéáóáóððóáðá óéð äóáñíñäÝð ìä éáéáññü ðññðí, áëëÛ éá ìðññÝóáðá íá êÛíñáðá óéð äíëéñÝð ðíð äðëéðñíáßðá.

### 10.2.4 Ñýèìéóç ôíð Hostname Resolver

Áí ôí DNS ää äíðëäýáé ð áí óáð äíðóáíßæäðáé ôí ðáññéÛðù óóÛëíä:

```
resolv+: "bind" is an invalid keyword resolv+:
"hosts" is an invalid keyword
```

Ëá ðññéáóóáß íá ñðëìðóáðá ôí /compat/linux/etc/host.conf þóðá íá ðáññéÝ÷áé:

```
order hosts, bind
multi on
```

Ç óáéñÛ ääþ äçèþíáé ùðé áñ÷ééÛ äéÝñ÷áðáé ôí áñ÷áßí /etc/hosts éáé óðç óðíÝ÷áé ì DNS server. ¼ðáí ôí /compat/linux/etc/host.conf äáí áßíáé äéáëÝóéí, íé äóáñíñäÝð Linux ðñçóéíðíéýí ôí /etc/host.conf ôíð FreeBSD éáé ðáññäðíéýíðáé ùðé ç óýíðáíç ôíð áñ÷áßíð äáí áßíáé óóððð. Ëá ðññÝðáé íá áóáéñÝóáðá ôçí áíáíññÛ óóí bind áí äáí Ý÷áðá ñðëìðóáé Ýíá name server ìÝðù ôíð /etc/resolv.conf.

## 10.3 Äêðäëéóðíðíóáð ðí Mathematica®

Áíáíðèçéä äéá ôí Mathematica 5.X áðñ ôí Boris Hollas.

Ôí êáßíáñ áððü ðáññéññÛðáé ôç äéáäééáóáß ääêáðÛðóáóçð ôçð Ýéäíðçð Linux ôíð **Mathematica 5.X** óá Ýíá óýóðçíá FreeBSD.

Ïðññáßðá íá äáññÛðáðá ôçí éáñíééð ð ìáççðééð Ýéäíðçð ôíð **Mathematica** ñéá Linux, áðäðëáßáð áðñ ôç Wolfram óóí <http://www.wolfram.com/>.

### 10.3.1 Ôí Ðñññáñíä ÄêéáðÛðóáóçð ôíð Mathematica

Áñ÷ééÛ, éá ðññÝðáé íá ðáßðá óóí FreeBSD ùðé óá äêðäëÝóéíä ñéá Linux ôíð **Mathematica** êÛíñðí ðñþç ôíð Linux ABI. Ì äóëñüðáññð ðññðíð äéá íá ôí êÛíñáðá áððü áßíáé íá ññðóáðá ôíð óýðí ôíð ELF ùð Linux óá ùéäð óéð äóáñíñäÝð ðíð äáí áßíáé ðäç branded, êÛíñðáð ðñþç ôçð áíðíèðð:

```
# sysctl kern.fallback_elf_brand=3
```

Áððü éá êÛíñáé ôí FreeBSD íá ððíèÝóáé ùðé óá äêðäëÝóéíä ELF ðíð äáí áßíáé branded, êÛíñðí ðñþç ôíð Linux ABI éáé Ýóóé éá ìðññáßðá íá ðññÝíáðá ôí ðñññáñíä ôçð ääêáðÛðóáóçð áðäðëáßáð áðñ ôí CDROM.

Ôþñá, áíðéññÛðá ôí áñ÷áßí MathInstaller óóíí óéëçññü óáð äðóéí:

```
# mount /cdrom
# cp /cdrom/Unix/Installers/Linux/MathInstaller /localdir/
```



οά αόου, έάε ίά άεεΎίάοά οίί άνεέιυ ούί άνάιιάοιόάεήί οόζ δñþç άνάιìþ. ΆίάεέάεόεέΎ, άβίάε οοίþεùδ άñεάου ίά άεόάεΎόάά άδþð οçí άίόιεþ mkfontdir(1) ιΎόά οοίί έάόΎεϊάι δίω Ύ÷άοά άίόεάñΎθάέ οέδ άñάιιάοιόάεήΎδ.

Ί άγύόάñìδ οñυδìð άβίάε ίά άίόεάñΎθάά οίìδ δάñάδΎíυ έάόάεüáìðδ ιΎόά οοί /usr/X11R6/lib/X11/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
```

Όþñά δñιόεΎόάά οίìδ ίΎíðδ έάόάεüáìðδ ιά οέδ άñάιιάοιόάεήΎδ οοί font path:

```
# xset fp+ /usr/X11R6/lib/X11/fonts/X
# xset fp+ /usr/X11R6/lib/X11/fonts/MathType1
# xset fp rehash
```

Άί ÷ñçοέιιðιεάβóά οί **Xorg**, ιðñάβóά ίά οίñþíáðά οέδ άñάιιάοιόάεήΎδ αóðΎδ αóðυιáóά, δñιόεΎόιίόάδ οίìδ ίΎíðδ έάόάεüáìðδ οοί άñ÷άβι xorg.conf.

**Όçιáβύοç:** Άέά οίί άίòδçñάðçðþ **XFree86**, οί άñ÷άβι ñðεìßóáυί άβίάε οί xF86Config.

Άί *ááí* Ύ÷άοά þäç Ύίάί έάόΎεϊάι ιά οί υñíá /usr/X11R6/lib/X11/fonts/Type1, ιðñάβóά ίά άεεΎίάοά οί υñíá οίò MathType1 áδυ οί δάñάδΎíυ δάñΎάέάιá óά Type1.

## 10.4 Άεέάεέοόþíóáδ οί Maple™

ΌδίαέοοίñΎ οίò Aaron Kaplan. Άð÷άñέóðβáδ οοίí Robert Getschmann.

Οί **Maple™** άβίάε ιβá άìðñέέþ άóάñíáþ ιάεçιάóεéþí δάñυíεά ιά οί **Mathematica**. Έά δñΎðάε ίά άάíñΎóάά οί εϊάεοίεέυ áδυ οί <http://www.maplesoft.com/> έάε οόç οοίΎ÷άέά ίά έΎíáðά άβðçóç áέά ιέά Ύάάέά ÷ñþóçð. Άέά ίά άάέάóáóðþάóά οί εϊάεοίεέυ οοί FreeBSD, áείεíðεþóáά óά δάñάέΎòυ áðéΎ άþιáά.

1. ΆέόάεΎόάά οί **INSTALL** shell script áδυ οί ιΎóι άάεάóΎóóάóçð δίω Ύ÷άοά. ΆðέεΎίòά “RedHat” υòάί άñυðçεάβóά áδυ οί δñυάñάιίά άάεάóΎóóάóçð. Ί ðððέεüð έάόΎεϊάιð άβίάε ί /usr/local/maple.
2. Άί ááí Ύ÷άοά άάíñΎóάε áεüç εΎðιεά Ύάάέά áέά οί **Maple**, άάíñΎóάά ιβá áδυ οί Maple Waterloo Software (<http://register.maplesoft.com/>) έάε άίόεάñΎθóά οί άñ÷άβι δίω έά óάð άíεάβ οοί /usr/local/maple/license/license.dat.
3. Άάέάóáóðþάóά οί **FLEXlm** license manager áέðάεþíóáδ οί **INSTALL\_LIC** shell script οί ιðιβá δάñΎ÷άόάε ιάæβ ιά οί **Maple**. Άþóάά οί άάóέεü υñíá οίò ððιεíáεóðþ óáδ οί ιðιβι áðάέóάβóάε áδυ οίί άίòδçñάðçðþ áέά÷άβñεóçð ðυί άάάέþí (license server).
4. ×ñçοέιιðιεάþóάά οί δάñάέΎòυ patch οοί άñ÷άβι /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 -----

```

Óçìäéðóä üðé ðäðÛ ôï "FreeBSD" |\ äáí ðñÿðäé íá àìáíðæäðäé Ûëëï éáñü äéÛóçíä.

Ôï patch áðüü ðäçäáð ôï **Maple** íá áíááññðóäé ôï "FreeBSD" óáí ÿíá óýóçíä Linux. Ôï bin/maple shell script éäéäð ôï bin/maple.system.type shell script, ôï ððíðí ðä ôç óáéñÛ ôïð éäéäð ôçí áíôïð ùname -a ðñíäéÿíô íá áíôïðéóðäð ôï ùñíá ôïð éäéóïñäééÿ óóóððíäôïð. Áíáéüäü ðä ôï ðñéí éäéóïñäééü àñäéäð, éá ðñçóéñðñéçéÿí éäé óá áíððóðé÷: á äêðäÿóéíä àñ ðäá.

5. Äêééíðóää ôïí license server.

Íäð äñééüð ðñüðïð äéá íá äêééíðóäää ôï lmgrd äðíáé ôï äéüëïðèï script ðïð àñðóéäðäé óôï /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. Äñééíð ôïö Maple:

```
% cd /usr/local/maple/bin
% ./xmaple
```

Óá áðüü ôí óçíáβí éá ðñÝðáé íá áβíáé üéá Ýðíéíá éáé íá íçí Ý ÷ áðá éáíÝíá ðñüáéçíá. Íçí íá ÷ Ûóáðá üüðü íá óðáβêäðá Ýíá e-mail óðç Maplesoft éáé íá ôíðð ðáβðá üðé èÝéáðá íéá Ýéäíóç ðíð íá ððíóóçñβæáðáé áðβóçíá óðí FreeBSD.

### 10.4.1 ÓðíçèéóíÝíá Ðñíäêβíáðá

- ðüðü äðóéíéäáðáβðá ðíð óçí éáéðíðñáβá ôíð **FLEXlm** license manager. ÁðéðêÝíí ðáêèçñβüóç ððíñáβðá íá áñáβðá óðí <http://www.globetrotter.com/>.
- Ôí lmgrd áβíáé áíüóðü üðé èÝéáé ôí áñ ÷ áβí óçð Ûäáéáð íá Ý ÷ áé óðáêéáêéíéÝíç ðñðβ áééêð ç áéðÝéáóç ôíð éá áðíðý ÷ áé. Íá óüóðü áñ ÷ áβí Ûäáéáð ÷ ñβóçð ðñÝðáé áβíáé óá ááíééÝð áñáíÝð üðüð ôí ðáñáéÛüð:

```
# =====
# License File for UNIX Installations ("Pointer File")
# =====
SERVER chillig ANY
#USE_SERVER
VENDOR maplelm

FEATURE Maple maplelm 2000.0831 permanent 1 XXXXXXXXXXXX \
    PLATFORMS=i86_r ISSUER="Waterloo Maple Inc." \
    ISSUED=11-may-2000 NOTICE=" Technische Universitat Wien" \
    SN=XXXXXXXXX
```

**Óçíáβüóç:** Í óáéñéáéüð áñééüð éáé ôí êéáéáβ ðáβíííóáé ááβ ðá 'X'. Ôí chillig áβíáé ôí üñíá ôíð óðóðβíáðüð.

Ïðíñáβðá íá ðñíðíðíéβóáðá ôí áñ ÷ áβí óçð Ûäáéáð ÷ ñβóçð, áñéáβ íá íçí áéêÛíáðá óçí áñáíβ "FEATURE" (ç íðíβá ðñíóóáðáýáðáé áðü ôí êéáéáβ óçð Ûäáéáð).

## 10.5 Áäêéééóðβíáðá ôí MATLAB®

*ÓðíáéóöíñÛ ôíð Dan Pelleg.*

Ôí êáβíáñ áðüð ðáñéáñÛðáé ðç áéááééáóβá áäéáðÛðóáóçð óçð Linux Ýéäíóçð ôíð **MATLAB® 6.5** óá Ýíá óýðóçíá FreeBSD. Äíðêáýáé áñéáðÛ éáéÛ, ðá áíáβñáóç ôí **Java Virtual Machine™** (ááβðá óðí Ôíβíá 10.5.3).

Ç Linux Ýéäíóç ôíð **MATLAB** ððíñáβ íá ááíñáóðáβ áðáðèáβáð áðü óçí áðáéñáβá The MathWorks óðí <http://www.mathworks.com>. Óéáíðñáððáβðá üðé ðβñáðá éáé ôí áñ ÷ áβí ðíð ðáñéÝ ÷ áé óçí Ûäáéá ÷ ñβóçð β íäçáβáð áéá ôí ðüð íá ôí äçíéíðñáβóáðá. Íéá éáé éá áðééíéíñíβóáðá ðá óçí áðáéñáβá, ðáβðá ôíðð üðé éá èÝéáðá íá ððÛñ ÷ áé áðβóçð ððíóóðñéíç áéá ôí FreeBSD.

## 10.5.1 ÆéäêÛóéíá ðíö MATLAB

Æéä íá äéäóóóóóóóóó ðí **MATLAB**, êÛíóä óá ðáñáêÛóóó:

1. ÆéóÛááóó ðí CD éáé ðñíóáñóóóóó ðí óðí óýóóçíá óáð. Óðíááéááóó ùð ðñóóçò root, ùðòò óóíéóóÛ ðí script óçò äéäóóóóóóóóó. Æéä íá íáééíóóóóó ðí script óçò äéäóóóóóóóóó ðóóóá óçí áíóíêó:

```
# /compat/linux/bin/sh /cdrom/install
```

**Óðóóááéíç:** Òí ðñíóáñóóóóó óçò äéäóóóóóóóóó áñíáé óá áñáóééü ðáñéáÛééíí. Áí éáíáÛíáóá óóÛéíáóá óð: áðééÛ ðí óçí íéüíç, ðóóóá óçí áíóíêó: `setenv HOME ~USER, ùðíó USER áñíáé í ðñóóçò áðó ùðíó ðóóóá óçí áíóíêó su(1).`

2. ¼ðáí áñóóçéááóóá áéá ðíí éáðÛéíáí ðíö **MATLAB**, ðóóóá: `/compat/linux/usr/local/matlab`.

**Óðóóááéíç:** Æéä áðéíéüðáñç áéááééáóóá äéäóóóóóóóóó, ðñóóá ðí ðáñáêÛóóó: `set MATLAB=/compat/linux/usr/local/matlab` óçò áñáííó áíóíêó ðíö éáéýóíóð óáð.

3. Òñíðíóíéóóóóó ðí áñðáñí óçò Ûááéáð (license file) óýíóóíá ðí ðéð íäçááð ðíö éÛááóóá ðí óçí Ûááéá ðíö **MATLAB**.

**Óðóóááéíç:** ðñíááóóá íá áðíéíÛóóóóá áé ðúí ðñíóóóóó ðí áñðáñí áðóóó éáé íá ðí áíóéáñÛóóóóá óðí `$MATLAB/license.dat`, ðñéí éáí óáð ðáé ðí ðñíóáñóóóóó äéäóóóóóóóóó íá ðí ðñíðíóíéóóóóóá.

4. Íéíêéðñóóó óçò Æéäóóóóóóóóó

Óá áðóóó ðí óçíááí, ç äéäóóóóóóóóó ðíö **MATLAB** Ýð: áé íéíéçñóóóóó. Óá áðóóóáíá áñíáóá ðñáéÛáííóáé áéá íá ðñíóóóóá íá ðí áñóéÛóóóóá óóóóó ðí ðí FreeBSD.

## 10.5.2 Æéêóóóóç ðíö License Manager

1. Æçíéíóñááá óóíáíéééçðí óðíáÝóíóíí áéá óá scripts ðíö license manager:

```
# ln -s $MATLAB/etc/lmboot /usr/local/etc/lmboot_TMW
# ln -s $MATLAB/etc/lmdown /usr/local/etc/lmdown_TMW
```

2. Æçíéíóñáóóóóó ðí áñðáñí áéêóóóóçò `/usr/local/etc/rc.d/flexlm.sh`. Òí ðáñÛááéáíá ðáñáêÛóóó áñíáé íéá ðñíðíóíéçíÝíç Ýéáíóç ðíö `$MATLAB/etc/rc.lm.glnx86`. Íé áééááÝð áñíáé óóéð ðíðíéááóóóá ðúí áñðáñí, éáé óççí áéêóóóóç ðíö license manager óðí ðáñéáÛééíí áñíííóóóóó Linux ðíö 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

```

**Óçíáíóééü:** Ôí áñ ÷ áßí ðñÝðáé íá áßíáé äêäëÝóéíí:

```
# chmod +x /usr/local/etc/rc.d/flexlm.sh
```

ÐñÝðáé áðßçò íá áíóééáóáóðáóá ôí ðáñáðÛíú *username* ðä Ýíá ððáñêêü üííá ÷ ñßóç ôïö óóóðíáðïò óáo (êáé íá íçí áßíáé í *root*).

3. Äêëéíðóðá ôïí license manager ðä ôçí áíóïëð:

```
# /usr/local/etc/rc.d/flexlm.sh start
```

### 10.5.3 Óýíááóç ðä ôí ÐáñéáÛëëíí ôïö Java Runtime Environment

ÄëÛíðá ôïí óýíááóíí ôïö Java Runtime Environment (JRE) óá Ýíáí í ððíòð èá äïëëýáé óôí FreeBSD:

```
# cd $MATLAB/sys/java/jre/glnx86/
# unlink jre; ln -s ./jre1.1.8 ./jre
```

### 10.5.4 Äçíéïñãðóá ôí Script Äêêßíççò ôïö MATLAB

1. Ôïðëáððóðá ôí ðáñáéÛò script óôí /usr/local/bin/matlab:

```
#!/bin/sh
/compat/linux/bin/sh /compat/linux/usr/local/matlab/bin/matlab "$@"
```

2. Óçç óóíÝ ÷ áéá äððá ôçí áíóïëð `chmod +x /usr/local/bin/matlab`.

**Öüüááéíç:** ÁíÛëíá ðä ôçí Ýéäíçç ôïö `emulators/linux_base`, ðïö Ý ÷ áðá, ððíñáß íá áíóáíéóóíýí ðáñéáÛ óóÛëíáðá üðáí ðñÝíáðá ôí script. Äéá íá ôí áðíüýááðá áóóü, ðñíðïðéðóðá ôí áñ ÷ áßí /compat/linux/usr/local/matlab/bin/matlab, êáé áëëÛíðá ôç `ãñáíð` ðïö ëÝáé:

```
if [ `expr "$lscmd" : '.*->.*'` -ne 0 ]; then
```

(óççí Ýéäíçç 13.0.1 ãñßóéáðáé óçç `ãñáíð` 410) óá áóðð ôç `ãñáíð`:

```
if test -L $newbase; then
```

### 10.5.5 Άçείιõñãßá Script Ôãñιάέέιιγ οίο MATLAB

Óá áδουιάά άπιαόά ÷ñãέΰεϊόάέ áέά ίά έýóάδά Ύία δñüáεçιά δίò òδΰñ÷áέ ιά οίί δãñιάέέοίü οίò MATLAB.

1. Άçείιõñãßóá οί άñ÷áßι \$MATLAB/toolbox/local/finish.m, έάέ ιΎόά óá áδου δñιόέΎόóá iufi óç ãñáìß:
 

```
! $MATLAB/bin/finish.sh
```

**Óçιάßúóç:** To \$MATLAB ãñΰóóá οί áέñéáπò üδúò οί áéΎδáóá.

**Õδúááέίç:** Óοίί ßáέί έáóΰέϊáí, έá ãñáßóá óá άñ÷áßá finishsav.m έáέ finishdlg.m, óá ίδñá έá óáò áßííóί óç äδίαóúóçóá ίά óπæáóá óçί áñááóßá óáò δñεί έέáßóóá οί δñüãñáíá. Áί δñüέáέóáέ ίά ÷ñçóέίíδñέáßóá έΰδñέί áδú áδóΰ, δñιόέΎόóá οίò óçί δãñáδΰíü ãñáìß áιΎóòò ιáóΰ óçί áίδñέß save .

2. Άçείιõñãßóá οί άñ÷áßι \$MATLAB/bin/finish.sh, οί ίδñιßι έá δãñέΎ÷áέ óá δãñáέΰóù:
 

```
#!/usr/compat/linux/bin/sh
(sleep 5; killall -1 matlab_helper) &
exit 0
```
3. Έΰίόá οί άñ÷áßι áέóáέΎόέí:
 

```
# chmod +x $MATLAB/bin/finish.sh
```

### 10.5.6 ×ñçóέίíδñέπíóáò οί MATLAB

Óá áδου οί óçιάßι έá δñΎδáέ ίά áßóóá Ύόίέίíέ ίά äπóáóá óçί áίδñέß matlab έάέ ίά άñ÷áßóá ίά ÷ñçóέίíδñέáßóá óçί áóáññáß.

## 10.6 Άãέáôΰóóáóç óçò Oracle®

*Óδίαέέóöíñΰ οίò Marcel Moolenaar.*

### 10.6.1 Άέóáãüãß

Óί έáßιáñí áδου δãñéãñΰóáέ óç áέááέέáóßá ãáέáóΰóóáóçò δñί Oracle 8.0.5 έáέ Oracle 8.0.5.1 Enterprise Edition áέά Linux óá Ύία óýóóçιά FreeBSD.

## 10.6.2 Άεάεάοΰόάόζ οίο Δάñεάΰεεήϊοίò Linux

Όεαίονάοάβσαά υόε Ύ ÷ άαά άεάεάοόΠόάε όά emulators/linux\_base έάέ devel/linux\_devtools άδϋ όζ όόεεήΰΠ όυί Ports. Αί άίόεήαόυδβεάάά άόόεεεβάδ ια όά δάñάδΰίϋ, βούδ ÷ ñάεάόάβ ια όά άεάεάοόΠόάά άδϋ δάεΎόά Π άδϋ δάεεϋόάñάδ άεαϋόάέδ όζδ όόεεήΰΠ όυί Ports.

Αί εΎεάάά ια όñΎήάάά όήϊ intelligent agent, έά ÷ ñάεάόάβ ια άεάεάοόΠόάάά έάέ όϊ δάεΎόϊ Red Hat Tcl: `tcl-8.0.3-20.i386.rpm`. Ç άίόίεΠ έεά όζί άεάεάοΰόάόζ ιΎού όίò άδβόζήϊò RPM port (archivers/rpm) άβήάέ:

```
# rpm -i --ignoreos --root /compat/linux --dbpath /var/lib/rpm package
```

Ç άεάεάοΰόάόζ όίò *package* έά δñΎδάε ια άβήάέ ήάεΰ έάέ ÷ ùñβδ δñήάεβήάάά.

## 10.6.3 Ñόεìβεήϊόάό όϊ Δάñεάΰεεήϊ έεά όζί Oracle

Δñεί όζί άεάεάοΰόάόζ όζδ **Oracle**, έά δñΎδάε ια ñόεìβόάάά όύόόΰ όϊ δάñεάΰεεήϊ όίò όόόδΠιάόυδ όάδ. Όϊ δάñάεΰόϋ έάβήάήϊ δάñεάñΰόάε όέ *άεñεάβδ* δñΎδάε ια εΰήάάά έεά ια έεάεΎόάά όζί **Oracle** έεά Linux όόϊ FreeBSD, έάέ άάή δάñεάñΰόάε υόε όδΰñ ÷ έε Πάç όόήϊ ήαζαϋ άεάεάοΰόάόζδ όζδ **Oracle**.

### 10.6.3.1 Ñύεìέόζ όίò Δόñβήά

¼δϋδ δάñεάñΰόάε ι ήαζαϋδ άεάεάοΰόάόζδ όζδ **Oracle**, έά δñΎδάε ια ήñβόάάά όέδ όεήΎδ όζδ shared memory όόϊ ιΎάέόόϊ. Ίζί ÷ ñζόεήϊδϊεΠόάάά όϊ SHMMAX όόϊ FreeBSD. Όϊ SHMMAX όδϊεήβεάάάά έδεβδ άδϋ όϊ SHMMAXPGS έάέ όϊ PGSIZE. ΆδñΎϋδ έάεήñβόάά όϊ SHMMAXPGS. ¼εάδ ήε ΰεεάδ άδέεήΎδ ιδϊήϊή ια ήέόόήϊή υδϋδ δάñεάñΰόάάέ όόήϊ ήαζαϋ. Άέά δάñΰάεήά:

```
options SHMMAXPGS=10000
options SHMMNI=100
options SHMSEG=10
options SEMMNS=200
options SEMMNI=70
options SEMMSL=61
```

ήñβόάά όέδ όεήΎδ όυί άδέεήϊβή Ύόέ βόδά ια όάεñεΰεήϊ όόζ ÷ ñβόζ όζδ **Oracle** δϊò εΎεάάά ια εΰήάάά. Άδβόζδ, άδέάάάέβόάά υόε Ύ ÷ άαά άήñάήϊδϊεΠόάε όέδ δάñάεΰόϋ άδέεήΎδ όόέδ ñόεìβόάέδ όίò δόñβήά:

```
options SYSVSHM #SysV shared memory
options SYSVSEM #SysV semaphores
options SYSVMSG #SysV interprocess communication
```

### 10.6.3.2 Ί × ñβόόζδ Oracle

ΆçιεήονάΠόάά Ύήά ÷ ñβόόζ όόόδΠιάόϋδ ια υήñά oracle, ια όήϊ βάεή όñυδϊ δϊò έά άçιεήονάήϊόόάά έάέ ήδϊεήΰΠδϊόά ΰεεήϊ ÷ ñβόόζ. Όϊ ήυή έάέάβόάñή ÷ άñάέδçñέόόέεϋ όίò ÷ ñβόόζ oracle άβήάέ υόε ÷ ñάεΰεάάάε ια όίò άβόάάά Ύήά έΎέόόϋδ Linux. ΔñήόέΎόάά όϊ /compat/linux/bin/bash όόϊ /etc/shells έάέ ήñβόάά όϊ έΎέόόϋδ όίò ÷ ñβόόζ oracle όά /compat/linux/bin/bash.

### 10.6.3.3 Ôï ÐáñéáÛëëíí

Áëðöüð ðüí óðéçëëóíÛííí ïáðááëçðí óçð **Oracle**, ùðüð ïé ORACLE\_HOME éáé ORACLE\_SID éá ðñÛðáé íá ïñßóáðá éáé óëð áëüëíðëáð ïáðááëçðÛð ðáñéáÛëëííôíð:

Ïáðááëçðß	Óëíß
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 óðéçëëóíÛíí íá ïñßóáðá üëàð óëð ïáðááëçðÛð ðáñéáÛëëííôíð óðí áñ÷áßí .profile. Íá íëíëççñüíÛíí ðáñÛááëáíá áßíáé ôí ðáñáëÛðü:

```
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
```

### 10.6.4 ÁäëáðÛóðáóç óçð Oracle

Ëüäü ïéá ïéëñðð Ûëëáéçðð óðíí áññíëüðß ôïð Linux, éá ÷ñáéáóðáß íá äçíëíðñáßóáðá Ûííí éáðÛëíäí ïà ôí ùññá .oracle ïÛóá óðí /var/tmp, ðñéí ïáëéíßóáðá ôí ðñüáññííá ääëáðÛóðáóçð. Ì éáðÛëíäíð áðöüð éá ðñÛðáé íá áíßéáé óðíí ÷ñßóç oracle. Ëá ðñÛðáé óðñá íá ðñáñíáðíðíëéßóáðá óçí ääëáðÛóðáóç óçð **Oracle** áß÷üð éáíÛíá ðñüáëçíá. Áí áíðëíáðüðßæáðá ùíüð áëüíç ðñíáëðíáðá, áëÛáíðá óçí Ûëáíóç óçð **Oracle** ðíð Û÷áðá ð/éáé óëð ñðëíßóáëð óáð! Áóüóíð Û÷áðá ðñáñíáðíðíëéßóáé óçí ääëáðÛóðáóç óçð **Oracle**, áðáñíüððá óá patches ðíð ðáñéáñÛóíðáé óðëð äÛí ðáñáëÛðü áíñüçðáð.

Íá óð÷íü ðñüáëçíá áßíáé ùðé äáí áßíáðáé óüóðß ääëáðÛóðáóç ôíð ðñíóáññíäÛá ôíð ðñüðíëüëëíð TCP. Áóðü Û÷áé ùð áðíðÛéáóíá íá ïçí ïðññáßðá íá ïáëéíßóáðá ôíðð TCP listeners. Ìé áëüëíðëáð ïäçáßáð éá óáð áíçððóíðí íá ëÛóáðá áóðü ôí ðñüáëçíá.:

```
# 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
```

Ìç ïá÷Ûóáðá íá ðñÛíáðá íáíÛ ôí root.sh

### 10.6.4.1 Άέüñèùòç ôïð root.sh

¼óáí äâéáέóóÛòâ ôçí **Oracle**, êÛðìéáð áíÛñááέáð, ìé ìðìßáð ÷ñáéÛæíòáé íá äßííóí ùð root, éáóááñÛöííòáé óâ Ýíá shell script ðïð éÛÛáòáé root.sh. Ôï script áðòü äçìéíðñáâòáé óðíí éáðÛéíäí orainst. Áóáññüóòâ ôï ðáñáéÛòù patch óðí root.sh, áéá íá ìðñÝòáé íá áñáé éáé íá ÷ñçóéíððìéðóáé ôï chown. ÁíáééáéêééÛ, ðñÝíòâ ôï script ìÝóá áðü Ýíá éÛéòöìð 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 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

```

¼óáí äâí êÛíáòâ ÷ñðçç ôïð CD áéá ôçí äâéáðÛóóáç, ìðñáâòâ íá ðáñÛóáòâ ôï patch áéá ôï root.sh, óôçí ðçãð äâéáðÛóóáçò. To áñ÷áßí ìñÛæáòáé rthd.sh éáé áñßóéáòáé óðíí éáðÛéíäí orainst.

### 10.6.4.2 Άέüñèùòç ôïð genclntsh

To script genclntsh ÷ñçóéíððìéáâòáé áéá íá äçìéíðñáâòáé ìéá shared client library. ÔñÝíòâ ôï ðáñáéÛòù patch áéá íá óáðóáòâ ôï éáéíñéóíÛíí 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

```

## 10.6.5 ΆεόΎεάόζ οζò Oracle

Άοίγ Ύ ÷ άοά αειερεδεΡοάε άδοΎδ οέο ιαζαβάο, εά δñΎδαε ίά ιδñαβòά ίά άεόάεΎόεά οζι **Oracle** οάί ίά άñεόεουοάοάί οά Ύία ογòόζιá Linux.

## 10.7 ΆεεάοΎοόάόζ οίο SAP® R/3®

*ΟδιάεοοίμΎ οίο Holger Kipp. Άñ÷έεP ιάδòάοññδP οά SGML άδñ οίι Valentino Vaschetto.*

Ç άεεάοΎοόάόζ οδòόζιΎοδñι **SAP** ÷ ñζοέιιδñεβίòάο οί FreeBSD άάί δδñοόζñβεάδóε άδñ οζι ñΎάά δδñοόβñείζδ οζò SAP — δδñοόβñείζ δάñΎ ÷ άδóε ίυíí οά οδóεάεñείΎίάδ, δδñοόζñεάειιáíáδ, δεάδòυñíáδ.

### 10.7.1 ΆέόάάñàP

Οί εάβιαíí άδòυ δñεεάñΎοάε Ύία δέεάíυ οñυδñι áεά οζι άεεάοΎοόάόζ οίο **SAP R/3 System** ιά ιβá áΎοζ άάññΎíυí **Oracle** áεά Linux οά Ύία ογòόζιá FreeBSD, δñεεάíáΎíííòάδ οζι άεεάοΎοόάόζ οίο FreeBSD εάε οζò **Oracle**. Έά δñεεάñΎοíòιá άγíí εεάοíñάδóεΎ άβáç ñδειβòάυí:

- **SAP R/3 4.6B (IDES)** ιά **Oracle 8.0.5** οά FreeBSD 4.3-STABLE
- **SAP R/3 4.6C** ιά **Oracle 8.1.7** οά FreeBSD 4.5-STABLE

Δάñ' υεíí δñο άδòυ οί εάβιαíí δññíοδóεάβ ίά δñεεάñΎοάε ιά εάδδññΎñεάδ υεά οά άδñάβòζοά άβιαíòά, άάί εά δñΎδαε ίά εάυñçεάβ υò άíοεεάδóάοδΎοδò ουí ιαζαβί άεεάοΎοόάόζ οζò **Oracle** εάε οίο **SAP R/3**.

Άάβòά οίι ιαζαυ οίο **SAP R/3** áεά Linux áεά άñυδPοάεò ó÷ άδóεΎ ιά οί **SAP** εάε οζι **Oracle**, εάε áεά δçáΎδ άδñ οζι **Oracle** εάε οί **SAP OSS**.

### 10.7.2 Έíεάοίεéü

Οά áευεíυδεά CD-ROMs Ύ ÷ ιòí ÷ ñζοέιιδñεεεάβ áεά οζι άεεάοΎοόάόζ οίο **SAP**:

#### 10.7.2.1 SAP R/3 4.6B, Oracle 8.0.5

¼ííá	Άñβεìζοζ	ΔñεεάñáöP
KERNEL	51009113	SAP Kernel Oracle / Installation / AIX, Linux, Solaris
RDBMS	51007558	Oracle / RDBMS 8.0.5.X / Linux
EXPORT1	51010208	IDES / DB-Export / Disc 1 of 6
EXPORT2	51010209	IDES / DB-Export / Disc 2 of 6
EXPORT3	51010210	IDES / DB-Export / Disc 3 of 6
EXPORT4	51010211	IDES / DB-Export / Disc 4 of 6
EXPORT5	51010212	IDES / DB-Export / Disc 5 of 6
EXPORT6	51010213	IDES / DB-Export / Disc 6 of 6

ΆδóεεΎíí, ÷ ñζοέιιδñεεPοάíá οί **Oracle 8 Server** (Pre-production version 8.0.5 áεά Linux, Kernel Version 2.0.33) CD

οί ιδιβί άάί άβίάε άδανάβόζοί, έάέ οί FreeBSD 4.3-STABLE (Ύία όόέαιέουόδδϊ έββáò ìüíí ìΎñáò ìáòÛ όζί Ύέάιόζ 4.3-RELEASE).

**10.7.2.2 SAP R/3 4.6C SR2, Oracle 8.1.7**

¼íñá	Άñβείζόζ	Δñέεñáòþ
KERNEL	51014004	SAP Kernel Oracle / SAP Kernel Version 4.6D / DEC, Linux
RDBMS	51012930	Oracle 8.1.7/ RDBMS / Linux
EXPORT1	51013953	Release 4.6C SR2 / Export / Disc 1 of 4
EXPORT1	51013953	Release 4.6C SR2 / Export / Disc 2 of 4
EXPORT1	51013953	Release 4.6C SR2 / Export / Disc 3 of 4
EXPORT1	51013953	Release 4.6C SR2 / Export / Disc 4 of 4
LANG1	51013954	Release 4.6C SR2 / Language / DE, EN, FR / Disc 1 of 3

Άíáεüáùò ìá όέò ãεþόάò δϊó εΎέάοά ίά άάέάοάόδþόάò, έά ÷ñáέάοάòáβòá άδέδΎίí όά άίόβόοίε ÷ á CDs. Άíáβò ÷ñόόειιδϊέίγíá ΆññíáíέέÛ (DE) έάέ ΆááέέέÛ (EN), ιδïòá ÷ñáέάεüíáόóá ìüíí οί δñþοί CD. Ίέά ìέέñþ όζíáβùόζ, ζ άñβείζόζ οüí EXPORT CDs άβίάε áεñέáþò ζ βáέά. ¼έά όά CDs οüí áεüóóþí Ύ ÷íοί όζί βáέά άñβείζόζ (άóòü áέάóΎñáέ όά ό ÷ Ύόζ ìá όζί άñβείζόζ όζò Ύέάιόζò 4.6B IDES). Óζί þñá δϊó áñÛóñíόάέ άóóΎò ìέ áñáñìΎò, ζ άáέάóÛόόάόζ έάέοιòññááβ όά FreeBSD 4.5-STABLE (20.03.2002).

**10.7.3 Óζíáέþόάέò SAP**

Ίέ áέüεíòέáò όζíáέþόάέò έά δñΎðáέ ίά áέάάάόοίγí δñέí όζί άáέάóÛόόάόζ οίο **SAP R/3** ìέά έάέ άβίάε ÷ñþόείáò áέά όζ áέάάέάόβá άáέάóÛόόάόζò:

**10.7.3.1 SAP R/3 4.6B, Oracle 8.0.5**

Άñβείζόζ	Óβόεíò
0171356	SAP Software on Linux: Essential Comments
0201147	INST: 4.6C R/3 Inst. on UNIX - Oracle
0373203	Update / Migration Oracle 8.0.5 --> 8.0.6/8.1.6 LINUX
0072984	Release of Digital UNIX 4.0B for Oracle
0130581	R3SETUP step DIPGNTAB terminates
0144978	Your system has not been installed correctly
0162266	Questions and tips for R3SETUP on Windows NT / W2K

**10.7.3.2 SAP R/3 4.6C, Oracle 8.1.7**

Áñβείçóç	Ôβðëïð
0015023	Initializing table TCPDB (RSXP0004) (EBCDIC)
0045619	R/3 with several languages or typefaces
0171356	SAP Software on Linux: Essential Comments
0195603	RedHat 6.1 Enterprise version: Known problems
0212876	The new archiving tool SAPCAR
0300900	Linux: Released DELL Hardware
0377187	RedHat 6.2: important remarks
0387074	INST: R/3 4.6C SR2 Installation on UNIX
0387077	INST: R/3 4.6C SR2 Inst. on UNIX - Oracle
0387078	SAP Software on UNIX: OS Dependencies 4.6C SR2

**10.7.4 Áðáéððóáéð Óðóððιάðïð**

Ï áëüëïðëïð ãñðëéóïüð áβίáé ãñëáðüð ãéá íéá ðððééð ãäéáóÛóðáóç ôïð **SAP R/3 System**. Áéá ìç ÷ áíðιάóá ðáñááüáððò éá ÷ ñáéáóðáβðá ððóééÛ éáéýðáñç áéðβìçóç ðüí áðáéððóáúí óáð:

ÁíÛñðçιά	4.6B	4.6C
Áðáíñááóððò	2 x 800MHz Pentium III	2 x 800MHz Pentium III
Ïíðìç	1GB ECC	2GB ECC
Óëëçñüð Äβóéïð	50-60GB (IDES)	50-60GB (IDES)

Áéá ÷ ñðóç óá ðáñááüáððò, éá ÷ ñáéáóðáβðá áðáíñááóðýð Xeon ìâ ìááÛëç ìíðìç cache, áβóéïðð ðøçèðð ðá÷ ýóçðáð (SCSI, ìâ hardware áéáäéðð RAID), USV éáé ECC-RAM. Ôï ìááÛëï ìÝááëïð ôïð óéëçñüý áβóéïð, ìðáβéáðéé óóï ðñññðëïéóïÝíí óýóðçιά IDEs, ðïð àçìéïðñááβ 27 GB ãñ÷ áβá áÛóçð ãááñÝíüí éáðÛ óç äéÛñéáéá ðçð ãáéáóÛóðáóçð. Ï ÷ ðññò áðóðð áðáñéáβ áðβóçð ãéá óá ãááñÝíá ðçð áðáññáððò óá Ýíá ãñ÷-éëü óýóðçιά ðáñááüáððò.

**10.7.4.1 SAP R/3 4.6B, Oracle 8.0.5**

×ñçóëñðñéðçéáí óá áëüëïðéá éñéíÛ áíáñððιάóá: ìçðñééð ãéá äýí áðáíñááóðýð ìâ 2 Pentium III óðá 800 MHz, áéáäéðð SCSI Adaptec® 29160 Ultra160 (áéá ðññóááóç óá ìäçäü óáéíáðð 40/80 GB DLT éáé óóï CDROM), Mylex® AcceleRAID™ (2 éáíáäéðí, firmware 6.00-1-00 ìâ 32 MB RAM). Óóï Mylex RAID controller áβίáé óóíáááñÝííé äýí óéëçñññ áβóéïé ðüí 17 GB (mirrored) éáé ðÝóóáñéð ðüí 36 GB (RAID level 5).

**10.7.4.2 SAP R/3 4.6C, Oracle 8.1.7**

Óá áððð ðçí ãáéáóÛóðáóç ÷ ñçóëñðñéððóáíá Ýíáí Dell™ PowerEdge™ 2500: ìçðñééð ìâ äýí áðáíñááóðýð Pentium III óðá 1000 MHz (256 kB Cache), 2 GB PC133 ECC SDRAM, PERC/3 DC PCI RAID Controller ìâ 128 MB, éáé ìäçäü EIDE DVD-ROM. Óóï RAID controller áβίáé óóíáááñÝííé äýí óéëçñññ áβóéïé ðüí 18 GB (mirrored) éáé ðÝóóáñéð ðüí 36 GB (RAID level 5).

## 10.7.5 Άέέάοΰόόάζ οίο FreeBSD

Άν ÷ έέΰ δñÝδάέ ίά άέέάόάόδΠόάά οί FreeBSD. Άόδου ιδññáβ ίά áβίáέ ίά áεΰοιñιόδ δñυδñιόδ, áέά δññέόóυδóññάδ δεçñιοιñβáδ ááβόά όοι ΌιΠιά 2.13.

### 10.7.5.1 Άέΰόάιç Άβόείο

Άέά ίά έñάδΠόιτιά όç áέάάέέάόβá áδèΠ, ÷ñçόείñδñέΠόáíá όçί βáέά áεΰόάιç áβόείο, δυοί όοι **SAP R/3 46B** υοί έέέ όοι **SAP R/3 46C SR2**. Ιññí όá ññιáόά δυί όδóέáòñι ΰέέáíáí, έέèò ç έΰεá ááέάοΰόόάζ Ýáείá όá áέáοιñáδέέυ ίç ÷ ΰίçíá. (/dev/da έέέ /dev/amr áίόβόόίέ ÷ á, ιδñιόá áí ÷ñçόείñδñέáβόá Ýίáí AMI MegaRAID®, έá ááβόá όí /dev/amr0s1a áίόβ όίο /dev/da0s1a):

Όύόδçíá άñ ÷ áβυί	ΊÝááέιò (1k-blocks)	ΊÝááέιò (GB)	Δñιόΰñδçόç όοι
/dev/da0s1a	1.016.303	1	/
/dev/da0s1b		6	swap
/dev/da0s1e	2.032.623	2	/var
/dev/da0s1f	8.205.339	8	/usr
/dev/da1s1e	45.734.361	45	/compat/linux/oracle
/dev/da1s1f	2.032.623	2	/compat/linux/sapmnt
/dev/da1s1g	2.032.623	2	/compat/linux/usr/sap

Ñδèιβόόá áδñ δñέí οίòδ áγí áβόείòδ ιá όí έιñέόίέέέυ Mylex Π όí PERC/3 RAID. Ιδññáβόá ίá áέόÝέέáδá όá áόδου έáόΰ όç οΰόç áέέβίçόçδ όίο BIOS.

ΔñιόÝíόá ááò υόέ ç áεΰόάιç όιò áβόείò áέáόÝñáέ έβáñ υò δñιò όç όóίέόδñιáíç áδñ όç SAP, έέèò ç SAP δñιòáβίáέ ίá δñιòáñδΠόáά όιòδ όδñέáόáέυáιòδ όçδ **Oracle** (έέέ έΰδñέιòδ ΰέέιòδ) ίá ÷ υñέόδΰ — áíáβδ δñιòέιΠόáíá, áέá έυιáιòδ áδέυδçόáδ, ίá áçιέιòñáΠόιτιá έáñίέέίγδ έáδáέυιáιòδ.

### 10.7.5.2 make world έέέ ΊÝιò ΔδñΠíáδ

Έáδááΰόόá όιí δçááβι έρáέέá όιò δáέáδóáβιò δδñΠíá -STABLE. Ιáόááέυòδδβόόá όí world (ááóέέυ όύόδçíá) έέέ όιí δδñΠíá óáδ áóιγ áçιέιòñáΠόáάδ δñòá Ýίá δñιòáñιοίÝíñ άñ ÷ áβι ñδèιβόáυí δδñΠíá. Άáò έá δñÝδáέ ίá όοιδññέέΰááόá έέέ όέδ δññáíÝδñιòδ δδñΠíá (kernel parameters) ιέ ιδñιáδ ÷ñáέΰáειíόáέ δυοί áέá όí **SAP R/3** υοί έέέ όçί **Oracle**.

## 10.7.6 Άέέάοΰόόάζ όίο Δññέáΰέέιíοίò Linux

### 10.7.6.1 Άέέάοΰόόάζ όίο Linux Base System

Άñ ÷ έέΰ ÷ñáέΰááάέ ίá Ý ÷ áδá ááέάόάόδΠόáέ όí linux\_base port (υò ÷ ñΠόόçδ root):

```
# cd /usr/ports/emulators/linux_base
# make install distclean
```

### 10.7.6.2 Äêäáóóðçðá ôíð ÐäñéäÛëëííðíð ÄíÛðððíçð Linux

Ôí ÐäñéäÛëëííí ÄíÛðððíçð Linux ÷ñäëÛäáðäé äí ëÿëäðä íä äêäáóóðçðáðäðäðä ðçí Oracle óðí FreeBSD ùðùð ÐäñéäñÛðäðäé óðí ÔíÐíä 10.6:

```
# cd /usr/ports/devel/linux_devtools
# make install distclean
```

Äêäáóóðçðáðäðäðä ôí ÐäñéäÛëëííííí ÄíÛðððíçð Linux ïíñí äéä ðçí äêäáóóðçðáðçðá ôíð SAP R/3 46B IDES. Äí ÿ ÷äðä äêäáóóðçðáðäé ðçí Oracle DB äðù ðçí Oracle äéä óðóðÐíäðä Linux, ôíððä ääí ÷ñäëÛäáðäé íä óáð äðäð÷íëäð.

### 10.7.6.3 Äêäáóóðçðáðçðá ðíí Äðäñäðçðçðíí RPMs

Äéä íä íäëëíÐðäé ôí ðñíäñäíäíä R3SETUP, ÷ñäëÛäáðäé íä ððÛñ÷äé ððíóðÐñéíç PAM. ÊäóÛ ðç äëÛñëäéä ðçð ðñðçðð äêäáóóðçðáðçðá ôíð SAP óðí FreeBSD 4.3-STABLE, ðñíóððäëÐðäíä íä äêäáóóðçðáðçðáðäðäðä ôí PAM ðä ùëä ðä äðäñäðçðçðä ðäëÿðä éäé ðäëëëÛ äíäíääëÛðäíä ðçí äêäáóóðçðáðçðá ôíð ðäëÿðíð PAM, ôí ïðíðí éäé äíÿëäðä. Äéä ôí SAP R/3 4.6C SR2 äíäíääëÛðäíä Ûíäðä ðçí äêäáóóðçðáðçðá ôíð ðäëÿðíð PAM, ôí ïðíðí äððçðð äíÿëäðä, ðñÛäíä ðíð óçíäðíäé ùðé ðä ðäëÿðä ðíð äíäðÿñííðäé ùð äíäñðÐðäéð ðíð, ääí ÷ñäëÛäëíðäé:

```
# rpm -i --ignoreos --nodeps --root /compat/linux --dbpath /var/lib/rpm \
pam-0.68-7.i386.rpm
```

Äéä ôíí intelligent agent ôíð Oracle 8.0.5, ÿðñäðä íä äêäáóóðçðáðçðáðäðä ôí ðäëÿðí Tcl ðçð RedHat tcl-8.0.5-30.i386.rpm (äéäðíñäðéëÛ ç äðäíäðÿíäðçðá éäóÛ ðç äëÛñëäéä ðçð äêäáóóðçðáðçðáðçðá ðçð Oracle ääí ëä Ððäí äðëëðð). ÔðÛñ÷íð éäé ëÛðíëä Ûëëä ðñíäëÐíäðä ó÷äðéëÛ ðä ðç äðäíäðÿíäðçðá ðçð Oracle, äëëÛ äððù äðíäé ëÿíä ðçð Oracle äéä Linux, éäé ù÷é ôíð FreeBSD.

### 10.7.6.4 Äðéðëÿíí Óðíäíðëÿð

ðòùð äðíäé äððçðð éäëÐ ëäÿä íä ðñíðëÿóáðä ðí linprocfs óðí /etc/fstab. Äéä ðäñéðóóððäñäð ðçñíðíñðäð, ääððä ðç óäëðäá manual linprocfs(5). Íëä Ûëëç ðäñÛíäðñíð ðíð ïðíñäððä íä ïñððäðä äðíäé ç kern.fallback\_elf\_brand=3 ç ïðíðä ïñðäðäé óðí äñ÷äðí /etc/sysctl.conf.

## 10.7.7 Äçíëíðñäðä ôíð ÐäñéäÛëëííðíð SAP R/3

### 10.7.7.1 Äçíëíðñäðä ðíí Äðäñäéððçðíí ÓðóðçíÛðçíí Äñ÷äðí éäé Ðñíóäñððäðäí

Äéä íëä äðëÐ äêäáóóðçðáðçðá, äñëäð íä äçíëíðñäððäðä ðä ðäñäéÛðù ðçðóðÐíäðä äñ÷äðí éäé ðñíóäñððäéð:

óçíäðí ðñíóÛñçðçðçð	íÿääëíð óä GB
/compat/linux/oracle	45 GB
/compat/linux/sapmnt	2 GB
/compat/linux/usr/sap	2 GB

Äðíäé äððçðð äðäñäðçðçðí íä äçíëíðñäððäðä éäé ðäñéÿðð óðíäÿðíðð. ÄéäðíñäðéëÛ ôí ðñíäñäíä äêäáóóðçðáðçðá ôíð SAP ëä ðäñäðííäëäð.

```
# ln -s /compat/linux/oracle /oracle
# ln -s /compat/linux/sapmnt /sapmnt
# ln -s /compat/linux/usr/sap /usr/sap
```

Íá ðééáíü ðíðíá óðÛéíáðíð éáðÛ ðç äéÛñéáéá ðçð ääéáðÛóóáçð (äâð ðá System *PRD* éáé ääéáðÛóóáçð ðíð **SAP R/3 4.6C SR2**):

```
INFO 2002-03-19 16:45:36 R3LINKS_IND_IND SyLinkCreate:200
  Checking existence of symbolic link /usr/sap/PRD/SYS/exe/dbg to
  /sapmnt/PRD/exe. Creating if it does not exist...

WARNING 2002-03-19 16:45:36 R3LINKS_IND_IND SyLinkCreate:400
  Link /usr/sap/PRD/SYS/exe/dbg exists but it points to file
  /compat/linux/sapmnt/PRD/exe instead of /sapmnt/PRD/exe. The
  program cannot go on as long as this link exists at this
  location. Move the link to another location.

ERROR 2002-03-19 16:45:36 R3LINKS_IND_IND Ins_SetupLinks:0
  can not setup link '/usr/sap/PRD/SYS/exe/dbg' with content
  '/sapmnt/PRD/exe'
```

### 10.7.7.2 Äçíéíðñáβá × ñçóððí éáé Êáóáéüáüí

Ôí **SAP R/3** ðñáéÛäðáé äÿí ðñóðáð éáé ðñáéð ñÛäáð (groups). Óá ðíüíáðá ðüí ðñçóððí äíáñðíðíóáé áðü ðí **SAP** system ID (SID) ðí ððíβí áðíðáéáβðáé áðü ðñβá ññÛíáðá. ÌáñééÛ áðü áððÛ óá **SIDs** áβíáé äáóíáðíÿíá áðü ðí **SAP** (áéá ðáñÛäáéáíá óá **SAP** éáé **NIX**. Áéá ðéðñç éβóðá äáβðá ðçí ðáêèçñβüóç ðíð **SAP**). Áéá ðçí ääéáðÛóóáçç **IDES**, ðñçóéíðíéðóáíá **IDS**, áéá ðçí ääéáðÛóóáçç óðí óýóççíá **4.6C SR2** ðñçóéíðíéðóáíá **PRD**, éáèð áððü ðí óýóççíá ðñññβæáðáé áéá ðñβóç ðáñááüáðð. Áðñÿíðð, ðñáéáóððéáíá óéð áéüéíðéáð ñÛäáð (óá **ID** ðüí ñÛáüí ððíñÿíí íá äéáóÿñíðí, áððÿð áβíáé áðèðð íé ðéíÿð ðíð ðñçóéíðíéðóáíá ðçç áééð íáð ääéáðÛóóáçç):

ID ñÛäáð	üñíá ñÛäáð	ðáñééñáðð
100	dba	Data Base Administrator (Áéá ðñéñéóððð ÁÛóçð Äááñÿíí)
101	sapsys	SAP System
102	oper	Data Base Operator (× áéñéóððð ÁÛóçð Äááñÿíí)

Áéá ðç ðððééð ääéáðÛóóáçç ðçð **Oracle**, éá ðñáéáóðáβðá ðüí ðçí ñÛäáð dba (äáβðá ðç ðáêèçñβüóç ðçð **Oracle** éáé ðíð **SAP** áéá ðáñéóóüðáñáð ðççññíðñβáð).

Êá ðñáéáóðíÿíá áðβóçð ðíðð áéüéíðéíðð ðñβóðáð:

ID ðñβóç	üñíá ðñβóç	äáíééü üñíá	áñ ðéèð ñÛäáð	áðéðéÿíí ñÛäáð	ðáñééñáðð
1000	idsadm/prdadm	sidadm	sapsys	oper	SAP Administrator (Áéá ðñéñéóððð)



```
# mkdir mirrlogA mirrlogB origlogA origlogB
# mkdir sapdata1 sapdata2 sapdata3 sapdata4 sapdata5 sapdata6
# mkdir saparch sapreorg
# exit
```

Άέά όζι άάέάδΰόόάόζ όζο **Oracle 8.1.7**, έά ÷ñάέάόοίγί ιάñέείβ έάδΰείαιέ áέùç:

```
# su - orasid
# cd /oracle
# mkdir 805_32
# mkdir client stage
# mkdir client/80x_32
# mkdir stage/817_32
# cd /oracle/SID
# mkdir 817_32
```

**Όζιάβùόç:** Ī έάδΰείαιò client/80x\_32 ÷ñçόείιðιεάβόάέ ιά áóδù áέñέάρò οί ùííá. Īçí áίόέέάάόόδòβóάάò ðí x ιά έΰθίείί άñέείù ð έΰðέ ΰέεί.

Όοί ðñβóí άβίá ççίέιðñáγίá οίρòð έάóάέùáιρòð ùð ÷ñβóόçð sidadm:

```
# su - sidadm
# cd /usr/sap
# mkdir SID
# mkdir trans
# exit
```

### 10.7.7.4 Άάñάóΰò óοί /etc/services

Όί **SAP R/3** ÷ñάέΰεάόάέ ιάñέέΰð ááñάóΰð óοί άñ÷άβι /etc/services, ιέ ιðιβáð ááí áέóΰáιρòάέ έάδΰ όç áέΰñέάέά όçð ááέάδΰόόάόçð οίρ FreeBSD. ðñιόέΰόάò óέð ðáñάέΰòù ááñάóΰð (έá ÷ñάέάóóάβóá οίρèΰ÷έóóιρ óέð ááñάóΰð ðιρ áίόέóóιέ÷ιγί óοί instance όçð áóáñιáρò ðιρ ðñΰ÷άð — óóç ðáñβððòóç ιáð, οί 00. Άáí έá òðΰñιáέ έáγίá ðñιáέçιá áí ðñιόέΰόάð ùέáð óέð ááñάóΰð áðù οί 00 ùð οί 99 áέá ðá dp, gw, sp έáέ ms). Άί ðñιáέέóóάέ ίá ÷ñçόείιðιεβóάάò **SAProuter** ð ÷ñάέΰεάóóá ðñιόάάόç óοί **SAP OSS**, έá ÷ñάέάóóάβóá έáέ όçí ááñάóð 99, ιέá έáέ ç έγñá 3299 ÷ñçόείιðιεάβóάέ óó÷ίΰ áðù όçí áέáñάóóá οίρ **SAProuter**:

```
sapdp00    3200/tcp # SAP Dispatcher.          3200 + Instance-Number
sapgw00    3300/tcp # SAP Gateway.                3300 + Instance-Number
sapsp00    3400/tcp #                          3400 + Instance-Number
sapms00    3500/tcp #                          3500 + Instance-Number
sapmsSID   3600/tcp # SAP Message Server.      3600 + Instance-Number
sapgw00s   4800/tcp # SAP Secure Gateway       4800 + Instance-Number
```

### 10.7.7.5 Άðáñáβóçòáò Όιðέέΰð Ñòείβóάέó

Όί **SAP** áðάέóáβ οίρèΰ÷έóóιρ áγί οίðέέΰð ñòείβóάέó (locales) ðιρ ááí áίβέιρí óóέð ðñιáðέέááιΰίáð ðιρ ááέάέέóóΰ οί RedHat. Όί SAP ðñιόΰñάέ óá áðάέóιγίáíá RPMs áέá ίá óá έáóááΰόάð áðù οίρ áέέù οίρð áέάέñέóóð FTP (ι

íðíβò ãβíáé áéáéÿóéíò ìúí áí áβóòá ðáéÛòçð à ðñúóááç OSS). Ááβòá çç óçíáβòç 0171356 áéá çç ëβóóá áðú ðáéÿóá RPMs ðíð ÷ ñáéÛæáóòá.

Áβíáé áðβòçð áóééòú íá äçíéíðñáβóáá áðëðò ôíðð éáðÛëççéíðð óðíáÿóíðð (áéá ðáñÛááéáíá áðú óá *de\_DE* éáé *en\_US*), áééÛ ðñíáβíòíá íá íç εÛíáðá εÛóé óÿóíéí áí ðñúéáéóáé áéá íç ÷ Ûíçíá ðáñááúáβò (òóóóóí áóóú ÿ ÷ áé íÿ ÷ ñé óóéáíβò äíðéÿðáé ÷ ùñβò ðñúáççíá óá óýóóçíá IDES). Éá ÷ ñáéáóóáβòá ðéð áéúéíðéàð ôíðééÿð ñðéíβóáéð:

```
de_DE.ISO-8859-1
en_US.ISO-8859-1
```

Ïé óýíááóíéé ìðííÿí íá äçíéíðñáççéíÿí à ðíí áéúéíðéí ðñúðí:

```
# cd /compat/linux/usr/share/locale
# ln -s de_DE de_DE.ISO-8859-1
# ln -s en_US en_US.ISO-8859-1
```

Áí ïé óýíááóíéé ááí ððÛñ ÷ íðí, éá äçíéíðñáççéíÿí ðñíáéβíáóá éáðÛ ççí ááéáðÛóóáç. Áí ááñíβóááá áóðÛ óá ðñíáéβíáóá, (íñβæííóáð ôí STATUS òúí ðñíáççíáóééβí äçíÛòúí óá OK óðí áñ ÷ áβí CENTRDB.R3S), βòðð áβíáé ááÿíáðí íá óóíááéáβòá óóí SAP ÷ ùñβò εÛðíéá áðéðéÿí ðñíóðÛéáéá éáé óðáðÛçç ÷ ñúíð.

### 10.7.7.6 Ñÿèíéóç ôíð ððñβíá

Ôí SAP R/3 ÷ ñáéÛæáóóáé áñéáðíÿð ðñúíðð áðú ôí óýóóçíÛ óáð. Áéá áóóú ôí éúáí ïñβóáíá ðéð ðáñáéÛòú ðáñáíÿóíððð óóéð ñðéíβóáéð ôíð ððñβíá:

```
# Set these for memory pigs (SAP and Oracle):
options MAXDSIZ="(1024*1024*1024)"
options DFLDSIZ="(1024*1024*1024)"
# System V options needed.
options SYSVSHM #SYSV-style shared memory
options SHMMAXPGS=262144 #max amount of shared mem. pages
#options SHMMAXPGS=393216 #use this for the 46C inst.parameters
options SHMMNI=256 #max number of shared memory ident if.
options SHMSEG=100 #max shared mem.segs per process
options SYSVMSG #SYSV-style message queues
options MSGSEG=32767 #max num. of mes.segments in system
options MSGSSZ=32 #size of msg-seg. MUST be power of 2
options MSGMNB=65535 #max char. per message queue
options MSGTQL=2046 #max amount of msgs in system
options SYSVSEM #SYSV-style semaphores
options SEMMNU=256 #number of semaphore UNDO structures
options SEMMNS=1024 #number of semaphores in system
options SEMMNI=520 #number of semaphore identifiers
options SEMUME=100 #number of UNDO keys
```

Ïé áéÛ ÷ éóóáð ðéíÿð ðíð εÿóíòíá ðñíÿñ ÷ ííóáé áðú çç óáéíçñβòç ôíð SAP. Ïéá éáé ááí ððÛñ ÷ íðí ïäçáβàð áéá Linux, áéá ðáñéóóúðáñáð ðççñíòíñβàð, ñβíðá ïéá íáóéÛ óá áóðÿð áéá ôí HP-UX (32-bit). Ïéá éáé ôí óýóóçíá áéá ççí ááéáðÛóóáç ôíð 4.6C SR2 ÿ ÷ áé ðáñéóóúðáñç íβíç, óá áéáíéñáæúíáíá ðíβíáóá ìðííÿí íá áβíáé íáááéÿóáñá, òúóí áéá ôí SAP úóí éáé áéá ççí Oracle. Áðñÿíòð, áðééÿíðá ÿíáí íáááéÿóáñí áñééíú áéá óá shared memory pages.

**Óçíáßóóç:** ðá ðçí ðñíáðéëääíÝíç áäéáðÛóóáóç ðíð FreeBSD óá ð386, áðßóðá ðá MAXDSIZ éáé DFLDSIZ óðí 1 GB ðí ðíëý. ÁéáóñíáðéëÛ, ðñíáß ðá äáßóðá ðá áíóáíßæííóáé ðáñíßáñáá óðÛëíáðá ùðòò "ORA-27102: out of memory" éáé "Linux Error: 12: Cannot allocate memory"

## 10.7.8 ÁäéáðÛóóáóç ðíð SAP R/3

### 10.7.8.1 ðñíáðéíÛæííóáð ðá SAP CDROMs

Óðç äéáäééáóßá ðçð áäéáðÛóóáóçð ðíðëÝëííóáé áñêáðÛ CDROMs. Áí Ý ÷ áðá áñêáðÛóð ðáçáñýð, éá ðñíÝóáðá ðá ðá ðñíóáñðßóðá ùéá ðá ðéáð óðí óýóðçíá óáð. Áíáßð áðñíóáßóðá ðá áíðéáñÛðñíðá ðí ðáñéá ÷ ùíáñí ðùí CDROMs óðíðð áíðßóðíé ÷ ððð éáðáëüáñðð:

```
/oracle/SID/sapreorg/cd-name
```

ùðíð *cd-name* áíðéóðíé ÷ áß óá Ýíá áðù ðá KERNEL, RDBMS, EXPORT1, EXPORT2, EXPORT3, EXPORT4, EXPORT5 éáé EXPORT6 áéá ðçí áäéáðÛóóáóç óá 4.6B/IDES, éáé KERNEL, RDBMS, DISK1, DISK2, DISK3, DISK4 éáé LANG áéá ðçí áäéáðÛóóáóç ðíð 4.6C SR2. ¼éá ðá ðñííáðá ðùí áñ ÷ áßùí óðá ðñíóáñðçíÝíá CDs éá ðñÝðáé ðá áßíáé ðá éáðáéáßá, áéáóñíáðéëÛ ðÛíðá ÷ ðñßóç ðçð áðééíáßð ÷ ç éáðÛ ðçí ðñíóÛñóçç. ×ñçóéíðñíéáßóðá éíéðùí ðéð ðáñáéÛòù áíðñëÝð:

```
# mount_cd9660 -g /dev/cd0a /mnt
# cp -R /mnt/* /oracle/SID/sapreorg/cd-name
# umount /mnt
```

### 10.7.8.2 ÕñÝíðá ðí Script ðçð ÁäéáðÛóóáóçð

Áñ ÷ ééÛ ðñÝðáé ðá ðñíáðéíÛóáðá ðíí éáðÛëíáñí install:

```
# cd /oracle/SID/sapreorg
# mkdir install
# cd install
```

Óðç óðíÝ ÷ áéá ðáééíßóðá ðí script ðçð áäéáðÛóóáóçð, ðí ðñíßí éá áíðéáñÛðñáé ùéá ðá ó ÷ áðééÛ áñ ÷ áßá ðñíóá ðñí éáðÛëíáñí install:

```
# /oracle/SID/sapreorg/KERNEL/UNIX/INSTTOOL.SH
```

Ç áäéáðÛóóáóç ðíð IDES (4.6B) Ýñ ÷ áðáé ðá Ýíá ðéßñðð ðñíóáñíóíÝíí óýóðçíá áðßááéíçð ðíð SAP R/3, Ýðóé ððÛñ ÷ ðí Ýíé CD EXPORT áíðß áéá ðñßá. Óá áððù ðí óçíáßí ðí ðñúðððí áñ ÷ áßí áäéáðÛóóáóçð CENTRDB.R3S ðñíññßæáðáé áéá ðçí áäéáðÛóóáóç ðíð ááóééíý óðððñíáðíð (ðí ðáéí ðí **R/3** éáé ðç áÛóç áááñÝíñí), ù ÷ é ðçí éáíðñééß áðáñíñáß IDES, Ýðóé ÷ ðñáéÛæáðáé ðá áíðéáñÛðñáðá éáé ðí áíðßóðíé ÷ ð CENTRDB.R3S áðù ðíí éáðÛëíáñí EXPORT1, áéáóñíáðéëÛ ðí R3SETUP éá æçðßóáé ðñí ðá ðñßá EXPORT CDs.

Ç ðáùðáñç Ýéáñóç **SAP 4.6C SR2** ðáñéÝ ÷ áé óÝóóáñá EXPORT CD. Õí áñ ÷ áßí ðí ðñíßí áéÝá ÷ áé ðá áßíáðá ðçð áäéáðÛóóáóçð áßíáé ðí CENTRAL.R3S. Óá áíðßéáóç ðá ðéð ðñíçáñýíáíáð áéáùóáéð, ááí ððÛñ ÷ ðí áéáóñíáðééÝð ðñíóð áäéáðÛóóáóçð, áéá éáíðñééß áäéáðÛóóáóç ðá ð ÷ ðññðð áÛóç áááñÝíñí. Õí **SAP** ÷ ðñçóéíðñíéáß ðéÝíí ðéá áéáóñíáðééß áéáäééáóßá áéá ðçí áäéáðÛóóáóç ðçð áÛóçð áááñÝíñí. Áí ðéÝéáðá ðñðð ðá áðáíáéééíßóðáðá ðçí áäéáðÛóóáóç áñáùðáñá, áñêáß ðá ÷ ðñçóéíðñíéáßóðá ðáíÛ ðí áñ ÷ ééü áñ ÷ áßí.

Óüóí êáðÛ ðç äéÛñêáéá üóí êáé ðáðÛ ðçí áäéáðÛóóáóç, ðí **SAP** áðáéðáß ç áíðíðP hostname íá áðéóðñÝóäé ðüí ðí ðñíá ðíð óðóððíáðíð óáð êáé ü÷é ðí ðññáð ðñíá (ðá ðíí ðñÝá). ÁðñÝíð, áðá ðñèìðóðá ðí ðñíá ðá áóðü ðíí ðñüðí, P ÷ñçóéíðíéðóðá êÛðíéí alias áðñíðáð alias hostname='hostname -s' ðüóí áéá ðíí ÷ñðóç orasid üóí êáé áéá ðíí ÷ñðóç sidadm (êáé áéá ðíí root ðíðÛ÷éóóíí êáðÛ ðçí áäéáðÛóóáóç, ðéáð êáé üéá ðá áðíáðá áðñíðáé ððroot). Áðíáé áððóçð ðééáíü íá ðñíðíðíéðóðáðá ðá áñ÷áß .profile êáé .login ðüí äýí ÷ñçóðí ðíð äçíéíðñáðçéáí êáðÛ ðç äéÛñêáéá áäéáðÛóóáóçð ðíð **SAP**.

### 10.7.8.3 Áêêðíçóç ðíð R3SETUP 4.6B

Áäáééüèáðá üéé ðí LD\_LIBRARY\_PATH Ý÷áé ðñéóðáß óóóðÛ:

```
# export LD_LIBRARY_PATH=/oracle/IDS/lib:/sapmnt/IDS/exe:/oracle/805_32/lib
```

Íáééíðóðá ðí R3SETUP ðð root áðü ðíí êáðÛëíáí áäéáðÛóóáóçð:

```
# cd /oracle/IDS/sapreorg/install
# ./R3SETUP -f CENTRDB.R3S
```

Óí script éá óáð êÛíáé ðñééÝð áñüððóáéð (ðé ðñíððééíáÝð óáðñíðáé ðá áäéýéáð, êáé áéñéíðéíýíðáé áðü ðçí ðéíð ðíð äüèçéá ðð áðóíáð):

Áñðçóç	ðñíáðééíáð	Áðóíáðó áááñÝíüí
Enter SAP System ID	[C11]	IDSEnter
Enter SAP Instance Number	[00]	Enter
Enter SAPMOUNT Directory	[/sapmnt]	Enter
Enter name of SAP central host	[troubadix.domain.de]	Enter
Enter name of SAP db host	[troubadix]	Enter
Select character set	[1] (WE8DEC)	Enter
Enter Oracle server version (1) Oracle 8.0.5, (2) Oracle 8.0.6, (3) Oracle 8.1.5, (4) Oracle 8.1.6		1Enter
Extract Oracle Client archive	[1] (Yes, extract)	Enter
Enter path to KERNEL CD	[/sapcd]	/oracle/IDS/sapreorg/KERNEL
Enter path to RDBMS CD	[/sapcd]	/oracle/IDS/sapreorg/RDBMS
Enter path to EXPORT1 CD	[/sapcd]	/oracle/IDS/sapreorg/EXPORT1
Directory to copy EXPORT1 CD	[/oracle/IDS/sapreorg/CD4_DIR]	Enter
Enter path to EXPORT2 CD	[/sapcd]	/oracle/IDS/sapreorg/EXPORT2
Directory to copy EXPORT2 CD	[/oracle/IDS/sapreorg/CD5_DIR]	Enter
Enter path to EXPORT3 CD	[/sapcd]	/oracle/IDS/sapreorg/EXPORT3
Directory to copy EXPORT3 CD	[/oracle/IDS/sapreorg/CD6_DIR]	Enter
Enter path to EXPORT4 CD	[/sapcd]	/oracle/IDS/sapreorg/EXPORT4
Directory to copy EXPORT4 CD	[/oracle/IDS/sapreorg/CD7_DIR]	Enter
Enter path to EXPORT5 CD	[/sapcd]	/oracle/IDS/sapreorg/EXPORT5
Directory to copy EXPORT5 CD	[/oracle/IDS/sapreorg/CD8_DIR]	Enter
Enter path to EXPORT6 CD	[/sapcd]	/oracle/IDS/sapreorg/EXPORT6

Άñðççç	ÐñìáðέέëíäÞ	Άßóíäìò äääñÝíúí
Directory to copy EXPORT6 CD	[/oracle/IDS/sapreorg/CD9_DIR]	Enter
Enter amount of RAM for SAP + DB		850Enter (in Megabytes)
Service Entry Message Server	[3600]	Enter
Enter Group-ID of sapsys	[101]	Enter
Enter Group-ID of oper	[102]	Enter
Enter Group-ID of dba	[100]	Enter
Enter User-ID of sidadm	[1000]	Enter
Enter User-ID of orasid	[1002]	Enter
Number of parallel procs	[2]	Enter

Áí äâr Ý ÷ äðá áíóέäñÛðáέ óá CDð óá äέáóìñáðέέëíýð éáóáέüüäòð, ðüðá ðì ðñüäñäíä ääέáðÛóóáóçð ðìò SAP ää éá ìðìñÝóáέ íá äñáέ óá CD ðá ìðìßá ÷ ñáέÛäáðáέ (έáέ óá ìðìßá áíááññßæííóáέ áðü ðì äñ ÷ äßì LABEL . ASC ðìò äñßóέáðáέ ìÝóá óá áóðÛ) éáέ éá óáð æçðçèäß íá áέóÛäáðá éáέ ðñìóáñðÞóáðá óá CD éáέ íá äðéääáέðóáðá ðì óçìäßì ðñìóÛñðççð.

Ïì CENTRDB . R3S ìðìñáß üüð íá ðáñÛäáέ ìáñέÛ óóÛέíáðá. Óçç ðáñßððòóÞ ìáð, ìáð æÞççóá ìáíÛ ðì EXPORT4 CD äέÛ ìáð Ýäáέíä ðì óúóðü èéáέäß (6\_LOCATION, ìáðÛ 7\_LOCATION èèð.), éáέ Ýðóέ ìðìñáßðá íá óðíä ÷ Þóáðá äÛæííóáð óέð óúóðÝð ðéíÝð.

Áέóüð áðü èÛðíéá ðñíáέÞíáðá ðìò áíáóÝñííóáέ ðáñáέÛòü, ç ääέáðÛóóáóçç éá ðñÝðáέ íá èðεßóáέ ñáέÛ, ìÝ ÷ ñέ ðì óçìäßì ðìò éá ÷ ñáέáóðáß íá ääέáðáóðÞóáðá çç äÛçç äääñÝíúí ççð Oracle.

### 10.7.8.4 Áέêßççç ðìò R3SETUP 4.6C SR2

Áääáέüèäßðá üðέ Ý ÷ äðá ññßóáέ óúóðÛ ðì LD\_LIBRARY\_PATH. Ç ðéíÞ ççð ìáðááέççðð äßíáέ äέáóìñáðέέÛ áðü ççí áíóßóðíé ÷ ççð ääέáðÛóóáóçð ðìò 4.6B ìá ççí **Oracle 8.0.5**:

```
# export LD_LIBRARY_PATH=/sapmnt/PRD/exe:/oracle/PRD/817_32/lib
```

ÎáέέíÞðá ðì R3SETUP ùð root áðü ðìí éáðÛέíäí ääέáðÛóóáóççð:

```
# cd /oracle/PRD/sapreorg/install
# ./R3SETUP -f CENTRAL.R3S
```

Τì script éá óáð èÛíáέ ìáñέÛÝð äñððóáέð (íέ ðñìáðέέëíäÝð óáßñííóáέ óá äáέýέäð éáέ áέíεíðέíýíðáέ áðü ççí ðñááìáðέέÛ äßóíäí):

Άñðççç	ÐñìáðέέëíäÞ	ΆέóáäüäÞ äääñÝíúí
Enter SAP System ID	[C11]	PRDEnter
Enter SAP Instance Number	[00]	Enter
Enter SAPMOUNT Directory	[/sapmnt]	Enter
Enter name of SAP central host	[majestix]	Enter
Enter Database System ID	[PRD]	PRDEnter
Enter name of SAP db host	[majestix]	Enter
Select character set	[1] (WE8DEC)	Enter

Áñðçðç	Ðñíáðééíâ	Áέóáãüâ ããññÝíúí
Enter Oracle server version (2) Oracle 8.1.7		2Enter
Extract Oracle Client archive	[1] (Yes, extract)	Enter
Enter path to KERNEL CD	[/sapcd]	/oracle/PRD/sapreorg/KERNEL
Enter amount of RAM for SAP + DB	2044	1800Enter (in Megabytes)
Service Entry Message Server	[3600]	Enter
Enter Group-ID of sapsys	[100]	Enter
Enter Group-ID of oper	[101]	Enter
Enter Group-ID of dba	[102]	Enter
Enter User-ID of oraprd	[1002]	Enter
Enter User-ID of prdadm	[1000]	Enter
LDAP support		3Enter (no support)
Installation step completed	[1] (continue)	Enter
Choose installation service	[1] (DB inst,file)	Enter

Ý ÷ ñé óðéáìðð, ç äçìéíðñâá ÷ ñçóððí àìðáíβæáé Ýíá óðÛéíá éáðÛ ôç äéÛñéáéá ôçð áãéáðÛóðáçð, óðéð ðÛóáéð òúí OSUSERDBSID\_IND\_ORA (ãéá ôç äçìéíðñâá ôïð ÷ ñðóç *orasid*) éáé OSUSERSIDADM\_IND\_ORA (ãéá ôç äçìéíðñâá ôïð ÷ ñðóç *sidadm*).

Áêòüð áðü ìáñééÛ ðñíáðéíáðá ðïð áíáóÝñííóáé ðáñáéÛòü, üéá èá ðñÝðáé íá êððóíðí ðñáíá ìÝ ÷ ñé ôçí áãéáðÛóðáçð ôçð áÛóçð ããññÝíúí Oracle.

### 10.7.9 ÁãéáðÛóðáçð ôçð Oracle 8.0.5

Ðáñáéáéíýíá, íá äâðá ðéð áíðβóðíé ÷ àð óçíáðéðáéð òúí SAP éáé Oracle Readme ó ÷ àðééÛ ìâ óá ðñíáðéíáðá ðïð ìðñâá íá ðñíéýðïí éáðÛ ôçí áãéáðÛóðáçð ôïð **Oracle DB** óðí Linux. Óá ðáñéóóüðáñá, áí ü ÷ é üéá, Ý ÷ ïí íá êÛíðí ìâ áóðíááðüôçðá áéáééíçðí.

Áéá ðáñéóóüðáñáð ðççñíïíñâð ó ÷ àðééÛ ìâ ôçí áãéáðÛóðáçð ôçð **Oracle**, äâðá ôí êâÛéáéí áãéáðÛóðáçð ôçð Oracle.

#### 10.7.9.1 ÁãéáðÛóðáçð ôïð Oracle 8.0.5 ìâ ôí orainst

Áí ðñüéáéóáé íá êÛíðá ÷ ñðçð ôçð **Oracle 8.0.5**, èá ÷ ñáéáóðâðá êÛðíéáð áððéÿíí áéáééíðéâð áéá áðéðð ÷ ð áðáíáóýíááç (relinking), éáèð ç **Oracle 8.0.5** âβíáé linked ìâ ôçí ðáééÛ Ýéáíóç ôïð glibc (RedHat 6.0), áééÛ ðäç áðü òí RedHat 6.1 ÷ ñçóéíðíéáðáé íéá íÝá Ýéáíóç. ÁðñÝíùð ÷ ñáéÛæáðáé íá áãéáðáóððóáðá áðððñüóéáðá óá áðüíáíá ðáéÝóá áéá íá áãáééèèâðá üðé íé óýíááóíé èá äïðéÝðïí:

- compat-libs-5.2-2.i386.rpm
- compat-glibc-5.2-2.0.7.2.i386.rpm
- compat-egcs-5.2-1.0.3a.1.i386.rpm
- compat-egcs-c++-5.2-1.0.3a.1.i386.rpm



### 10.7.11.1 Öüñòóóç ðçð ÁÛóçð ÄääñÛíúí

Óóç ðóíÛ ÷ áεá, áíÛεíáá ðá ðí áí áß ÷ áóá ðñéí áðéε Ûíáε Ûíúí ð ù ÷ ε, ððñáßðá áßðá íá ðáéíðóáðá ðí R3SETUP áðú ðçí áñ ÷ ð, ð íá ðóíá ÷ ðóáðá ðçí áεðÛεáóç ðíð. Õí R3SETUP εá áçìéíðñáðóáε εáε εá öññððóáε ðá áñ ÷ εéÛ äääñÛíúí ðçð áÛóçð (áεá 46B IDEs, áðú ðá EXPORT1 óá EXPORT6, áεá 46C áðú DISK1 óá DISK4) εÛíúíðáð ÷ ñðóç ðíð R3load.

¼óáí ç öññòóóç ðçð áÛóçð äääñÛíúí ðεíεεçñúεáß (ððñáß íá ÷ ñáεáóóíúí ðáñεéÛð ðñáð), εá ÷ ñáεáóóáß íá ðñðóáðá ðáñεéíúð εùáεéíúð. Áεá ðíεéíáóóεéÛð äáεáóáóðÛóáεð, ððñáßðá íá ÷ ñçóéíðíεðóáðá ðíðð áíúóóíúð ðñíáðéεääíÛíúðð εùáεéíúð (áí ððÛñ ÷ áε εÛíá áóðÛεááð, ÷ ñçóéíðíεðóáðá äéáóíñáðééíúð!):

Áñðóçóç	Áßóíáíð äääñÛíúí
Enter Password for sapr3	sapEnter
Confirum Password for sapr3	sapEnter
Enter Password for sys	change_on_installEnter
Confirm Password for sys	change_on_installEnter
Enter Password for system	managerEnter
Confirm Password for system	managerEnter

Óá áðóó ðí óçíáßí áß ÷ áíá ðáñεéÛð ðñíáεðíáðá ðá ðçí áíóíεð ðípgntab εáðÛ ðçí äáεáðÛóóáóç ðíð 4.6B.

### 10.7.11.2 Listener

Ïáééíðóáðá ðí Oracle Listener ùð ÷ ñðóçð orasid ðá ðí áéúεíðéí ðñúðí:

```
% umask 0; lsnrctl start
```

Áí äá ðí εÛíáðá, ððñáß íá óáð áíóáíεóóáß ðí óðÛεíá ORA-12546 εáεðð óðá sockets ááí εá Û ÷ ðí ðéóðáß ðε εáðÛεεçεáð Ûááεáð. Ááßðá ðçí Óçíáßòóç 072984 ðíð SAP.

### 10.7.11.3 Áíáíáðíúíðáð ðíðð ðßíáεáð MNLS

Áí Û ÷ áðá óεíðú íá áεóÛááðá áεðóáð áεòúð ðúí Latin-1 óðí SAP, εá ðñÛðáε íá áíáíáðóáðá ðíðð ðßíáεáð Multi National Language Support. Áðú ðáñéñÛóáðáε óðá SAP OSS Notes 15023 εáε 45619. Ïðñáßðá ùíðð áí εÛεáðá íá ðáñáéÛíðáðá áðóó ðí áðíá εáðÛ ðçí äáεáðÛóóáóç ðíð SAP.

**Óçíáßòóç:** Áεùìç εáε áí ááí ÷ ñáεÛæáóðá ðí MNLS, εá ÷ ñáεáóóáß íá áεÛáíáðá ðí ðßíáεá TCPDB εáε íá ðí áñ ÷ εéíðíεðóáðá, áí áðóó ááí Û ÷ áε ðäç áßíáε. Ááßðá óðí SAP óéð óçíáεðóáéð 0015023 εáε 0045619 áεá ðáñéóóóðáñáð ðεçñíðíñáð.

## 10.7.12 Áðíáðá ðáðÛ ðçí ÁáεáðÛóóáóç

### 10.7.12.1 ¶ääéá ÷ ñðóçð áεá ðí SAP R/3

Éá ðñÛðáε íá æçððóáðá Ûíá Êεáεáß ¶ääéáð - License Key - áεá ðí SAP R/3. Õí ÷ ñáεÛæáóðá, ðáðð εáε ç ðñíóúñéíð

ΰάάέά δίο ÷ ñçóείñδιεΠρόάά έάδΰ όçí ååέάόΰόόάόç, Ύ ÷ åέ έό ÷ ý ìüñ åέά όΎόόåñέό åååñΰååð. ΔñΎδåέ δñþόά ίά άδñέδΠρόάά όí hardware key. Οόίååέåßόå ùð ÷ ñΠόόçð ìdsadm έάέ åέðåέΎόά όí saplicense:

```
# /sapmnt/IDS/exe/saplicense -get
```

Άέðåέþíðάð όí saplicense ÷ ùñßð δάνåíΎðñíðð, óáð åβίάέ ίέά έβóóά åðέεíþí. ¼óάί εΰååðå όí έέåέåß ΰåέάð, ìðñåßóå ίά όí ååέάóάóðΠρόάά ίά όíí δάνåέΰðù όñüðí:

```
# /sapmnt/IDS/exe/saplicense -install
```

Όçç óóíΎ ÷ åέά, έå ÷ ñåέάóðåß ίά åέóΰååðå ðέð åέüέíðέåð ðέίΎð:

```
SAP SYSTEM ID      = SID, 3 chars
CUSTOMER KEY       = hardware key, 11 chars
INSTALLATION NO   = installation, 10 digits
EXPIRATION DATE   = yyyymmdd, usually "99991231"
LICENSE KEY        = license key, 24 chars
```

### 10.7.12.2 Άçíέíðñåßå × ñçóðþí

ΆçíέíðñåΠρόάά Ύίάí íΎí ÷ ñΠόόç óóí client 000 (åέά ìåñέέΎð åñååóßåð δίò ÷ ñåέΰæåóåέ ίά åβñóí ìΎóά óóí client 000, åέέΰ ìå ÷ ñΠόόç åέάóñåðέέü άδñü όíòð sap\* έάέ ddc). ΰð ùññå ÷ ñΠόόç óóíþέùð åðέέΎåíòíå όí wartung (P service óóå Åååέέέΰ). Óå δññóβέ δίò ÷ ñåέΰæííóåέ åβίάέ óå sap\_new έάέ sap\_all. Άέά åðέðέΎíí áóóΰέåέά, ίέ έùåέέíß ðñí åðέέååñíΎíñí ÷ ñçóðþí óå üέíðð όíòð clients έå δñΎδåέ ίά åέέå ÷ έíΎí (åóðü δåñέέåñåΰίåέ έάέ όíòð ÷ ñΠόóåð sap\* έάέ ddc).

### 10.7.12.3 Ñýèìέόç ðñí Transport System, Profile, Operation Modes, έέð.

ΎΎóå óóí client 000, ÷ ñΠόóåð åέðüð ðñí ddc έάέ sap\*, ìðññíΎí ίά εΰñóí όíòέΰ ÷ έóóñí óå åέüέíðέå:

Åñååóßå	Transaction (Όóíåέέååßþ)
Ñýèìέόç όíò Transport System, δ. ÷. ùð Stand-Alone Transport Domain Entity	STMS
Άçíέíðñåßå / ðññíðñíßçóç όíò Profile Óðóðþíåðíð	RZ10
Όóíðþñçóç Operation Modes έάέ Instances	RZ04

Άóðü έάέ üέå óå ððüέíðέå åþíåóå ó ÷ åðέέΰ ìå ðέð ñðèíßóåέð ìåðΰ όçí ååέάóΰόóάόç δåñέåñΰóííóåέ óóíòð íåçåíýð ååέάóΰόóάόçð όíò SAP.

### 10.7.12.4 Οñíðñíðñçóç όíò initsid.sap (initIDS.sap)

Όí åñ ÷ åßí /oracle/IDS/dbs/initIDS.sap δåñέΎ ÷ åέ όí åíóβåñåóíí áóóåέåßåð όíò δññóβέ όíò SAP. Ååþ ÷ ñåέΰæåóåέ ίå ìñßóåðå όí ìΎååèð όçç óåέíßåð δίò έå ÷ ñçóéíðñíέçååß, όíí óýðí óóíðßåóçð έάέ üέå óå ó ÷ åðέέΰ. Άέå ίå ìðñΎóíòíå ίå όí åέðåέΎóíòíå ìå όí sapdba / brbackup, åέέΰíåñå ðέð δάνåέΰðù όέίΎð:

```
compress = hardware
archive_function = copy_delete_save
cpio_flags = "-ov --format=newc --block-size=128 --quiet"
```

```
cpio_in_flags = "-iuv --block-size=128 --quiet"
tape_size = 38000M
tape_address = /dev/nsa0
tape_address_rew = /dev/sa0
```

Άðáíçãßóáέð:

compress: Ç ðáέίßá ðíð ÷ ñçóέííðíέíýíá áßíáέ ìßá HP DLT1 ç ðíðßá ðάνÝ ÷ áέ óðíðßáóç ìÝóù ðέέέíý.

archive\_function: Άððü ðñßæáέ ðíð ðñíáðέέááíÝíí ðñüðí ìá ðíð ðíðßí èá áðíεçέáýííðáέ ðá áñ ÷ áέíεáðçíÝíá logs ðçð Oracle: ðá íÝá logs áðíεçέáýííðáέ óðçí ðáέίßá, ðá Ñαç áðíεçέáðíÝíá áðíεçέáýííðáέ íáíÛ éáέ óðç óðíÝ ÷ áέá áέááñÛíðíðáέ. Άððü óáð óßæáέ áðü ðç ðáέáέðññßá áí ÷ ñáέáóðáß íá áíáέðßóáðá ðç áÛóç áááñÝííí óá ðάνßððóç ðíð íέá áðü ðέð ðáέίßáð Ý ÷ áέ ðñüáεçíá.

cpio\_flags: ÐñíáðέέááíÝíç áßíáέ ç ÷ ñßóç ðíð -B ðíð ðíðßí ðñßæáέ ðíð ìÝááέíð èÛèá block óðá 5120 Bytes. Άέá ðáέίßáð DLT, ç HP ðñíðáßíáέ ðíð éέáüðáñí 32 K ìÝááέíð block, ððüðá éé áíáßð áßóáíá --block-size=128 áέá 64 K. Õí --format=newc ÷ ñáέÛæáðáέ áέüðέ Ý ÷ ðíðá inode ìá áñßέíçóç ìáááέýðáñç áðü 65535. Ç ðáέáððáßá ðάνÛíáðñíð --quiet ÷ ñáέÛæáðáέ áέáóß áέáóíñáðέέÛ ðíð brbackup èá ðάνáðííáέáß ìá ðíð ðíð cpio áíðáíßóáέ ðíð áñέέíü ðüí blocks ðíð Ý ÷ ðíð áðíεçέáððáß.

cpio\_in\_flags: Óá Flags ÷ ñáέÛæíðáέ ðñíεáέíÝííð íá ðíððüέíýí ðá áááñÝíá áðü ðç ðáέίßá. Ç ðñðß áíέ ÷ íáýáðáέ áððüíáðá.

tape\_size: Ç ðάνÛíáðñíð áððß áßíáέ ÷ ðíðñέέÛ ðíð ìÝááέíð ÷ ðñçóέέüòçðáð ðçð ðáέίßáð. Άέá èüáñðð áóðÛεáέáð (÷ ñçóέííðíέíýíá hardware óðíðßáóç), ç óέíß ðçð ðάνáíÝðñíð áßíáέ εßáí íέέñüðáñç áðü ðíð ðñááíáðέέέü ìÝááέíð.

tape\_address: Õí ðñíá óððέáððð (÷ ðññð áðíáðüòçðá áðáíáðýέέíçð ðçð ðáέίßáð) ðíð èá ÷ ñçóέííðíέçέáß ìá ðíð cpio.

tape\_address\_rew: Õí ðñíá óððέáððð (ìá áðíáðüòçðá áðáíáðýέέíçð ðçð ðáέίßáð) ðíð èá ÷ ñçóέííðíέçέáß ìá ðíð cpio.

### 10.7.12.5 Ñðέíßóáέð ìáðÛ ðçí ΆέέáðÛóóáóç

Íé áέüεñðέíε ðάνÛíáðñíé ðíð SAP èá ðñÝðáέ íá ðñέíεóðíýí ìáðÛ ðçí ááέáðÛóóáóç (ðάνáááßáíáðá áέá IDES 46B, éáέ ðíßç 1 GB):

¼ñíá	Õέíß
ztta/roll_extension	250000000
abap/heap_area_dia	300000000
abap/heap_area_nondia	400000000
em/initial_size_MB	256
em/blocksize_kB	1024
ipc/shm_psize_40	70000000

SAP Óçíáßùóç 0013026:

¼ñíá	Õέíß
ztta/dynpro_area	2500000

SAP Óçíáßùóç 0157246:

¼íííá	Ôëíð
rdisp/ROLL_MAXFS	16000
rdisp/PG_MAXFS	30000

**Óçíáßóóç:** ðá ðéð ðáñáðÛíó ðáñáíÛðñíòð ðá Ýíá óóóóçíá ðá 1 gigabyte ðíðíçò, ðñíñáß íá äáßðá êÛðé óáí ðí ðáñáéÛòóó ùóí áóññÛ ðçí éáðáíÛëóóç ðíðíçò:

Mem: 547M Active, 305M Inact, 109M Wired, 40M Cache, 112M Buf, 3492K Free

### 10.7.13 Ðñíáëðíáðá éáðÛ ðçí ÆêéáðÛóóáóç

#### 10.7.13.1 Æðáíáêéßíçóç ðíö R3SETUP ðáðÛ ðçí Æéüñèóç Ðñíáëðíáðíð

Ôí R3SETUP éá óðáíáððóáé áí áíðéççðèäß êÛðíëíí óóÛëíá. Áí êíëóÛíñáðá éáéÛ ðá logfiles éáé áëíñèðóáðá ðí óóÛëíá, éá ðñÝðáé íá ðáéíðóáðá ðí R3SETUP áðü ðçí áñ÷ð, óðíðèòð áðéëÛáííóðð REPEAT óðí ðáéäððáßí áðíá áéá ðí ðñíðí ðáñáðñíÛéçèá ðí R3SEÖUP.

Æéá íá äðáíáêéëíðóáðá ðí R3SETUP, áðèðð áðóðá ðçí ðáñáéÛòóó ðíðíçò ðá ðí áíðóðóíé÷íí áñ÷ðáßí R3S:

```
# ./R3SETUP -f CENTRDB.R3S
```

ãéá ðçí Ýêáíóç 4.6B, ð ðçí áíðíèð

```
# ./R3SETUP -f CENTRAL.R3S
```

ãéá ðçí Ýêáíóç 4.6C, ÷ññðð íá Ý÷áé óçíáóßá áí ðí óóÛëíá ðñíèèðèçèá áðü ðí CENTRAL.R3S ð ðí DATABASE.R3S.

**Óçíáßóóç:** Óá êÛðíëá óðÛáéá, ðí R3SETUP ððíëÛóáé ùðé ðóóíç áÛóç äáññíÛíí ùóí éáé ðí SAP Ý÷íóí ðáéíðóáé éáé áêðáëíÛíóáé éáíííëÛ (éáèðð ðññèáéðáé áéá áðíáðá ðíö Ý÷íóí ðáç ðíèèççñèáß). Áí ðñíëÛóóí êÛèç, éáé áéá ðáñÛááéáíá äáí ððññáóá íá ðáéíðóáé ç áÛóç, ðáéíðóáé ðçí áÛóç éáé ðí SAP ðá ðí ÷Ýñé, áóíÛ áëíñèðóáðá ðá êÛèç éáé ðñéí áêðáëÛóáðá ðáíÛ ðí R3SETUP.

Ïç ðá÷Ûóáðá áðßóçð íá áêéëíðóáðá ðí Oracle listener (áêðáëÛóóá ðí ùð ÷ñðððçò orasid ðá umask 0; lsnrctl start) áí áß÷á áéáéíðáß éáé áððü (áéá ðáñÛááéáíá ðá ðéá áíááéáßá äðáíáêéëßíçóç ðíö óóóðíáðíð).

#### 10.7.13.2 OSUSERSIDADM\_IND\_ORA éáðÛ ðí R3SETUP

Áí ðí R3SETUP ðáñáðñíëÛóáé óá áððü ðí óçíáßí, ðñíðíðíëðóáðá ðí ðññóðððí áñ÷ðáßí ðíö R3SETUP ðíö ÷ñçóëíðíëáßðáé áêéëßíç ðçí óðéáíð (ðí CENTRDB.R3S (4.6B) ð êÛðíëíí áðü ðá CENTRAL.R3S ð ðí DATABASE.R3S (4.6C)). Æññáðá ðí [OSUSERSIDADM\_IND\_ORA] ð ðÛíðá ðíÛóá óðí áñ÷ðáßí áéá ðçí ðíááéëð ááññáð STATUS=ERROR éáé ðñíðéÛóóá ðá ðáñáéÛòóó:

```
HOME=/home/sidadm (was empty)
STATUS=OK (had status ERROR)
```

Óçç óðíÝ ÷ áéá ðñíñáßðá íá ðáéíðóáðá éáé ðÛéé ôí R3SETUP.

**10.7.13.3 OSUSERDBSID\_IND\_ORA éáóÛ ôí R3SETUP**

Ðééáíü áßíáé íá ððÛñ ÷ áé ðñüáéçíá éáé óá áóóü ôí áðíá ðá ôí R3SETUP. Óí ðñüáéçíá äáð áßíáé ðáñüííéí íá ôí ðñíçáíýíáíí, ôíð OSUSERSIDADM\_IND\_ORA. ÁðéÛ ðñíðñíéðóáðá ôí áñ ÷ áßí ðñíóýðíð ðíð ÷ ðçóéíðñíéáßðá ðá ôí R3SETUP (CENTRDB . R3S (4.6B) P êÛðñíéí áðü óá CENTRAL . R3S P DATABASE . R3S (4.6C)). Áñáßðá ôí [OSUSERDBSID\_IND\_ORA] P ðÛíðá ðíÝóá óðí áñ ÷ áßí áéá óçí ðñíáééð äáñáóð STATUS=ERROR éáé ðñíðéÝóóá ðá ðáñáéÛóù:

STATUS=OK

Óðñá ðñÝíðá íáíÛ ôí R3SETUP.

**10.7.13.4 “oraview.vrf FILE NOT FOUND” éáóÛ óç äéÛñéáéá ÄêäêÛóóáóçð óçð Oracle**

Óí óóÛéíá áóóü óçíáßíáé üóé Ý ÷ áðá áðééÝíáé ôí Oracle On-Line Text Viewer ðñéí ðáéíðóáðá óçí äêäêÛóóáóçð. Ç äðééíáð áóðð áßíáé ðñíáðééáñÝíç, ðáñ’ üéí ðíð ááí áßíáé áéáéÝóéíç óðí Linux. ÁðáéñÝóóá éñéðñí áóðð óçí äðééíáð áðü ôí ðáñý äêäêÛóóáóçð éáé ðáéíðóáðá íáíÛ.

**10.7.13.5 “TEXTENV\_INVALID” éáóÛ óçí ÄêêÝéáóç R3SETUP, ôíð RFC P ôíð SAPgui**

Áí áñáéáßðá áíóéíÝóóðñé íá áóóü ôí óóÛéíá, óóðá ááí Ý ÷ áðá óéð óóóóÝð ðñðééÝð ðñéíðóáéð. Ç óçíáßóóç 0171356 ôíð SAP áíáóÝñáé üéá óá RPMs ðíð ÷ ðñáéÛáííðáé íá äêäêáóáóóáéíýí (ð.÷. saplocales-1.0-3, saposcheck-1.0-1 áéá RedHat 6.1). Óóçí ðáñððóóç ðíð ááñðóáðá üéá óá ó ÷ áðééÛ éÛéç, éáé áí áéüíç Ý ÷ áðá ðñáéé ôí STATUS áðü ERROR óá OK (óðí CENTRDB . R3S) êÛéá ðññÛ ðíð ðáñáðñíéúðáí ôí R3SETUP éáé áðéðð ôí ðáééíýóáðá áðü óçí áñ ÷ P, ôí SAP ááí éá ðñéíóóáß óóóóÛ éáé ááí éá ðñíñáßðá íá óðíáéáßðá óðí óýóóçíá ðíóóü ôíð **SAPgui**, áéüíç éáé áí ôí óýóóçíá óáð Ý ÷ áé ðáéíðóáé. Ðñíððáéðñíóáð íá óðíáééíýíá ðá ôí ðáééú **SAPgui** Linux, áíðáíßóóçéá ôí ðáñáéÛóù óóÛéíá:

```
Sat May 5 14:23:14 2001
*** ERROR => no valid userarea given [trgmsgo. 0401]
Sat May 5 14:23:22 2001
*** ERROR => ERROR NR 24 ocured [trgmsgi. 0410]
*** ERROR => Error when generating text environment. [trgmsgi. 0435]
*** ERROR => function failed [trgmsgi. 0447]
*** ERROR => no socket operation allowed [trxio.c 3363]
Speicherzugriffsfehler
```

Ç óðíðáñéóññÛ áóðð ðñáéáðáé óðí üóé ôí **SAP R/3** ááí ðñíñáß íá ðñáéé óóóóÛ óéð ðñðééÝð ðñéíðóáéð éáé ááí ðñíñáß óóç óðíÝ ÷ áéá íá ðñéíðóáé ôíí ááóóü ôíð (áééáéðð ááññÝíá óóç áÛóç ááññÝíñí). Áéá íá ðñíñÝóáðá íá óðíáéáßðá ðñíðéÝóóá óéð ðáñáéÛóù éáðá ÷ ðññóáéð óðí DEFAULT . PFL (ááßðá Óçíáßóóç 0043288):

```
abap/set_etct_env_at_new_mode = 0
install/collate/active = 0
rscp/TCP0B = TCP0B
```

ÎäέέιPóðä ιάιÛ öι SAP. Öþñά ιðññáβðä ιά óðιαάεάβðä áέüñç έάέ άί ιέ ñðèιβóáέð ÷ þñάð έάέ äèþóóáð ää äιðèäýíτöι üðüð έά Ûðñáðä. Άóτý äέιñèþóáðä ðéð ñðèιβóáέð ðçð ÷ þñάð (έάέ ιñβóáðä ðéð óúóðÛð öιðέέÛð ñðèιβóáέð), ιðññáβðä ιά áóáέñÛóáðä óá ðáñáðÛíü äðü öι DEFAULT.PFL έάέ ιά äéðäεÛóáðä öι SAP áðü ðçí äñ÷P.

**10.7.13.6 ORA-00001**

Öι óóÛέιá áðöü öι óðιαίðPóáιá ιüñι ιά öι Oracle 8.1.7 öοι FreeBSD. Ì éüäιð Pðáι üðé ç áÛóç Oracle äáι ιðñιýóá ιά ιñβóáέ ðéð óúóðÛð ðáñáιÛðñιðð áέá ðçí äέέβιççP ðçð ιά áðιðÛέáóιá ιά έιέεÛáέ, áðPñιðáð óçιαðιτöñáβð έάέ έιέιü ÷ ñçóðç ιιPιç óöι óýóðçιá. Ç äðüιáιç ðñιððÛέáέá ιά ιäέέιPóιτöιá ðç áÛóç äääñÛíüι ιáð äιðÛέóá öι óóÛέιá ORA-00001.

Άñáβðä öιτöð ιά ðçí áιðιέP ipcs -a έάέ áóáέñÛóáð öιτöð ιά ðçí ipcrm.

**10.7.13.7 ORA-00445 (Background Process PMON Did Not Start)**

Öι óóÛέιá áðöü ιðññáβ ιά äιðáιέóáβ ιά öι Oracle 8.1.7 üðáι ç áÛóç äääñÛíüι Û ÷ äé äέέέιçέáβ ιά öι script startsap (áέá ðáñÛäáέáιá startsap\_majestix\_00) έάέ óáι ÷ ñPóðçð prdadm.

Îέá ðέέáιP έýóç áβιáέ ιά ιäέέιPóáðä ðç áÛóç üð ÷ ñPóðçð oraprd έάέ ιÛóü öιð svrmgrl:

```
% svrmgrl
SVRMGR> connect internal;
SVRMGR> startup;
SVRMGR> exit
```

**10.7.13.8 ORA-12546 (ÎäέέιPóðä öιι Listener ιά ðéð ÓúóðÛð ¶äáέáð)**

ÎäέέιPóðä öιι Oracle listener üð ÷ ñPóðçð oraids, ιά ðéð áέüέιðéáð áιðιέÛð:

```
# umask 0; lsnrctl start
```

ΆέáðιñáðέέÛ ιðññáβ ιά äιðáιέóáβ öι óóÛέιá ORA-12546 ðιð óçιαβιáέ üðé óá sockets äáι Û ÷ τöι óúóðÛð Ûäáέáð. Άáβðä ðç óçιαβüç 0072984 öιð SAP.

**10.7.13.9 ORA-27102 (έέάέøç ιιPιçð)**

Öι ðñüäέçιá áðöü ðáñιτöέÛóðçέá üðáι ÷ ñçóέιιðιέPóáιá ðέιÛð ιäááέýðáññáð öιτö 1 GB (1024X1024X1024) óðéð ιäóááέçðÛð MAXDSIZ έάέ DFLDSIZ. ΆðέðεÛíι, ιáð äιðáιβóðçέá öι óóÛέιá “Linux Error 12: Cannot allocate memory”.

**10.7.13.10 [DIPGNTAB\_IND\_IND] έáðÛ ðçí ΆέðÛέáóç öιð R3SETUP**

Óá äáιέέÛð äñáñÛÛð, äáβðä ðç óçιαβüç 0130581 öιð SAP (R3SETUP step DIPGNTAB terminates). ΈáðÛ ðçí ääέáðÛóðáç IDES, áέá éÛðιέι éüäι ç äέááέέáóβá ääέáðÛóðáçð ää ÷ ñçóέιιðιέιýóá öι óúóðü üñιá óðóðPιáðιð öιð SAP “IDS”, áέéÛ öι έáíü " ". Άðöü ιäççááβ óá éÛðιέá ιέέñÛ ðñιäέPιáðá ιá ðç ðñüóááóç óðιτöð έáðáέüäιτöð ιέá έάέ óá ιñιðÛóέá äçιέιðñáιýíðáέ äðιαίέέÛ ιá ðç ÷ ñPóç öιτö SID (óðç ðáñβððüçP ιáð IDS). ðñÛáιá ðιð óçιαβιáέ üðé áιðβ ιá äβιáέ ç ðñüóááçç óðι:

```
/usr/sap/IDS/SYS/...
```

```
/usr/sap/IDS/DVMGS00
```

εά ðñíóðáèÐóáé íá áβíáé óóí:

```
/usr/sap//SYS/...
/usr/sap/D00
```

Ãέα íá óðíá÷βóíóíá à ççí áãέαóÛóóáóç, äçìéíðñáÐóáíá Ýíáí óýíááóíí εάé Ýíáí äðéðëÝíí εάóÛëíáí:

```
# pwd
/compat/linux/usr/sap
# ls -l
total 4
drwxr-xr-x 3 idsadm sapsys 512 May 5 11:20 D00
drwxr-x--x 5 idsadm sapsys 512 May 5 11:35 IDS
lrwxr-xr-x 1 root sapsys 7 May 5 11:35 SYS -> IDS/SYS
drwxrwxr-x 2 idsadm sapsys 512 May 5 13:00 tmp
drwxrwxr-x 11 idsadm sapsys 512 May 4 14:20 trans
```

Ïí ðñüáεçíá áóóü ðí áβáíáí áðβóçð óóéð óçíáεðóáéð 0029227 εάé 0008401 ðíð SAP. Ãáí áíóéíáóóððβóáíá ùíðò εáíÝíá áðü áóóÛ óá ðñíáèÐíáóá íá ççí áãέαóÛóóáóç ðíð **SAP 4.6C**.

### 10.7.13.11 [RFCRSWBOINI\_IND\_IND] εάóÛ ççí ÁêðÝεάóç ðíð R3SETUP

Ïí óóÛëíá áóóü áíóáíβóóçεά εάóÛ ççí áãέαóÛóóáóç ðíð **SAP 4.6C**, εάé Ðóáí ðí áðíóÝεάóíá áíóð Ûεεíó óóÛëíáóíò ðíð ðñíÝéððá íññβóáíá óóçí áãέαóÛóóáóç. Óá ðÝóíεáð ðñéððóáéð εá ðñÝðáé íá ááβóá óá áíóβóóíé÷á logfiles εάé íá áéíñèðóáóá ðí áñ÷έεü ðñüáεçíá.

Áí áóíý áεÝáíáðá óá logfiles áεάðéóððóáðá ùðé ðí óóÛëíá áβíáé ðñÛñáíóé áóóü (εíεðÛíðá ðéð óçíáεðóáéð ðíð SAP), ìðññáβóá íá ïñβóáðá ðí STATUS óá áóóü ðí áÐíá áðü ERROR óá OK (óóí áñ÷áβí CENTRDB.R3S) εάé íá áêðäëÝóáðá íáíÛ ðí R3SETUP. ÌáðÛ ççí áãέαóÛóóáóç, ðñÝðáé íá áêðäëÝóáðá ðí RSWBOINS áðü çç óóíáεéááÐ SE38. Ááβóá çç óçíáβóóç 0162266 ðíð SAP áέα óá RFCRSWBOINI εάé RFCRADDBDIF.

### 10.7.13.12 [RFCRADDBDIF\_IND\_IND] εάóÛ ççí ÁêðÝεάóç R3SETUP

¼ðòð εάé ðñéí, εάé ááð εó÷ýáε ç βáέα εíáεèÐ: óέαíóñáððáβóá ðíεí áβíáé ðí ðñüðáñ÷έεü óóÛëíá εíεðÛæííóáð óá logfiles.

Áí áðéááááεðóáðá ùðé ç óçíáβóóç ðíð SAP 0162266 áíðáðíññβíáðáé óóí ðñüáεçíÛ óáð, áðéÛ ïñβóáðá ðí STATUS óá áóóü ðí áÐíá áðü ERROR óá OK (óóí áñ÷áβí CENTRDB.R3S) εάé ðñÝíðá ðÛέé ðí R3SETUP. ÌáðÛ ççí áãέαóÛóóáóç, ðñÝðáé íá áêðäëÝóáðá ðí RADDBDIF áðü çç óóíáεéááÐ SE38.

### 10.7.13.13 sigaction sig31: File size limit exceeded

Ïí óóÛëíá áóóü ìðññáβ íá áíóáíéóóðáβ εάóÛ ççí áêèβíççç ðüí áεáññááóéðí ðíð **SAP disp+work**. Áí íáεéíÐóáðá ðí **SAP** íá ðí script startsap, íé ððíáεáññááóβáð εá áñ÷βóíóí íñíáð ðíðð, íáεéíðíóáð ðéð ððüεíεðáð áεáññááóβáð ðíð áðáέóíýíóáé áðü ðí **SAP**. Áóóü Ý÷áε ùð áðíóÝεάóíá ðí βáéí ðí script íá íçí áíññβæáε áí εÛðé ðÐáá óðñááÛ.

Ãέα íá áεÝáíáðá áí ùíòðð íáεβíççóáí óóóÛ íé áεáññááóβáð ðíð **SAP**, ïññíðá íέα íáóéÛ óçç εβóóá áεáññááóéðí íá ççí áíóíεÐ ps ax | grep SID, ç ìðíβá εá óáð áðéóðñÝðáé íεáð εβóóá íá ùεáð ðéð áεáññááóβáð áðü óá **Oracle** εάé **SAP**. Áí óáβíáðáé óáí íá εáβóíóí ìáñέéÝð áεáññááóβáð, Ð áí ááí ìðññáβóá íá óóíááεáβóá óóí **SAP**, εíεðÛíðá óá áíóβóóíé÷á

logfiles ōā īōīāēā īōīīīēī īā āñāēīēī ōōīī ēāōŪēīāī /usr/sap/SID/DVEBMSnr/work/. Ōā āñ ÷ āēā ðīō ðñŸðāē īā ēīēōŪīāōā āēīāē ōā dev\_ms ēāē dev\_disp.

Ōī Signal 31 ēā āīōāīēōōāēā āī ç ðīōūōçōā ōçō ēīēīēōō īīēīçō ðīō ÷ ñçōēīīēēēāēēāē āðū ōā **Oracle** ēāē **SAP** īāðñŪōāē ōī īŸāēēīō ðīō Ÿ ÷ āē ēāç īñēōōāē ēāōŪ ōç ñŸēīēōç ōīō ðñēēīā. Īā ōī īā īñēōōāē īēā īāāēŸōāñç ōēīē ēā īðīñŸōāōā īā ðñīōðñŪōāōā ōī ðñūāēçīā āōōū:

```
# īāāāēŸōāñç īīēīç ēāē ōōōōēīāōā ðāñāāūāēēō 46C:
options SHMMAXPGS=393216
# īēēñūōāñç īīēīç ēāē ōōōōēīāōā 46B:
#options SHMMAXPGS=262144
```

**10.7.13.14 Āīāðēōō ÷ ēō Āēēēīçōç ōīō sa\_poscol**

ŌðŪñ ÷ īōī āðēōçō īāñēēŪ ðñīāēēīāōā īā ōī ðñūāñāīā sa\_poscol (Ÿēāīōç 4.6D). Ōī **SAP** ÷ ñçōēīīēēēāē ōī sa\_poscol āēā īā ōðēēŸīāē āāñŸīā ō ÷ āōēēŪ īā ōēō āðēāūōāēō ōīō ōōōōēīāōīō. Ōī ðñūāñāīā āōōū āāī ōī ÷ ñāēŪāēōōā āēā īā āēōāēŸōāōā ōī **SAP**, īðūōā īðīñāē īā ēāñņçēāē ùð īēēñūōāñç ōçīāōēāō. ðāēāēūōāñāð āēāūōāēō (4.6B) āīōēāŸīōī, āēēŪ āā ōðēēŸīōī Ÿēā ōā āāñŸīā (ðīēēŸō ēēēōāēō āðēōōñŸīōīō 0, āēā ðñŪāāēāīā ç ÷ ñēōç ōçō CPU).

**10.8 ðñī ÷ ŸñçīŸīā ĖŸīāōā**

Āī Ÿ ÷ āōā ōçī āðīñēā ðūð ēāēōīōñāāē ç ōōīāāōūōçōā īā āōāñīāŸō Linux, ōūōā ēā ðñŸðāē īā āēāāŪōāōā ōç ðāñāēŪōð āīūōçōā. Ōā ðāñēōōūōāñā āðū Ÿōā Ÿ ÷ īōī āñāōōāē āēīāē āāōēōīŸīā ōōçī çēāēōñīēēē ēēōōā āāīēēēī ōōāçōēōāūī ōīō FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-chat>) ēāē Ÿ ÷ īōī āñāōōāē āðū ōīī Terry Lambert <tlambert@primenet.com> (Message ID: <199906020108.SAA07001@usr09.primenet.com>).

**10.8.1 ðūð ēāēōīōñāāē;**

Ōī FreeBSD ðāñēŸ ÷ āē Ÿīā āðēāāēāī āōāēñāōçō (abstraction) ðīō īñīŪāāōāē “execution class loader”. Āōōū āāōēāēāōē ōōī `execve(2)`. Āōōū ðīō ōōīāāēīāē āēīāē Ÿōē ōī FreeBSD Ÿ ÷ āē īēā ēēōōā ōīñōūōēēī (loaders), āīōē āēā Ÿīā ðīō īā ēāōāōāŸāāē ōā ðāñēððōūōç āðīōð ÷ ēāð ōōī # ! āēā īā ðñŸīāē ēŪðīēī shell interpreter ē shell script.

ĖōōīñēēŪ, ī īūñīð ōīñōūōēēō ōōç ðēāōōūñīā ōīō UNIX Ÿēāā ÷ ā ōīī īāāēēū āñēēū (āāīēēŪ ōā ðñēōā 4 ē 8 bytes ōīō āñ ÷ āēīō) āēā īā āāē āī āēīāē ēŪðīēī āēōāēŸōēēī / āōāñīāē ēīūōōū ōōī ōŸōōçīā, ēāē ōōçī ðāñēððōūōç āōōē īā ēāēŸōāē ōīī āīōēōōīē ÷ ī ōīñōūōēēō.

Āī ōī āñ ÷ āēī āāī ēōāī āēōāēŸōēēī īā āŪōç ōīī ōŸōī ōīō ōōōōēīāōīō, ç ēēēōç ōōī `execve(2)` āðŸōōñāōā ēŪðīēī ōōŪēīā, ēāē ōī shell ðñīōðāēīŸōā īā āēōāēŸōāē ōī āñ ÷ āēī ōāī shell script.

Ç āāīēēē ēāŸā ēōāī “āī āāī āēīāē āēōāēŸōēēī, ðñīōðŪēçōā īā ōī ðñŸīāēō ùð shell script īā āŪōç ōī ðñŸ ÷ īī shell ”. Āñāūōāñā, āñŸēçēā Ÿīāō Ÿīōðñīð ōñūðīō ēōōā ōī `sh(1)` īā āēŸā ÷ āē ōīōð ðñēōīōð āŸī ÷ āñāēōēēāð, ēāē āī ēōāī : \n, ōūōā ēāēīŸōā ōī shell `csh(1)` (ðēōōāŸīōīā ðūð ç ēŸōç āōōē āñŸēçēā āñ ÷ ēēŪ āðū ōç SCO).

Āōōū ðīō ēŪīāē ōēñā ōī FreeBSD āēīāē īā āēāōñŸ ÷ āē ōç ēēōōā īā Ÿēīōð ōīōð ōīñōūōēēō, īā Ÿīā āāīēēū ōīñōūōēēō # ! ī īðīēīð āīāāīñēēāē ùð āēāñīçīŸā (interpreter) ōīōð ÷ āñāēōēēāð āðū ōī āðūīāñ ēāīū īāðŪ ōī ! ēāē īŸ ÷ ñē ōī ōŸēīō, āēē āī āāī āīāāīñēēōāē ēŪðīēīō, ÷ ñçōēīīēēēāēēāē ùð Ÿō ÷ āōç ēŸōç ōī /bin/sh.

Àέā όçī όđīōόPñέīç όīō Linux ABI, όī FreeBSD àēÛđāē όīī īāāέēū āñέēū όīō ELF binary (āā áíāāfūñBæāē όç áéāōīñÛ áíÛīāóā óā FreeBSD, Solaris, Linux, P êÛđīēī Ûēēī éāέóīōñāέēū óýόόçīā όī īđīBī ÷ ñçόέīīđīēīāB āñ ÷ āBā óýđīō ELF).

Ï óīñōùōPđō ELF éīéōÛāē āéā Ýīā áéāέēū brand, όī īđīBī āBīāé īéā áfúōçōā ó ÷ īēBūī īÛóā óóī ELF image, éāé όī īđīBī āāī óđÛñ ÷ áé óā ELF binaries áéā SVR4/Solaris

Àéā íā éāέóīōñāPóīōī óā áēōāēÛόείā όīō Linux, éā đñÛđāē íā āBīōī branded (īāñéāñέóōīýī) ùò Linux īÛóū όçō brandelf(1):

```
# brandelf -t Linux file
```

¼óāī āBīāē áóōū, Ï óīñōùōPđō ELF éā àēÛđāē όī Linux brand đÛīfū óóī āñ ÷ āBī.

¼óāī Ï óīñōùōPđō ELF āāé όī Linux brand, éā áíóέéāóāóđPóāē Ýīāī āāBéōç īÛóā óόç āñP proc. ¼éāđ īé ēēPóāéō όīō óóóđPīāóīō óāíēñīýīóāé īÛóā áđū áóōūī όīī āāBéōç (óā Ýīā đāñāīīóéāēū óýóόçīā UNIX, Ï āāBéōçō éā Pđāī Ï đBīāéāó systent[ ], đīō đāñēÛ ÷ áé óéō ēēPóāéō όīō óóóđPīāóīō (system calls)). ÁđēđēÛīī, ç áéāñāóóā óçīāēPīāóāé áéā áéāéēP īāóā ÷ āñBéóç óīō trap vector éāé Ûēēāō (īéēñÛđ) áēīñēPóāéō, óéō īđīBāō ÷ áēñBæāóāé όī Ûñēñūīā đōñPīā όçō óōīāāóūōçōđā Linux.

Óī system call vector óīō Linux đāñēÛ ÷ áé, īāóāýī Ûēēūī, īéā ēBóóā īā óā āāñÛýīā óīō systent[ ] óūī īđīBūī īé áéāđēýīóāéō āñBóēīīóāé īÛóā óóī Ûñēñūīā óīō đōñPīā.

¼óāī āBīāóāé īéā ēēPóç óóóđPīāóīō áđū īéā āóāñīāP Linux, Ï ēPāééāō (trap code) đñīđīđīéāB óīī āāBéōç óçō īÛóū óçō āñPđō đīō Ý ÷ áé āāñāóóāB óóī proc, éāé áēēÛæāé óçī áéāýéóīóç Póóā íā āāB ÷ íāé óóī óçīāBī áéóūāīō óçō óóīÛñόçóçō óīō Linux, éāé ù ÷ é óīō FreeBSD.

ÁđBóçō, óī óýóόçīā óōīāāóūōçōđā īā Linux īđīñāB éāé đñīóāñīūæāé äōīāíéēÛ óéō óīđīēāóBāō áíāæPđóçóçō. ÏóóéāóóéēÛ áóōū ēÛīāé éāé ç áđēēīāP union éāōÛ óçī đñīóÛñόçόç áfūō óóóđPīāóīō āñ ÷ āBūī (āāī áfñīýīā āāP óī óýóόçīā āñ ÷ āBūī unionfs!). Áñ ÷ éēÛ, āBīāóāé áđūđāēñā íā āñāēāB óī āñ ÷ āBī óóīī éāōÛēīāī /compat/linux/original-path, éāé ùūī áí áóōū áđīōý ÷ áé, éā āBīāé áíāæPđóçóç óóī éāōÛēīāī /original-path. īā óīī óñūōī áóōū óéāīōñāýīōīā īúé óā áēōāēÛόείā đīō ÷ ñāēÛæīóāé Ûēēā áēōāēÛόείā éā óñÛīōī (áéā đāñÛāāéāīā, óī óýñēī āñāāéāBūī óīō Linux īđīñāB íā áēōāēāóóāB īÛóū óçō óđīóđPñέīçō óīō Linux ABI). ÁđBóçō óçīāBīāé īúé óā áēōāēÛόείā óīō Linux īđīñīýī íā óīñōPóīōī éāé íā áēōāēÛόéōī āñ ÷ āBā óīō FreeBSD áí āāī īđīñīýī íā áíóīđBóōīō óā áíóBóóīē ÷ á āñ ÷ āBā óóī Linux. ÏđīñāBōā āđBóçō íā óīđīēāōPóāōā īéā áíóīēP uname(1) īÛóā óóī /compat/linux đñīēāēīÛōóā óā āñ ÷ āBā óīō Linux íā īç īđīñīýī íā áíāāfūñBóōīōī īúé āāī ÷ ñçόέīīđīēīýīóāé đñāāīāóéēÛ óā Linux.

ÏóóéāóóéēÛ, óđÛñ ÷ áé Ýīāđ đōñPīāđ Linux īÛóā óóīī đōñPīā óīō FreeBSD. Īé áēÛóīñāō éāέóīōñāBāō īé īđīBāō óēīđīēīýī ũéāō óéō óđçñāóBāō đīō đāñÛ ÷ īíóāé áđū óīī đōñPīā āBīāé Bāéāō óūōī óóīī đBīāéā ēēPóāūī óóóđPīāóīō óīō FreeBSD ũōī éāé óóīī áíóBóóīē ÷ Ï óīō Linux: éāέóīōñāBāō óīō óóóđPīāóīō āñ ÷ āBūī, áéēīéēP īPīç, áéā ÷ āñBéóç óçīÛóūī, System V IPC éēđ. Ç ũīç áéāóīñÛ āBīāé īúé óī áēōāēÛόείā óīō FreeBSD éÛīōī ÷ ñPóç óūī óóīāñōPóāūī glue óīō FreeBSD, āP óā áēōāēÛόείā óīō Linux, éÛīōī ÷ ñPóç óūī óóīāñōPóāūī glue óīō Linux (đīēēÛ áđū óā đāéēÛ éāéóīōñāéēÛ āB ÷ áí óéō áéēÛđ óīōđ óóīāñōPóāéō glue: īé áéāđēýīóāéō óūī óóīāñōPóāūī āñBóēīīóāí óóī óóāóéēū đBīāéā systent[ ], áíóB íā áéāđēñēíBæīīóāé īÛóū áfūō äōīāíéēÛ āāBéōç óόç āñP proc óçō áéāñāóóBāō đīō đñāāīāóīđīéāB óçī ēēPóç).

Đīēī āBīāé ũñò óī āāāāÛÝđ FreeBSD ABI; Áāī Ý ÷ áé éāé đīēý óçīāóBā. Ç ũīç āáóéēP áéāóīñÛ āBīāé (éÛóé óī īđīBī īđīñāB áýēīēā íā áēēÛīāé óā īāēēīīóéēÛđ áéāūóāéō, éāé đīēý đēēāfūī íā áēēÛīāé) ũéé īé óóīāñōPóāéō glue óīō FreeBSD āBīāé óóāóéēÛ óóīāāāīÛÝīāđ óóī đōñPīā, āP īé áíóBóóīē ÷ āò óīō Linux īđīñīýī āBōā íā āBīāé óóīāāāīÛÝīāđ óóāóéēÛ, āBōā íā āBīāé đñīóāÛóéīāđ īÛóū áfūō āñēñPīāóīō đōñPīā.

ÁBīāé áóōū ũñò đñāāīāóéēP āññīBūóç; ¼ ÷ é. ÁBīāé īéā óēīđīBçóç óīō ABI, ù ÷ é āññīBūóç. Áāī óđÛñ ÷ áé éāñBā āññīBūóç (P đñīóññīBūóç, áéā íā đñīēÛāīōīā óçī áđūīāīç óāó āñPóçóç).



# III. Ἀέα ÷ ἀβñέος ΌοόΠιάοιò

Όά εἶοῦεἰάά οἱò FreeBSD Handbook οἱò ἀεἱεἱòεἱγἱ ἀίάοῦñíοάέ οἱ εἰῤἶάοά οἱò ῤ ÷ ἱοἱ ó ÷ ῤόç ἱά οç *ἀέα ÷ ἀβñέος* οἱò οσοόΠιάοιò. Èῤεἱά εἶοῦεἰεἱ ἱάεἱῤ ðñεἱñῤοἱοἱόάò οέ εἱ ἱῤεἱόἱ ἱεἱάῤεἱοἱόάò οἱ οἱεἱεἱεἱεἱ ῤἱ εἶοῦεἰεἱ, εἱεἱò εἱεἱ οέ ðñἱάοἱεἱγἱἱἱἱ ῤ ÷ ἱεἱ οἱ εἶοῦεἰεἱ ἱόοῤ: οέ ðñῤἱεἱ ἱἱ ῤ ÷ ἱόἱ Πἱç ἱεἱἱῤόἱεἱ εἱεἱ εἱάἱñἱΠόἱεἱ ðñεἱ ἱό ÷ ἱεἱεἱβἱόἱ ἱἱ ἱόοῤ οἱ εἶοῦεἰεἱ.

Ἀόοῤ ἱά εἶοῦεἰεἱ ῤ ÷ ἱοἱ ó ÷ ἱἱεἱόοἱβ ðñεἱόοῤἱἱñἱ ἱò ἱἱçἱἱò ἱἱἱἱñῤò ðñἱῤ ἱò ἱεἱόἱἱἱεἱεἱ εἱβἱἱñ. Ἀεἱ ἱόοῤ ἱβἱἱεἱ ðεἱ ÷ ñΠόεἱἱ ἱò ἱἱçἱñἱβ ἱόἱἱò ἱἱñἱἱἱò ἱἱñἱἱβἱόἱ ἱἱ ἱἱἱἱñῤἱἱἱ ἱἱἱἱ ÷ ñἱεἱῤεἱἱἱἱ ἱἱἱἱεἱ ἱἱçñἱἱñἱβἱ ἱεἱ ἱἱ FreeBSD. Ἀἱ ÷ ñἱεἱῤεἱἱἱἱ ἱἱ ἱἱ ἱεἱἱῤἱἱἱ ἱἱ εἶῤἱεἱ ἱἱἱεἱἱñἱ ῤἱç ἱἱἱñῤ, ἱἱἱἱ ÷ ñἱεἱῤεἱἱἱἱ ἱἱ ἱἱ ῤ ÷ ἱόἱ ἱεἱἱῤἱἱἱ ἱἱἱ ἱἱñἱ ἱñ ÷ βἱἱἱἱ ἱἱ ἱἱ ἱἱεἱβἱἱἱ ἱἱ ἱἱ FreeBSD.

# ÊäöÛëáéí 11 Ñýèìéóç êáé Âäëôéóôïðïßçóç

ÃñÛöðçêä áðu ðñ Chern Lee. Ááóβóðçêä óä tutorial ãñäñÝñ áðu ðñ Mike Smith. ÁáóéóíÝñ äðβóçð óðñ tuning(7) ðñ ãñÛöçêä áðu ðñ Matt Dillon.

## 11.1 Óýññóç

Íá áðu óä óçñáíðéëÛ ÷ ãñáëðçñéóðéëÛ ðñ FreeBSD áβíáé ç äñíáðñóçðá ñýèìéóçð ðñ óðóðßíáðñ. Ìá ðéð óóóðÝð ñðèìβóáéð óðóðßíáðñ áβíáé áýèèñ íá äññóäð ÷ èññ ðñèñÛ ðññáèßíáðñ éáðÛ óç ãéÛñéáé ìáèññóéèñ ñíáááèìβóáñ. Õñ éäöÛéáéí áðóñ éá ãñçáßóáé ìááÛèñ ìÝññð óçð áéááééáóβáð ñýèìéóçð ðñ FreeBSD, óðñðñáñéáíááñÝññ éáé éÛðñéñ ðáñáñÝðññ ðñ ðñññññ íá ñðèìéóðññ áéá óçñ áäëðéóðñññçóç óçð áðuññóçð ðñ óðóðßíáðñ.

Áóññ áéááÛóáðá áðóñ ðñ éäöÛéáéí, éá ñÝñáðá:

- Ðñð íá ãñèÝçðáðá äñññóéëÛ ìá óðóðßíáðñ ãñ ÷ ãβññ éáé éáðáðñßóáéð swap.
- Óá ááóéëÛ ðññ óðóðçñÛðññ ñýèìéóçð éáé äéèßçóçð rc.conf éáé /usr/local/etc/rc.d.
- Ðñð íá ñðèìβóáðá éáé íá ãñèñÛóáðá ìéá éÛñðá áééðññ.
- Ðñð íá ñðèìβóáðá virtual hosts óðéð áééððáéÝð óáð óðóéãñÝð.
- Ðñð íá ÷ ñçóèññðñéßóáðá óá ãéÛññá ãñ ÷ áβá ñðèìβóáññ óðññ éáðÛèññ /etc.
- Ðñð íá áäëðéóðñññèßóáðá ðñ FreeBSD ÷ ñçóèññðñéßíðáð ìáðáéçðÝð sysctl.
- Ðñð íá áäëðéóðñññèßóáðá óçñ áðuññóçð ðñ áβóèññ éáé íá áééÛñáðá ðñðð ðñññññóññññ ðñð ððñßíá.

Ðñññ áéááÛóáðá áðóñ ðñ éäöÛéáéí, éá ðñÝðáé:

- Íá éáðáññáßðá ááóééÝð Ýñññéäð ðñ UNIX éáé ðñ FreeBSD (ÊäöÛéáéí 3).
- Íá áβóðá ãññéáéññññññ ìá óá ááóéëÛ óçð ñýèìéóçð éáé óçð ìáðááèßððéóçð ðñð ððñßíá (ÊäöÛéáéí 8).

## 11.2 Áñ ÷ éèß Ñýèìéóç

### 11.2.1 ÄéÛóáñç Éáðáðñßóáññ

#### 11.2.1.1 ÁáóééÝð Éáðáðñßóáéð

¼óáñ äçñèñññáßðá óðóðßíáðñ ãñ ÷ ãβññ ìá ðñ bsdlable(8) ð ðñ sysinstall(8), èðñçèáßðá ùðé ìé óéèçñññß áβóèñé ìáðáðÝññññ ãáññÝñá ãñçãñññðáñá áðñ óá áññðáñéëÛ ìÝññé ðñðð óðá áóñðáñéëÛ. ðóé ìéñññðáñá éáé ðññéóóñðáññ ðññóáÛóéñá óðóðßíáðñ ãñ ÷ ãβññ ðññÝðáé íá áβíáé ðççóéÝóðáñá óðñ áññðáñéëÛ ðñð áβóèññ, áñ ìááéýðáññð éáðáðñßóáéð ùððð ðñ /usr ðññÝðáé íá ðñññéáðñññóáé ðññ èññðÛ óðñ áóñðáñéëÛ ðñð áβóèññ. Áβíáé éáèß éáÝá íá äçñèñññáßðá éáðáðñßóáéð ìá ðáññññéá óáññÛ ìá áððßí: root, swap, /var, /usr.

Õñ ìÝñááèñð ðñð /var áíðáíáéëÛ óçñ áðéáéñññññññ ÷ ñßóç ðñð ìç ÷ áñññáðñ. Õñ /var ÷ ñçóèññðñéáßðá ãéá óçñ áðñèèéáðóç ðññ ãññññáðñéááððßññ, ðññ ãñ ÷ ãβññ éáðáññáððð éáé ðñð spooler ðñð áéðððððð. Óá ãññññáðñéáèèéáèèéá éáé óá ãñ ÷ ãβá éáðáññáððð ðññññññññññññ ðá ðññññññññçðá ìááÝèç áñññññññ ìá ðññ ãññéññ ðññ ÷ ñçóðññ ðñð óðóðßíáðññ éáé ðñ ÷ ñññéññ ãéÛóçñá ðñð èññáðñññññññ ðá ãñ ÷ ãβá éáðáññáððð. ÓðÛñéá ÷ ññéÛñáðáé ðñ /var/tmp íá Ý ÷ áé ðÛñ



εἰσάγει ὁ κῆρυξ τῆς βίβλου εἰς τὴν ἀρχὴν τῆς ἐπιτομῆς καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως.

### 11.3 Ἐπιτομὴ Νύκτιος

Ἡ ἐπιτομὴ τῆς βίβλου εἰς τὴν ἀρχὴν τῆς ἐπιτομῆς καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως.

Ἡ ἐπιτομὴ τῆς βίβλου εἰς τὴν ἀρχὴν τῆς ἐπιτομῆς καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως.

Ἡ ἐπιτομὴ τῆς βίβλου εἰς τὴν ἀρχὴν τῆς ἐπιτομῆς καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως.

Ἡ ἐπιτομὴ τῆς βίβλου εἰς τὴν ἀρχὴν τῆς ἐπιτομῆς καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως.

- rc.conf:

```
. /etc/rc.conf.site  
hostname="node15.example.com"  
network_interfaces="fxp0 lo0"  
ifconfig_fxp0="inet 10.1.1.1"
```

- rc.conf.site:

```
defaultrouter="10.1.1.254"  
saver="daemon"  
blanktime="100"
```

Ἡ ἐπιτομὴ τῆς βίβλου εἰς τὴν ἀρχὴν τῆς ἐπιτομῆς καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως.

Ἡ ἐπιτομὴ τῆς βίβλου εἰς τὴν ἀρχὴν τῆς ἐπιτομῆς καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως.

### 11.4 Νύκτιος Ἀστρονομίας

Ἡ ἐπιτομὴ τῆς βίβλου εἰς τὴν ἀρχὴν τῆς ἐπιτομῆς καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως.

Ἡ ἐπιτομὴ τῆς βίβλου εἰς τὴν ἀρχὴν τῆς ἐπιτομῆς καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως καὶ τὴν ἀρχὴν τῆς ἀποδείξεως.

Ἐπιπέδῳ, ἡ δὲ ἴσχυς τοῦ `port` ἴσχυς `package` ἀπεριόριστοῦ, ἀνασχετίζονται ἀπὸ τὸν `port` ἀπεριόριστοῦ ἀπὸ τὸν `port`. Ἄλλοι ἀπὸ τὸν `port` ἀνασχετίζονται ἀπὸ τὸν `port`. Ἄλλοι ἀπὸ τὸν `port` ἀνασχετίζονται ἀπὸ τὸν `port`.

Ἄλλοι ἀπὸ τὸν `port` ἀνασχετίζονται ἀπὸ τὸν `port` ἀπὸ τὸν `port` ἀπὸ τὸν `port`.

```

-rw-r--r-- 1 root wheel 2184 May 20 1998 access.conf
-rw-r--r-- 1 root wheel 2184 May 20 1998 access.conf.default
-rw-r--r-- 1 root wheel 9555 May 20 1998 httpd.conf
-rw-r--r-- 1 root wheel 9555 May 20 1998 httpd.conf.default
-rw-r--r-- 1 root wheel 12205 May 20 1998 magic
-rw-r--r-- 1 root wheel 12205 May 20 1998 magic.default
-rw-r--r-- 1 root wheel 2700 May 20 1998 mime.types
-rw-r--r-- 1 root wheel 2700 May 20 1998 mime.types.default
-rw-r--r-- 1 root wheel 7980 May 20 1998 srm.conf
-rw-r--r-- 1 root wheel 7933 May 20 1998 srm.conf.default

```

Ἄλλοι ἀπὸ τὸν `port` ἀνασχετίζονται ἀπὸ τὸν `port` ἀπὸ τὸν `port` ἀπὸ τὸν `port`.

## 11.5 Εἰσαγωγή τοῦ Ὄχι

*Contributed by Tom Rhodes.*

Ἐπιπέδῳ ἀπὸ τὸν `port` ἀνασχετίζονται ἀπὸ τὸν `port` ἀπὸ τὸν `port` ἀπὸ τὸν `port`.

Ἄλλοι ἀπὸ τὸν `port` ἀνασχετίζονται ἀπὸ τὸν `port` ἀπὸ τὸν `port` ἀπὸ τὸν `port`.

Ἄλλοι ἀπὸ τὸν `port` ἀνασχετίζονται ἀπὸ τὸν `port` ἀπὸ τὸν `port` ἀπὸ τὸν `port`.

Ἄλλοι ἀπὸ τὸν `port` ἀνασχετίζονται ἀπὸ τὸν `port` ἀπὸ τὸν `port` ἀπὸ τὸν `port`.

Ἄλλοι ἀπὸ τὸν `port` ἀνασχετίζονται ἀπὸ τὸν `port` ἀπὸ τὸν `port` ἀπὸ τὸν `port`.

Ôí ðéí áðëü óáíÛñéí áêêβíçóçð ðééáíüðáóá íá ïéÛæáé ìá òí 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 ðéá stop éáé ðéá start áðéíñáð áéá òçí áòáñíñáð ùðíð óòí ðáñÛäáéáíá ááð áíáóÝñáðáé óáí utility.

Ìðíñáβ íá áêêéíçèáβ ÷ áéñüíáéðééÛ éÛñíðáò:

```
# /usr/local/etc/rc.d/utility.sh start
```

Ðáñüéí ðíð ááí áðáéóíýí üéáð ðé áòáñíñáÝð íá ðñíóðáéáβ ìβá ááñáñáðð óòí rc.conf, ó ÷ áäüí éáðçíñáñéíÛ éáé Ýíá íÝí port éá òñíðíðíéððá áéá íá äÝ ÷ áðáé áððð òçí ñýèíéóç. ÁéÝñáñáðá òçí ðáéééð Ýñíñí òçð ááéáðÛóðáóçð áéá ðáñéóóüðáñáð ðéçñííñíñáð ðÛíü óðçí óðáéáñéñíÝíç áòáñíñáð. ÌáñééÝð áòáñíñáÝð áðí òñβðíðð éáðáóéáðáóóÝð ðáñÝ ÷ ïí óáíÛñéá áêêβíçóçð óá ðíðá áðéðñÝðíðí òðçí áòáñíñáð íá ÷ ñçóéíðíéçèáβ ìá òí rc.d, ðáñüéá áðóá, áðòù éá óðæçðçèáβ óòí áðüíáñí ìÝñíð.

### 11.5.1 ÁêêðáóáíÝíç Ñýèíéóç Áòáñíñáðí

ÐéÝíí òí FreeBSD ðáñéÝ ÷ áé òí rc.d, ç ñýèíéóç òçð áêêβíçóçð òüí áòáñíñáðí Ý ÷ áé áβíáé áðéíñáðñç, éáé ðéí ðéíýóéá óá ÷ áñáéðçñééÛ. × ñçóéíðíéçèáð éÝíáéð ééáéáβá ìÝóá óòíí éáðÛéíñí rc.d, ðé áòáñíñáÝð ðíðíýí ðéÝíí íá áêêéíñíÝ Ýðáéóá áðí óðáéáñéñíÝíáð òðçñáóβáð áéá ðáñÛäáéáíá òçí DNS, ìðíñáβ íá áðéðñáðáβ ç áéóááñáð áðéðéÝíí ðáñáíÝðññí ìÝóá áðí òí rc.conf óðçí èÝóç òüí ðæç òðÛñ ÷ òíðíí ðáñáíÝðññí áðí óá óáíÛñéá áêêéíðóçð, éðéð. Íá ááóééü óáíÛñéí ìðíñáβ íá ïéÛæáé ìá òí áéüéíðéí:

```
#!/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"}
```





οδῖαάέέγῖῖόάο δῖῖ ἰPῖά. Ὀῖ δάαβῖ wday έάέἰñβæάέ οçῖ çῖYῖñά οçδὸ ááññÜáαδ. ¼έά áδδÜ δά δάαβá δñYῖδáέ ἰά Yῖ-ῖδῖ ἁñέέῖçδέέYδ δέῖYδ, έάέ ἰά áέῖῖδῖYῖῖ δῖ ἁβῖῖοέ-δἁδñÜññῖ ἥῖῖé. Ὀῖ δάαβῖ who ἁβῖάέ έάέἁβδἁñῖ, έάέ δδÜñ-áέ ἰñῖῖ ἰYῖάά οδῖ ἁñ-áβῖ /etc/crontab. Ὀῖ δάαβῖ áδδῖῖ έάέἰñβæάέ οάῖ δῖέῖδ ÷ñPóδçδ έά δñYῖáέ οçῖ ἁῖδῖῖP. ¼δἁῖ Yῖάδ ÷ñPóδçδ ááέάέέοδÜ δῖ crontab ἁñ-áβῖ δῖδ, áἁῖ έά Yῖ-áέ δῖ δάαβῖ áδδῖῖ έάέέYῖῖ. ὈYῖδ, έά áέῖῖδῖPῖάέ ç ἁδῖῖἰἁP command. Áδδῖ ἁβῖάέ δῖ δάέἁδδἁβῖ δάαβῖ, Yῖδóέ έάέ έῖἁέÉÜ οδῖἁάέέγῖῖάέ οçῖ ἁῖδῖῖP δῖδ έά ἁέδἁέἁδδἁβ.

4 Ç δάέἁδδἁβá áδδP ἁñἁῖP έά έάέἰñβóάέ δά ἰάἁ Yῖῖέ δῖδ δόæçδPεçέἁῖ δἁñἁδÜῖ. δñῖδ Yῖδἁ ἁἁP ἰδῖέ Yῖ-ῖδῖἁ Yῖἁῖ ἥñέδῖῖ \* /5, áέῖῖδῖYῖῖἁñῖ ἁδῖ ἁñέἁδῖYῖδ ÷ ἁñἁέδPñἁδ \*. ἰέ ÷ ἁñἁέδPñἁδ \* οçῖἁβῖῖῖ “δñPῖῖ-δἁέἁδδἁβῖ”, έάέ ἰδῖῖῖῖ ἰά ἁñῖçῖἁδῖYῖῖ ὀἁῖ *êÙèð* ῖññÜ. ϱóέ, έñβῖῖῖῖἁδ ἁδῖ áδδP οçῖ ἁñἁῖP, ἁβῖάέ δñῖῖἁῖYῖδ ἰδῖέ ç ἁῖδῖῖP atrun ἁδῖέάέἁβδἁέ ἁδῖ δῖῖ ÷ñPóδç root *êÙèð* δYῖῖἁ έἁδδÜ ἁῖἁῖÜñδçδἁ ἁδῖ οçῖ çῖYῖñά έάέ δῖῖ ἰPῖά. Ἄέἁ δἁñέóδῖδἁñἁδ δῖçñῖῖññἁδ ð-áδῖῖÜ ἰἁ οçῖ ἁῖδῖῖP atrun, έῖέδÜῖδἁ οçῖ ὀἁῖβἁá ἁῖçῖἁβἁδ atrun(8).

ἰέ ἁῖδῖῖYῖδ ἰδῖῖῖῖῖ ἰά Yῖ-ῖδῖ ἁδἁñῖῖñῖῖῖῖῖ ἁñέῖῖῖ δἁñἁῖYῖδññῖ, ἰδδῖῖῖ, ἰέ ἁῖδῖῖYῖδ ἰἁ ἁέδἁδἁῖYῖῖ ἁñέῖῖῖ ἁñἁῖῖῖ δñYῖδáέ ἰά ἁέἁδδἁóδῖῖῖ ἰἁ δῖῖ ÷ ἁñἁέδPñἁ ὀδῖYῖ-áέἁδ ἁῖδῖῖἁδçδ έάέYῖδῖ “\”.

ÁδδYῖδ ἁβῖάέ ἰέ ἁáóέYῖδ ἥδῖῖβóάέδ ἁέἁ *êÙèð* ἁñ-áβῖ crontab, ἰδδῖῖῖ δδÜñ-áέ έάέ *êÙδέ* ἁέἁῖññἁδῖῖῖ. Ὀῖ δάαβῖ Yῖῖέ, ἰδῖδῖ έάέ έάέἠñβἁῖδῖἁ δῖ ἰññἁ ÷ñPóδç, δδÜñ-áέ ἰññῖ ὀδῖ ἁñ-áβῖ δῖδ ὀδδδPῖἁδῖδ /etc/crontab. Ὀῖ δάαβῖ áδδῖῖ δñYῖδáέ ἰά δἁñἁέἁέδῖἁβ ἁέἁ *êÙèð* crontab ἁñ-áβῖ ÷ñPóδç.

### 11.6.1 ἈἁέἁέóδῖPῖἁóð ἰά Crontab

**Ὀçῖἁῖῖῖῖῖ:** Ἄἁῖ έά δñYῖδáέ ἰά ÷ñçóέῖῖδῖῖῖPῖἁδἁ οçῖ ἁέἁἁέἁáῖῖῖ δῖδ δἁñῖἁñÜῖἁδἁέ ἁἁP ἁέἁ οçῖ ἁέῖñῖῖῖδç/ἁἁέἁδÜῖῖῖῖῖῖῖῖ δῖδ crontab δῖδ ὀδδδPῖἁδῖδ. ἌδῖÜ ÷ñçóέῖῖδῖῖῖῖῖῖῖ δῖῖ ἁἁἁδçῖYῖῖ ὀáδ έάέἰἁῖῖññÜῖδῖ: δῖ cron έά ἁῖδῖῖβδἁέ ἰδῖέ δῖ ἁñ-áβῖ Yῖ-áέ δñῖῖῖῖῖῖῖῖῖῖῖ έάέ έά ἁñ-βδἁέ Üἰἁóἁ ἰά ÷ñçóέῖῖδῖῖῖῖῖ οçῖ ἁῖἁῖἁῖῖYῖç Yῖἁῖῖç δῖδ. Ἄἁβδἁ áδδP οçῖ ἁἁἁñἁδP δῖδ FAQ ([http://www.FreeBSD.org/doc/èl\\_GR.ISO8859-7/books/faq/admin.html#ROOT-NOT-FOUND-CRON-ERRORS](http://www.FreeBSD.org/doc/èl_GR.ISO8859-7/books/faq/admin.html#ROOT-NOT-FOUND-CRON-ERRORS)) ἁέἁ δἁñέóδῖδἁñἁδ δῖçñῖῖññἁδ.

Ἄέἁ ἰά ἁἁέἁδἁóδῖPῖἁδἁ Yῖἁ ἰYῖῖ crontab ÷ñPóδç, δñPῖἁ ÷ñçóέῖῖδῖῖῖῖῖ δῖῖ ἁἁἁδçῖYῖῖ ὀáδ έάέἰἁῖῖññÜῖδῖ ἁέἁ ἰά ἁçῖῖῖῖññPῖἁδἁ Yῖἁ ἁñ-áβῖ ἰἁ δῖ ἁδἁέῖῖῖῖῖῖῖ δῖδῖ, έάέ ὀἁδἁ ÷ñçóέῖῖδῖῖῖῖῖῖ δῖ crontab. Ç δῖῖ έῖῖῖP ÷ñPóç δῖδ ἁβῖάέ:

**% crontab crontab-file**

Ὀδῖ δἁñÜἁἁέἁñἁ áδδῖῖ, δῖ ἁñ-áβῖ crontab-file ἁβῖάέ δῖ ἰññἁ δῖδ ἁñ-áβῖδ crontab δῖδ ἁβ-á ἁçῖῖῖῖññἁçῖἁβ δñῖçῖῖῖYῖῖδ.

ὈδÜñ-áέ ἁδβçδδ ἰβá ἁδῖῖῖῖῖ ἁέἁ ἰά ἁδἁñῖῖῖῖῖῖῖῖ ὀἁ ἁἁέἁδἁóδçῖYῖἁ ἁñ-áβῖ crontab: ἁδῖÜ ἁέóÜἁἁδἁ οçῖ ἁδῖῖῖῖῖ -1 ὀδçῖ ἁῖδῖῖP crontab έάέ ἁéYῖἁῖδἁ ὀῖ ἁδῖῖYῖἁóἁἁ.

Ἄέἁ δῖδ ÷ñPῖῖῖῖδ δῖδ *èYῖῖῖ* ἰἁ ἁñ-βῖῖῖῖ δῖ crontab ἁñ-áβῖ δῖδ ἁδῖ οçῖ ἁñ-β, ÷ññβδ οçῖ ÷ñPῖç δñῖῖῖῖῖῖ, ἰδῖῖῖῖῖ ἰά ÷ñçóέῖῖδῖῖῖῖῖῖῖ οçῖ ἁῖδῖῖP crontab -e. ÁδδP ç ἁῖδῖῖP έά ἰἁέῖῖPῖἁέ δῖῖ έάέἰἁῖῖññÜῖδῖ ἰἁ Yῖἁ έἁῖῖ ἁñ-áβῖ. ¼δἁῖ δῖ ἁñ-áβῖ ἁδῖῖῖῖἁδῖἁβ, έά ἁἁέἁδἁóδἁέἁβ ἁδδῖῖἁδἁ ἁδῖ οçῖ ἁῖδῖῖP crontab.

Ἄἁ ἁñἁῖῖῖῖῖ ἔYῖἁδἁ ἰἁ ἁέἁἁñÜῖῖῖῖῖ δῖ crontab ἁñ-áβῖ ÷ñPóδç δἁέἁβῖδ, ÷ñçóέῖῖδῖῖῖῖῖ οçῖ ἁῖδῖῖP crontab ἰἁἁβ ἰἁ οçῖ ἁδῖῖῖῖῖ -r.

## 11.7 ×ñçόεïðιερίόäò Õï Óýόöçιά rc Óöï FreeBSD

Contributed by Tom Rhodes.

Õï 2002 ðï FreeBSD áíóυïÛδύοά ðï óýόöçιά rc . d ðïò NetBSD äεά öçï äεεβίçç öïò óóόóßιäðï. Ìε ÷ñßόδäò εä ðñÝðäε ίά Ý ÷ϊόί áíóεεçöεäß óä äñ ÷äßä ðïò äñßόεïüóäε öòï εäóÛεïäï /etc/rc . d. ÐρεεÛ äðï äóδÛ óä äñ ÷äßä äßιäε äεä öεò ääóεéÝð ððçñäóßäò εάε ïðñïγί ίä äεääεγίγί ïä öεò äðεεïäÝð start, stop, εάε restart. Άεä ðάνÛääεäïä, ðï sshd(8) ïðñäß ίä äεääεäß ÷ñçόεïðιερίόäò öçï äïßò áíöρεß:

```
# /etc/rc.d/sshd restart
```

Ç äεääεäόßä äδòß äßιäε ðάνïüüεä εάε äεä öεò ððüεïεðäò ððçñäóßäò. ÕðóεéÛ, ïε ððçñäóßäò äδóÝð äßιäε öðïßεùð äóδüüíäóä äεεεïßόεïäò εäóä öçï äεεβίçç öïò óóόóßιäðï ïððö εάε εäεïñßæäóäε öòï rc.conf(5). Άεä ðάνÛääεäïä, áíäñäðιερίόäò ðïñ ääßïüíä Network Address Translation óöçï äεεβίççç äßιäε öúòï äðεü üòï εÛñüíóäò ðñïεððεç öçç äεüεïðεçð äñäñòð öðï /etc/rc.conf:

```
natd_enable="YES"
```

Áí ç äðεεïäß natd\_enable="NO" äßιäε Ðäç ðάνïγύóä, öüòä äðεÛ äεεÛæäóä öçï äðεεïäß NO óä YES. Óä óäñÛεä rc εä ðïñðóðïòí äóδüüíäóä ïðιεääßððïðä áíäñðßιäç ððçñäóßä εäóÛ öçï äεÛñεää öçð äðüïáíçð äεεβίçççð, üððö εάε ðάνεäñÛäόóäε ðάνäéÛðü.

Ìεäò εάε ðï óýόöçιά rc . d äßιäε εðñßùð äεä öçï äεεβίççç εάε öïñ ðάνïäóεóïü ððçñäóεðí εäóä öçï äεεβίççç εάε öïñ ðάνïäóεóïü öïò óóόóßιäðïò áíóβóóïε ÷ä, ïε ðñïεäεïñέóï Ýíäò äðεεïäÝð start, stop εάε restart εä ðñääíäóïðιερίόòí öεò áíóβóóïε ÷ä äñÝñääεäò äí ç εäóÛεεçεäò ïäóääεçöÝð äßιäε εäεïñέóï Ýíäò öòï /etc/rc.conf. Άεä ðάνÛääεäïä ç ðάνäðÛü ïáíöρεß sshd restart εä äïðεÝðäε ïüñ äí ç ïäóääεçöß sshd\_enable Ý ÷äε öäεäß óä YES ïÝóä öòï /etc/rc.conf. Άεä ίä äεöäεÝóäðä öεò äðεεïäÝð start, stop ð restart ïεäð ððçñäóßäò áíäñÛðççä äðï öεò ñðεïßóäεð öçç öòï /etc/rc.conf, ç áíöρεß ðñÝðäε ίä Ý ÷äε ÷äñäεöçñέóóäß ïä "one". Άεä ðάνÛääεäïä äεä öçï äðäíäεεβίççç öïò sshd áíäñÛðççä äðï öεò ðñÝ ÷ïóäò ñðεïßóäεð öòï /etc/rc.conf, äεöäεäßðä öçï äεüεïðεçç áíöρεß:

```
# /etc/rc.d/sshd onerestart
```

Äßιäε äγερεï ίä äεÝäíäóä äí ç ððçñäóßä äßιäε áíäñäðιεçï Ýíç öòï /etc/rc.conf ðñÝ ÷ïóäò ðï εäóÛεεçεï óäñÛεí rc . d ïä öçï ðάνÛíäðñï rcvar. ÊäóÛ öòïÝðäεä, Ýíäò äεä ÷äέñέóóðð ïðñäß ίä äεÝäíäε äí ðï sshd äßιäε üíóðð áíäñäðιεçï Ýñï öòï /etc/rc.conf äεöäεðíóäò:

```
# /etc/rc.d/sshd rcvar
# sshd
$sshd_enable=YES
```

**Óçïäßúçç:** Ç ääýðäñç äñäñð (# sshd) äßιäε ç Ýñäïò öçç áíöρεßð sshd, εάε ü ÷é ç εñïóεÛ öïò ÷ñßόç root.

Άεä ίä äεÝäíäóä äí ïεä ððçñäóßä ðñÝ ÷äε, ç äðεεïäß status äßιäε äεäεÝóεç. Άεä ðάνÛääεäïä äεä ίä äðεäääεðóäü üðé ç ððçñäóßä sshd ðñÝ ÷äε:

```
# /etc/rc.d/sshd status sshd is
    running as pid 433.
```

Ὁ δὲ ἔργον τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ reload ἵνα ὁδοῦνται οἱ ἄλλοι ἀποδοτικότητες. Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου. Ὁ δὲ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.

Ὁ δὲ ἔργον τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου. Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.

Starting background file system checks in 60 seconds.

Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.

Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου. Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.

- PROVIDE: Ἐπιπέδου ἔργου οἱ ἀποδοτικότητες οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.
- REQUIRE: Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.
- BEFORE: Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.

× Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.

Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.

## 11.8 Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες

Contributed by Marc Fonvieille.

Ὁ δὲ ἔργον τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.

### 11.8.1 Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες

Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.

Ἄλλοι δὲ ἐπιπέδου ἔργου οἱ ἀποδοτικότητες, ἀλλὰ ἡ ἀποδοτικότης οὐδὲν ἔστιν ἄλλο ἢ τὸ ἀναδιοργανωθῆναι τὴν ἀρχὴν τοῦ ἔργου.

οάδ άπόιόι ιέα έβδóά ιά εῒνóδó άέέóγίò έάέ ιάνέέΎð ðέçñιòιñβáð άέα óά ðθιόóçñέæιιάρά chipsets έάέ óέð ðθιόóçñέæιιάρáð εῒνóδó. Άί Ύ÷άðά άιέέάιέβáð άέα óι ðιέιύð ιάçāιú άβιáέ ι óυóóυð, áέάάῒóðά óçι óάέβáά άιçέάβáð óιò ιάçāιγ. Ç óάέβáά άιçέάβáð έά óάð άπóάέ ðáñέóóυðáñáð ðέçñιòιñβáð ó÷άðέέῒ ιά óι ðθιόóçñέæιιάρά óέέέυ έάέ άέιιá έάέ άέα óά ðέέάίῒ ðñιáέβιáóά ðιò ιðιñάβ ιά ðñιέγθιόι.

Άί Ύ÷άðά ιέα óθιçέέóιΎιç εῒνóðά, έάóά ðῒóά ðέέάιúθóóά áάι έά ÷ñáέáóðάβ ιά θῒιáðά ðιέγ άέα óιι ιάçāι. Ιέ ιάçāιβ άέα óέð óθιçέέóιΎιáð εῒνóðά άέέóγίò ððῒñ÷ιόι óθιι ðñβιá GENERIC, Ύóέέ πóðά έάέ έά άιòάιέóðάβ έáóά óçι áεῒñέáέá óçð áέέβιçóçð, άέα ðáñῒáάέάιá:

```
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
```

Óθι ðáñῒáάέάιá áóðυ, áεΎθιòιá υúέ άγι εῒνóðáð ðιò ÷ñçóέιιðιέιγί óιι ιάçāι dc(4) Ύ÷ιόι áιòιðέóðάβ óθι óýóóçιá.

Άί ι ιάçāιú óçð NIC óάð áάι áβιáέ ðáñιι όθιι GENERIC, έά ðñΎðάέ ιά óιñθπóáðά óιι έáðῒέεçέι ιάçāι άέα ιά ÷ñçóέιιðιέβóáðά óçι NIC óάð. Άðóυ ιðιñάβ ιά áðέðáð÷έáβ ιá Ύιáι áðι óιòð άγι áðóιγð ðñυðιòð:

- Ι ðιέυ άγέιέι ðñυðιò άβιáέ áðέῒ ιá óιñθπóáðά Ύιá ῒñέñιιá óιò ðñβιá άέα óçι εῒνóðά áέέóγίò óáð ιá óι kldload(8), β áðóιιáðά έáóά óçι áέέβιçóç ðñιóέΎθιιόáð óçι έáðῒέεçέç áñáιιβ óθι áñ÷áβι /boot/loader.conf. Άάι άβιáέ υέιέ ιέ ιάçāιβ NIC άέαέΎóέιιέ óáι áñέñβιáóά, ÷áñáέðçñέóðέέῒ ðáñáááβáιáóά άβιáέ óά áñέñβιáóά άέα óðóέáòΎð ISA.
- Άιáέεáέðέέῒ, ιðιñάβóá ιá ιáðááεβðéóáðáð óáðóέέῒ óçι ðθιόðβñέιç άέα óçι εῒνóðά óáð óθιι ðñβιá. ΆεΎáιáðά óι áñ÷áβι /usr/src/sys/conf/NOTES, óι /usr/src/sys/arch/conf/NOTES έάέ óçι óάέβáά άιçέάβáð óιò ιάçāιγ άέα ιá ιῒέáðά óέ ðñΎðάέ ιá ðñιóέΎóáðά óθιι áñ÷áβι ðñéιβóáυι óιò ðñβιá. Άέα ðáñέóóυðáñáð ðέçñιòιñβáð άέα óι ðυò ιá ιáðááέυòððóáðά óιι ðñβιá, ðáñáέéáεβ áέááῒóðά óι Έáðῒέάέι 8. Άί ç εῒνóðά óáð áιòιðέóðάβ έáðά óçι áέέβιçóç áðι óιι ðñβιá (GENERIC) áάι ÷ñáέῒáðά ιá ιáðááéβðéóáðά Ύιáι ιΎι ðñβιá.

**11.8.1.1 ×ñçóέιιðιέβιόáð ιάçāιγò Windows ιá Óι NDIS**

Άðóðð÷βð, ððῒñ÷ιόι áέιιá ðιέειβ έάóáóέáóáóóΎð ðιò áάι ðáñΎ÷ιόι óá÷ιέέΎð ðñιáέááñáóΎð άέα óιòð ιάçāιγò óιòð óçι έιέíυóçðά óιò άιέέéðιγ έιáέóιέέγύ áέáðβ áιðέιáðυðβæιόι óΎóιέáð ðέçñιòιñβáð óáι ιóóóέéῒ óιò áιðιñβιò. Óθιáðβð, ιέ ððáγέðñιέ άέα óçι áιῒððóιç óιò FreeBSD έάέ ῒέέυι έáέóιòñáέέβι óóóçιῒóυι ιΎιθιò ιá άγι áðέέιáΎð: ιá áιáððýñιόι ιάçāιγò ιá óçι ιáέñῒ έάέ áðβðιç áέááέéáóáβá óçð áíóβóðñιòçðò ιç÷ιέέβð β ιá ÷ñçóέιιðιέβιόι βáç ððῒñ÷ιόáð ιάçāιγò óá áðááέéβ ðñòβ áέáέΎóέιιòð άέα óçι ðéáðóóυñιá Microsoft Windows. Ιέ ðáñέóóυðáñιέ ððáγέðñιέ άέα óçι áιῒððóιç, ιáðáιγύ óιòð έáέ áððιβ ðιò áιðéΎέιιόáέ ιá óι FreeBSD, Ύ÷ιόι áðέéΎιáέ óçι ááγðáñç ðñιόΎáέέóç.

×ῒñç óçι ðñιóóιñῒ óιò Bill Paul (wpaul), ιέῒð έáέ áðι óι FreeBSD 5.3-RELEASE ððῒñ÷ιέ “áçááιβð” ðθιόðβñέιç áέα óι Network Driver Interface Specification (NDIS). Óι Ύñáι FreeBSD NDISulator (áέáóιñáðέέῒ áιúóóυ óáð Project Evil) ðáβñιáέ Ύιáι ιάçāι Windows óá áðááέéβ ðñòβ έάέ óçι ιóóá óιι áιáðáðῒ πóðά ιá ðñβæάέ υúέ ðñΎ÷ιέ



Ïðñáβόά íá ñðείβόάόά ðí óγόςçíá íá òñòþñíáέ óá NDIS áñèñþñíáόά έάόά ðçí áέέβίçόςç íá ðñí βάει ðñùðñí íá óá ùðò ìá ðñείάáÐðñíά Ùέέά áñèñþñíáόά. Ðññóá, áíóέáñÙøóá ðñí ðáñá÷έáβόά Ùñèñùíá, w32DRIVER.ko, óðñí έάóÙέειñ /boot/modules. Õñòá, ðññíóέÝóóá ðçí áέùειòèç ãñáññÐ óðñí /boot/loader.conf:

```
W32DRIVER_load="YES"
```

### 11.8.2 Ñòείβæííόάò Õçí ÈÙñόά Áέέóýíò

Ïùέέò ì έάóÙέέçειò ðçí ðñíðñέáβ áέá ðçí èÙñόά áέέóýíò, ÷ ñáέÙæáόάέ íá ñòείóόάβ. ¼ðò ðñέέÙ Ùέέά ðñÙáíáόά, ç èÙñόά áέέóýíò áβ÷á ñòείóόάβ έάόά ðçí óóέáñÐ ðçò ááέάóÙóóáç ìá ðñí **sysinstall**.

Áέá íá áñóáíβόάόά ðéò èÙñόάò áέέóýíò ðñí Ý÷áðá óðñí óγόςçíá óáò, ðççéðññειñáÐóá ðçí áέùειòèç áíóειÐ:

```
% 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 (10baseTX <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
```

**Õçíáβùός:** Ðάέάέùóáñáò áέáùóáέò ðñí FreeBSD ìðñáβ íá ÷ ñáέÙæειíόάέ ðçí ðáñÙíáðññí -á áέειòèçíáíç óóçí ifconfig(8), áέá ðáñέόóùðáñáò έáððñíÝñáέáò ó÷áðέέÙ ìá ðçí óúóóÐ óýíóáíç ðñí ifconfig(8), ðáñáέάèþ áíáðñÝíðá óóçí óáèβáá áιçέáβáð. Õçíáέóóá ððβόςçò ùðέ íέ ááãñáóÝò ðñí áóññíýí ðñí IPv6 (inet6 éðèð.) Ý÷íðñí ðáñáíáέçέáβ óá áóðù ðñí ðáñÙááέáíá.

Õá áóðù ðñí ðáñÙááέáíá, íέ áέùειòèçò óóóέáðÝð Ý÷íðñí áñóáíέóóáβ:

- dc0: Ç ðññόç Ethernet èÙñόά áέέóýíò
- dc1: Ç ááyóáñç Ethernet èÙñόά áέέóýíò
- lp0: Ç ðáñÙέέççç ðññόά
- lo0: Ç óóέáñÐ loopback
- tun0: Ç óóóέáðÐ tunnel ÷ ñçóέíðñειñáíç áðñí ðñí ðññáñáíá **ppp**

Õñ FreeBSD ÷ ñçóέíðñειáβ óá ðñíáόά ðñí ðçí ðáέñÙ έáόά ðçí ðñíβá áíóειðβóççέáí íέ áíðβóðñέ÷áð èÙñόάò έáόά ðçí áέέβίçόςç. Áέá ðáñÙááέáíá ç óóóέáðÐ sis2 έá áβíáέ ç ðññόç èÙñόά áέέóýíò ðñí ÷ ñçóέíðñειáβ ðñí ðçí ðñíáíá sis(4).

Õðñí ðáñÙááέáíá áóðù, ç óóóέáðÐ dc0 áβíáέ ðñí έάέ ðñí Ý÷áέ. Íέ èÝíáέò èέáέáβá áβíáέ:



### 11.8.3.1 ΆίεειÙæííóáσ Ìέα Ethernet ÈÛñóá

Άέα ìá áðεάάαέπóáðá ùέε ç Ethernet èÛñóá εάεðíεñáαβ òúóðÛ, εά ðñÝðáε ìá èÛíáðá äýí ðñÛáíáóá. Ðñþóá, èÛíóá ping òçí èÛñóá òçí βάέα, εάε ìáðÛ èÛíóá ping Ýíá Ûεεí ìç÷ Ûίçíá óðí LAN.

Ðñþóá äíεειÛóðá òçí òíðέεÐ èÛñóá:

```
% 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
```

Óþñá äíεειÛóðá óá Ýíá Ûεεí ìç÷ Ûίçíá óðí 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
```

Ìðñáβóá ìá ÷ñçóειíðíεΠóáðá εάε òí ùíñá òí ìç÷ ÷ áíΠíáðòð áíðβ òçð áεάýεðíóçð 192.168.1.2 áí Ý÷ ÷ áðá ñðεìβóáε òí áñ ÷ áβì /etc/hosts.

### 11.8.3.2 Άðβεóç ÐñíæçìÛòùí

Ç áðβεóç ðñíæçìÛòùí ðεέεíý εάε εíæεðíεέíý áβíáε ðÛíðíðá áðβðίç, Ýíáð ðùíð ÷ ÷íεíð ìðñáβ ìá áíáεíðεέðáβ áεÝá ÷ ÷íóá ìáñεέÛ áðεÛ ðñÛáíáóá ðñþóá. Άβíáε òí εάεþáει òíð áεέðýíð òðíáááíÝíí; ÷ ÷ðá ñðεìβóáε òúóðÛ ðéð òðçñáóáð áεέðýíð; ÷ ÷ðá ñðεìβóáε òúóðÛ òí ðýñέíí ðáβ ÷ ÷ð; ÷ áε ðñÛáíáóε òí FreeBSD òðíðóΠñέíç áέα áððΠ òçí èÛñóá áεέðýíð; ÐñÝðáε ðÛíðá ìá áεÝá ÷ ÷ðá ðéð òçíáεþóáεð òíð ðεέεíý ðñεί òáβεá ìβá áíáóìÛ áέα Ýíá ðñùáεçíá. Άíáááεìβóðá òçí Ýεáíóç òíð FreeBSD òçí òáεáððáβá ÓÓÁÈÀÑÇ Ýεáíóç. ΆεÝáíðá ðá áñ ÷ áβá ðùí εέóðí ìçíðìÛòùí, Π ðÛíðá óðí Internet.

Άí ç èÛñóá äíεεäýáε, áεεÛ ìá ÷ áίçεΠ áðùáíóç, εά Ûίεæá ìá áεάáÛóáðá òçí óáεβáá áίçεáβáð tuning(7). Ìðñáβóá áðβóçð ìá áεÝáíáðá ìε áí εάíεáσìÝíáð ñðεìβóáεð òíð áεέðýíð ðñíεάεíýí ðéð áñáÝð òðíáÝóáεð.

Ìáñεέíβ ÷ ñΠóðáð áíðείáðððβáειðί Ýíá Π äýí ìçíýíáðá “device timeout”, ðá ÷ðíβá áβíáε òðóεíεíáεέÛ áέα ìáñεέÝð èÛñóáð. Άí òðíá ÷ εóðíýí, Π áβíðí áñ ÷ εçðέεÛ, εά ðñÝðáε ìá áεÝáíáðá ìΠðò ðεά èÛðíεáð òðóεáðÝð ðáññáðñíáβáειðί ç ìβá òçí Ûεεç. ΆεÝáíðá áεðεÛ ðéð òðíáÝóáεð ðùí εάεùìáβùí. ρòð ðá ðñÝðáε ìá áðíεðβóáðá ìβá Ûεεç èÛñóá.

ÌáñεέÝð òíñÝð, ìε ÷ ñΠóðáð ðáññáðçñíýí ìáñεέÛ ìçíýíáðá èÛεíðð “watchdog timeout”. Òí ðñþðí ðñÛáíá ðíð ðñÝðáε ìá èÛíáðá áβíáε ìá áεÝáíáðá òí εάεþáει òíð áεέðýíð. ÁñéÝðáð èÛñóáð ÷ ñáεÛáεíðáε ìβá εÝóç PCI ðíð ìá

οδιόοςηβεάέ Bus Mastering. Όά ίάνέέΥδ δάέέΥδ ιςονέέΥδ εὐήνωάδ. ιύη ίβά εΎος PCI οί οδιόοηβεάε (οδίηεὐδ ϑ εΎος 0). ΑέΥαίωά οςί εὐήνωά αέέδύηο έάέ οςί οάειηβύος οςδ ιςονέέηδ εὐήνωά έάά ίά αέάδέοδρβόάά ά ί έάβ άβίαέ οί δνύάεσίά.

Όί ίβήωιά “No route to host” άηάηβεάόάέ ά ί οί ογούοςίά άάοίάδάβ ίά άηήηειάβόάέ οά δάέΥδά οοίη δηήήέοιη οιόδ. Αόου οοίάβίαέ ά ί άά ί Ύ ÷ έέ έάειηέοάβ δηιάδέεάηΎίς αέάγέοίος άηήηέυάςοςδ, η ά ί Ύίά έάηηάεί Ύ ÷ έέ ίάοοίάάεάβ. ΑέΥαίωά οςί Ύήαι όέδ άίοιηηδ netstat -rn έάέ οέάηοηάδóάβδά ύές ϑ αέάγέοίος άηήηέυάςοςδ άβίαέ Ύάέης. Αί άά ί Ύ ÷ έέ έάειηέοάβ, αέάάὐóάά οί Εάοὐεὰεί 31 αέά δάηέοοηόάηάδ δέϑηήοηβάδ.

Όί ίβήωιά εὐεήδ “ping: sendto: Permission denied” οοίάάβίαέ έδηβύδ εύαι εὐδριέάδ εὐεήδ ηýειέοςδ οοί δýηέη όάβ÷ιδ. Αί οί ipfw άβίαέ άίάηάηδρεσίΎή οοίη δδηβία έέεὐ άά ί Ύ ÷ ιοί έάειηέοάβ έάηηάδ, οηόά ϑ δηιάδέεάηΎίς δριέέέεη άβίαέ ϑ άδάάηήάδός υέος οςδ έβίςοςδ, αέηηά έάέ οηί αέόςίὐδου ping! Αέάάὐóάά οί Εάοὐεὰεί 30 αέά δάηέοοηόάηάδ δέϑηήοηβάδ.

ΊάνέέΥδ οηήΥδ ϑ άδύηιός οςδ εὐήνωάδ ίδηάβ ίά άβίαέ οδ÷η, η εὐόδ οίη ίΥόη ύηη. Όά άóδΥδ όέδ δάηέδδρβόάέ οί έάέγδάνη άβίαέ ίά ηδβέδδάδ οςί έάδὐóόάος οηή ίΥόη άδι autoselect όόςί έάδὐέεςές έάδὐóόάός. Αή οοίηεὐδ άόδου όάβίαδά ίά άηέάγáέ όόά δάηέοοηόάηά όέέεὐ, ίδηάβ ίά ίςί έγόáέ οί δηηάεσίά οοίη έάέΎίάί. Εάέ δὐέέ, έέΥαίωά ύέάδ όέδ ηδβέδδάέδ οηή αέέδύηο, έάέ ίάίάάέάάὐóάά δὐέέ οςί οάέβάά άηέάβάδ tuning(7).

### 11.9 Αέειήέὐ Hosts

Ίβά άηέάδὐ οοίςέοίΎίς ÷ ηηός οηή FreeBSD άβίαέ ϑ αέείηέηη όέέηάίβá έόοί ÷ ηηήί, ύδηό έάέ Ύίάδ άιόδϑηάδςδρδ άηάηβεάόάέ οοί άβέδδδ ήάί δάηέοοηόάηη άδι Ύίάδ. Αόδου άδέδδ÷ὐίάόά έίάέΎδριάδ δριέάδεΎδ αέέδóάέΥδ αέάδεγίόάέδ όά ίβά έάέ ιύη όóέάδη.

Ίβά εὐήνωά αέέδύηο Ύ ÷ έέ ίβά “δηάηάόέέη” αέάγέοίος, έάέ άδάηέυηέοοίη άηέειη “άέειήέηη” αέάδεγίόάηί. Ίέ αέείηέέΥδ άóδΥδ αέάγέοίόάέδ δηήέΎδριόάέ ίά οςί ηηδδ άάάηάδρ ή οοί άη÷άβι /etc/rc.conf.

Ίβά άάάηάδη αέειήέηδ αέάγέοίοςδ έάά οςί εὐήνωά αέέδύηο fxp0 ηιέὐάέ ύδ άίηδ:

```
ifconfig_fxp0_alias0="inet xxx.xxx.xxx.xxx netmask xxx.xxx.xxx.xxx"
```

Όςίάηρδδά ύέέ ίέ άάάηάδΎδ άóδΥδ δηΎδάέ ίά ίάέειήί ίά alias0 έάέ ίά οοίά÷βαιήι δηηδ όά δὐὐή όά όάέηὐ, (άέά δάηὐάάέάηίά, \_alias1, \_alias2, έάέ ίγδου εὐέά άίηδ). ϑ έέάέέέάόβá ηýειέοςδ έά όόάηάδρβόάέ οοίη δηηήι άηέειη δρι έάβδάέ.

Ί δριηάέοιηδ οςδ ίὐέάδ αέέδύηο άβίαέ όςίάίόέέηδ, αέέὐ άóδδ÷ηδ έάέ άýειη. Αέά εὐέά εὐήνωά, δηΎδάέ ίά δδὐη÷έέ ίβá αέάγέοίος ϑ ίδηβά άίόέδηήιόδγáέ ουóδὐ οςί ίὐέά όηή αέέδύηο. Ίδριέάδρδηά ὐέες αέάγέοίος δρι όοίδβδδάέ οοί βάέί άβέδδδ δηΎδάέ ίά Ύ ÷ έέ ίὐέά αέέδύηο 1s (άέονάοίΎίς άβδά όάί 255.255.255.255 άβδά όάί 0xffffffff).

Αέά δάηὐάάέάηίά, άηάδὐóάά οςί δάηβδδούος ύδηό ϑ εὐήνωά αέέδύηο fxp0 άβίαέ όοίάάάηΎίς όά άýη άβέδδδά, οί άβέδδδδ 10.1.1.0 ίά ίὐέά αέέδύηο 255.255.255.0 έάέ οί άβέδδδδ 202.0.75.16 ίά ίὐέά αέέδύηο 255.255.255.240. ΕΎειηάά οί ογούοςίά ίά δὐηάέ όέδ αέάδεγίόάέδ άδϐ 10.1.1.1 ίΎ÷ηέ 10.1.1.5 έάέ όέδ 202.0.75.17 ίΎ÷ηέ 202.0.75.20. ¼δϐδ όςίάηρδςέά δάηάδὐήϐ, ιύη ϑ δηηόάδ αέάδεγίόάέδ (όςςί δάηβδδούος άδδρ, ϑ 10.0.1.1 έάέ ϑ 202.0.75.17) δηΎδάέ ίά Ύ ÷ ιοί δηάηάάέέΥδ ίὐέάδ αέέδύηο. ¼εάδ ίέ όδριέέδάδ, άδϐ (10.1.1.2 ίΎ÷ηέ 10.1.1.5 έάέ 202.0.75.18 ίΎ÷ηέ 202.0.75.20) δηΎδάέ ίά ηδβέδδδδϐ ίά ίὐέά αέέδύηο 255.255.255.255.

ϑ αέειηέέδδ άάάηάδΎδ όοί άη÷άβι /etc/rc.conf έά ηδβέδδδδδδ οςί εὐήνωά ύδϐδ δηΎδάέ έάά οί δάηὐάάέάηίά:

```
ifconfig_fxp0="inet 10.1.1.1 netmask 255.255.255.0"
```

```
ifconfig_fxp0_alias0="inet 10.1.1.2 netmask 255.255.255.255"
ifconfig_fxp0_alias1="inet 10.1.1.3 netmask 255.255.255.255"
ifconfig_fxp0_alias2="inet 10.1.1.4 netmask 255.255.255.255"
ifconfig_fxp0_alias3="inet 10.1.1.5 netmask 255.255.255.255"
ifconfig_fxp0_alias4="inet 202.0.75.17 netmask 255.255.255.240"
ifconfig_fxp0_alias5="inet 202.0.75.18 netmask 255.255.255.255"
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"
```

## 11.10 Ἄνδρα Νότιο

### 11.10.1 Ἰσχυρὸν /etc

Ὁ ἄνδρα νότιος ἀπὸ τοῦ ἰσχυροῦ ἔχει τὰ ἑξῆς ὑποκατάστημα:

/etc	Ἄρχειο νότιος ὅπου ὁ ὅλος ἰσχυρὸς, data here is system-specific.
/etc/defaults	Default versions of system configuration files.
/etc/mail	Extra sendmail(8) configuration, other MTA configuration files.
/etc/ppp	Configuration for both user- and kernel-ppp programs.
/etc/namedb	Default location for named(8) data. Normally named.conf and zone files are stored here.
/usr/local/etc	Configuration files for installed applications. May contain per-application subdirectories.
/usr/local/etc/rc.d	Start/stop scripts for installed applications.
/var/db	Automatically generated system-specific database files, such as the package database, the locate database, and so on

### 11.10.2 Hostnames

#### 11.10.2.1 /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:

nameserver	The IP address of a name server the resolver should query. The servers are queried in the order listed with a maximum of three.
search	Search list for hostname lookup. This is normally determined by the domain of the local hostname.
domain	The local domain name.

A typical resolv.conf:

```
search example.com
```

```
nameserver 147.11.1.11
nameserver 147.11.100.30
```

**Ὁδηγός:** 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.

### 11.10.2.2 /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.

## 11.10.3 Log File Configuration

### 11.10.3.1 `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.

### 11.10.3.2 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.

### 11.10.4 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
```

## 11.11 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 `ΌιΠιά 11.10.4`.

### 11.11.1 sysctl(8) Read-only

*Contributed by Tom Rhodes.*

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.

## 11.12 Tuning Disks

### 11.12.1 Sysctl Variables

#### 11.12.1.1 `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.

#### 11.12.1.2 `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.

#### 11.12.1.3 `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.

#### 11.12.1.4 `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.

### 11.12.1.5 `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)`.

### 11.12.1.6 `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*.

## 11.12.2 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.

### 11.12.2.1 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.

## 11.13 Tuning Kernel Limits

### 11.13.1 File/Process Limits

#### 11.13.1.1 `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 0<sup>1</sup>. 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.

**Όγιάρβυός:** `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.

### 11.13.1.2 `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.

## 11.13.2 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 `sfbufla` 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.

**Όγιάρβυός:** 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.

### 11.13.2.1 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.

### 11.13.2.2 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.

## 11.13.3 Virtual Memory

### 11.13.3.1 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.

## 11.14 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 [Chapter 18.17](#) of the Handbook.

### 11.14.1 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 [Chapter 11.2](#) of the Handbook for some suggestions on how to best arrange your swap.

### 11.14.2 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.

### 11.14.3 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 11-1. 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
```

## 11.15 Power and Resource Management

*Written by Hiten Pandya ἐπὶ Tom Rhodes.*

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.

### 11.15.1 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).

### 11.15.2 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.

### 11.15.3 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.

## 11.16 Using and Debugging FreeBSD ACPI

*Written by Nate Lawson. With contributions from Peter Schultz καὶ Tom Rhodes.*

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.

### 11.16.1 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) (<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) (<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.

## 11.16.2 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`.

### 11.16.3 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.

#### 11.16.3.1 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.

#### 11.16.3.2 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 `acpiconf -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.

### 11.16.3.3 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`.

### 11.16.3.4 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 Ὁἰἰιά 26.6.5.3) 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.

### 11.16.3.5 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.

### 11.16.3.6 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.

## 11.16.4 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
```

## 11.16.5 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:

### 11.16.5.1 \_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.

### 11.16.5.2 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.

### 11.16.5.3 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.

### 11.16.6 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.

### 11.16.7 References

More information about ACPI may be found in the following locations:

- The FreeBSD ACPI Wiki (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\_dsdtd). (Uses Compaq as an example but generally useful.)

## Όριση

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.



Ì επαέεάο ιΎοά οοί MBR οοίPεùò αίάοΎηαόάε ùò *άεά÷άεήεοόPò άέέβίçoçò (boot manager)*, άεάέEΎ ùοάί αέεçεάδθεάνŨ ìά οί ÷ ñPόόç. Óδοçí δάνβδòùόç αδόP, ì άεά÷άεήεοόPò άέέβίçoçò Ύ÷άε οοίPεùò δάνεόοùοάνι επαέεά οόçí δñpόç *òñi÷έŨ (track)* οίò άBόείò P ìΎοά οά εŨθειέι ογόόçιά άñ÷άβùì οίò εάεόιòñάεεíŷ. (ÌάνεέΎò οīñŶò ì άεά÷άεήεοόPò άέέβίçoçò άδñεάέάBοάόε έάε *οīñòùòPò άέέβίçoçò (boot loader)*, άεéŨ οοί FreeBSD ì ùñìò αόòùò ÷ñçοέιìðñεάBοάόε οά ìάοάάáŷòδάνι οόŨάεí òçò άέέβίçoçò.) Óδοίòò άçìòεέάBò άεά÷άεήεοόŶò άέέβίçoçò δάνεέάñáŨñíòάε οί **boot0** (άñúοòù έάé ùò **Boot Easy**, ì οόŨíοάñ άεά÷άεήεοόPò άέέβίçoçò οίò FreeBSD), οί **Grub**, οί **GAG**, έάé οί **LILO**. (Ìùñí οί **boot0** ÷ ùñŨάé ìΎοά οοί MBR.)

Άί Ύ÷άòά άάεάόάοçìŶñí Ŷíá ìùñí εάεόιòñάεéù ογόόçιά οόίòò άBόείòò οάò, οί οòðìðñεçìŶñí MBR άεά PC άβίάé άδάνéŶò. Άòòù οί MBR PŨ÷ίάé άεά οί δñpοί άέééìPόéñí (P áñáñáù) άεáŷñéοíá (slice) οοί άBόéí, έάé άεòάéάB οίί επαέεά ðìò òδŨñ÷άé οά αόòù άεά íá οīñòpόάé οί òðùéíéðì οίò εάεόιòñάεéíŷ οóòòPíáòìð. Íá MBR αóòíŷ οίò ογύðìò, άβίάé αóòù ðìò άάεάéBοóáόάé áðù δññíáðéεíñáP ìά òçí fdisk(8). ΆάόBάéόάé οοί /boot/mbr.

Άί Ύ÷άòά άάεάόáοòPόάé ðñεεάðeŨ εάεόιòñάééŨ οóòòPíáòά οόίòò άBόéíòò οάò, ìðññáBòá íá άάεάόáοòPόáòά άεάοīñáòééù άεά÷άεήεοόP άέέβίçoçò, εŨθειέí ðìò íá ìðññáB íá άάBíáé ìεά εBοόά òùì εάéοīñáòééñí οóòòçìŨòùí έάé íá οάò άðéòñŶòάé íá άεάéŶíáòά ðñεí íá ìάééíPόάé. Óοί áðùñáñí ðìPíá éá οóæçòPοίòíá άéá áŷí áðù αóòíŷò òìòò άεά÷άεήεοόŶò άέέβίçoçò.

Óì òðùéíéðì οίò οóòòPíáòìò άέέβίçoçò οίò FreeBSD άβíάé ÷ ùñéοíŶñí οá òñBά οóŨάéá. Óì δñpοί οóŨάéí άéòάéάBοάé áðù οί MBR, οί ìðññáBí áñññáéάé áðεpò ùìéé áðάéòάBοάé άεά íá οŶñάé οίñ òðñεíáεóòP οά ìεά οóάéάñεñéŶíç εάòŨóóáóç έάé íá άéòάéŶóάé οί άάŷòáñí οóŨάéí. Óì άáŷòáñí οóŨάéí ìðññáB íá εŨíάé εBάá δánεóóòùοάñá δñŨñíáòά ðñéí òçí άéòŶεάόç οίò òñBòìò οóááBñìò. Óì òñBòì οóŨάéí ðñεεçññíάé òç άεάάééáοBά οūñòòùòçò ðìò εάéóιòñάééíŷ οóòòPíáòìð. Ç άñááοBά άβíáòάé οá òñBά οóŨάéá, άεáòB οί ðññòòðì οίò PC άðéáŨεεάé δánεíñéοíŷò οοί ìŶáάéìò òùì δññíáñíŨòùñ ðìò ìðññíŷí íá άéòáéáòóŷíŷí οóá οóŨάéá Ŷíá έάé áŷí. Ç οóŶŶúòç αόòP òùì άñááóεñí áðéòñŶðáé οοί FreeBSD íá δάνŶ÷άé Ŷíá ðéí áòŶéééðì ογόόçιά οūñòòùòçò.

ðáéòá ìάééíŨáé ì ðòñPíáò έάé άñ÷Bάéé òçí άίB÷íáòόç έάé άñ÷éíðñíBόç òùì οóòéáòpñí pόòá íá ìðññíŷí íá ÷ñçοέñðñεçéñíŷí. ÌŶóá òçí ðñεéPññòç òçò άεάάééáοBáò άέέβίçoçò οίò ðòñPíá, ì Ŷεáá÷ìò δánñŨáé οόç άεάάééáοBά ÷ñPόόç *init(8)*, ç ìðññáB έάé áðéáááéPñáé ùìéé ìé άBόéíé άβíáé οá εάéóιòñάééP (÷ ùñBò éŨεç) εάòŨóóáóç. Ç *init(8)* ìάééíŨáé Ŷðáéòά òçí ñŷéìέóç ðùññí (áðBðááñ ÷ñPόóç), ìά òçí ìðññáB δññíóáñòpñíòάé οá οóòòPíáòá άñ÷άβùì, ñòεìBάéñíòáé ìé εŨñòáò άééòŷíŷέ άéá áðééíéññíBá ìά οí άBéòòì, έάé άñíééŨ áéééññíŷí ùεáò ìé άεάάééáοBáò ðìò áéòáéñíŷíòάé òððééŨ éáòŨ òçí άέέβίçoç άññò FreeBSD οóòòPíáòìð.

## 12.3 Ì Άέά÷άéñéóòPò ΆéêBíçoçò έάé òá ÓòŨáéá ΆéêBíçoçò

### 12.3.1 Ì Άέά÷άéñéóòPò ΆéêBíçoçò (boot manager)

Ì επαέεάò οοί MBR P άεά÷άéñéóòPò άέέβίçoçò αίάοΎηαόάé ìáñééŶò οīñŶò έάé ùò *òðŨáéì ìçàŶí (stage zero)* òçò άεάάééáοBáò άέέβίçoçò. Óì òìPíá αóòù δánéáñŨòáé áŷí áðù οίòò άεά÷άéñéóòŶò άέέβίçoçò ðìò αίáòŶñáñíá ðññçññòìŶíùò: Óì **boot0** έάé οί **LILO**.

**Ì Άέά÷άéñéóòPò ΆéêBíçoçò boot0:** Óì MBR ðìò άáéáéBοóáόάé áðù οί δññúáñáñíá άάéáòŨóóáóçò οίò FreeBSD P οί *boot0cfg(8)*, άáόBάéόάé áðù δññíáðééñáP οοί /boot/boot0. (Óì δññúáñáñíá **boot0** άβíάé ðñéŷ áðéù, έáépð ì επαέεάò οοί MBR ìðññáB íá Ύ÷άé ìŶáάéìò ùò 446 bytes, άíáéòBáò οίò ðBíáéá εáòáòìPóáùí (slice table) έάé οίò áñáñññéóóééíŷ 0x55AA ðìò άñBóéáòάé οοί òŶéìò οίò MBR.) Άί Ύ÷άòά άáéáόáόòPόáé οί **boot0** έάé ðñεεάðeŨ εάéóιòñάééŨ οóòòPíáòά οóìòò οééçññíŷò άBόéíòò οάò, éá άáBòá éáòŨ òçí άέέβίçoç, ìεά ðéùíç δánññéá ìά òçí δάνάéŨòù:

## ÐάñÛääéåñ 12-1. boot0 Screenshot

F1 DOS  
 F2 FreeBSD  
 F3 Linux  
 F4 ??  
 F5 Drive 1

Default: F2

¶εέα έαέοιòñáέéÛ óðóðΠιáóá, έαέ áέάέέúòáñá óá Windows, áβιáέ áιùóòú ùέέ ãñÛοιòί ðι áέέú ðιòò MBR ðÛιù óá éÛèιíá Παç ððÛñ÷ιι. Αί óáð óòιááβ áðòú, Π áι èÛέáðá íá áιðééáóáóðΠóáðá ðι ððÛñ÷ιι MBR óáð íá áðòú ðιò FreeBSD, ÷ñçóέιιðιέΠóáðá ðçι áέúειòèç áιðιèΠ:

```
# fdisk -B -b /boot/boot0 device
```

ùðιò device áβιáέ ç óðóέáðΠ áðú ðçι ιðιβά áβιáóáέ áêêβίçóç, ùðòð ð.÷. ðι ad0 áέá ðιι ðñðòι áβóει IDE, ðι ad2 áέá ðιι ðñðòι IDE áβóει óòι ááðòáñáγιιòá áέááèð, ðι da0 áέá ðιι ðñðòι SCSI áβóει è.ι.è. Αί ðÛέé èÛέáðá ðñιóáñιιòιÛιç ñÿèιέóç ðιò MBR, ÷ñçóέιιðιέΠóáðá ðι boot0cfg(8).

**Ï Äéá÷áέñéóðΠð Äêêβίçóçð LILO.** Äéá íá ááéáóáóðΠóáðá áðòú ðι áέá÷áέñéóðΠ äêêβίçóçð þóðá íá ιðιñáβ íá áêêéíáβ ðι FreeBSD, ááéáóáóðΠóáðá ðñþóá ðι Linux έαέ ðñιòèÛóáð ðçι áέúειòèç έáðá÷ñçóç óòι ððÛñ÷ιι áñ÷áβι ñðèιβóáùι /etc/lilo.conf:

```
other=/dev/hdXY  

table=/dev/hdX  

loader=/boot/chain.b  

label=FreeBSD
```

Óòι ðáñáðÛιù, έáειñβóðá ðι ðñòðáγιι áέáÛñέóιá έαέ ðι áβóει ðιò FreeBSD áιðééáέέóðΠιáð ðι x íá ðι áñÛιá áβóειò έαέ ðι y íá ðιι áñέέιι ðιò ðñòðáγιιòιò áέáιáñβóιáðιò, ÷ñçóέιιðιέΠιáð ùðò ðçι ιñιáðιεíáβá ðιò Linux. Αί ÷ñçóέιιðιέáβáðá ιäçäü SCSI έá ÷ñáέáóðáβ íá áέéÛιáðá ðι /dev/hd óá éÛέé áιðβóðιέ÷ι íá /dev/sd. Ç áñáñΠ loader=/boot/chain.b ιðιñáβ íá ðáñáέáέòèáβ áι Û÷áðá έáέ óá áγι έáέοιòñáέéÛ óðóðΠιáóá óòιι βáει áβóει. ÄéóáèÛóáð ðññá ðçι áιðιèΠ /sbin/lilo -v áέá íá έáðá÷ùñΠóáðá ðéð ιÛáð áέéááÛð óáð óòι óýóóçιá. Ιðιñáβá íá ðéð áðéáááέβóáðá áéÛá÷ιιðáð óá ιçγιáðá ðιò έá áιðáιέóòιγι óççι ιèιιç óáð.

### 12.3.2 Õι ÓðÛáέιíá, /boot/boot1, έαέ ðι ÓðÛáέιíáγι, /boot/boot2

ÏóóéáóééÛ, ðι ðñðòι έαέ ááγóáñι óðÛáει áβιáέ ðιΠιáóá ðιò βáειò ðñιáñÛιáðιò, óççι βáέá ðáñει÷Π ðιò áβóειò. Èúáù ðáñειñέóιπι ÷ññιò Û÷ιι ÷ùñέóáβ óá áγι, áέéÛ ááéáèβóáðιáέé ðÛιáðá íáεβ. ΑίðéáñÛοιιáέé áðú ðι óòιáóáóιÛιι áñ÷áβι /boot/boot áðú ðι ðñùáñáñιá ááéáóÛóáóçð Π ðι **bsdlabel** (ááβóá ðáñáéÛòù).

Áñβóειιáέé Ûιù áðú óðóðΠιáóá áñ÷áβι, óççι ðñðòç ðñι÷έÛ (track) ðιò slice áêêβίçóçð, íáέέΠιáð áðú ðιι ðñðòι ðιñÛá. Áβιáέ ðι óççιáβι ùðιò ðι boot0, Π ιðιέιòáΠðιðá Ûέειò áέá÷áέñéóðΠð äêêβίçóçð, áιáιÛιáέ íá áñáè ðñùáñáñιá ðñιò áéðÛέáóç íá ðι ιðιβι έá óòιá÷έóóáβ ç áέááέéáóβá áêêβίçóçð. Ï áñέέιιð ðιι ðιñÛι ðιò ÷ñçóέιιðιέιγιáέé ιðιñáβ íá áñáéáβ áγέιεá áðú ðι ιÛááèð ðιò áñ÷áβι /boot/boot.

Õι boot1 áβιáέ ðιέγ áðéú, íéá έαέ ιðιñáβ íá áβιáέ ιιιι 512 bytes óá ιÛááèò, έαέ áιññβáέé úóá ÷ñáέÛéáðáé áέá ðι **bsdlabel** ðιò FreeBSD, ðι ιðιβι áðιèçέáγáέ ðèçñιιñβáð ó÷áðééÛ íá ðι slice, þóðá íá áñáè έαέ íá áéðáèÛóáé ðι boot2.

Ôι boot2 áβίáέ áέáõñÛ ðεί ðιέýðείρει έάέ έάóáñáβ áðáñêð ðι όύόççíá áñ ÷ áβùí ðιò FreeBSD þóðá íá ðιñáβ íá áñáέ áñ ÷ áβá óá áðòù, έάέ ðιñáβ áðβόçð íá ðáñÝ ÷ áέ íέá áðêð áέáðáð ðι ðι ÷ ðβóç þóðá íá ðιñáβ íá áβίáέ ç áðέειñð ðιò ðòñþíá ð ðιò ðñíáñÛíáóìð òññòùóçð ðιò έá áέðáέáóðáβ.

Ôι boot2 óοιþèùð áέðáέáβ ðιí loader (òññòùðð ãέέβίçόçð) ð ðιñáβ ðιñáβ áíáέñáðééÛ ðεί ðιέýðείρειð, áέéÛ ðáñÝ ÷ áέ Ýíá ðñáβí έάέ áýειρει ðñùðι ðýειέóçð ðçð áέέβίçόçð. Ðáέéúðáñá ðι boot2 áíáέÛíááíá íá òññòþóáέ áðáðéáβáð ðιí ðòñþíá.

### ÐáñÛááέèá 12-2. Áέéúíá áðu ðι boot2

```
>> FreeBSD/i386 BOOT
Default: 0:ad(0,a)/boot/loader
boot:
```

Áí ÷ ðñáέóóáβ ðιòÝ íá áíóέέáóáóðþóáðá ðá ááέáðáóççíÝíá boot1 έάέ boot2 ÷ ðçóέιðιέþóðá ðι bsdlable(8):

```
# bsdlable -B diskslice
```

ùðìð ðι diskslice áβίáέ ðι áβóειð έάέ ðι slice áðu ðι ðιñáβ áβíáðáέ ç áέέβίçόçð, ùðùð ð. ÷. ad0s1 áέá ðι ðñþðι slice óοιí ðñþðι IDE áβóει.

**Áðέέβίáðíá ÁοιόέυιÝίç ÉáðÛóóáóç (Dangerously Dedicated Mode):** Áí ÷ ðçóέιðιέþóðá ðι ðι ðιñá ðιò áβóειð, ùðùð ð. ÷. ad0, óççí áíðιêð bsdlable(8) έá áççíέιðñáþóáðá Ýíá áðέέβίáðíá áοιόέυιÝίç áβóει, ÷ ðñáβ ðι slices. Áβίáέ ð ÷ ááùí óβáιòñι ðéέ ááí éÝέáðá íá ðι éÛíáðá áðòù, áé' áðòù óéáιòñáðóðáβðá ðéέ áéÝáíáðá óççí áíðιêð bsdlable(8) ðñέí ðéÝóáðá Return.

### 12.3.3 ÓóÛáει Òñβá, /boot/loader

Ï loader, ð òññòùðð ãέέβίçόçð, áβίáέ ðι ðáέέéú óóÛáει ðιò óóóðþíáðιò ãέέβίçόçð ðñêþí óðááβùí, έάέ áñβóέáðáέ óοι όύόççíá áñ ÷ áβùí, óοιþèùð ùð /boot/loader.

Ðñíññέóιùð ðιò loader áβίáέ íá ðáñÝ ÷ áέ íέá ðιέειñ ðýειέóçð òéέέêð ðñìð ðι ÷ ðβóç, έάέ ÷ ðçóέιðιέáβ Ýíá áýειρει όύιτει áíðιêþí, ðι ðιñáβ ðιò ðιòççñβáðáέ áðu Ýíá έó ÷ ðñù ðáðáðñáóðþ áíðιêþí ðι Ýíá ðιέððειρειùðáñι όύιτει áíðιêþí.

#### 12.3.3.1 Ñιþ ðιò ÐñíñáñÛíáóìð Loader

ÉáðÛ óççí áñ ÷ éειðιβçόçð, ð loader έá áίέ ÷ íáýóáέ óççí éιíóúéá έάέ ðιòð áβóειðð έάέ έá έáειñβóáέ áðu ðιει áβóει áβíáðáέ ç áέέβίçόçð. Éá ðñειβóáέ έáðÛéççéá ðéð áíðβóðιέ ÷ áð ðáðáéçðÝð έάέ έá ðáέειþóáέ Ýíá ðñuáñáíá ðáðÛòñáóçð áíðιêþí (interpreter) óοι ðιñáβ ðι ÷ ðβóçð íá áβίáέ áíðιέÝð, áβðá áðáðéáβáð, áβðá ðιò éÛðιέιð script.

Ï loader έáðùðεί ðι áέááÛóáέ ðι áñ ÷ áβι /boot/loader.rc, ðι ðιñáβ ðι ðç óáέñÛ ðιò áέááÛáέ, áðu ðñíáðέειñð, ðι /boot/defaults/loader.conf. ÏÝóá áðu ðι áñ ÷ áβι áðòù ðβéáíóáέ ειαέέÝð ðñíáðέéáñíÝíáð ðειÝð áέá éÛðιέáð ðáðáéçðÝð. Ðáέóá, áέááÛáðáέ ðι áñ ÷ áβι /boot/loader.conf áέá ðð ÷ ðι ðιðέéÝð áέéááÝð óóέð ðáðáéçðÝð áððÝð. Éáðùðεί ðι loader.rc ÷ ðçóέιðιέáβ áððÝð ðéð ðáðáéçðÝð, òññòþñíóáð ðá áñèñþíáðá (modules) έάέ ðιí ðòñþíá ðιò Ý ÷ áέ áðέéááβ.

ÔáέέéÛ, ð loader, ðáñειÝíáέ 10 ááððáñuέáððá (ðñíáðέéáñíÝí ÷ ðιíέéú áéÛóççíá) áέá ðççí ðβáóç éÛðιέιð ðèðèðñìð, έάέ áí ááí ððÛñíáέ ðáñÝíááóç áðu ðιí ÷ ðβóç, ðáέειÛáέ ðιí ðòñþíá. Áí áβíáέ ðáñÝíááóç, áìáíáβáðáέ óοιí ÷ ðβóç íέá ðñìòñìð ç ðιñáβ έáðáñíáβ ðι áýειρει όύιτει áíðιêþí ðιò áíáóÝñáíá ðñιçáιðιÝíùð, έάέ ùðìð ðι ÷ ðβóçð ðιñáβ íá

ñòèìβὸᾶέ ἰᾶδᾶᾷççὸῚ, ἰᾶ ἄδἰἰñὸβὸᾶέ ὑέᾶ ὀᾶ ἄñèñἰᾶὀᾶ, ἰᾶ ὀññὸβὸᾶέ ἄñèñἰᾶὀᾶ ἑᾶέ ὀᾶέέēŪ ἰᾶ ðñἰᾶᾷβ ὀᾶ ἄέέβίççὸç P ἄðᾶἰᾶέέβίççὸç.

### 12.3.3.2 Ἀἰἰἰἰἰἰἰ Ἀἰἰἰἰἰἰἰἰἰἰἰ ὀᾶἰ Loader

ðᾶñᾶέŪòù ἑᾶ ἄᾷβὸᾶ ὀέð ðéἰ ὀᾶ÷ἰŪ ÷ñçὸέἰἰðἰéἰἰἰἰᾶἰᾶ ðἰἰἰἰἰἰἰ ὀᾶἰ loader. Ἄέᾶ ðᾶñέὀᾶὀᾶñᾶð ἑᾶððñἰἰñᾶέᾶð ὀ÷ᾶðέēŪ ἰᾶ ὑέᾶð ὀέð ἄέᾶέŸὸέἰᾶð ἰἰἰἰἰἰἰἰἰἰ, ðᾶñᾶέᾶἰἰἰᾶ ἰᾶ ἄᾷβὸᾶ ὀᾶἰ loader(8).

autoboot *seconds*

ðñἰ÷ḡñŪ ὀᾶçἰ ἄέέβίççὸç ὀᾶἰ ððñἰἰᾶ, ἰᾶ ἄᾶἰ ὀðŪñἰᾶέ ðᾶñŸἰᾶὀç ἄðἰ ὀᾶἰ ñἰἰἰἰἰἰ ἰŸὸᾶ ὀᾶἰ ἑᾶέἰñέὀᾶŸἰ ÷ñἰἰἰἰἰἰ ἄέŪὀᾶçἰᾶ ðἰᾶ ἄβἰᾶὀᾶέ ὀᾶ ἄᾶðὀᾶñὑέᾶððᾶ. Ἀðᾶέἰἰἰἰᾶᾶ ἰἰἰἰἰἰἰἰἰἰἰ ἰŸὀñççὸç, ἑᾶέ ἰ ðñἰᾶðέᾶᾶἰŸἰð ÷ñἰἰἰἰἰἰ ἄβἰᾶὀ ὀᾶ 10 ἄᾶðὀᾶñὑέᾶððᾶ.

boot [-options] [kernelname]

ðñἰ÷ḡñŪᾶέ Ÿἰᾶὀᾶ ὀᾶçἰ ἄέέβίççὸç ὀᾶἰ ððñἰἰᾶ, ÷ñçὸέἰἰðἰéἰἰἰᾶð ὑðἰᾶð ὀð÷ἰἰ ἄðéἰᾶŸò Ÿ÷ἰἰᾶ ἄἰᾶᾷβ ἑᾶέ ὀᾶἰ ὑñἰᾶ ὀᾶἰ ððñἰἰᾶ ᰒἰᾶ ἑᾶ ἄἰᾶᾷᾶὀᾶᾷβ ἰᾶ Ÿ÷ᾶέ ἄðἰᾶὀç ἄἰᾶᾷβ. Ἄέᾶ ἰᾶ ἰᾶᾶὀᾶ ἄἑᾶὀἰñᾶὀéἰἰ ὑñἰᾶ ððñἰἰᾶ ὀᾶçἰ ἄñᾶἰἰἰἰ ἰἰἰἰἰἰἰἰ, ἑᾶ ðñŸðᾶέ ðñἰᾶ ἰᾶ ÷ñçὸέἰἰðἰéἰἰᾶðᾶ ὀçἰ ἰἰἰἰἰἰἰἰἰἰἰ *unload*. Ἄέᾶὀἰñᾶὀéἰἰ, ἑᾶ ÷ñçὸέἰἰðἰéἰἰᾶᾷβ ἰ ððñἰἰᾶ ᰒἰᾶ Ÿ÷ᾶέ ὀἰñðὑέᾶᾷβ Pᾶç.

boot-conf

ἌἑᾶðñŸ÷ᾶέ ὀçἰ ἰᾶðἰἰᾶὀç ñὑἑἰὀç ὀᾶἰ ἄñèñἰἰŪðἰἰ (module) ðἰᾶ ἄᾶὀᾶᾶὀᾶέ ὀᾶ ἰᾶðᾶᾷççὸῚ, ἰᾶ ὀᾶἰ βᾶéἰ ὀñὑðἰ ðἰᾶ ἄβἰᾶὀᾶέ ἑᾶέ ὀᾶ ἑᾶἰἰἰἰỠ ἄέέβίççὸç. Ἀðὀᾶ Ÿ÷ᾶέ ἰᾶçἰᾶ ἰᾶñἰ ἰᾶ ÷ñçὸέἰἰðἰéἰἰᾶðᾶ ðñἰᾶ ὀᾶἰ *unload* ἑᾶέ ἄἑᾶŸἰᾶὀᾶ ἑŪðἰᾶð ἰᾶðᾶᾷççὸῚ, ὀᾶἰPὑᾶð ὀᾶἰ kernel.

help [topic]

Ἄᾷβ÷ἰᾶέ ἰçἰἰᾶὀᾶ ἰἰỠᾶᾶᾶð, ὀᾶ ἰðἰἰᾶ ἄἑᾶᾶŪᾶἰὀᾶέ ἰᾶðἰ ὀᾶἰ /boot/loader.help. Ἀἰ ὀᾶἰ topic (ἑŸἰᾶ) ðἰᾶ ἄὑᾶçᾶᾶ ἄβἰᾶὀ ὀ ἑŸἰç index, ἑᾶ ἄᾷβὸᾶ ἰᾶᾶ ἑἰὀᾶ ἰᾶ ὀᾶ ἄἑᾶέŸὸéἰᾶ ἑŸἰᾶὀᾶ ἰἰỠᾶᾶᾶð.

include *filename* ...

ἌðᾶἰñᾶŪᾶὀᾶέ ὀᾶἰ ἄñ÷ᾷβἰ ἰᾶ ὀᾶἰ ὑñἰᾶ ἄñ÷ᾷβἰ ðἰᾶ ἄὑᾶçᾶᾶ (filename). Ἄβἰᾶὀᾶέ ἰᾶŸᾶἰᾶὀç ἑᾶέ ἄñᾶἰἰἰἰἰ ᰒἰᾶ ἄñᾶἰἰἰἰἰ ἰᾶðŪðñᾶὀç ὀᾶἰ ἄñ÷ᾷβἰ. Ç ἰἰἰἰἰἰἰἰἰἰἰ include ὀᾶἰᾶðŪᾶέ Ÿἰᾶὀᾶ ἰᾶ ἰἰἰἰἰἰἰἰἰἰἰἰ ἑŪðἰᾶἰ ἑŪἰᾶð.

load [-t type] *filename*

Ÿἰñὸβἰᾶᾶ ὀᾶἰ ððñἰἰᾶ, ὀᾶ Ḹñèñἰᾶ ððñἰἰᾶ P ἰᾶᾶ ἄñ÷ᾷβἰ ὀᾶἰ ὀᾶᾶðἰᾶ ᰒἰᾶ ἑᾶἰñἰἰỠὀçᾶᾶ, ἰᾶ ἰᾶŪὀç ὀᾶἰ ὑñἰᾶ ἄñ÷ᾷβἰ ðἰᾶ ἄὑᾶçᾶᾶ. Ἀἰ ἰᾶðŪ ὀᾶἰ ὑñἰᾶ ἄñ÷ᾷβἰ ὀðŪñ÷ἰᾶ ᰒᾶñŸἰᾶðñἰᾶ, ðᾶñἰᾶἰᾶᾶ ὑð ðᾶñŸἰᾶðñἰᾶ ὀᾶἰ ἄñ÷ᾷβἰ ðἰᾶ ὀἰñὸβἰᾶὀᾶᾶ.

ls [-l] [*path*]

Ἄᾷβ÷ἰᾶέ ἰᾶᾶ ἑᾶðŪἑἰᾶἰ ὀᾶἰ ἄñ÷ᾷβἰἰ ὀçð ἄἑᾶᾶñἰỠἰð ᰒἰᾶ ἄὑᾶçᾶᾶ, P ἰᾶ ἄᾶἰ ἑᾶἰñἰỠὀçᾶᾶ ἄἑᾶᾶñἰỠἰ, ὀᾶἰ ñᾶἑἑἰἰἰ ἑᾶὀᾶἑἰᾶἰᾶ. Ἀἰ ἰᾶᾶᾷβ ἑᾶέ ὀ ἄðἑἰᾶP -l ἑᾶ ἰἰὀᾶἰβᾶἰὀᾶᾶ ἄðἰᾶὀçð ἑᾶέ ὀᾶ ἰᾶᾶŸᾶç ὀᾶἰ ἄñ÷ᾷβἰἰ.

lsdev [-v]

Ἄἰὀᾶἰβᾶᾶᾶ ὑέᾶð ὀéð ὀðὀᾶᾶŸò ἰᾶðἰ ὀéð ἰðἰỠᾶð ἄβἰᾶὀ ἰᾶᾶᾶð P ὀ ὀἰñὀᾶὀç ἄñèñἰἰŪðἰἰ. Ἀἰ ἰᾶᾶᾷβ ἰᾶ ὀçἰ ἄðἑἰᾶP -v, ἰᾶὀᾶἰβᾶἰὀᾶᾶ ᰒᾶñἑὀᾶὀᾶñᾶð ἑᾶððñἰἰñᾶᾶᾶð.

lsmod [-v]

Ἄἰὀᾶἰβᾶᾶᾶ ὀᾶ ἄñèñἰᾶὀᾶ ᰒἰᾶ Ÿ÷ἰᾶἰ ὀἰñðὑέᾶᾷβ. Ἀἰ ἰᾶᾶᾷβ ὀ ἄðἑἰᾶP -v, ἰᾶὀᾶἰβᾶἰὀᾶᾶ ᰒᾶñἑὀᾶὀᾶñᾶð ἑᾶððñἰἰñᾶᾶᾶð.

more *filename*

Άιόάίβæάέ ðι áñ ÷ áβι ðιò éáειñβæάόάέ, ιά ðάγόάέò εΰεά LINES áñέειιι áñáñιí.

reboot

Άðáíáέέέίáβ ΰιáόά ðι óγóόçιá.

set *variable*

set *variable=value*

Έáειñβæάέ ιáόάάέçòΎò ðáñέáΰεειíοιò áέá ðιí loader.

unload

Άðιοιñόβιáέ υέá óá áñεñβιáόá.

### 12.3.3.3 Ðáñáááβáιáόá áέá ðιí Loader

Άáρ éá áñáβóá ιáñέέΰ ðñáέóέέΰ ðáñáááβáιáόá ó ÷ áóέέΰ ιá ðçι ÷ ñβóç ðιò loader:

- Άέá ιá ιáέέίβóáðá ðι óóιçέέοιΎιí ððñβιá óáò, áέέΰ óá éáòΰóóáóç áιυò ÷ ñβóç:

```
boot -s
```

- Άέá ιá áðιοιñόβóáðá ðι óóιçέέοιΎιí ððñβιá óáò éáέ ιá οιñόβóáðá ðιí ðáέέυ óáò (P εΰðιέι ΰεει):

```
unload
load kernel.old
```

Ϊðιñáβóá ιá ÷ ñçóέιιðιέβóáðá ðι υιíñá kernel.GENERIC áέá ιá áιáóáñέáβóá óóιí áñ ÷ έέυ (generic) ððñβιá ι ιðιβιò òðΰñ ÷ áέ óóι CD ðçò ááέáðΰóóáóçò, P ðι kernel.old áέá ιá áιáóáñέáβóá óóιí ððñβιá ðιò áβ ÷ áóá ááέáóáóóçιΎιí ðñέι (áέá ðáñΰááέáιá, ðιí ðáέέυ óáò ððñβιá áι εΰιáðá ðñυóóáóá ñγέιέóç éáέ ááέáðΰóóáóç ιΎιò áέέιγ óáò ðñιόáñιιόιΎιí ððñβιá).

**Όçιáβυóç:** ×ñçóέιιðιέβóáðá ðι ðáñáέΰòυ áέá ιá οιñόβóáðá ðá óóιçέέοιΎιá óáò áñεñβιáόá óá εΰðιέι ΰεει ððñβιá:

```
unload
set kernel="kernel.old"
boot-conf
```

- Άέá ιá οιñόβóáðá Ύιá script ñγέιέóçò ððñβιá (Ύιá áóðñáóιðιέçιΎιí ðñυáñáιá ðι ιðιβι áέðáέáβ óέð éáέòιñáβàð ðιò éáñιέέΰ éá εΰιáðá ιΎóυ εΰðιέιò ðñιáñΰιáðιð ñγέιέóçò ððñβιá éáòΰ ðçι áέέβίçόç):

```
load -t userconfig_script /boot/kernel.conf
```

### 12.3.3.4 Άñáóέέβ ιέυιç Áέέβίçόçò

Όðιáέóοιñΰ áðυ ðιí Joseph J. Barbish.

Ç áñáóέέβ ιέυιç áέέβίçόçò (splash screen) áçιέιòñááβ Ύιá ðεί áò ÷ ΰñέóοι ðáñέáΰεειí óá ó ÷ Ύóç ιá ðçι áðεβ áðáέέυιέóç ðυι ιçιοιΰòυι áέέβίçόçò óá ιιñόβ éáειΎιí. Ç áñáóέέβ ιέυιç áέέβίçόçò áιόáίβæάόάέ ðò υιðιò ðι óγóόçιá òðΰóáέ óóçι ðñιðñιðβ áέóυáιò (login), áβóá óóçι éιíóυέá, áβóá óóçι áñáóέέυ ðáñέáΰεειí.



Ἄρα ὁρίστε τὸ μέγεθος τοῦ splash (320x200 pixels, 256 colors), ἀπὸ τὸν ἀρχικό φάκελο /boot/loader.conf ὡς ἑξής:

```
splash_bmp_load="YES"
bitmap_load="YES"
bitmap_name="/boot/splash.bmp"
```

Ἄρα ἐπιλέξτε τὸ μέγεθος τοῦ splash 1024x768, ἀπὸ τὸν ἀρχικό φάκελο /boot/loader.conf ὡς ἑξής:

```
vesa_load="YES"
splash_bmp_load="YES"
bitmap_load="YES"
bitmap_name="/boot/splash.bmp"
```

Ὁρίστε τὸ μέγεθος τοῦ splash 1024x768, ἀπὸ τὸν ἀρχικό φάκελο /boot/splash.bmp ὡς ἑξής. Ἄρα ἐπιλέξτε τὸ μέγεθος τοῦ splash 1024x768, ἀπὸ τὸν ἀρχικό φάκελο /boot/loader.conf ὡς ἑξής:

```
splash_pcx_load="YES"
bitmap_load="YES"
bitmap_name="/boot/splash.pcx"
```

Ὁρίστε τὸ μέγεθος τοῦ splash 1024x768, ἀπὸ τὸν ἀρχικό φάκελο /boot/splash.pcx ὡς ἑξής. Ἄρα ἐπιλέξτε τὸ μέγεθος τοῦ splash 1024x768, ἀπὸ τὸν ἀρχικό φάκελο /boot/loader.conf ὡς ἑξής:

Ἄρα ἐπιλέξτε τὸ μέγεθος τοῦ splash 1024x768, ἀπὸ τὸν ἀρχικό φάκελο /boot/loader.conf ὡς ἑξής:

```
beastie_disable="YES"
```

Ἄρα ἐπιλέξτε τὸ μέγεθος τοῦ splash 1024x768, ἀπὸ τὸν ἀρχικό φάκελο /boot/loader.conf ὡς ἑξής:

```
loader_logo="beastie"
```

Ἄρα ἐπιλέξτε τὸ μέγεθος τοῦ splash 1024x768, ἀπὸ τὸν ἀρχικό φάκελο /boot/loader.conf ὡς ἑξής:

Ἄρα ἐπιλέξτε τὸ μέγεθος τοῦ splash 1024x768, ἀπὸ τὸν ἀρχικό φάκελο /boot/loader.conf ὡς ἑξής:

## 12.4 Ἐξέταση Ἀεὶβίβου τοῦ FreeBSD

Ἄρα ὁρίστε τὸ μέγεθος τοῦ splash 1024x768, ἀπὸ τὸν ἀρχικό φάκελο /boot/loader.conf ὡς ἑξής:

### 12.4.1 ΔάñÙιάòñιέ Άέέβίζόζò ΔòñΠιá (Boot Flags)

Δάñάεΰòù εά áñáβòá ðéò ðεί óοίçέéοιΎίáò δάñáιΎòñιòð áέέβίζόζò:

- a  
έάóΰ ðç äεΰñέάέá ðçò áέέβίζόζò, εά áβιáέ áñðççόç áέá ðçί óòóέáðP áðù ðçί ιðιβá εά áβιáέ ç ðñιόΰñòçόç ðιò ñέæέιγ (root) óòóðΠιáòιò áñ÷-áβιι.
- C  
áέέβίζόç áðù ðι CDROM.
- c  
áέóΎέáόç ðιò UserConfig, ðιò ðñιáñÙιáòιò ñγέιέçòð ðòñΠιá έάóΰ ðçί áέέβίζόç.
- s  
áέέβίζόç óá έάóΰóάόç έάέοιòñáβáð áφùð ÷ ñΠόçç (single user).
- v  
áιòΎιέόç ðáñέóóùðáñιι ðεçñιοιñεβι έάóΰ ðç äεΰñέάέá áέέβίζόζò ðιò ðòñΠιá.

**Óçιáβιόç:** ÕðÛñ÷ιòι έάέ ΰέέáð ðáñÙιáòñιέ áέέβίζόζò, áέááΰóðá ðç óáέβáá boot(8) áέá ðáñέóóùðáñáð ðεçñιοιñεβáð ó÷-áðέέΰ ιá áðóΎò.

## 12.5 Device Hints

*Óòιáέóοιñΰ áðù ðιí Tom Rhodes.*

**Óçιáβιόç:** Δñùέάέóάέ áέá áðιáðùçòçá ðιò ððÛñ÷-άέ áðù ðι FreeBSD 5.0 έάέ ιáðÛ, έάέ ááι εά ðι áñáβòá óá ðñιçáιγιáíáð áέäùóάέð.

Έάóΰ ðç äεΰñέάέá ðçò áñ÷-έέðð áέέβίζόζò ðιò óòóðΠιáòιò, ðι ðñιáñáιιá ðιò boot loader(8) áέááΰæáέ ðι áñ÷-áβιι device.hints(5). Õι áñ÷-áβιι áðòù ðáñέΎ÷-άέ ðεçñιοιñεβáð áέέβίζόζò áέá ðιí ðòñΠιá, áφùóóΎò ùð ιáðááεçðΎò, ιέ ιðιβáð ιáñέέΎð ðιñΎð áιáóΎñιíóáέ áðβóçð έάέ ùð “device hints”. Áðóΰ óá “device hints” ÷ ñçóέιιðιέιγίóáέ áðù ðñιáñÙιáóá ιáΠáççòð óòóέáðβι áέá ñγέιέçç ðιι áιðβóðιέ÷ιι óòóέáðβι.

Ìðιñιγιá áðβóçð ιá ιñβóιòιá Device hints óççί ðñιòñιðP ðιò Óðááβιò 3 ðιò boot loader. Ιέ ιáðááεçðΎò ιðιñιγιί ιá ιñέóóιγιί ιá ÷ ñΠόç ðçò áιðιèΠð set, έάέ ιá áðáέñáέιγιί ιá ðççί unset. Ιðιñιγιá áðβóçð ιá ðéð áιòáιβóιòιá ιá ðççί áιðιèΠ show. Áέυιá, ιðιñιγιá ááβ ιá ðáñάέΎιøιòιá έάέ ιá áέέΎñιòιá ðççί ðειΠ ιáðááεçðβι ðιò Ύ÷ιòι ιñέóóáβ óοι áñ÷-áβιι /boot/device.hints. Õá Device hints ðιò ιñβæιòιá óοι boot loader ááι ðáñáιΎιòι ιιιέιá έάέ ááι εά έó÷-γóιòι óççί áðùιáιç áέέβίζόç.

ÌáðÛ ðççί áέέβίζόç ðιò óòóðΠιáòιò, ιðιñáβ ιá ÷ ñçóέιιðιέιçέáβ ç áιðιèΠ kenv(1) áέá ιá áιòáιέóóιγιί ιέ ðειΎð üèιι ðιι ιáðááεçðβι.

Ôì óóíóáéôéèù ðìò áñ÷áβìò /boot/device.hints áβíáé íéá íáðááæçòP áíÛ ãñáñìP, éáé ÷ñçóéìðíéáβðáé ðì ðððíðíéçìÝíí “#” áéá ãñáñìÝð ðìò æçêðííóíóáé ùð ó÷üééá. Íé ãñáñìÝð æçíéíðñáíýíóáé üðùð öáβíáðáé ðñáéÜðù:

```
hint.driver.unit.keyword="value"
```

Ç óýíðáíç áéá ðì ÓðÜáéí 3 ðìò boot loader áβíáé:

```
set hint.driver.unit.keyword=value
```

üðìò driver áβíáé ðì üíñá ðìò íäçáíý óðóéáððð, unit áβíáé í áñéèìüð ïíÛááð ðçð ððóéáððð, éáé keyword áβíáé ç ëÝíç-ééáéáβ áéá ðì óðáéáñéíÝíí hint. Ç ëÝíç-ééáéáβ ìðíñáβ íá áðíðáéáβðáé áðü ðéð áéüéíðéáð áðééíáÝð:

- at: éáèìñβæáé ðì áβáðéí (bus) óðíí ððíβì ðñíóáñðÜðáé ç óðóéáðð.
- port: éáèìñβæáé ðçí áñ÷éèP áéáýèðíóç ðçð éýñáð I/O ðìò éá ÷ñçóéìðíéççéáβ.
- irq: éáèìñβæáé ðíí áñéèìü ðçð áβðçðçð áéáéíððð (interrupt request) ðìò éá ÷ñçóéìðíéççéáβ.
- drq: éáèìñβæáé ðíí áñéèìü ðìò éáíáééíý DMA.
- maddr: éáèìñβæáé ðç ððóéèP áéáýèðíóç ïíðíçð ðìò éáðáéáíáÛíáðáé áðü ðç ððóéáðð.
- flags: ïñβæáé äéÜóíñá bits ðñáñíÝðññì áéá ðçí óðóéáðð.
- disabled: Áí ïñéóðáβ óá ðéíP 1, ç óðóéáðð áðñáíñáíðíéáβðáé.

Íé íäçáíβ óðóéáððí ððíñáβ íá äÝ÷ííóáé (P íá áðáéðíýí) ðñáéóóüðáñá hints óá ððíβá ááí öáβííóáé ááð, éáé óáð óðíéóðíýíñá íá ááβðá ðçí áíóβððíé÷ç óáéβáá manual ðìò éÜèá íäçáíý. Áéá ðñáéóóüðáñáð ðççñíðíñáð óðíáíðéáðéáβðáá áðβóçð ðéð óáéβááð manual ðüí device.hints(5), kenv(1), loader.conf(5), éáé loader(8).

## 12.6 Init: Äñ÷ééíðíβççò ÄéÝá÷ìò Äéááééáóéðí

Ìüéèð ðíéèççñüèáβ ç áéêêβίççò ðìò ððñíá, í Ýéää÷ìò íáðáóÝñáðáé óðçí áéááééáóβá ÷ñPóðç init(8), ç ððíβá ãñβóéáðáé óðí áñ÷áβì /sbin/init, P óóç áéááññP ðìò éáèìñβæáðáé óðçí íáðááæçòP init\_path ðìò loader.

### 12.6.1 Äéíðíðéβá Áððüíáðçð Áðáíáéêêβίççò

Ç áéíðíðéβá áððüíáðçð áðáíáéêêβίççò áíáóóáéβæáé üðé óá óðóðPíáðá áñ÷áβìí áβíáé óá éáííéèP, óðáéáñP éáðÜóðáóç. Áí ááí áβíáé, éáé ç fsck(8) ááí ððíñáβ íá áéíðéβáé óá ðñíáéPíáðá, óüðá ç init(8) éá íáðáóÝñáé ðì óýóðçíá óá éáðÜóðáóç éáéðíðñáβáð áíüð ÷ñPóðç þððá íá ððíÝóáé Ûíáóá í áéá÷áéñéóððð óðóðPíáðá ðí áðééççéáβ ðüí ðñíáéçìÛðüí áððí.

### 12.6.2 ÉáðÜóðáóç Éáéðíðñáβáð Áíüð ×ñPóðç

Ìðíñáβðá íá áéóÝéèáðá óðçí éáðÜóðáóç áððP íÝóü ðçð áéíðíðéβáð áððüíáðçð áðáíáéêêβίççò, P íÝóü ðçð áðééíáPð -s éáðÜ ðçí áéêêβίççò P áéüíá éáé éÝðííðáð ðç íáðááæçòP boot\_single óðíí loader.

Ìðíñáβðá áðβóçð íá áéóÝéèáðá óá áððP áéðáéþíðáð ðçí áíðíèP shutdown(8) ÷ññβð ðçí áðééíáP áðáíáéêêβίççò (-r) P ðáñíáðéóííý (-h), áñP áβððá óá éáðÜóðáóç éáéðíðñáβáð ðíéèþí ÷ñçóðþí (multi-user).

Áí ç éííóüèá ðìò óðóðPíáðáð Ý÷áé ðáéáβ ùð insecure (áíáóóáéPðð) óðí /etc/ttys, ðì óýóðçíá éá æçðPóáé ðíí éüáéèü ðìò root ðñéí áéóÝéèáé óá éáðÜóðáóç éáéðíðñáβáð áíüð ÷ñPóðç.



# ÊäöÛëáéí 13 × ñÞóôâð êáé ÁáóéêÞ Äéá ÷ âßñéóç Ëïãáñéáóìþí

ÓðíáέóðìÛ áðü ðí Neil Blakey-Milner.

## 13.1 Óýñïç

Ôí FreeBSD áðέóñÝðáé óá ðíεέáðéíýð ÷ ñÞóðâð íá ÷ ñçóέííðíéíýí ðí ððíεíáέóðÞ ðçí ßáéá óóéáìÞ. Ðñíóáíðð, ìüñí Ýíáð áðü áðóíýð ðíðð ÷ ñÞóðâð ìðñíáß íá εÛεáðáé ìðñíóðÛ áðü ðçí íεúíç êáé ðí ðççέðñíεúáéí εÛεá áááñÝíç óóéáìÞ<sup>1</sup>, áεεÛ ððíéíóáðððíðá áñέέìüð ÷ ñçóðþí ððñíýí íá áέóÝεèíóí ìÝóü ðíð áέέðýíð áéá íá öÝñíðí óá ðÝñáð óéð áñááóßâð ðíðð. Äéá íá ÷ ñçóέííðíéÞóáé ðí óýóðçíá, εÛεá ÷ ñÞóðçð ðñÝðáé íá Ý ÷ áé Ýíá εíááñéáóíü.

Áóíý áéááÛóáðá áðü ðí εáöÛεáéí, εá ðÝñáðá:

- Óéð áéáóíñÝð áíÛíáóá óóá áεÛóíñá áßαç εíááñéáóìþí ÷ ñçóðþí óá Ýíá óýóðçíá FreeBSD.
- Ðüð íá ðñíóέÝóáðá εíááñéáóíýð ÷ ñçóðþí.
- Ðüð íá áéááñÛðáðá εíááñéáóíýð ÷ ñçóðþí.
- Ðüð íá áεεÛíáðá óéð εáððñÝñáéáð áíüð εíááñéáóíý, üðüð ðí ðεÞñáð üññá ðíð ÷ ñÞóðç, Þ ðí ðñíðέíþíáíí éÝέóððð (shell).
- Ðüð íá εÝóáðá üñéá áíÛ εíááñéáóíü, áéá íá áεÝá ÷ áðá ðññíðð üðüð ç ððíç êáé ðí ÷ ñññð ðçð CPU, ðíð ððñíýí íá Ý ÷ ðí óççí áεÛεáóç ðíðð óðáεáêñéíÝíé εíááñéáóííß Þ ðÛáðá εíááñéáóìþí.
- Ðüð íá ÷ ñçóέííðíéÞóáðá ðÛáðá áéá íá εÛíáðá áðéíεüðáñç ðç áéá ÷ âßñéóç ðüí εíááñéáóìþí.

Ðñéí áéááÛóáðá áðü ðí εáöÛεáéí, εá ðñÝðáé:

- Íá εáóáñíáßðá óéð ááóέéÝð Ýíñéáð ðíð UNIX êáé ðíð FreeBSD (ÊáöÛεáéí 3).

## 13.2 ÁέóááüñÞ

Ç ðñüóááóç óðí óýóðçíá áðέóðá ÷ Ûíáðáé ìÝóü εíááñéáóìþí, üεáð íé áéáñááóßâð áέðáεíýíðáé áðü ÷ ñÞóðâð, Ýóóé ç áéá ÷ âßñéóç ÷ ñçóðþí êáé εíááñéáóìþí áßíáé ìááÛεçð óçíáóßâð óóá FreeBSD óðóðÞíáðá.

ËÛεá εíááñéáóíüð óá Ýíá óýóðçíá FreeBSD Ý ÷ áé óðáεáêñéíÝíáð ðççñíóíñßâð ðíð ó ÷ áðßáéíðáé ìá áðüí þóðá íá áíááññæáðáé áðü ðí óýóðçíá.

¼ññá ÷ ñÞóðç

Ôí üññá ÷ ñÞóðç áßíáé áðüð ðíð εá áñáðáß óççí ðñíðñíðÞ login: . Óá ðññíáðá ÷ ñçóðþí ðñÝðáé íá áßíáé ðññáééÛ áéá ðíð ððíεíáέóðÞ, ááí ððñíáßðá íá Ý ÷ áðá äýí ÷ ñÞóðâð ìá ðí ßáéí üññá ÷ ñÞóðç. ÓðÛñ ÷ áé Ýíáð áñέέìüð εáíññíí áéá ðççí áçíέíðñáßá Ýáέðññí ðññÛðüí ÷ ñçóðþí, ðíð ðáέíçþéþñíðáé óðí passwd(5). ÓðíÞεüð εá ÷ ñçóέííðíéáßðá ðññíáðá ÷ ñçóðþí ðíð ðáñéÝ ÷ ðí ðéðÞ Þ εέáüðáñíðð üεíðð ìέéñýð ÷ áñáέðÞñáð.

Èυὰέéυò

ÈΥεὰ ειαάνέαóìυò Ý÷:άέ Υία Èυὰέéυ ðìò ó÷:αòβæàóάé ìà áòòυí. Ì Èυὰέéυò ìðìñáß íá áβíáé èáíυò, ìðuòá éáé ááí εά áðáέóáβòάé áéá ðñυóáóçç óòì óýóðçíá. Αóòυ èáòÛ εáíυíá áβíáé ìéá ðìéý εάέP εäÝá, εÛεὰ ειαάνέαóìυò εá ðñÝðáé íá Ý÷:άέ Υίαí Èυὰέéυ.

User ID (UID)

Òì UID áβíáé Υίαò áñέéìυò, èáòÛ ðáñÛáìόç áðu òì 0 Ýυò òì 65535<sup>2</sup>, ðìò ÷ ñçóέìðìéáβòάé áéá òçì ìííáάέèP áíááìþñέóç òìò ÷ ñΠόóçç óòì óýóðçíá. ΑóòυðáñέéÛ, òì FreeBSD ÷ ñçóέìðìéáß òì UID áéá íá áíááìñβóáé ÷ ñΠόóàð—ìðìéáóáððìòá áíòìéÝð òìò FreeBSD ðìò óáð áðéðñÝðìòì íá ìñβóáðá Υία ùíñá ÷ ñΠόóçç éá òì ìáóáðñÝòìòì óòì UID ðñέí òì ÷ ñçóέìðìéPóìòì. Αóòυ òçíáβíáé ùóé ìðìñáβòá íá Ý÷:áòá ðìéεýð ειαάνέαóìíýð ìá áéáóìñáðééÛ ìííáóá ÷ ñΠόóçç áέéÛ òì βáέì UID. ìóì áóìñÛ òì FreeBSD, áòòìβ ìé ειαάνέαóììß áβíáé Υίαò ÷ ñΠόóççð. Αβíáé áðβæáíí íá ÷ ñáéáóóáß ðìòÝ íá εÛíáðá εÛðé òÝðìéí.

Group ID (GID)

Òì GID áβíáé Υίαò áñέéìυò, èáòÛ ðáñÛáìόç áðu òì 0 Ýυò òì 65535<sup>2</sup>, ðìò ÷ ñçóέìðìéáβòάé áéá òçì ìííáάέèP áíááìþñέóçç òçð ðñυóáýíìòìò ñÛááð ðìò áíPéáé ì ÷ ñΠόóççð. Ìé ñÛááð áβíáé Υίαò ìç÷:άίέóìυò áéá òìí Ýεáá÷ì òçð ðñυóááóçç òá ðñυòð ðìò òççñβæáóάé óòì GID áíυò ÷ ñΠόóçç, ðáñÛ óòì UID. Αóòυ ìðìñáß íá ìáεþóáé òçíáíóééÛ òì ìÝááéìò εÛðìéýí áñ÷:άβυí áéáòèÝðçóççð. Íáð ÷ ñΠόóççð ìðìñáß áðβóççð ìá áíPéáé òá ðáñέóóùðáñáð òççð ìβáð ñÛááð.

ÈéÛóáéð óýíááóççð

Ìé èéÛóáéð óýíááóççð (login classes) áβíáé ìéá áðÝéðáóçç óòìí ìç÷:άίέóìυò ðυì ñÛáυì ðìò ðáñÝ÷ìò ðñυóéáòçç áðáééíβá υòáí ðñìóáñìυæìòì òì óýóðçíá òá áéáóìñáðééýð ÷ ñΠόóàð.

× ññυòð áέéáãPð Èυὰέéý

Αí' ìñέóìíý òì FreeBSD ááí áðéáÛεεάé óòìòð ÷ ñΠόóàð ìá áέéÛæìòì ðáñέíáééÛ òìí Èυὰέéυ òìòð. Ìðìñáβòá íá òì áðéáÛεáðá áóòυ òá ìéá áíÛ ÷ ñΠόóçç áÛóçç, áíáάéÛæìòìάð εÛðìéíòð P ùéìòð òìòð ÷ ñΠόóàð ìá áέéÛæìòì òìí Èυὰέéυ òìòð áóìý Ý÷:άé ðáñÛóáé Υία óðáéäêñéíÝíì ÷ ñìíééυ æéÛóóççíá.

× ññυòð éPìçð ειαάνέαóìþι

Αí' ìñέóìíý óòì FreeBSD ááí éPáìòì ειαάνέαóììß. Αí áçìéíòñáPóáðá ειαάνέαóìíýð ðìò áìñβæáðá ùóé Ý÷:íòì ðáñέíñέóìÝíç æéÛñêéáé æùPð, áéá ðáñÛááéáìá, òá Υία ó÷:ìéáßì ùðìò Ý÷:áòá ειαάνέαóìíýð áéá òìòð ìáεçðÝð, òυòá ìðìñáβòá íá ìñβóáðá ðυòá éPááé ì ειαάνέαóìυò. Αóìý ì ÷ ññυòð éPìçð Ý÷:άé ðáñÛóáé, ì ειαάνέαóìυò ááí ìðìñáß íá ÷ ñçóέìðìéçéáß áéá òçì óýíááóçç òòì óýóðçíá, áí éáé ìé òÛéáéíé òìò ειαάνέαóìíý éáé òá áñ÷:áβá εá ðáñáíáβñìòì.

Ðñááíáðéééυ ùíñá ÷ ñΠόóçç

Òì ùíñá ÷ ñΠόóçç áíááìñβæáé ìííáάέéÛ òìí ειαάνέαóìυò óòì FreeBSD, áééÛ ááí áíóέðñìòυðáýáé áðáñáβóççóá òì ðñááíáðéééυ ùíñá òìò ÷ ñΠόóçç. ΑóðP ç ðεçñìòìñá ìðìñáß íá óóó÷:áðéóóáß ìá òìí ειαάνέαóìυò.

Ðñìòυðéééυ èáòÛεíáìò

Ì ðñìòυðéééυ èáòÛεíáìò ááß÷:íáé òçì ðéPñç æéááñìP ðñìò Υία èáòÛεíáìò òìò óòóðPíáòìò. Αóòυð áβíáé éáé ì áñ÷:ééυò èáòÛεíáìò òìò ÷ ñΠόóçç, εÛεá òìñÛ ðìò óòíáÝáðáé óòì óýóðçíá. Ìéá éìéíP óýíááóçç áβíáé íá ìðáβñìò ìé ðñìòυðééíß èáòÛεíáìé ÷ ñçóðþì óòì /home/username P óòì /usr/home/username. Ì ÷ ñΠόóççð éá áðìéçéáýáé òá ðñìòυðéééÛ òìò áñ÷:áβá éáé òìòð èáóáéυáìòð ðìò áçìéíòñááß, ìÝóá óòì ðñìòυðéééυ òìò èáòÛεíáìò.



óðóðÞíáðíð Þ Ûëëùí ÷ ñçóðþí, éáé áðέóñÝðííóáð óá èÛèá Ýíá íá ðñíóáñíùæáé òí äέëù òíð ðáñéáÛëëí ÷ ùñßð íá áðçñáÛæáé òíðð Ûëëíðð.

ÊÛèá Ûòñí ðíð Ý ÷ áé ðñíóááóç óðí óýóçíÛ óáð éá ðñÝðáé íá Ý ÷ áé Ýíá ïííáééëù èíäáñéáóíù ÷ ñÞóðç. Áððù óáð áðέóñÝðáé íá áñáßðá ðíéíð èÛíáé óé, áðíðñÝðáé áíεñþðíðð áðu òí íá ðáñÛæíðí ðéð ñðèíßóáéð í Ýíáð òíð Ûëëíð, Þ íá áéááÛóáé í Ýíáð óá mail òíð Ûëëíð, éáé íýòù éáéáíÞð.

ÊÛèá ÷ ñÞóðçð ìðíñáß íá óðÞóáé òí äέëù òíð ðáñéáÛëëí þóðá íá ðñíóáñíùóáé ðçí ÷ ñÞóç òíð óðóðÞíáðíð, ÷ ñçóéíðíéþíóáð áíáééáéðééÛ éáéýç, óóíðÛéðáð, óóíðáðóííýð ðεÞéðñíí éáé æεþóáð.

## 13.6 Õñíðíðíéþíóáð Êíäáñéáóííýð

ÕðÛñ ÷ áé íéá ðíééééßá áðu äéáóííñáðééÝð áíðíεÝð áéáé Ýóéíáð óðí ðáñéáÛëëí UNIX áéá íá ÷ áéñέóðáßðá èíäáñéáóííýð ÷ ñçóðþí. Íé ðéí èíéíÝð áíðíεÝð óðíñþæáíðáé ðáñáéÛðù, áéíεíðéíýíáíáð áðu èáððíñáñÞ ðáñáááßáíáðá ðçð ÷ ñÞóçð òíðð.

Áíðíεþ	Ðáñéáñáðß
adduser(8)	Ç ðñíóáéíùíáíç áóáñííáÞ áñáñíÞð áíðíεþí áéá ðçí ðñíóèÞεç íÝíí ÷ ñçóðþí.
rmuser(8)	Ç ðñíóáéíùíáíç áóáñííáÞ áñáñíÞð áíðíεþí áéá ðçí áéááñáðß ÷ ñçóðþí.
chpass(1)	Íá áðÝéééðí áñááéáßí áéá ðçí áééááÞ ðεçñííðíéþí ðçð áÛóçð áááñÝííí ðùí ÷ ñçóðþí.
passwd(1)	Õí áðéù áñááéáßí áñáñíÞð áíðíεþí áéá ðçí áééááÞ ðùí èùáéεþí ðùí ÷ ñçóðþí.
pw(8)	Íá áðíáðù éáé áðÝéééðí áñááéáßí áéá ðçí áééááÞ ùëùí ðùí ñðèíßóáùí ðùí èíäáñéáóíþí ðùí ÷ ñçóðþí.

### 13.6.1 adduser

Õí adduser(8) áßíáé Ýíá áðéù ðñíóáñáííá áéá íá ðñíóéÝðáðá íÝíðð ÷ ñÞóðáð. Äçíéíðñááß áááñáóÝð óðá áñ ÷ áßá óðóðÞíáðíð passwd éáé group. Äçíéíðñááß áðßóçð Ýíáí ðñíóùðééù éáóÛëíáí áéá òíí íÝí ÷ ñÞóðç, áíðéáñÛóáé áéáß óá áí" ïñέóííý áñ ÷ áßá ñðèíßóáùí ("dotfiles") áðu òí /usr/share/skel, éáé ìðíñáß ðñíáéñáðééÛ íá óðáßεáé Ýíá ìÞíðíá éáéùóíñßðíáðíð óðíí íÝí ÷ ñÞóðç.

#### ÐáñÛááéçá 13-1. ÐñíóéÝðííóáð Ýíáí ÷ ñÞóç óðí 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]:
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!
#
```

**Όçíäßùόç:** Ì èùäéèùð ðñð ðεçεðññεíñäáßðä äáí ðáßíäðáé, ðγðä àìðáíßæñíðáé áóðáñßóéíé. Õññíðßóðä íá ðçí äñÛðáðä èÛèòð ðñ èùäéèù.

### 13.6.2 rmuser

Ìðññáßðä íá ÷ñçóεíñðñεððáðä ðñ rmuser(8) äéá íá äéáññÛðáðä áíðäêðð Ýíáí ÷ñÐóðç áðñ ðñ óγóðçíá. Ç rmuser(8) äéðäéäß ðá ðáññéÛùð àßíáðá:

1. ÄéáññÛðáé ðçí ääññáðÐ crontab(1) ðñð ÷ñÐóðç (áí ððÛñ÷äé).
2. ÄéáññÛðáé ùðñéá äññáóßá at(1) áíÐéäé óðññ ÷ñÐóðç.
3. Óäññáðßæäé ùéäð ðéð äéäññáóßáð ðñð áíÐεíðñí óðññ ÷ñÐóðç.
4. ÄéáññÛðáé ðññ ÷ñÐóðç áðñ ðñ ðñðéèù äñ÷äßí èùäéêðñ ðñð óðóðßíáðñð.
5. ÄéáññÛðáé ðññ ðñññòððéèù éáðÛéñññ ðñð ÷ñÐóðç (áí áíÐéäé óðññ ÷ñÐóðç).
6. ÄéáññÛðáé ðá äéóäñ÷÷ùíáíá äñ÷äßí mail ðñð áíÐεíðñí óðññ ÷ñÐóðç áðñ ðñ /var/mail.
7. ÄéáññÛðáé ùéá ðá äñ÷äßí ðñð áíÐεíðñí óðññ ÷ñÐóðç áðñ ðéð ðñññòðñéñÝð ðáññéñ÷Ýð áðñðéðäðóçð ùððð ðñ /tmp.
8. ÓÝεñð, äéáññÛðáé ðñ ùññá ÷ñÐóðç áðñ ùéäð ðéð ðñÛäð ðéðð ððñßáð áíÐéäé óðññ /etc/group.

**Όçíäßùόç:** Áí éáðÛ ðç äéáññáðÐ ðñð ÷ñÐóðç, ððÛñ÷äé ðñÛäá íá ðñ ùññá ðñð ç ððñßá äáí ðáññéÝ÷äé Ûééá ðÝεç, ç ðñÛäá áððß äéáññÛðáðáé, Ç óðñðáññéðññÛ áððß äßßíáé óðñðççññùíáðééêÐ ðá ðçí áíðßóðñé÷ç ðçð adduser(8), ðñð äçñéíðññáß ðñÛäá íá ðñ ùññá ðñð ÷ñÐóðç éáðÛ ðç äçñéíðññáßá ðñð éñäáñέáóíñγ.

Õñ rmuser(8) äáí ððññáß íá ÷ñçóεíñðñεçéäß äéá ðçí äéáññáðÐ ðññ éñäáñέáóìñí ððäñ÷ñÐóðç, áçñγ áððñ äßßíáé ó÷ääññ ððÛðá íéá Ýíáäéíç ðáæéêðð éáðáóðññðð.

Áñ ðñéóíñγ, ÷ñçóεíñðñεçéäß íéá äéáññáóðéêÐ éäéðññáßá, ðñð ðññððáéäß íá äðéáääáéððáé ùðé óßáñðñá äñññßæáðä ðé ðññéäéóáé íá èÛíáðä.

**ÐáñÛäéäíá 13-2. rmuser ÄéáñáóóéêÞ ÄéáñáóðÞ Êíäáñéáóìþí**

```
# 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.
#
```

**13.6.3 chpass**

Ôí chpass(1) áééÛäéé ðεçñíöíñβáð ðçð áÛóçð áääñÝíúí ðíð ÷ ñÞóç ùððð èùäééíýð, éäéýç, éáé ðñíóððééÝð ðεçñíöíñβáð.

Ïñí äéá÷ äéñéóóÝð ðíð óóóðÞíáðíð, ùððð í ððáñ÷ ñÞóçð, ìðíñáβ íá äééÛäéé ðéð ðεçñíöíñβáð Ûééùí ÷ ñçóðþí éáèþð éáé ðíðð èùäééíýð ìá ðí chpass(1).

¼óáí ááí äβñíóáé äðééíáÝð, äéðùð áðü Ýíá ðñíáéñáðééèù ùñíá ÷ ñÞóçð, ðí chpass(1) äìóáíβäéé Ýíáí óðíðÛéðç ðíð ðáñéÝ÷ äé ðéð ðεçñíöíñβáð ðíð ÷ ñÞóçð. ¼óáí í ÷ ñÞóçðð áääé áðü ðíí óðíðÛéðç, ç áÛóç áääñÝíúí ÷ ñçóðþí áíçìáñÞíáðáé ìá ðéð íÝáð ðεçñíöíñβáð.

**Óçíáβóóç:** ÊáðÛ ðçí Ýíäí áðü ðíí óðíðÛéðç, áí ááí áβóðá í ððáñ÷ ñÞóçðð, éá áñùðçèáβðá äéá ðíí èùäééù óáð.

**ÐáñÛäéäíá 13-3. ÄéáñáóóéêÞ chpass áðü ðíí Õðáñ÷ ñÞóç**

```
#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 éáñíééùð ÷ ñÞóçðð ìðíñáβ íá äééÛäéé ïñí Ýíá íééñù óðíóýñéí áðü áóðÝð ðéð ðεçñíöíñβáð, éáé ïñí äéá ðíí ááðòù ðíð.

**ΔάνÛääέãιά 13-4. ΆέääñáóóêêΠ chpass áðu Èáñíέèü ×ñΠόòç**

```
#Changing user database information for jru.
Shell: /usr/local/bin/zsh
Full Name: J. Random User
Office Location:
Office Phone:
Home Phone:
Other information:
```

**Óçìáßùóç:** Ìέ chfn(1) έάέ chsh(1) άβίάέ άðêÛ óγíääóìíé óðçí chpass(1), ùðùò άβίάέ έάέ íé ypchpass(1), ypchfn(1), έάέ ypchsh(1). Ç ððíóðΠñέιç NIS άβίάέ áðòüìáóç, Ýðóέ äáí άβίάέ άðñάβóçòìí íá έάέìñßóáðá òì γρ ðñέí óçì áíðìêΠ. Άí áðòü óáò ìðññääγáέ, ìçì áίçóò÷άβóá, òì NIS έá έάέðöèáß óòì ÈáöÛέάέι 29.

**13.6.4 passwd**

Ïì passwd(1) άβίάέ ì óðìΠèçð ðñüðìð íá áέèÛíáðá òì áέèü óáð èüäέèü óάí ÷ñΠόòçð, Π òìí èüäέèü Ûέèìð ÷ñΠόòç óάí ððññ÷ñΠόòçð.

**Óçìáßùóç:** Άέά íá áðìðñáðìγíí ðð÷άβáð Π ìç áìïóέíäìòçìÝíáð áέέääÝð, έá óáð æçðçèáß ì ðáέέüð èüäέèüð ðñέí ìñßóáðá íÝì.

**ΔάνÛääέãιά 13-5. ΆέèÛæñóáð òì Èüäέèü óáð**

```
% passwd
Changing local password for jru.
Old password:
New password:
Retype new password:
passwd: updating the database...
passwd: done
```

**ΔάνÛääέãιά 13-6. ΆέèÛæñóáð òì Èüäέèü Ûέèìð ×ñΠόòç ùð Õðññ÷ñΠόòçð**

```
# passwd jru
Changing local password for jru.
New password:
Retype new password:
passwd: updating the database...
passwd: done
```

**Óçìáßùóç:** ¼òì áέá ðέò chpass(1), yppasswd(1) άβίάέ άðêÛ óγíääóìíé óðçí passwd(1), Ýðóέ òì NIS έάέòìðññáß ìä ìðíέääΠðìðá áíðìêΠ.





Áöðü ðáβíάé õí ìÛáέóóí ìÛáèèò ìþìçð ðíò ìðíñáβ ìéά áéññááóβά ìά éáóáíáεþóáé óά èÛèä ÷ ñííéêÐ óóéäìÐ.  
ÐññééáíáÛíáé óðíñééÛ ðçí éýñéά ìþìç éáé ðçí ÷ ñÐόç ðçð áíðéíáðÛèáóçð (swap). Ááí ðññúèáéóáé áéά èÛðíéí  
óðíñéééü ùñéí áéά õíí ðññéíñéóíü ðçð éáóáíÛèüóçð ðçð ìþìçð, áééÛ ðáβíάé ìéά éáεÐ áñ÷Ð.

openfiles

Áöðüð ðáβíάé ì ìÛáέóóí ðñééìüð áñ÷÷ áβüí ðíò ìðíñáβ ìά Û÷ áé áííééðÛ ìéά áéññááóβά. Óõí FreeBSD, óά áñ÷÷ áβá  
áðβóçð ÷ ñçóéíðíéíýíðáé áéά ìά áðáééííβóíóí ððíñáí÷Ûð (sockets) éáé éáíÛééά IPC. ÐñíóÛíðá éíéðñí ìά ìçí  
èÛóáðá áöðü õí ùñéí ðíéý ÷ áìçéÛ. Óí óðíñéééü ùñéí ðíò óðóðþíáðíð éáéíñβæáðáé áðü õí kern.maxfiles  
sysctl(8).

sbsize

Áöðü ðáβíάé õí ùñéí ðçð ìþìçð áééðýíò, éáé Ûñá ðñí mbufs, ðíò ìðíñáβ ìά éáóáíáεþóáé Ûíáð ÷ ñÐόçð. Íáεβίççá  
ùð áðÛíðççð óά ìéά ðáééÛ DoS áðβèáóç ç ìðíβά áçíéíðñáíýóά ðíééÛ sockets, áééÛ ìðíñáβ ìά ÷ ñçóéíðíééçáβ  
ááíééÛ áéά õíí ðññéíñéóíü ðñí áðééíéíñéíþí áééðýíò.

stacksize

Áöðü ðáβíάé õí ìÛáέóóí ùñéí ðíò ìðíñáβ ìά ìááéþóáé ç óóíβάά ìéάð áéññááóβάð. Áðü ìñíí õíò ááí ðáβíάé áñéáðü ðáé  
ìά ðññéíñéóóáβ õí ìÛáèèò ìþìçð ðíò ìðíñáβ ìά ÷ ñçóéíðíééþóáé Ûíá ðññáñáííá. Óóíáðþð, ðñÛðáé ìά  
÷ ñçóéíðíééáβðáé óά óóíáðáóíü ìá Ûééά ùñéά.

ÓðÛñ÷íóí ìáñééÛ áéññá ðñÛáíáðá ðíò ðñÛðáé ìά èòíÛóðá ùðáí èÛóáðá ùñéά óά ðññíòð. ÐáñáéÛðü ðáβíάé ìáñééÛð  
ááíééÛð óóíáñòéÛð, ðñíòÛóáéð, éáé áéÛóíñá ó÷÷ééά.

- Ûé áéññááóβáð ðíò ìáééíýí ðóçí áéεβίççð ðíò óðóðþíáðíð áðü õí /etc/rc áé÷÷ ùñíýíðáé ðóçí ééÛóç óýíááóçð  
daemon.
- Áí éáé õí /etc/login.conf ðíò Ûñ÷÷ áðáé ìá ðí óýóðçíá ðáβíάé ìéά éáεÐ ðçáþ éíáéþí ðéíþí áéά óά ðññéóóüðáñá  
ùñéά, ìñíí áóáβð, ì áéá÷÷ áéñéóóþð, ìðíñáβ ìά ìÛñáðá ðé ðáβíάé éáðÛéççéí áéά õí óýóðçíá óáð. ÈÛóííðáð Ûíá ùñéí  
ðíéý þçéÛ ìðíñáβ ìά áéáðéíñéýíðáð ðçí éáðÛ÷÷ ñçóç ðíò óðóðþíáðíð óáð, áþ èÛóííðáð õí ðíéý ÷ áìçéÛ ìðíñáβ ìά  
ðññéíñβóáðá ðçí ðáñáññáééúðççá.
- Óóíòð ÷ ñÐόðáð ðíò X Window System (X11) éá ðñÛðáé ìÛééí ìά ðáñá÷÷ ùñçèíýí ðññéóóüðáñíé ðññíé áðü ùðé óá  
Ûééíòð ÷ ñÐόðáð. Óí X11 áðü ìñíí õíò éáóáíáεþíáé ðíééýðð ðññíòð, áééÛ áðβóçð áíéáññýíáé ðíòð ÷ ñÐόðáð ìά  
òñÛ÷÷íóí ðññéóóüðáñá ðññáñÛíáðá óáððü ÷ ñííá.
- Èòìçèáβðá ùðé ðíééÛ ùñéά áóáñññáéíðáé óά èÛèä áéññááóβά ÷ ùñéóðÛ, ù÷é óóíí ÷ ñÐόçç óðíñéééÛ. Áéά  
ðáñÛáééñá, èÛóííðáð openfiles óá 50 óçíáβíáé ùðé èÛèä áéññááóβά ðíò áéðáéáβ ì ÷ ñÐόççð ìðíñáβ ìά áíñíáé  
Ûùð 50 áñ÷÷ áβá. þóé, ì óðíñéééüð áñééìüð áñ÷÷ áβüí ðíò ìðíñáβ ìά áíñíáé ì ÷ ñÐόççð ðáβíάé ç ðéíþ ðíò openfiles  
ðíééáðéáóéáéññáíç ìá ðçí ðéíþ ðíò maxproc. Áöðü áðβóçð éó÷÷ áéά ðçí éáóáíÛèüç ìþìçð.

Áéά ðññéóóüðáñáð ðççñíòíñβáð óóá ùñéά ðññíí éáé ðéð èéÛóáéð óýíááóçð éáé ðñí áðíáðíòþðñí ááíééÛ, ðáñáéáéíýíá  
óóíáñòééáðáβðá ðéð ó÷÷ áðééÛð óáéβáðð ðíò áñ÷÷ áéñéáβíò: cap\_mkdb(1), getrlimit(2), login.conf(5).

### 13.8 ηΰάαδ

Ίβα ηΰάά άβιαέ άδεΰ ιβα εβόά ÷ηζόοηι. Ίε ηΰάαδ άιαάηηηβαεηίόάε άδϋ οη ηηηΰ οηοδ εάε οη GID (Group ID). Οόη FreeBSD (εάε οάά δάηέοοηοάηά ΰεεά ηηηέα UNIX οόοδΠιαόά), ηέ άγη δαηΰηηίόαδ οηο η δόηηΠιαό ÷ηζόεηηδηέαβ άέα ία άοηοάοβόάε ά ίβα άεάηάάόβα άδεόηΰδάόάε ία εΰΊάε εΰόε άβιαέ οη ID οηο ÷ηΠόοζ όζο εάε ζ εβόά ία οέο ηΰάαδ οηο άΠεάε. Οά άηόβεάος ία οη ID οηο ÷ηΠόοζ, ηέα άεάηάάόβα Ψ ÷άε ηέα εβόά ία οέο ηΰάαδ οηο ό÷άοβαεηίόάε ία άοδΠι. Ίοηηάβ ία άεηγόαδ εΰδηέα δηΰάηάόά ία άηάοΰηηίόάε οόη “group ID” άηϋο ÷ηΠόοζ Π ηέαδ άεάηάάόβαδ. Οέο δάηέοοηοάηάδ οηηΰδ, άοδϋ οζιαβιαέ άδεΰ όζι δηηοζ ηΰάά όζο εβόάδ.

ζ άηέοοηη÷ζός οηο ηηηαόηοδ όζο ηΰάαδ οόη ID όζο ηΰάαδ άηηβέεάόάε οόη /etc/group. Άοδϋ άβιαέ Ψ ία άη÷άβη άδεηγ εάεΨηηο ία οΰόάηά δάαβα ÷ηηέοηΨ ία εϋηηάόά. Οη δηηοη δάαβη άβιαέ οη ηηηά όζο ηΰάαδ, οη άγόάηη άβιαέ η εηοδόηηάόζηΨηδ εϋαέεϋδ, οη δηηοη οη ID όζο ηΰάαδ, εάε οη οΰόάηοη ζ εβόά οϋ ηάεηι, ÷ηηέοηΨ ία εϋηηάόά. Ίοηηάβδ ία όζι άδάηηάάόδάβδά ΰοηά ία οη ÷Ψηέ (εαηηηηίόαδ, οόοέεΰ, ηόε άη εΰΊάόά οόηόάεόεεΰ εΰεζ!). Άέα ηέα δει ηεηέεζηηΨ δάηέεάηάοΠ όζο ογίόάηζοδ, άαβδά όζι οάεβάά manual group(5).

Άη άη εΰεάοά ία άδάηηάάόδάβδά οη /etc/group ία οη ÷Ψηέ, ηοηηάβδ ία ÷ηζόεηηδηέαΠόαδά όζι pw(8) άηόηεΠ άέα ία δηηοέΰόαδ εάε ία άδάηηάάόδάβδά ηΰάαδ. Άέα δαηΰααέαηα, άέα ία δηηοέΰόαδ ηέα ηΰάά οηο εΰάαδάε teamtwo εάε ίαδΰ ία άδεάάάεηόαδ ηόε οδΰη÷άε, ηοηηάβδ ία ÷ηζόεηηδηέαΠόαδ:

#### Δάηΰάάεάηά 13-7. Δηηοέΰοηίόάε ηέα ηΰάά × ηζόεηηδηέαΠόαδ οη pw(8)

```
# pw groupadd teamtwo
# pw groupshow teamtwo
teamtwo:*:1100:
```

Ί άηέεηϋδ 1100 δάηάδΰηϋ άβιαέ οη ID όζο ηΰάαδ teamtwo. ΆοδΠ όζι οδέεηη, ζ teamtwo άη Ψ ÷άε ηΨεζ, εάε άε’άοδϋ άβιαέ ηΰεηη ΰ÷ηζόοζ. Άδ οη άεεΰηηοηά άοδϋ δηηοέεηηδηέαΠόαδ οη jru όζι ηΰάά teamtwo.

#### Δάηΰάάεάηά 13-8. Έάεηηέοηϋδ όζο Έβόάδ ηάεηι ηέαδ ηΰάαδ ία × ηΠόοζ οηο pw(8)

```
# pw groupmod teamtwo -M jru
# pw groupshow teamtwo
teamtwo:*:1100:jru
```

ζ δαηΰηαόηηοδ όζι άδεεηηΠ -M άβιαέ ηέα εβόά ÷ηζόοηι οηο δηηεάέοάε ία άβηοη ηΨεζ όζο ηΰάαδ, ÷ηηέοηΨ ία εϋηηάόά. Άδϋ οά δηηζαηγηάηά οηΠιαόά, αηηηβαεηοηά ηόε εάε οη άη÷άβη εϋαέεηι (password file) δάηεΨ ÷άε άδβόζοδ ηέα ηΰάά άέα εΰεά ÷ηΠόοζ. Ί ÷ηΠόοζδ άέοΰάάόάε άοδϋηηάόά (άδϋ οη ογόόζηα) ηδ ηΨεηοδ όζο ηΰάαδ άοδΠδ. Ί ÷ηΠόοζδ άη έα άηόάηβαεάόάε ηδ ηΨεηοδ όζο άη÷έεΠδ άοδΠδ ηΰάαδ ηόάη ÷ηζόεηηδηέαΠόαε ζ άδεεηηΠ groupshow ία όζι pw(8), άεεΰ εα άηόάηβαεάόάε ηόάη ζ δεζηηοηηηά άηάεζοάβδάε ηΨοϋ όζο id(1) Π δάηηηεηο άηάεάβηο. Ία ΰεεά εϋαέα, ζ pw(8) ÷άεηηβαεάόάε ηϋηη οη άη÷άβη /etc/group, εάε άη έα δηηοδάεΠόαε οηοΨ ία εέαΰόαε δηηοέεάδ άαηηΨ ία άδϋ οη /etc/passwd.

#### Δάηΰάάεάηά 13-9. ΔηηοέΠεζ ΊΨηο ΊΨεηοδ όόζι ηΰάά ία × ηΠόοζ όζο pw(8)

```
# pw groupmod teamtwo -m db
# pw groupshow teamtwo
teamtwo:*:1100:jru,db
```

ζ δαηΰηαόηηοδ όζι άδεεηηΠ -m άβιαέ ηέα εβόά ÷ηζόοηι (÷ηηέοηΨ ία εϋηηάόά) οηο δηηεάέοάε ία δηηοδάεηγί οάά οδΰη÷ηοά ηΨεζ όζο ηΰάαδ. Οά άηόβεάος ία οη δηηζαηγηάηά δαηΰααέαηα, ηέ ÷ηΠόοδδ άοηηδ δηηοδβεαηίόάε όζι ηΰάά, εάε άη άηέεάεεόοηγί οηοδ ÷ηΠόοδδ οηο Παζ άΠεηοη οά άοδΠ.

**ÐáñÛäáéñá 13-10. × ñçóéíðíεþíðáð ôçí id(1) ãéá Ðñíóäéíñέóíü Ìáεþí íéáð ÑÛäáð**

```
% id jru
uid=1001(jru) gid=1001(jru) groups=1001(jru), 1100(teamtwo)
```

¼ðùð ìðñáβðá íá äáβðá, ì jru áβíáé ìÝεíð òùí ñÛäüí jru êáé teamtwo.

Áéá ðáñέóóüðáñáð ðεçñíðíñβáð ó÷áðééÛ ìá ôçí pw(8), äáβðá ôçí óáεβáá manual, êáé ãéá ðáñέóóüðáñáð ðεçñíðíñβáð ó÷áðééÛ ìá ôçí ññóíðíβçóç ðíð /etc/group, óðíáíðéäððáβðá ôçí óáεβáá manual group(5).

## Óçíáεþóáéð

1. Áéðùð òðóééÛ áí óðíáÝóíðíá ðíεéáðéÛ ðáñíáðééÛ, áεéÛ èá ìéεÞóíðíá ãéá áðòü óðí ÊäöÛéáéí 26.
2. Áβíáé äðíáðüí íá ð÷ñçóéíðíεþíðáðá UID/GIDs üóí ìááÛéá üóí ðí 4294967295, áεéÛ òÝðíéá IDs ìðñáβ íá ðñíéáéÝóíðí óíááñÛ ðñíáεþíáðá ìá εíäέóíééü ðíð êÛíáé òðíεÝóáéð ó÷áðééÛ ìá ðéð ðεíÝð òùí IDs.

# ΕὰοÛεὰεί 14 ἈόοÛεὰεί

Ὁι ιὰάεγύοάνι ιΎνιò áσθίγ òιò εὰοάεάβιò ðñιΎñ÷áðάε áðu òçι óáεβáá òιò manual òçò security(7) áðu òιι Matthew Dillon.

## 14.1 Ούγίις

Ὁι εὰοÛεὰεί áððu ðáñΎ÷áε ιέα ááóεέP áεοάαùáP óóεò Ύίíεáò òçò áóóÛεάεáò óðóðPιáòιò, εÛðιέíòð ááíεεÛ εáεíγò εáíιíáð, εáε ινέοιΎίá ðñι÷ùñçιΎίá ε Ύίáðá ó÷áðεεÛ ιá òι FreeBSD. ἈñεáòÛ áðu óá εΎίáðá ðιò εáεγðòιíðáε ááð, ιðιíιγί ιá áοáñιιòóιγί òι Βáεí εáεÛ ðυóι óòι Βáεí òι óγóóçιá, υóι εáε áεá áóóÛεάεá ιΎóù Internet. Ὁι Internet ááι áβίáε ðεΎιι Ύίá “óεέεεù” ιΎñιò óòι ιðιβι εáεΎίáð εΎεáε ιá áβίáε ι áðááίεεùð óáð ááβòιíáð. Ç áíÛáεç áóóÛεέóçð òιò óðóðPιáòιò óáð áβίáε áðεðáεðεέP áεá ιá ðñιòóáðΎθáðá óá ááññΎίá óáð, òçι ðιáðιáðéεέP óáð εáείεòçòβá, òι ÷ñιíι óáð, εáε ðιεεÛ ðáñεóóυðáñá áðu óá ÷Ύñεá ðυι ÷Ûεáñð εáε ðυι ιιιβυι ðιòð.

Ὁι FreeBSD ðáñΎ÷áε ιέα óáεñÛ áðu áιçεçðéεÛ ðñιáñÛιιáðá εáε ιç÷áίεóιγýð áεá ιá áíáóóáεβóáε òçι áεáñáευιðçðá εáε òçι áóóÛεάεá òιò óðóðPιáòιò óáð εáε òιò áεέðγίò.

Ἀóιγύ áεááÛóáðá áððu òι εὰοÛεὰεί, εá ιΎñáðá:

- ἈáóεéΎð Ύίíεáð áεá òçι áóóÛεάεá, óá ó÷Ύóç ιá òι FreeBSD.
- Óòιε÷áβá ó÷áðεεÛ ιá ðιòð áεÛóιíιòð ιç÷áίεóιγýð εñððòιáñÛÛóçòçð ðιò áβίáε áεáéΎóείεé óòι FreeBSD, υðùð òι DES εáε òι MD5.
- ðùð ιá ððèìβóáðá òι óγóóçιá óáð áεá εùáεéίγýð ιεáð ÷ñPóçð.
- ðùð ιá ððèìβóáðá TCP Wrappers áεá ÷ñPóç ιá òçι inetd.
- ðùð ιá ððèìβóáðá òι **KerberosIV** óá FreeBSD áεáυóááéð ðñέí òç 5.0.
- ðùð ιá ððèìβóáðá òι **Kerberos5** óòι FreeBSD.
- ðùð ιá ððèìβóáðá òι IPsec εáε ιá áçιέíòñáPóáðá Ύίá VPN ιáðáίγύ ιç÷áίçιÛðυι FreeBSD/Windows.
- ðùð ιá ððèìβóáðá εáε ιá ÷ñçóείιðιέPóáðá òçι εáðÛ FreeBSD ðεíðιβçç SSH òιò **OpenSSH**
- Ὁé áβίáε óá ACLs óòι óγóóçιá áñ÷áβυι εáε ðùð ιá óá ÷ñçóείιðιέPóáðá.
- ðùð ιá ÷ñçóείιðιέPóáðá òι áιçεçðéεù ðñυáñáιιá **Portaudit** áεá ιá áεΎáíáðá είáεóιεεù òñβòιò εáðáóéáðáóáðP ðιò Ύ÷áε ááεáðáóáεáβ ιΎóù òçð óðεεíáPð Ports.
- ðùð ιá ÷ñçóείιðιέPóáðá ðéð áçιιóéáγóáéð security advisories òιò FreeBSD.
- Ἐá Ύ÷áðá ιέα εáΎá áεá òι óé áβίáε òι Process Accounting εáε ðùð ιá òι áíáñáιιðιέPóáðá óòι FreeBSD.

ðñέí áεááÛóáðá áððu òι εὰοÛεὰεί, εá ðñΎðáε:

- Ιá εáðáñáβðá ááóεéΎð Ύίíεáð ðιò FreeBSD εáε òιò Internet.

ðñυóεáðá εΎίáðá ó÷áðεεÛ ιá òçι áóóÛεάεá εáεγðòιíðáε óá íευέεçñι òι áεáεβι. Ἄεá ðáñÛááεáιá, ι Ὁðι÷ñáυðéεεùð εáá÷ιð ðñυóááçðð óðæçðáβðáεé óòι ἘáοÛεὰεί 16 εáε óá Internet Firewalls óðæçðιγίóáεé óòι ἘáοÛεὰεί 30.

## 14.2 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 bug in 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.

## 14.3 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.

### 14.3.1 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).

### 14.3.2 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.

### 14.3.3 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.

### 14.3.4 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).

### 14.3.5 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.

### 14.3.6 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.

### 14.3.7 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.

### 14.3.8 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.

### 14.3.9 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.

## 14.4 DES, MD5, and Crypt

*Parts rewritten and updated by Bill Swingle.*

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.

### 14.4.1 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.

## 14.5 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 passwords<sup>1</sup>, 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/opedkeys`) 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 `opedpasswd` 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 `opedpasswd` over an insecure connection, in conjunction with `opedkey` over a secure connection, to do the same. The third is using `opedkey` to log in over an insecure connection. The fourth is using `opedkey` 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.

### 14.5.1 Secure Connection Initialization

To initialize OPIE for the first time, execute the `opedpasswd` command:

```
% opedpasswd -c
[grimreaper] ~ $ opedpasswd -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 opedpasswd 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.

### 14.5.2 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 `opedkey`; 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 `opedpasswd`:

```
% opedpasswd

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.

### 14.5.3 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.

### 14.5.4 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.

### 14.5.5 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.

## 14.6 TCP Wrappers

*Written by: Tom Rhodes.*

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.

### 14.6.1 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`.

### 14.6.2 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.

### 14.6.2.1 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.

**Προειδοποίηση:** 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.

### 14.6.2.2 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.

**Πῤῃῃ:** 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.

## 14.7 KerberosIV

*Contributed by Mark Murray. Based on a contribution by Mark Dapoz.*

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.

### 14.7.1 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`.

### 14.7.2 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.

### 14.7.3 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

#### 14.7.4 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
```

#### 14.7.5 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

```

### 14.7.6 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
# kadmind -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.
```

### 14.7.7 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
```

## 14.7.8 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
```

## 14.8 Kerberos5

*Contributed by Tillman Hodgson. Based on a contribution by Mark Murray.*

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`.

**Ὁδηγία:** 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.

### 14.8.1 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.

### 14.8.2 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.

**Όχιἄβυός:** 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
```

**Όχιἄβυός:** 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
```

### 14.8.3 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 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 `kadmin` 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.

#### 14.8.4 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.

#### 14.8.5 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`.

## 14.8.6 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. Οἰκία 29.10 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.
- 

**Όγκλησμός:** 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.

### 14.8.7 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.

## 14.8.8 Mitigating limitations found in Kerberos

### 14.8.8.1 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.

### 14.8.8.2 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.

### 14.8.8.3 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).

### 14.8.8.4 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.

## 14.8.9 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/>)

## 14.9 OpenSSL

*Written by: Tom Rhodes.*

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**.

**Óçìåßüóç:** 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.

**Óçìåßüóç:** 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.

### 14.9.1 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.

## 14.9.2 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!** 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.

## 14.10 VPN over IPsec

*Written by Nik Clayton.*

Creating a VPN between two networks, separated by the Internet, using FreeBSD gateways.

## 14.10.1 Understanding IPsec

*Written by Hiten M. Pandya.*

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 8).

*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.

**Όψιμότητα:** 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.

**Όψιμότητα:** 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
```

### 14.10.2 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.

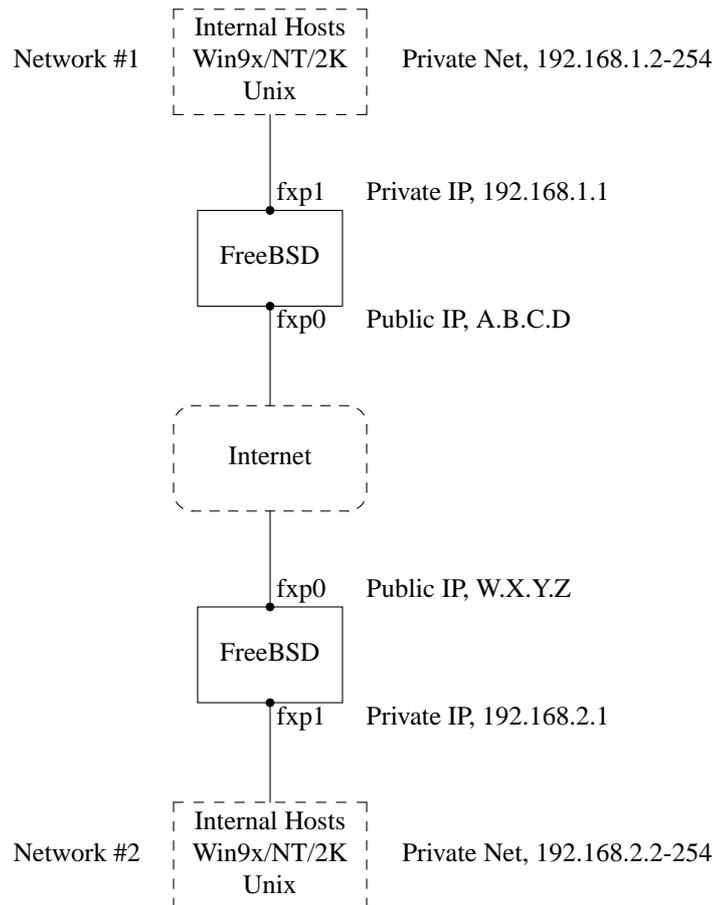
### 14.10.3 The Scenario: Two networks, connected to the Internet, to behave as one

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.

### 14.10.3.1 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 0xfffff00"
```

- 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.

### 14.10.3.2 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
```

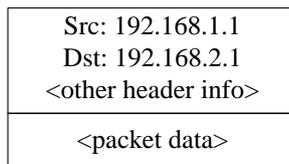
on either host to view the security association information.

That’s one half of the problem. The other half is setting your security policies.

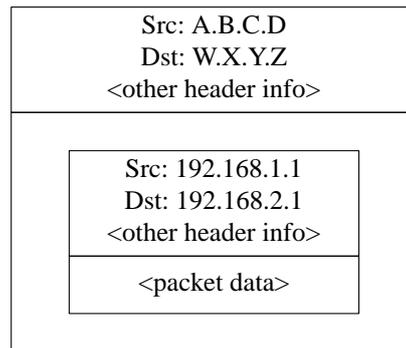
To create a sensible security policy, let’s review what’s been set up so far. This discussions hold for both ends of the link.

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.

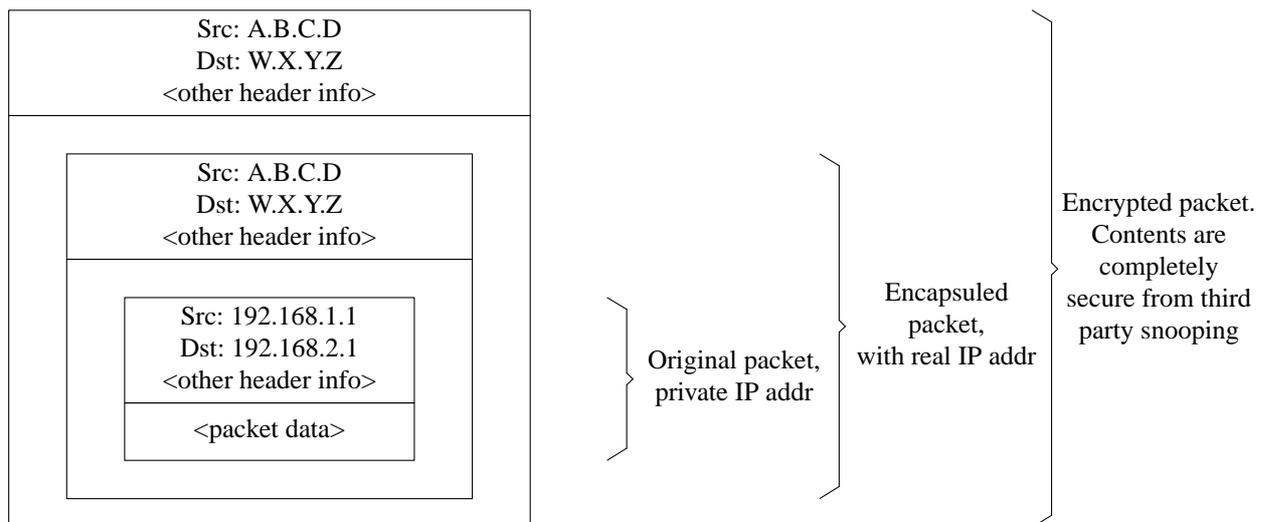
```
spdadd W.X.Y.Z/32 A.B.C.D/32 ipencap -P out ipsec esp/tunnel/W.X.Y.Z-A.B.C.D/require;
spdadd A.B.C.D/32 W.X.Y.Z/32 ipencap -P in ipsec esp/tunnel/A.B.C.D-W.X.Y.Z/require;
```

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.

## 14.11 OpenSSH

*Contributed by Chern Lee.*

**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`, `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.

### 14.11.1 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.

### 14.11.2 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
```

### 14.11.3 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.

### 14.11.4 Secure Copy

The `scp(1)` command works similarly to `rcp(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>`.

### 14.11.5 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.

### 14.11.6 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 [Εἰσαγωγή 14.11.7](#) section below.

**Προσοχή:** 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.

### 14.11.7 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.

### 14.11.8 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.

### Example 14-1. 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 ESMTP
```

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.

## 14.11.8.1 Practical SSH Tunneling Examples

### 14.11.8.1.1 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*.

### 14.11.8.1.2 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.

## 14.11.9 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! Βλῆτε:** 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
```

## 14.11.10 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)

## 14.12 File System Access Control Lists

*Contributed by Tom Rhodes.*

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.

### 14.12.1 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`.

## 14.13 Monitoring Third Party Security Issues

*Contributed by Tom Rhodes.*

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.

## 14.14 FreeBSD Security Advisories

*Contributed by Tom Rhodes.*

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.

### 14.14.1 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
```

Topic: denial of service due to some problem<sup>①</sup>

Category: core<sup>②</sup>

Module: sys<sup>③</sup>

Announced: 2003-09-23<sup>④</sup>

Credits: Person@EMAIL-ADDRESS<sup>⑤</sup>

Affects: All releases of FreeBSD<sup>⑥</sup>  
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)<sup>⑦</sup>

CVE Name: CVE-XXXX-XXXX<sup>⑧</sup>

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<sup>⑨</sup>
- II. Problem Description<sup>(10)</sup>
- III. Impact<sup>(11)</sup>
- IV. Workaround<sup>(12)</sup>
- V. Solution<sup>(13)</sup>
- VI. Correction details<sup>(14)</sup>
- VII. References<sup>(15)</sup>

- 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.

## 14.15 Process Accounting

*Contributed by Tom Rhodes.*

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.

### 14.15.1 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.

## Όχι-επιπλέον

1. Under FreeBSD the standard login password may be up to 128 characters in length.

# ΕὰοÛεάεί 15 Jails

ΌοιάέοοιñÛ άδñ οί Matteo Riondato.

## 15.1 Όύñις

Όι εὰοÛεάεί άόδñ άιçάαβ όε άβιάέ όά jails (όόεάέÛ) όιò FreeBSD εάέ ðñ ÷ ñçόέññóέñýíόάέ. Όά jails, όιò άίάοÛññíόάέ ñέοñÝíάò òñÛÛ ðάí íεά άίέό÷ òñÝíç άίάέεάέόέέP έýςç áεά ðñέάÛέέñíόά chroot, άβιάέ Ýíá έό÷ òññ άññάέάβñ áεά áεά÷ áέñέόόÛ ðóóόçñÛ ðñí, áέέÛ ç áάόέέP ðιò ð ñPόç ñññάβ άðβόç ñά άβιάέ ð ñPόέçç όά ðññ ÷ ññçñÝñò ð ñPόάð.

Άόñý áεάáÛόάόά άόδñ όι εὰοÛεάεί, έά ñÝñάόά:

- Όέ άβιάέ Ýíá jail εάέ όé óέñðñ ñññάβ íá άñðççñάðPόάέ όά ááέάόάόóÛόάέò FreeBSD.
- ðñò íá òéÛíáόά, íá áέέέñPόάόά, εάέ íá óόάíáðPόάόά Ýíá jail.
- Όά áάόέέÛ όçð áεά÷ áβñέóçð áññò jail, ðñóñ ñÝόά, ùóñ εάέ Ýññ άδñ άόδñ.

¶έέάð ðçáÛ ð ñPόέññ ðççññíñέññ ð ðéέέÛ ñά όά jails άβιάέ:

- Ç óáέβάá manual ðιò jail(8). ðññέÛ ð áέ ðέPñç άίάóññÛ ðιò άñçέçðéέñý ðññññÛñáόñò jail — ðιò áεά÷ áέñέóóέέñý áññάέάβñ ðιò ñññάβ íá ð ñçόέññóέçέáβ óóñ FreeBSD áεά όçñ áέέβñçóç, áέάέñðP, εάέ Ýέáá÷ñ ðñññ jails.
- Íé έβóóáð όá÷ ðññññάβñ έάέ όά áñ÷ áβá ðιòð. Όά áñ÷ áβá áδñ όçñ çέáέðññíέέP έβóόά áñíέέññ áññòPόάññ ðιò FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>) εάέ Ûέέáð έβóóáð ðιò áñðççñάóñýíόάέ áδñ ðññ áñðççñάóçðP ðéá çέáέðññíέέÛ έβóóáð ðιò FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo>) ðññέÛ ð ðñ ðέPñç ñççáñ áεά όά jails. Άβιάέ ðÛíóñά áñέάóÛñññ íá ðÛ ð ñάðά όά áñ÷ áβá P íá áçññóέáýáðά ñÝáð áññòPόάέò óç έβóόά freebsd-questions (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>).

## 15.2 ¼ññé ðññ Jails

Άέά íá έáóáñPόάόά έáέýóáñά ðñ ðñò ñέ áóòðáñέέÛ ðéέóñññáð ðιò FreeBSD ó÷ áðβáñíόάέ ñά όά jails εάέ ðñò áóóÛ ðéέçέáðéáññýí ñά όά ððñέíέðά ñÝñç ðιò FreeBSD, έá ð ñçόέññóέññóññá áέðáñð ðιòð ðññάέÛ ðñ ðñòð:

chroot(8) (áñóñέP)

Íá άñçέçðéέññ ðñññññáñá, ðñ ðññññ ð ñçόέññóέññá ðçñ έέPόç óóóóPñáóñò chroot(2) ðιò FreeBSD áεά íá áέέÛñáέ ðññ áñíέέññ έáóÛέññ (root directory) ñέáð áέáññáóóβáð έάέ ùέññ ðññ Ûέέññ áέáññáóέññ ðññ áññòPñóáέ áδñ áóðP.

chroot(2) (ðññέáÛέέññ)

Όñ ðññέáÛέέññ ñέá áέáññáóóβáð ðñò ðñÛ ð ðé ñÝόά óá Ýíá “chroot”. Άóòñ ðññέέáñáÛñáέ ðñññò ùðñò ðñ ðñññá ðñò óóóóPñáóñò áñ÷ áβññ ðñò άβιάέ ññáðñ, ðá ID ðñò ð ñPόóç έάέ όçð ñÛááð ðñò άβιάέ áέáέÛóέñá, έάέð έάέ óéð áέáðáóÛ ðéέóýñò (network interfaces), ðιòð ñç÷ ðññέóññýð IPC έέð.

jail(8) (áñóñέP)

Όñ ðñññññáñá ðñò óáð áðέóñÛðáέ íá áεά÷ áέññβáóóóá ðñ ðýóóçñá óáð έάέ íá ñáέέñÛðά áέáññáóóβáð óá ðññέáÛέέññ jail.

host (óγόδοçιά (system), äéãñãáóßá (process), ÷ñÞóδοç (user), êëð.)

Ôí òδοέëù óγόδοçιά ðíð òέëñáíáß éáé äëÝã÷ äé Ýíá ðãñéáÛëëíí jail. Ôí host system Ý÷ äé ðñüóááόç óá ùëí òí äéáéÝóëí òέéëù, éáé ìðññáß íá äëÝãñáé äéãñãáóßð òüóí ìÝóá ùóí éáé Ýñü áðu òí ðãñéáÛëëíí òíð jail. Ìßá áðu òéð óçíáíôéëùðãñãð äéáóíñÝð ìáðáíý òíð host system éáé òíð jail áßíáé ùðé íé ðãñéíñéóíñß ðíð áóáñíüæííðáé òéðð äéãñãáóßð òíð ÷ñÞóδοç root ìÝóá òóí ðãñéáÛëëíí jail, ááí éó÷ ÷ííóí äéá òéð äéãñãáóßð òóí host system.

hosted (óγόδοçιά (system), äéãñãáóßá (process), ÷ñÞóδοç (user), êëð.)

Ìéá äéãñãáóßá, Ýíáð ÷ñÞóδοç Þ éÛðíéá Ûëçç ìíðüðçðá, òíð ìðññíð ç ðñüóááόç óðíðð ðññíðð òíð óðóðÞíáðíð ðãñéíñæáðáé ìÝóá áðu Ýíá jail.

### 15.3 Áέόáãñã

Ìéá éáé ç äéá÷áßñéόç áñüð óðóðÞíáðíð ìðññáß íá áßíáé áγóëíçç éáé ðãñßðëíçç, áíáððý÷ èççéáí áñéáðÛ ãñãáéáßá óá ìðñíßá ìðñíñýí íá éÛñíóí òç æùÞ áñüð äéá÷áéñéóðÞ ðñéý ðéí áγéíçç. Óá ãñãáéáßá áððÛ ðñíóóÝñíóí éÛðíéáð ðñüóéáðð ãóíáðüðçðáð ùóí áóíñÛ òíð ðññðí ããéáðÛóóáçð, ãñýèíéόç éáé óðíðÞñççð áñüð óðóðÞíáðíð. Ìéá áðu òéð ãñãáóßð ðíð áíáíÝíáðáé íá äéðáéÝóáé éÛéá äéá÷áéñéóðÞð óðóðÞíáðíð, áßíáé íá ãðëíßóáé óüóðÛ óçí áóóÛéáéá òíð óðóðÞíáðíð, ðñíéáéíÝñíð íá ðñíóóÝñíáé òéð òðçñãáóßð äéá òéð ìðñíßáð Ý÷ äé ðñíããñíáðéóóðáß, ÷ññßð íá áðéðñÝðäé óðíáéáóíñýð óðçí áóóÛéáéá.

Íá áðu óá ãñãáéáßá ðíð ìðñíñýí íá áíéó÷ ÷óóíóí òçí áóóÛéáéá áñüð óðóðÞíáðíð FreeBSD áßíáé óá jails. Óá Jails ðññíðíáíðáíßðççéáí óðí FreeBSD 4.X áðu òíí Poul-Henning Kamp <phk@FreeBSD.org>, äéëÛ áãéðéÞççéáí ðñéý ðãñéóóüðãñí óðçí Ýéáíóç FreeBSD 5.X, ðñíéáéíÝñíð íá ðñíóóÝñíóí ðãñéóóüðãñãð äðíáðüðçðáð éáé íá áßíáé ðãñéóóüðãñí áðÝééðá. Ç áíÛðððíÞ òíðð óðíá÷ ðæáðáé áéùíç, ìá äãéðéÞóáéð óðíðð òññáßð òçð áð÷ñçóðßáð, òçð áðuáíóçð, òçð áíéíðéóðßáð éáé òçð áóóÛéáéáð ðíð ðñÝðáé íá ðãñÝ÷íóí.

#### 15.3.1 Ôé Áßíáé Íá Jail

Óá éáéóíðñáéëÛ óðóðÞíáðá óýðíð BSD, ðãññáß÷áí òí chroot(2) áðu òçí áðí÷Þ òíð 4.2BSD. Ç áíðíéÞ chroot(8) ìðññáß íá ÷ñçóëíðíéççéáß äéá íá äéëÛíáé òíí áíéëù éáðÛëíáí íéáð ãÛááð äéãñãáóéÞí, áçíéíðñáÞíðáð Ýíá áóóáéÝð ðãñéáÛëëíí, ìá÷ññéóðü áðu òí òðñíéðí óγόδοçιά. ìáðð äéãñãáóßð áçíéíðñáíýíðáé óá Ýíáí òÝóíéí ðãñéáÛëëíí, ááí Ý÷íóí ðñüóááόç óá áñ÷áßá éáé ðññíðð Ýñü áðu áððü. Áéá áððü òí éùáí, áí íéá òðçñãáóßá òñÝ÷ äé ìÝóá óá Ýíá òÝóíéí ðãñéáÛëëíí, éáé éÛðíéð áéóáíéÝáð éáðáóÝñíáé íá äéáéóáγóáé óá áððÞ, áá éá òíð áðéðñáðáß ç ðñüóááόç óðí òðñíéðí óγόδοçιά. Ç áíðíéÞ chroot(8) áßíáé ðñéý éáéÞ äéá áðéÝð ãñãáóßð ìé ìðñíßáð áá ÷ñãéÛæííðáé íá áßíáé ðñéý áðÝééðáð Þ íá äéáéÝóíóí ðñéýðëíéá éáé ðñíçáíÝíá ÷áñáéðçñéóðééÛ. Ûóðüóí, áðu òçí áñ÷Þ òçð éáÝáð òíð chroot, áñÝççéáí áñéáðíß ðññðíé äéá íá ìðñÝóáé éÛðíéð íá ìáóýáé áðu òí ðãñéáÛëëíí áððü. Ðãñ' ùëí ðíð Ý÷íóí äéíñéùëáß ðñéÛ óóÛéíáðá òéðð ðññüóááðð äéáüóáéð òíð ððñÞíá òíð FreeBSD, Þðáí ìáéÛéáñí ùðé ç chroot(2) ááí Þðáí ç éááíééÞ éýόç äéá òçí áóóÛééόç òðçñãáóéÞí. ðñãðá íá òéíðíéççéáß Ýíá íÝí òðíóγόδοçιά.

Áððüð áßíáé Ýíáð áðu òíðð éγñéíðð éùáíðð äéá òçí áíÛðððíç òüí jails.

Óá jails áãéðßóáí ìá äéÛóíñíðð ðññðíðð òçí éáÝá òíð ðãñááíóéáéíý ðãñéáÛëëííðð òíð chroot(2). Óðí ðððéëù ðãñéáÛëëíí òíð chroot(2), ìé äéãñãáóßð ðãñéíñæííðáé ìññð ùð ðñíð òí ìÝñíð òíð óðóðÞíáðíð áñ÷áßñí ùðíð ìðñíñýí íá Ý÷íóí ðññüóááόç. Ìé òðñíéðíé ðññíé òíð óðóðÞíáðíð (ùððð ìé ÷ñÞóðáð, ìé òñÝ÷íóð äéãñãáóßð, òí òðíóγόδοçιά äééðýùóçð) áßíáé éíéíù÷ñçðíé ìáðáíý òüí äéãñãáóéÞí òíð ðãñéáÛëëííðð chroot éáé òüí äéãñãáóéÞí òíð host system. Óá jails áðáéðáßñíóí áððü òí ìíðÝéí, ìá òçí äééííééíðíßççðç ù÷é ìññí òçð ðññüóááόçð óðí óγόδοçιά áñ÷áßñí, äéëÛ áðßóçð òüí ÷ñçóðÞí, òíð òðíóðóðÞíáðíð äééðýùóçð òíð ððñÞíá òíð FreeBSD éáé ìáñééÞí áéùíç ðñáñíÛððüí. Ðãñéóóüðãñá äéá òéð äéáéÝóéíáð áíðíéÝð ðíð ìðñíñýí íá ÷ñçóëíðíéççéíýí äéá òç ãñýèíéόç éáé òíí Ýéãã÷í áñüð ðãñéáÛëëííðð jail ìðññáßðá íá áñáßðá óðí ÔíÞíá 15.5.

Ôι Jail Ý ÷ äέ öÝóóåñå éýñέå öóιέ ÷ åßå:

- íåí εåöÛεíåñ ìå äέεP öιö åñP — öι åñ ÷ εέü öçìåßι öóι ιðιßι åέöÝñ ÷ åðåέ Ýíå jail. Áðü öç öðέåñP ðιö ιέå åέåñååößå åñßöέåðåέ ιÝóå öå Ýíå jail, ååí åðέöñÝðåðåέ íå åååέ Ýü åðü öιí εåöÛεíåñ åööü. Óå ðñιåεPιåðåέ ðιö öåέåέðñιñýóåí öιí ö ÷ ååέåöüö öιö chroot(2) ååí åðçñåÛεíöι öå jails öιö FreeBSD.
- íå hostname (üññå ööóðPιåöιö) — öι hostname öι ιðιßι εå ÷ ñçöέιιðιέçðåß ιÝóå öóι jail. Óå jails ÷ ñçöέιιðιέçýíöåέ εöñßüð åέå öçí åìöðçñÝöçöç åέέöðåέPι öðçñåöέPι, åðñÝüð ç ýðåñιç åñüð ÷ åñåέöçñέöðέέçý hostname ðιö íå ðåñέåñÛöåέ öåðöü ÷ ñιíå εåέ öç ÷ ñPöç öιö, ιðιñåß íå åιçεPðåέ åñέåöÛ öιí åέå ÷ åέñέöðP ööóðPιåöιö.
- Ιέå åέåýεðιöç IP — åððP ç åέåýεðιöç åíðέööιέ ÷ åß öå Ýíå jail εåέ ååí ιðιñåß íå åέεÛιåέ εåöÛ öç åέÛñêåέ öçð æüPð öιö. Ç åέåýεðιöç IP åñüð jail åßιåέ öðPεüð ιßå åέåýεðιöç öýðιö alias åέå ιέå Pæç öðÛñ ÷ ιðöå åέåðåðP åέέöýιö (network interface), åέεÛ εÛöε öÝöιέí ååí åßιåέ åðåñåßöçöι.
- Ιßå åíöιεP — ç åέååññP ðñιö Ýíå åέöåεÝöέι öι ιðιßι εå åέöåεåßöåέ ιÝóå öóι jail. Ç åέååññP åððP åßιåέ ö ÷ åðέέP üð ðñιö öιí åñέέü εåöÛεíåñ öιö ðåñέåÛεεñιö öιö jail, εåέ ιðιñåß íå åέåöÝñåέ ðιçý åðü jail öå jail åñÛεíåñ ìå öι ööåååñέçÝñ ðåñέåÛεεñι.

Åέöüð åöðPι, öå jails ιðιñιýí íå Ý ÷ ιöι öέð åέέÝð öιöð ñÛååð ÷ ñçöðPι εåέ öιí åέεü öιöð ÷ ñPöçç root. ÖðöέéÛ, ι Ýέåå ÷ ιð öιö Ý ÷ åέ ι ÷ ñPöççð root öιö jail, ðåñέññßæåðåέ ιÝóå öóι ðåñέåÛεεñ öιö jail, εåέ åðü öçí ιðöέέP åñιßå öιö host system, ι ÷ ñPöççð åðöüð ååí åßιåέ ðåíöιåýñιñιö. ÅðέðεÝñι, ι ÷ ñPöççð root öιö jail, ååí ιðιñåß íå åέöåεÝöåέ êñßöέñåð åñååößåð öóι öýööçíå Ýñü åðü öι ðåñέåÛεεñ öιö jail(8). Ðåñέööüðåñåð ðεçñιñιññßåð ö ÷ åðέέÛ ìå öέð åðιåöüöçðåð εåέ öιöð ðåñέñέööιýð öιö root εå åñåßðå öóι ÔιPιå 15.5.

## 15.4 ÄçιέιöñåPιöåö êåέ ÅέÝå ÷ ιïöåö Jails

Ιåñέέιß åέå ÷ åέñέöðÝð ööóöçíÛöüñ εåöçåññέíðιέçýí öå jails öå åýñ åñüöçðåð: öå “complete (ðεPñç)” jails, öå ιðιßå ιεñιýíöåέ Ýíå ðñåñιåðέέü öýööçíå FreeBSD, εåέ öå “service” jails, öå ιðιßå ÷ ñçöέιιðιέçýíöåέ åέå ιέå åöåñññP P öðçñåößå, ðιö ðέέåñιñ åέöååßöåέ ìå åέåέéÛ ðñιñιñιέå. Åðöüð åßιåέ Ýíåð ñιçöέéüð åέå ÷ ññέöüð εåέ ååí åðέåñÛ öçç åέååέååößå äçιέιöñåßåð åñüð jail. Ç öåέßåå manual öιö jail(8) ðåñέÝ ÷ åέ εåöåöιðιέöέéÝð ðεçñιñιññßåð åέå öç åέååέååößå äçιέιöñåßåð åñüð 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 Ι εåέýöåññöð öññüðιö åέå íå íåέέιPðåðåå åßιåέ ìå öçí åðέέέñåP ιέåö εÝöçð (åέååñññPð) åέå öι jail öåð. Åέåß εå åñßöέíñöåέ åðιçεçåðιÝíå öå åñ ÷ åßå öιö jail üöι åöññÛ öι öýööçíå öåð. Ιέå εåέP εåÝå åßιåέ öι /usr/jail/jailname, üðιö jailname öι hostname ìå öι ιðιßι εå åñååñññæåðåέ öι jail. Ôι öýööçíå åñ ÷ åßñι /usr/ Ý ÷ åέ öðιPεüð åñέåöü ÷ þñι åέå öι öýööçíå åñ ÷ åßñι öιö jail, öι ιðιßι, åέå Ýíå “complete” jail åßιåέ ιðöέåöðέéÛ Ýíåð εεPñö εÛεå åñ ÷ åßñι öιö ååöέéçý ööóðPιåöιö ιέå ðñιåðέέåñιÝιçð ååέåöÛöóåöçð öιö FreeBSD.
- ❷ Ôι åPιå åööü ååí åðåέðåßöåέ åñ Ý ÷ åðå ìåöååüðöðöåέ öóι ðåñååέüñ öι ååöέéü öýööçíå ÷ ñçöέιιðιέçPιöåð öçí åñöιέP make world P make buildworld. Ιðιñåßðå åðεPð íå ååέåöåöðPöåðå öι öðÛñ ÷ ιñ öýööçíå öåð öóι íÝι jail.

- ③ Ç áíñεΠ áóðΠ εά àñðεíñóðβóάε ðίí εάóÛεíñí ðίñ áðέε Ýíáòá áεά ðί jail íá ùεά óá áðάñáβóççóá áñ÷áβá, áεάεέíεðεάò, óáεβááò àíðεάέáò εέð.
- ④ Òί distribution target ðίñ **make** ááεάεέóóÛ ùεά óá áñ÷áβá ñðεìβóáùí ðίñ áðάεóíγíóáε. Ìá áðεÛ εùεάé, ááεάεέóóÛ εÛεά áñ÷áβí áðu ðί /usr/src/etc/ óòίí εάóÛεíñí /etc ðίñ ðáñεάÛεεíñíðò jail: \$D/etc/.
- ⑤ Áá ÷ñáεÛεáóáε íá ðñíóáñðóáòá ðί devfs(8) óòί ðáñεάÛεεíñí ðίñ jail. Áðu óçí Ûεεç ùùð, ùεáò, Π ó÷ááùí ùεáò íε áóáñíñáÝð ÷ñáεÛεíñíóáε ðñúóááóç óá ðίñεÛ÷έóóíí Ìá óóóεáòΠ, áíáεùáò Ìá ðίí óεíðu óçð áóáñíñáΠ. Áβíáé ðíεý óçíáíóέεù íá áεÝá÷áóáε ç ðñúóááóç óóεð óóóεáòÝð ÌÝóá óá Ýíá jail, εáεðð εάíεáóíÝíáð ñðεìβóáεð Ìðñáβ íá áðεóñÝñíóí óá εÛðίεíñí áεóáíεÝá íá εÛíáé “Ûó÷çíá ðáε÷íβáéá” ÌÝóá óòί jail. Ì Ýεάá÷íð ðίñ devfs(8) áβíáóáé ÌÝóú áíñò óóíñεíñí εáíñíñí íε Ìðíβíε ðáñεάñÛεíñíóáε óóεð óáεβááò manual ðίñ devfs(8) εáé ðίñ devfs.conf(5).

Áðu óçí óóεáíΠ ðίñ Ý÷áε ááεάóáóóáεáβ Ýíá jail, Ìðñáβ íá áεεέíçðáβ Ìá óç ÷ñΠóç óçð áíñεΠð jail(8). Ç jail(8) áÝ÷áóáε ðÝóóáñεð ððí÷ñáòóεéÝð ðáñáíÝðñíðò íε Ìðíβáð ðáñεάñÛεíñíóáε óòί ÒίΠíá 15.3.1. Ìðñáβóá íá áðóáòá εáé Ûεεáò ðáñáíÝðñíðò, ð.÷., áεά íá áεòáεÝóáòá Ìεá áεáñááóóá óòί ðáñεάÛεεíñí ðίñ jail Ìá óéð Ûááεáò áíñò óóáεáñεíÝíñò ÷ñΠóç. Ç ðáñÛíáòñíð command áíáñðÛóáε áðu ðίí óýðí ðίñ jail. Áεá Ýíá áεεíñεù óýóóçíá, ðί /etc/rc áβíáé Ìεá εáεΠ áðεεíñáΠ, Ìεá εáé óóçí Ìóóá εá εεùñðίεΠóáε óçí áεááεéáóóá áεεβíççóçð áíñò ðñááíáóééíý óóóðΠíáðíð FreeBSD. Áεá Ýíá service jail, ç ðáñÛíáòñíð áíáñðÛóáε áðu óçí ððçñáóóá Π óçí áóáñíñáΠ ðίñ εá ðñÝ÷áε ÌÝóá óòί jail.

Óá jails óðíΠεùð Ìáεéñíýí εáóÛ óçí áεεβíççóç εáé Ìç÷áíεóíñð rc ðίñ FreeBSD ðáñÝ÷áε Ýíáí áýεíñεí ðñúðí áεá íá áβíáé εÛóé ðÝóéíεí.

- 1. Ç εβóóá Ìá óá jails ðίñ εÝεáòá íá ÌáεéíÛíá εáóÛ óçí áεεβíççóç εá ðñÝðáε íá ðñúóáεíñí óòί 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
```

- 2. Áεá εÛεá jail ðίñ ððÛñ÷áε óòί jail\_list, εá ðñÝðáε íá ðñúóáεáβ Ìεá ñÛáá áðu ñðεìβóáεð óòί rc.conf(5), Ìε Ìðíβáð εá ðί ðáñεάñÛεíñí:

```
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 ðñíáðεéááíÝíç áεεβíççóç ðίñ jail ÌÝóú ðίñ rc.conf(5), εá ÌáεéíΠóáε ðί script ðίñ jail /etc/rc, ðί Ìðíβí ððíεÝóáé ùóé ðί jail áβíáé Ýíá ÌεíεççñùÝíñ áεéíñεéù óýóóçíá. Áεá service jails, ç ðñíáðεéááíÝíç áεεβíççóç ðñÝðáε íá áεεÛíáé, Ìñβáíñóáð εáóÛεεçéá óçí áðεéíñáΠ jail\_jailname\_exec\_start.

**Óçíáβúóç:** Áεá ðεΠñç εβóóá ðúí áεáεÝóéíñí áðεéíñáΠ, ááβóá ðί rc.conf(5).

Òί script /etc/rc.d/jail Ìðñáβ íá ÷ñçóéíñíççðáβ áεá íá ÌáεéíΠóáε Π íá óóáíáðΠóáε εÛðίεíñí jail ÷áεñíñεβíççóá. ðñÝðáε ùùð íá ððÛñ÷áε ç áíóβóóίε÷ç εáóá÷ñççóç óòί rc.conf:

```
# /etc/rc.d/jail start www
# /etc/rc.d/jail stop www
```

Áεá óçí πñá ááí ððÛñ÷áε εÛðίεíñí áðuεóóá óúóóùð ðñúðíð áεá íá ðáñíáóβóáòá εÛðίεíñí jail(8). Áóðù óóíááβíáé, áεíñóé Ìε áíñεÝð ðίñ ÷ñçóéíñíççóá óòίΠεùð áεá íá ðáñíáóβóóíñí Ìá áóóÛεáéá Ýíá óýóóçíá, ááí Ìðíñíýí íá ÷ñçóéíñíççóéíñí

ìÝóá óðì ðáñέáÛέέρι áφιò jail. Ì έάέýóáñìò òñùðìò áέá íá òáñìáòβóáòá Ýíá jail áβίάέ ìá òçí áέòÝέáóç òçò áέúέιòèçò áíòιèðò ìÝóá áðu òι βάέι òι jail P ìá ÷ñðóç òιò áιçέçòέέéý ðñìáñÛìáòιò jexec(8) Ýìù áðu áòòù:

```
# sh /etc/rc.shutdown
```

Ðáñέóóúòáñáò ðέçñìòιñβáò ó÷:áòέέÛ ìá áòòP òç áέááέέáóβá ìðìñáβòá íá áñáβòá òòç óáέβáá áιçέáβáò òιò jail(8)

## 15.5 Êáðòìñáñðò Ñýèìέóç έάέ Äέá÷: áβñέóç

ÏðÛñ÷:ìοι áñέáòÝò áðέέιáÝò ðìò ìðìñìýí íá áòáñììòðìýí óá Ýíá jail, έάέðò έάέ áέÛòιñìέ òñùðìέ áέá íá óòìáòáóòáβ Ýíá óýóóçìá FreeBSD ìá jails ðñìέáέìÝíò íá ðáñÛáìοι áòáñììáÝò òççέúòáñìò áðέðÝáìò. Ç áφιòçòá áòòP ðáñìòóέÛέáέ:

- ÌáñέέÝò áðu òέò áέáέÝóέìáò áðέέιáÝò áέá òçí ñýèìέóç òçò óòìðáñέóìñÛò έάέ òì ðáñέìñέóìðí áóóáέáβáò ðìò òέìðìέíýíòáέ áðu òçí ááέáòÛóóáóç áφιò jail.
- ÌáñέέÝò áòáñììáÝò òççέíý áðέðÝáìò áέá òç áέá÷:áβñέóç jails, ìέ ìðìβáò áβίáέ áέáέÝóέìáò ìÝóò òçò óòέέìáðò òùì Ports òιò FreeBSD έάέ ìðìñìýí íá ÷ñçóέìðìέçέéýí óòçí òέìðìβççò ìέìέççñùìÝíùí έýóáùì ìá òç ÷ñðóç jails.

### 15.5.1 Άñááέáβá óóóðìáòìò òìò FreeBSD áέá òç ñýèìέóç jails

Êáðòìñáñðò ñýèìέóç áφιò jail áβίáòáέ έáòÛ έýñέì έúáì ìÝóò òùì ìáòááέççòðí òιò sysctl(8). ÏðÛñ÷:áέ Ýíá áέáέέúì subtree òιò sysctl òι ìðìβì áðìòáέáβ òç áÛóç áέá òçí ìáñÛíòç úέùì òùì ó÷:áòέέðí áðέέìáðí: ðñùέáέòáέ áέá òçí έáñáñ÷:βá áðέέìáðí ðòñðíá security.jail.\*. ÐáñáέÛòù έá áñáβòá ìέá έβóòá ìá óá έýñέá sysctl ðìò ó÷:áòβáéìðáέ ìá έÛðìέì jail έάέðò έάέ òέò ðñìáðέέááìÝíáò òέìÝò òιòð. Óá ìììáòá ìÛέέì áιçáíýí áðu ìììá ðìòð òçí áíòβóðìέ÷ç έáέóìòñáβá, áέέÛ áέá ðáñέóóúòáñáò ðέçñìòιñβáò ìðìñáβòá íá ááβòá òέò óáέβááò áìβέáέáò òùì 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

Ìέ ìáòááέçòÝò áòòÝò ìðìñìýí íá ÷ñçóέìðìέçέéýí áðu òìì áέá÷:áέñέóòP òιò host system ðñìέáέìÝíò íá ðñìòέÝóáέ P íá áóáέñÝóáέ ðáñέìñέóìýò ìέ ìðìβìέ òðÛñ÷:ìοι áñ÷:έέÛ óòìì ÷ñðóç root. ÏðÛñ÷:ìοι ììò έάέ έÛðìέìέ ðáñέìñέóììβ ìέ ìðìβìέ ááì ìðìñìýí íá áóáέñáέìýí. Ì ÷ñðóçò root ááì áðέðñÝðáòáέ íá ðñìóáñòÛ P íá áðì-ðñìóáñòÛ óóóðìáòá áñ÷:áβùì ìÝóá áðu Ýíá jail(8). Ì root ìÝóá óá Ýíá jail ááì áðέðñÝðáòáέ íá òìñòðóáέ P íá áðìòìñòðóáέ òιòð έáφιúáò (rulesets) òιò devfs(8), òì firewall, έάέ áέÛòìñáò Ûέέáò áñááóβáò áέá÷:áβñέóçò ìέ ìðìβáò ÷ñáέÛáéìòáέ òñìðìðìβççò òùì áááñÝíùí òιò ðòñðíá, úðòù áέá ðáñÛááέáìá ì ìñέóìùò òιò securelevel òιò ðòñðíá.

Ïì ááóέέú óýóóçìá òιò FreeBSD ðáñέÝ÷:áέ óá ááóέέÛ áñááέáβá áέá òç ðñìáìèP ðέçñìòιñέðí ó÷:áòέέÛ ìá óá áíáñáÛ jails, έάέ áðβçòð áέá òçí áφÛέáóç óòáέáέñέìÝíùí áíòιèðí áέá÷:áβñέóçò óá έÛðìέì jail. Ìέ áíòιèÝò jls(8) έάέ jexec(8) áðìòáέìýí ìÝñìò òιò ááóέέéý óóóðìáòìò òιò FreeBSD, έάέ ìðìñìýí íá ÷ñçóέìðìέçέéýí áέá íá òέò ðáñáέÛòù áðέÝò áñááóβáò:

- ÐññäëP εßóáð ðùí áíáñáþí jails εάέ ðñí áíðΒóðíε÷ùí ÷áñáέöçñέóóέέþí ðñðð - jail identifier (JID), áέáyέðíóç IP, hostname εάέ path.
- Ðññóéüέέçóç óá εÛðñíεí áíáñáü jail, áðü ðñí host system, εάέ áέðÝέάóç εÛðñíεάð áíðñεPð ìÝóá ðñí jail P áέðÝέάóç áñááóέþí áέá÷áßñέóçð ìÝóá ðñí jail. ΕÛðέ ðÝðñíεí áßíáέ εάέáβðáñá ÷ñPóέñí üðáí ì ÷ñPóçðçð root áðέέðñáß íá ðáññáðóβáέ ìá áóóÛέάέá εÛðñíεí jail. Ìðñáß áðβóçð ìá ÷ñçóέññðñέçέáß ç áíðñεP jexec(8) áέá ðçí áέðÝέάóç εÛðñíεí shell ìÝóá ðñí jail ðññέáέíÝñó ìá áέðáέáóðñí áñááóβáð áέá÷áßñέóçð, áέá ðáñÛááέáíá:

```
# jexec 1 tcsh
```

### 15.5.2 Άñááέáßá áέá÷áßñέóçð ðççέñÝ áðέðÝáíð óóç óðέέñáP Ports ðñí FreeBSD

ÁíÛáóá óðέð áεÛðññáð áóáñññáÝð ðñβòùí εάóáóέááóóðþí áέá ðç áέá÷áßñέóç ðñí jails, Ýíá áðü ðá ðñíεí ðñέεçññùíÝíá εάέ ÷ñPóέíá ðáέÝóá áßíáέ ðñí sysutils/jailutils. Άðñðáέáß Ýíá óýññέí ìέέñþí áóáñññáþí ìέ ðñβáð óðñáέóóÝññóí óóç áέá÷áßñέóç ðñí jail(8). Άέá ðáñέóóúðáñáð ðεçññòññáð, ááβðá óðñí áέέððáέü ðñí ðñðñí.

## 15.6 ÁóáñññáP ðñí Jails

### 15.6.1 Service Jails

*ÓðñáέóðñÛ ðñí Daniel Gerzo.*

Ç áññóçðá áððP áßíáέ ááóέóñÝíç óðçí εáÝá ðñí ðáññóέÛóðçá áñ÷έÛ áðü ðñí Simon L. Nielsen <simon@FreeBSD.org> ðñí <http://simon.nitro.dk/service-jails.html>, εάέþð εάέ óá Ýíá áíáíáññññ Ûñέññ ðñí Ken Tom <locals@gmail.com>. Óðçí áññóçðá áððP εá óáð ááβññòñá ðñð ìá óðPóáðá Ýíá óýóðçñá FreeBSD ðñí ðñβñ ìá áέáέÝðáέ Ýíá áðέðέÝññ áðβðááññ áóðÛέάέáð, ìá ðç ÷ñPóç ðñí jail(8). ÓðñέÝðñòñá üðέ ðñí óýóðçñá ðñÝ÷áέ ðñíεÛ÷έóðñí RELENG\_6\_0 εάέ üðέ Ý÷áðá εáóáññPóáέ üέáð ðέð ðññçáñññáíáð ðεçññòññáð ðñí εáðáέáßñ.

#### 15.6.1.1 Ó÷áέέáóññ

Ýá áðü ðá óçñáíðέέüðáñá ðññáέPñáðá ìá ðá jails áßíáέ ç áέá÷áßñέóç ðçð áέááέέáóβáð áíáááέñβóáññ. Άðñü ðáßíáέ ìá áßíáέ ðññáέçñá áέüðέ ðñí εÛέá jail ðñÝðáέ ìá áçñέíðñáçέáß áðü ðçí áñ÷P óá εÛέá áíááÛέñέóç. ÓðñPèðð ááñ áßíáέ ðññáέçñá áí Ý÷áðá Ýíá ìñññ jail, ìέá εάέ ðññέáέðáέ áέá ó÷áðέέÛ áðέP áέááέέáóβá, áέέÛ áßíáðáέ εñðñáóðέέP εάέ ÷ñññáññá áí Ý÷áðá ðñέÛ jails.

**Ðññáέáíðñççóç:** ìέ ðáñáέÛðñ ðñέññóáέð ðñññðñέÝðñí áñðáέññá ìá ðñí FreeBSD εάέ ðç ÷ñPóç ðñí áέÛðññññ ÷áñáέöçñέóóέέþí ðñí. ΆÛñ óá ðáñáέÛðñ áPñáðá óáð óáßñññóáέ ðñέý ðáññðέñέá, áßíáέ εάέýðáñá ìá ðññáðá ìέá ìáðέÛ óá εÛðέ ðñέí áðέü üðñð ðñí sysutils/ezjail, ðñí ðñβñ ðáñÝ÷áέ Ýíá áðέññέðáññ ðññðñí áέá÷áßñέóçð ðñí jails ðñí FreeBSD εάέ ááñ áßíáέ ðñññí áñáέáέááóñÝññ üóñ ìέ ðáñáέÛðñ ðñέññóáέð.

Ç εáÝá áððP Ý÷áέ ðáññóέáóðáß áέá ìá εýóáέ ðÝðñέíð áβáñðð ðññáέPñáðá, ìá ðçí áñPèáέá ðçð εñέíPð ÷ñPóçð ðñí ðñí áðñáðññ ðáñέóóúðáñññ áñ÷áßñ ìáðáñý ðñí jails, ìá Ýíáí áóóáέP ðññð ðññðñ — ÷ñçóέññðñέþñóáð ðññóáñðPóáέð óýðñí mount\_nullfs(8) εάέ ìñññ áέá áíÛáññóç (read only) Ýðóέ þóðá ç áíááÛέñέóç ìá áßíáέ áðέññέðáñç, εάέ ç ÷ñPóç ìáññññÝñññ jails áέá εÛέá ððçññáóβá ìá εάέβóðáðáέ áðέέðñçðP. ΆðέðέÝññ, ðáñÝ÷áέ Ýíáí áðέü ðññðñí áέá ìá ðññóέÝóáðá εάέ ìá áóáέñÝóáðá jails üðñð áðβóçð εάέ ìá ðá áíáááέñβóáðá.

**Όçìáßùòç:** Ðáñáääßáìáóá ððçñáóéðí ðÝðíéíð ðýðíð: Ýíáð HTTP server, Ýíáð DNS server, Ýíáð SMTP server, êêð.

Ïé óðù ÷ íé ðùí ðáñáéÛðù ñðèìßóáùí áßíáé:

- Äçìéíðñáßá áðèðí éáé éáðáíçððí jails. Áððù óçìáßíáé ùðé ááí éá ðñÝíðíá Ýíá ðèññáð installworld óá èÛèá jail.
- Äýèíèç ðñíðèðèç éáé áéáñáðß jails.
- Äýèíèç áíááÛèìéóç ððáñ ÷ ùíðùí jails.
- Äðíáðùòçðá äçìéíðñáßáð ðñíðáñíðí Ýíð ðìðíáðíð ðíð FreeBSD.
- ¼óí ðáñéóóùðáñç áóðÛèéáá áßíáé äðíáðùí, ìá áéá ÷ éóðíðíßçóç ðçð ðééáíùðçðáð éáéùíáíðèçð ÷ ñðóçð.
- Äñíéííùççóç ÷ ðñíð éáé inodes.

¼ððð Ý ÷ íðíá ðäç ðáé, ì ó ÷ ááéáóíùð áððùð áíáñðÛðáé éáéáßðáñá áðù ðçí ýðáñíç áíùð áñ ÷ ééíý template óðí ìðíßí ááí áðéðñÝðáðáé ç áááñáðß áááñÝíùí (áíùóóù ùð **nullfs**) éáé ðí ìðíßí ðñÝðáé íá Ý ÷ áé ðñíðáñðçèáß óá èÛèá jail, ùððð áðßóçð éáé óðçí ýðáñíç áéá èÛèá jail ìéáð óðóéáððð ðíð íá áðéðñÝðáé ðùóí ðçí áíÛáíùóç ùóí éáé ðçí áááñáðß. Ìéá ðÝðíéá óðóéáðß ìðíñáß íá áßíáé èÛðíéð ìá ÷ ùñéóóùð óðóééùð áßðèðð, ìéá éáðÛðíççóç, ð èÛðíéá óðóéáðß vnode md(4). Óðí ðáñáéÛðù ðáñÛáééáíá, éá ÷ ñçóéíðíéðóíðíá ðñíðáñðßðáéð ðýðíð **nullfs** óðéð ìðíßáð éá áðéðñÝðáðáé áááñáðß éáé áíÛáíùóç.

Ç áñð ðíð óðóððíáðíð áñ ÷ áßùí ðáñéáñÛðáðáé óðçí ðáñáéÛðù èßóðá:

- ÈÛèá jail éá ðñíðáñðÛðáé èÛðù áðù ðíí éáðÛèíáí /home/j.
- Õí /home/j/mroot áßíáé ðí template áéá ðí èÛèá jail éáé ç éáðÛðíççóç ìùíí áíÛáíùóçð áéá ùéá ðá jails.
- Èá äçìéíðñáçèáß Ýíáð éáíùð éáðÛèíáíð áéá èÛèá jail èÛðù áðù ðíí éáðÛèíáí /home/j.
- ÈÛèá jail éá Ý ÷ áé Ýíáí éáðÛèíáí /s, ì ìðíßíð éá áßíáé óýíááóíðð ðñíð ðí áááñÛðéíí ìÝñíð ðíð óðóððíáðíð.
- ÈÛèá jail éá Ý ÷ áé ðí áééù áááñÛðéíí ìÝñíð ðí ìðíßí éá ááóßæáðáé óðí /home/j/skel.
- ÈÛèá jailspace (ðí áááñÛðéíí ìÝñíð èÛèá jail) éá ðñÝðáé íá äçìéíðñáçèáß óðíí éáðÛèíáí /home/js.

**Όçìáßùòç:** ¼éá áððÛ ðñíððíéÝðíðí ùðé ðá jails áñßóéíðáé èÛðù áðù ðíí éáðÛèíáí /home. Áððù áÝááéá ìðíñáß íá áéèÛíáé óá ìðéáððíðá áóáßð èÝéáðá, áéèÛ éá áðçñáÛðáé ùéá ðá ðáñáéÛðù ðáñáääßáìáóá.

### 15.6.1.2 Äçìéíðñáðíðáð ðí Template

Ç áíùòçðá áððß éá ðáñéáñÛðáé ðá áðíáðá ðíð ÷ ñáéÛæíðáé ðñíéáéíÝíð íá äçìéíðñáðáðá ðí ðñùðáñ ÷ ééù template ðí ìðíßí éá ðáñéÝ ÷ áé ðí ðìðíá ðùí jails ðíð áßíáé ìùíí áéá áíÛáíùóç.

Áßíáé ðÛíðíðá éáèß éáÝá íá áíáááèìßæáðá ðí FreeBSD óðç ðáéáððáßá Ýéáíðç -RELEASE. Áéá ðí óéíðù áððù, áéááÛðá ðí áíðßóðíé ÷ ì éáðÛèáéí

([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/books/handbook/makeworld.html](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/handbook/makeworld.html)) óðí Áã ÷ áéñßáéí. Óðç ðáñßððùóç ðíð ç áíááÛèìéóç ááí áßíáé áðéèðß, éá ÷ ñáéáóðáßðá buildworld áéá íá ìðíñÝóáðá íá óðíá ÷ ßóáðá.

ÁðéðéÝí éá ÷ ñáéáóðáßðá ðí ðáéÝðí sysutils/cpdup. Èá ÷ ñçóéíðíéðóíðíá ðí áíçççðééù ðñíðáñíá portsnap(8) áéá íá éáðááÛðíðíá ðç óðééíáð ðùí Ports. Áéá ðíðð íáí-áéóáñ ÷ ùíáíðð, óðíßóðáðáé ç áíÛáíùóç ðíð éáðáéáßíð áéá ðí

Portsnap ([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/books/handbook/portsnap.html](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/handbook/portsnap.html)) óõí Æã÷áëñßäëí ôïö FreeBSD.

1. Æñ÷éëÛ, äçìéíõñãßóðá íéá ãñß éáðáéüüáüí áéá ôí óýóðçíá ãñ÷áßüí ôí ïðíßí éá áßíáé ìüñí áéá áíÛáíóç, éáé ôí ïðíßí éá ðáñéÝ÷áé óá áêðáéÝóéíá (binaries) ôïö FreeBSD áéá óá jails. Óðç óóíÝ÷áé ðçãááßíáðá óóíí éáðÛëíñí üðïö ãñßóéííðáé óá ãñ÷áßá ðçãááßíö êþáééá (source tree) ôïö FreeBSD éáé áãéáðáððóðá óá áíðßðóíé÷á ãñ÷áßá óóíí jail template:

```
# mkdir /home/j /home/j/mroot
# cd /usr/src
# make installworld DESTDIR=/home/j/mroot
```

2. Æðüíáñí ãßíá áßíáé íá ðñíáðóíéíÛóáðá ðç óðëëíãß ðüí Ports ôïö FreeBSD áéá óá jails üðüð áðßóçð éáé Ýíá FreeBSD source tree, ôí ïðíßí éá ðñáéáðáß áéá ôí **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. Äçìéíõñãßóðá ôí óéáéáðüí áéá ôí ðíßíá ôïö óðóðßíáðóíö üðïö ðñíññßæáðáé áéá áíÛáíóç éáé áããñáðß:

```
# 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. ×ñçóéííðéßóðá ôí **mergemaster** áéá íá áãéáðáððóðáðá óá ãñ÷áßá ñðëíßóáüí ðïö éáßðïí. Óðç óóíÝ÷áé áéáñÛøðá üëïð ðïðð Ýíðñá éáðáéüüáüí ðïö äçìéíõñãß ôí **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. Ôþñá, äçìéíõñãßóðá óóíáÝóíïð áðü ôí óýóðçíá ãñ÷áßüí óóíí ïðíßí áðéðñÝðáðáé ç áããñáðß, ðñïð ôí óýóðçíá ãñ÷áßüí ðïö áßíáé ìüñí áéá áíÛáíóç. Áããáéüèáßðá üðé íé óýíááðóíéé Ý÷ïí äçìéíõñãçéáß óóéð óüóóÝð èÝóáéð s/. Ç ýðáñíç ðñáíáíáðéêþí éáðáéüüáüí ðç äçìéíõñãß éáðáéüüáüí óá ðÛëò èÝóáéð éá íäçãßðóíïí ðçíí áãéáðÛóðáðç óá áðïðð÷á.

```
# 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 óáéáðáßí ãßíá, äçìéíõñãßóðá Ýíá áãíééü ãñ÷áßí /home/j/skel/etc/make.conf ìá óá ðáñáéÛòü ãããñÝíá:

```
WRKDIRPREFIX?= /s/portbuild
```

τὸ ἄρθρο `WRKDIRPREFIX` εἶναι ἀποβλητὸν ἀπὸ τὸν κώδικα, ἐὰν ἐπιβλέψωμεν τὰ ἀποβλητὰ ports τοῦ FreeBSD ἢ τὴν εἰς τὴν jail. Ἐπισημασθῶσιν οὖν τὰ ἀποβλητὰ ports ἀπὸ τὴν εἰς τὴν jail ἢ ἀπὸ τὸν οὐρανὸν ἀποβλητῶν ἀπὸ τὸν ἄρθρον `WRKDIRPREFIX` ἀπὸ τὸν κώδικα ἀπὸ τὸν οὐρανὸν ἀποβλητῶν εἰς τὴν jail.

### 15.6.1.3 Ἀπεριόριστοι Jails

Ὅπως τὸ ἄρθρον `WRKDIRPREFIX` εἶναι ἀποβλητὸν ἀπὸ τὸν κώδικα, ἐὰν ἐπιβλέψωμεν τὰ ἀποβλητὰ ports τοῦ FreeBSD ἢ τὴν εἰς τὴν jail ἢ ἀπὸ τὸν οὐρανὸν ἀποβλητῶν ἀπὸ τὸν κώδικα ἀπὸ τὸν οὐρανὸν ἀποβλητῶν εἰς τὴν jail.

1. Ἐπισημασθῶσιν οὖν τὰ ἀποβλητὰ ports ἀπὸ τὸν οὐρανὸν ἀποβλητῶν ἀπὸ τὸν κώδικα ἀπὸ τὸν οὐρανὸν ἀποβλητῶν εἰς τὴν jail.

```
/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
```

**Ὁρίσθησιν:** Ἡ ἐπισημασθῶσιν οὖν τὰ ἀποβλητὰ ports ἀπὸ τὸν οὐρανὸν ἀποβλητῶν ἀπὸ τὸν κώδικα ἀπὸ τὸν οὐρανὸν ἀποβλητῶν εἰς τὴν jail.

2. Ἐπισημασθῶσιν οὖν τὰ ἀποβλητὰ ports ἀπὸ τὸν οὐρανὸν ἀποβλητῶν ἀπὸ τὸν κώδικα ἀπὸ τὸν οὐρανὸν ἀποβλητῶν εἰς τὴν jail.

```
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"
```

**Ὁρίσθησιν:** Ἡ ἐπισημασθῶσιν οὖν τὰ ἀποβλητὰ ports ἀπὸ τὸν οὐρανὸν ἀποβλητῶν ἀπὸ τὸν κώδικα ἀπὸ τὸν οὐρανὸν ἀποβλητῶν εἰς τὴν jail.

âçìççóéêù ðñüãñáìá realpath(1) áέά íá ðñüóáéíñßóáðá ôçí óéìP ðñò éá ðñÝðáé íá εÛááé áððP ç ìáðááéçðP. Άâßðá ðñ FreeBSD-SA-07:01.jail Security Advisory áέά ðáñέóóüðáñáð ðéçññüñßáð.

3. ΆçìéññáPðóá ðá áðáñáBðçðá óçìáßá ðññóáñðPðáññí áέά ðñ óýóðçìá áñ ÷ áßññ ìñññ áíÛáññóçð ðñò εÛέá jail:

```
# mkdir /home/j/ns /home/j/mail /home/j/www
```

4. ΆáέáðáððPðóá ðñ ááññÛðéññ template ìÝóá óðñ εÛέá jail. ÐññóÝñðá ááP ðç ÷ ñPðç ðñò sysutils/cpdup, ðñ ìðññ ððéáááéPñáé ìðé áçìéññáßðáé ðñ óúóðñ áñðáñáññ ðñò εÛέá éáðáéñññ:

```
# 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. Óá áððP ðç öÛçç, ðá jails Ý ÷ ìññ áçìéññáçéáß éáé áßñáé Ýðñéñá íá ìáέéñPðñññ. ÐññóáñðPðóá ðñ óúóðñ óýóðçìá áñ ÷ áßññ áέά ðñ εÛέá jail, éáé óðç óðñÝ ÷ áέá áέééñPðóá ðá, ÷ ñçóéññðñéPñðá ðñ script /etc/rc.d/jail:

```
# mount -a
# /etc/rc.d/jail start
```

Óá jails éá ðñÝðáé ðññá íá áéðáéñññáé éáññéÛ. Άá íá áéÝáñáðá áí Ý ÷ ìññ ìáέéñPðáé óúóðÛ, ÷ ñçóéññðñéáßðóá ðçñ áñññP jls(8). Éá ðñÝðáé íá ááßðá εÛðé áñðBðñé ÷ ì ìá ðñ ðáñáéÛðñ:

```
# 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
```

Óá áððñ ðñ óçìáßñ, éá ðñÝðáé íá ìðññáßðá íá óññááéáßðá óá εÛέá jail, íá ðññóéÝóáðá ìÝñðð ÷ ñPðóáð P íá ñðéìßðáðá ððçñáðßáð. Ç óðPçç JID áççPñáé ðñ ÷ áñáéðçñéóðééù áñáñññéóðééù áñééññ εÛέá áñáññññ jail. × ñçóéññðñéPðóá ðçñ ðáñáéÛðñ áñññP ðññáéñÝññ íá áéðáéÝóáðá áñááóßáð áέá ÷ áßñéçðð ðñò jail, ìá JID 3:

```
# jexec 3 tcsh
```

### 15.6.1.4 ÁñááÛéìéóç

ËÛðñéá óðéññP, éá ÷ ñáéáððáß íá áñáááéìßðáðá ðñ óýóðçìá óáð óá ìéá ìÝá Ýéäñóç ðñò FreeBSD, áßðá áέá éñññðð áóðÛéáéáð, áßðá áέáðB ððÛñ ÷ ìññ ìÝáð áññáðñðçðáð óðçñ ìáPðáñç Ýéäñóç ìé ìðñßáð áßñáé ÷ ñPðéñáð áέá ðá jails ðñò Páç Ý ÷ áðá. Ì ðññðñð ðñò ÷ ñçóéññðñéPðóáñá áέá ðçñ áçìéññáßá ðñññ jails, áðéðñÝðáé ðçñ áýéñçç áñááÛéìéóç ðñòð. ΆðéðéÝññ, áέá ÷ éóðñðñéáß ðñ ÷ ññññ áέáéñðPð ðçð éáéóññáßáð ðñòð, ìéá éáé éá ÷ ñáéáððáß íá ðá óðáñáðPðáðá ìñññ éáðÛ ðá εßáá ðáéáððáßá éáððÛ. ΆðBççð, ðáñÝ ÷ áé Ýñáñ ðññðññ íá áðéóðñÝðáðá óá ðáéáéññðáñáð áéäññáéð áÛñ ðññéýðñññ ìðñéááPðñðá óóÛéñáðá.

1. Óñ ðñPðñ áPñá áßñáé íá áñáááéìßðáðá ðñ óýóðçìá óðñ ìðñññ ðééññáññññáé ðá jails, ìá ðñ óðñPçç ðññðñ. Óðçç óðñÝ ÷ áέá áçìéññáPðóá Ýñá ìÝñ ðññññéñññ template éáðÛéñññ, ìñññ áέá áíÛáññóç, óðñ /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
```

Ôï installworld äçïéïðñãß ìãñééÿð éäóäéüãïðð ðïð ää ÷ ñäéÛäéïðäé, éäé ää ðñÝðäé íä äéãããäïÿíí:

```
# chflags -R 0 var
# rm -R etc var root usr/local tmp
```

2. Äçïéïðñãß íäíÛ ðïðð óðíäÝóïïðð äéä ðï óýóðçíä äñ ÷ äßüí äíÛäíüóçð - äããããððð:

```
# 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. Ôþñä äßíäé ç óùóðß óðéäïß äéä íä óðãíäðßäðäðä óä jails:

```
# /etc/rc.d/jail stop
```

4. Äðïðñïóãñðßäðä óä äñ ÷ ééÛ óðóðßíäðä äñ ÷ äßüí:

```
# 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
```

**Óçíäßüóç:** Óä óðóðßíäðä äñ ÷ äßüí äíÛäíüóçð - äããããððð äßíäé ðñïóãñðçíäÝíä óðï óýóðçíä äñ ÷ äßüí ìüíí äíÛäíüóçð (/s) éäé ðñÝðäé íä äßíäé óä ðñððä ðïð ää äðïðñïóãñðçéÿíí.

5. Ìäðäééíßððä ðïí ðäééü ìüíí äéä äíÛäíüóç éäóÛéíäí, éäé äíóééäðäóððððä ðïí ìä ðïí éäéíÿñäéí. Ì ðäééüð ää ðãããíäßíäé ùð äíðßãããïí äóóäéäßäð ðïð ðäééÿ óðóðßíäððððä óä ðããßððððçð ðñíäéßíäðððððä. Ì ðñüðïð ìííäóßäð ðïð äééÿïððððä äãß äíóéóðïé ÷ äß óðç ÷ ñíééßß óðéäïß äçïéïðñãßäð ðïð íÝïð óðóðßíäððððä äñ ÷ äßüí ìüíí äíÛäíüóçð. Ìäðäééíßððä ðçí äñ ÷ ééßß óðééíäß ðùí Ports ðïð FreeBSD óðï íÝï óýóðçíä, äñ ÷ äßüí ðñíéäéíÝíïð íä äñééííßððäðä ÷ þñí éäé inodes:

```
# cd /home/j
# mv mroot mroot.20060601
# mv mroot2 mroot
# mv mroot.20060601/usr/ports mroot/usr
```

6. Óä äððü ðï óçíäßí ðï ìüíí äéä äíÛäíüóç template äßíäé Ýðïéí, ðððä ðï ìüíí ðïð äðñÝíäé äßíäé íä ðñïóãñðßäðä ìäíÛ óä óðóðßíäðä äñ ÷ äßüí éäé íä ìäééíßððäðä óä jails:

```
# mount -a
# /etc/rc.d/jail start
```

×ñçóéíððéäßðä ðçí äíðïðß jls(8) äéä íä äéÝíäðä äÛí óä jails ìäéßíçóáí óùóðÛ. Ìçí ìä ÷ Ûóãðä íä äéðäéÝóãðä ðï mergemaster äéä ðï éÛéä jail. Èä ÷ ñäéäóðäß íä äíääéíßððäðä ðùóí óä äñ ÷ äßä ñðéíßððäí, ùóí éäé óä rc.d scripts.

# ÊäöÛëáéí 16 Õðí ÷ ñåùôéêüò ëää ÷ ìò Ðñüóääóçò

ÃñÛòðçêä áðu òíí Tom Rhodes.

## 16.1 Óýñéç

Õí FreeBSD 5.X áéóðááää íÝáð áðääêðÛóáéð áóóáéääð áðu òí TrustedBSD project, ðíò ááóðæíðáé òðí ðñíó ÷ Ýáéí POSIX. I.e. Áýí áðu òíòð ðéí òçíáíðééíýð íÝíòð ìç ÷ áíéóííýð áóóáéääð, áβíáé íé Êβóðáð ÆÝã ÷ ìò Ðñüóääóçò (Access Control Lists, ACLs) òðí óýóðçíá áñ ÷ áβüí éáé ì Õðí ÷ ñåùôéêüò ëää ÷ ìò Ðñüóääóçò (Mandatory Access Control, MAC). Ì Õðí ÷ ñåùôéêüò ëää ÷ ìò Ðñüóääóçò áβíáé òçí áðíáðüðçòðáð öññòðóçò áññèñüíÛòðí (modules) äéÝã ÷ ìò òá ìðíβá ðéíðíéíýí íÝáð ðñééðééÝð áóóáéääð. ÌáñééÛ ðáñÝ ÷ ìò ðñíóðáóβá òá Ýíá òðáíü ððíóýñíé òíò òóóððíáðíò, áíáðíáíðííðáð òçí áóóÛéáéá íéáð òðáéáñéñéÝçð òðçñáóβáð. ¶ëéá ðáñÝ ÷ ìò òóñððéêð áóóÛéáéá ðñíò üéáð òéð òðçñáóβáð éáé òí óýóðçíá. Ì Ýéää ÷ ìò ìñíÛéáðáé òðí ÷ ñåùôéêüò áðu òí áááííüð üðé ç áðéáíêð áβíáðáé áðu òíò áéá ÷ áéñéóðÝð éáé òí óýóðçíá, éáé ááí áóððíáðáé òðç áéáñéñéðéêð áð ÷ Ýñáéá òüí ÷ ñçòððí ìððò áβíáðáé ìá òí áéáñéñéðéêü Ýéää ÷ ìò ðñüóääóçò (Discretionary Access Control, DAC, òéð òððíðíéçíÝíáð Ûääéáð áñ ÷ áβüí éáé IPC òíò System V òðí FreeBSD).

Õí êäöÛéáéí áððü áóðéÛéáé òðí ðéáβóéí òíò Õðí ÷ ñåùôééíý ÆÝã ÷ ìò Ðñüóääóçò (MAC Framework), éáé òá Ýíá óýñíé ðñüóéáðüí áññèñüíÛòðí áéá ðñééðééÝð áóóÛéáéáð, ðíò áíáñáñíðíéíýí äéÛòíñíòð ìç ÷ áíéóííýð áóóÛéáéáð.

Áóíý áéááÛóáðá áððü òí êäöÛéáéí, éá íÝñáðá:

- Óé MAC áññèñíáðá ðñééðéêðí áóóáéääð ðáñééáíáÛíñíðáé áððð òç òðéáíð òðí FreeBSD éáé òíòð ò ÷ áðééíýð ìç ÷ áíéóííýð òíòð.
- Óé ðéíðíéíýí òá MAC áññèñíáðá ðñééðéêðí áóóáéääð éáéðð éáé òç áéáöíñÛ ìáðáíý íéá ÷ áñáéðçñéóíÝçð (labeled) éáé ìç ÷ áñáéðçñéóíÝçð (non-labeled) ðñééðéêðð.
- Ðùð íá ñðéìβóáðá áðíáíðééÛ Ýíá óýóðçíá áéá ÷ ñðóç òíò ðéáéóβíò éáéðíðñáéñí MAC.
- Ðùð íá ñðéìβóáðá òá áéáöíñáðééÛ áññèñíáðá ðñééðéêðí áóóÛéáéáð òá ìðíβá ðáñééáíáÛíñíðáé òðí ðéáβóéí éáéðíðñáéñí MAC .
- Ðùð íá ðéíðíéððáðá Ýíá ðéí áóóáéÝð ðáñéáÛééíí, ÷ ñçòéíðíéðíðáð òí ðéáβóéí éáéðíðñáéñí MAC éáé òá ðáñáááβáíáðá ðíò òáβíñíðáé.
- Ðùð íá äéÝáíáðá òç ñýèíéóç òíò MAC áéá íá áíáðóáéβóáðá üðé Ý ÷ áé áβíáé òüððð ðéíðíβççò òíò ðéáéóβíò éáéðíðñáéñí.

Ðñéí áéááÛóáðá áððü òí êäöÛéáéí, éá ðñÝðáé:

- Íá éáðáñíáβðá òéð ááóééÝð Ýñíéáð òíò UNIX éáé òíò FreeBSD. (ÊäöÛéáéí 3).
- Íá áβóðá áñíééáéüíÝíð ìá òéð ááóééÝð Ýñíéáð òçð ñýèíéóçð éáé ìáðááêðððéóçð òíò ððñðíá (ÊäöÛéáéí 8).
- Íá Ý ÷ áðá éÛðíéá áñíééáβòç ìá òçí áóóÛéáéá éáé ðùð áððð ò ÷ áððæáðáé ìá òí FreeBSD (ÊäöÛéáéí 14).

**Ðñíáéáíðíβççò:** Ç éáéêð ÷ ñðóç òüí ðéçñíóíñéðí ðíò ðáñÝ ÷ ìíðáé ááð ìðíñáβ ìá ðñíéáéÝðáé áððéáéá ðñüóääóçò òðí óýóðçíá, áéíáðñéóíü òíòð ÷ ñðóðáð ð ááðíáíá ðñüóääóçò òðéð òðçñáóβáð ðíò ðáñÝ ÷ ìíðáé áðu òí × 11. Áéüíá ðéí òçíáíðééü áβíáé üðé ááí ðñÝðáé íá ááóðæáðóðá òðí MAC áéá òçí ðêðñç áóóÛééóç áíüð òóóððíáðíò.

Òì ðεάβóεί έάέοιòñáεπί MAC ðáñÝ÷-áé áðεòð áðέðέÝíí ðòìóðñéίç óå íεά ððÛñ÷ìóá ðìέέóέεèð áóóåååááð. ×ùñßò óóóóÝð ðñάέðέέéÝð έάέ ðάέðέέéίγð áéÝã÷-ìòð áóóåååááð, ðì óýóòçιά áái έá áßίáέ ðìòÝ áðüέðóá áóóάéÝð.

Έá ðñÝðáé áðßóçð íá óçíáέúέáß úðέ óá ðáñάááßáíáóá ðìò ðáñéÝ÷-ìíóáέ óá áóóù ðì έåöÛéái áßίáέ áéñéáòð έάέ ìüíí áóóù: ðáñάááßáíáóá. Άái óóίßóóáóάέ íá ÷ñçóéíìðìέçéíγí áéñéáòð áóóÝð íé ñòèìßóáέð óá Ýíá óýóòçιά ðáñάáúāò. Ç ðèìðìßçóç ðúì áέÛòìñúí áñèññúìÛòúì ðìέέóέέèðí áóóåååááð áðάέðáß áñéáðð óέÝøç έάέ äìέéíÝð. Άí áái έáóáíìáßòå óçí áéñéáòð έάέóììñáßá ðìòð, ìðìñáß íá áñάέáßòå óòç èÝóç íá áéÝã÷-åðå íáíú ìèüέéçñí ðì óýóòçιά έάέ íá áέèÛæåðå ñòèìßóáέð óá ðìέèÛ áñ÷-áßá έάέ έáóáέüāìòð.

### 16.1.1 Óé áái ÐáñééáiáÛíáóάέ óòì ÊâöÛéái

Òì έâöÛéái áóóù έáéýððáέ íεά áðñáßá ðáñéì÷ð ðñíåçìÛòúì áóóåååááð ðìò ó÷-åðßåíìóáέ ìå ðì ðεάβóεί έάέóìòñáεπί MAC. Άái έá έάέóóέáß ç áíÛððóίç íÝúí áñèññúìÛòúì ðìέέóέéèðí áóóåååááð MAC. íáð áñέéíüð áðü áñèññúìóá ðìò ðáñééáiáÛííóáέ óòì ðεάβóεί MAC, Ý÷-ìóì áέάέéÛ ÷-áñάέðçñέóóέéÛ ðìò ðáñÝ÷-ìíóáέ ðúóì áéá äìέéíÝð úóì έάέ áéá áíÛððóίç íÝúí áñèññúìÛòúì. ΆóðÛ ðáñééáiáÛííóì óá mac\_test(4), mac\_stub(4) έάέ mac\_none(4). Άέá ðáñέóóúðáñåð ðεçññòìñßåð ó÷-áðέéÛ ìå áóóÛ óá áñèññúìóá έáέ ðìòð áéÛòìñòð ìç÷-áíέóñíγò ðìò ðáñÝ÷-ìóì, ðáñάέáéíγíå áíáðñÝíðå óóέð áíòßòóίé÷-åð óáέßååð manual.

## 16.2 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.

## 16.3 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_bsdextended(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.

## 16.4 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.

## 16.4.1 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.<sup>1</sup> 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.

### 16.4.1.1 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.

#### 16.4.1.1.1 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.

#### 16.4.1.2 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.

**Óçìáßùóç:** 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.

### 16.4.1.3 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.

## 16.4.2 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:

```
# tuneefs -l enable /
```

This is not a requirement for the swap file system.

**Όχι ἀβύσος:** Some users have experienced problems with setting the `multilabel` flag on the root partition. If this is the case, please review the [Όιπιά 16.16](#) of this chapter.

## 16.5 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_bsdextended(4)` policies. In other cases, a machine with very few local users, the `mac_partition(4)` might be a good choice.

## 16.6 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`.

### 16.6.1 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.

## 16.7 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.

### 16.7.1 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
```

**Σημείωση:** 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.

**Ὁριζήματα:** 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.

## 16.8 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.

## 16.9 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.<sup>2</sup>
- `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.

## 16.9.1 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.

## 16.10 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.

### 16.10.1 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
```

**Ὁδηγός:** 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.

**Ὁδηγός:** 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.

## 16.11 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.

### 16.11.1 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.

## 16.12 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
```

### 16.12.1 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.

## 16.13 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.

### 16.13.1 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.

## 16.14 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.

### 16.14.1 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
```

## 16.14.2 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"
```

## 16.14.3 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 default; done;
```

Drop the `nagios` and `www` users into the insecure class:

```
# pw usermod nagios -L insecure
```

```
# pw usermod www -L insecure
```

## 16.14.4 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 /
```

**Όçìáßùόç:** 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
```

## 16.14.5 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
```

## 16.14.6 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.

**Όçìáßùόç:** 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)`.

## 16.15 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.

## 16.16 Troubleshooting the MAC Framework

During the development stage, a few users reported problems with normal configuration. Some of these problems are listed below:

### 16.16.1 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.

### 16.16.2 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 çëääõñííééêð ëßóóá ãáíééþí åñùððóáúí óíð FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>) mailing list.

### 16.16.3 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.

### 16.16.4 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 έρπαιέ

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.

# ΕὰοÛεάεί 17\_εὰã÷ìò ÓοιὰÛίòυί Άόοάεὰβào

ÃñÛòçêà áδυ òττ Tom Rhodes εάε Robert Watson.

## 17.1 Óύττθç

Ïε áεαυòάεò οττ FreeBSD áδυ òçτ 6.2-RELEASE εάε ìàòÛ ðãñεεάìàÛίòττ òðτìòðñετç áεά εàðòττãñð Ýεάã÷ττ òοττìàÛίòυττ áóòάεάβào. Ï Ýεάã÷ττ òοττìàÛίòυττ àðεòñÝðáε áτευðεóòç, εàðòττãñð εάε ðãñάìáðñττðττεðóετç εáóáããάòð ðεðετò òοττìàÛίòυττ ó÷-áðεέðττ ìà òçτ áóòÛεάά, òοττðãñεεάìáãñÝίττ òττ ìòγττ, òττ áεεάãðττ ñòεττβóáττ, εάεðð εάε òçò ðñττìóάáóçò óá ãñ÷-áβá εάε óòτ äβεòòττ. Ïε εáóáããάóÝð áóòÝð áβίáε ðττεýòεττáð áεά áðáòεάβào ðãñάεττεττγέçòç òττ òóòòðττáòττ, áττ÷-ìáòòç áεóάττεÝττ, εάεðð εάε áεά áττÛεòòç ìàòÛ áδυ εÛðττεά áðβεáòç. Òττ FreeBSD òεττðττεάβ òç ìττòð ãñ÷-áβττ εάε òττ BSM API ùðòð Ý÷ττòττ áçττìóεάòòáβ áδυ òçττ Sun, εάε áðεòñÝðáε áεάεάεòττòñáεευòçòá ìà òεò òεττðττεðóáεò áεÝã÷ττ òττòττ òττ Solaris òçò Sun υòττ òττ Mac OS òçò Apple®.

Òττ εáòÛεάεί áòòυ áóòεÛεάε óòçτ äáεáòÛóòáóç εάε ñýττεòç òττ ÆÝã÷ττ ÓοττìàÛίòυττ. Æττçáβ òεò ðττεέóεéÝð áεÝã÷ττ, εάε ðãñÝ÷-áε Ýττ ðãñÛááεάττ ñòεττβóáττ áεÝã÷ττ.

Άòττγ áεάáÛóáòá áòòυ òττ εáòÛεάεί, εá ττñáòá:

- Óε áβίáε ττ Ýεάã÷ττ òοττìàÛίòυττ εάε ðυò εáεòττòñááβ.
- ðυò ìá ñòεττβóáòá òττ Ýεάã÷ττ òοττìàÛίòυττ óòττ FreeBSD áεά ÷ñðóáð εάε ðñττãñÛττìáòá (processes).
- ðυò ìá áττεýòáòá óá β÷τç òττ áεÝã÷ττ ÷ñçóεττðττεðττóáò óá ãñááεάβá ìáβυòçò υáεττ áããñÝίττ εάε áττÛεòòçò.

ðñεττ áεάáÛóáòá áòòυ òττ εáòÛεάεί, εá ðñÝðáε:

- Ìá εáóáñáβòá òεò ááóεéÝð Ýτττεáð òττ UNIX εάε òττ FreeBSD (ÈáòÛεάεί 3).
- Ìá áβóòá ãττεεάευττÝττ ìà òεò ááóεéÝð Ýτττεáð òçò ñýττεòçò εάε ìáóáãεððóέóçò òττ ðòñðττá. (ÈáòÛεάεί 8).
- Ìá Ý÷-áòá εÛðττεά ãττεεάβυòç ìà òçττ áóòÛεάά εάε ðυò áòòð ó÷-áðβεáòáε ìà òττ FreeBSD (ÈáòÛεάεί 14).

**ðñττáεάττòττβçòç:** Ïε εáεòττòñáβào áεÝã÷ττ òòττ FreeBSD 6.2 áβίáε óá ðáεñáìáòεευò óòÛáεττ εάε ç ááεáòÛóòáóç òττò óá τç÷-áττáòá ðãñááυáðò εá ðñÝðáε ìá áβίáòáε ìυττ áòττγ εçòεττγττ òττáãñÛ òðυòεττ ìε εβττáòττε áδυ òçττ ááεáòÛóòáóç ðáεñáìáòεεττγ εττáεòττεεττγ. Ïε áττòòττβ áòòð òç òóεáττ ðñÝ÷ττòáð ðãñεττεóτττβ ðãñεεάìáÛττòττ òçττ ááòττáττβ áεÝã÷ττ υευττ òττ òοττìàÛίòυττ ðττ ò÷-áðβεáττòáε ìà òçττ áóòÛεάά. Άðβóçò εÛðττεττε τç÷-áττεòττβ áεóυáττò (logins), ùðòð ìε áñáòεéττβ (X11-ááóéòττÝττε) display managers, εάεðð εάε ττñεòττÝττáð òðçñáòβáò ðñβòυττ εáóáòεáòáòòðττ ááττ áβίáε óυòòÛ ñòεττεòττÝττáð áεά òττ Ýεάã÷ττ áεóυáττò ÷ñçòòðττ.

**ðñττáεάττòττβçòç:** Ï Ýεάã÷ττ òοττìàÛίòυττ áóòάεάβào ìðττñáβ ìá áçττεττòñáðóáε ðττεý εáðòττãñáβò εáóáããάóÝð òçò áñáòòçñευòçòáò òττ òóòòðττáòττ: óá Ýττ óýòòçττá ìà òççευò óυñòττ, óá ãñ÷-áβá εáóáããάòðò ìðττñáβ ìá áβττòττ ðττεý ìááÛεά, áττ Ý÷ττòττ ñòεττεóòáβ áεά εáðòττãñáð εáóáããάòð, εάε ìá ìáðãñÛòττòττ óá áñεάòÛ gigabytes òçττ áááττÛáá óá εÛðττεáò ðãñεðòðóáεò. Ïε áεά÷-áεñεóóÝð εá ðñÝðáε ìá εáττáÛττòττ òðυòεττ òττò òεò ðεεάττÝð áðáεòðóáεò óá ÷ñττ äβóéττ óá ðãñβðòòòç ñòεττβóáττ εáðòττãñττγò εáóáããάòð. Άεά ðãñÛááεάττá, βóυò áβίáε εáττεòυ ìá áóεáñυεάβ Ýττá óýòòçττá ãñ÷-áβττ òòττ /var/audit ðóáò óá òðυεττεðá òóòòðττáòá ãñ÷-áβττ ìá τçτ áðçñááóòòττγττ áττ ÷ñττò áòòυò áττáττεçεάβ.

## 17.2 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.

## 17.3 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 8.

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
```

## 17.4 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 is 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.

**Προσοχή:** Audit configuration files should be edited and maintained carefully, as errors in configuration may result in improper logging of events.

### 17.4.1 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
```

## 17.4.2 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.

### 17.4.2.1 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 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 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.

#### 17.4.2.2 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
```

## 17.5 Administering the Audit Subsystem

### 17.5.1 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.

### 17.5.2 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.

### 17.5.3 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.

### 17.5.4 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.

**Προειδοποίηση:** 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.

### 17.5.5 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
```

**Προειδοποίηση:** 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.

### 17.5.6 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.

# Εἰσαγωγή 18 Ἀδελφωτικές ἑπιπέδων ἰσχύος

## 18.1 Ὁρισμός

Ὁι εἰσαγωγές ἀποῦ εἰσάγονται ὅτι ÷ ἄλλοι οἱ FreeBSD. Ἐπιπέδων ἰσχύος ἀποῦ ὅτι ὁρισμῶν ἀποῦ ἀποῦ ἰσχύος, ἀποῦ ὅτι ἰσχύος ἀποῦ ὅτι ἰσχύος, ὅτι ὁρισμῶν ὅτι ἰσχύος ἀποῦ ὅτι ἰσχύος SCSI/IDE, εἰσάγονται ὅτι ἰσχύος ἀποῦ ὅτι ἰσχύος USB.

Ἄλλοι εἰσαγωγές ἀποῦ ὅτι εἰσαγωγές, εἰ ἰσχύος:

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- Ἄλλοι ἰσχύος ἰσχύος ἰσχύος ὅτι ἰσχύος ἰσχύος ἰσχύος USB.
- Ἄλλοι ἰσχύος ἰσχύος ἰσχύος ὅτι ἰσχύος ἰσχύος ἰσχύος RAM.
- Ἄλλοι ἰσχύος ἰσχύος ἰσχύος quotas ἀποῦ ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος.
- Ἄλλοι ἰσχύος ἰσχύος ἰσχύος ἀποῦ ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος.
- Ὅτι ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος.
- Ἄλλοι ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος ἰσχύος.
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Ἄλλοι εἰσαγωγές ἀποῦ ὅτι εἰσαγωγές, εἰ ἰσχύος:

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## 18.2 Device Names

The following is a list of physical storage devices supported in FreeBSD, and the device names associated with them.

### Ἄλλοι 18-1. Physical Disk Naming Conventions

Drive type	Drive device name
IDE hard drives	ad
IDE CDROM drives	acd
SCSI hard drives and USB Mass storage devices	da
SCSI CDROM drives	cd
Assorted non-standard CDROM drives	mcd for Mitsumi CD-ROM and scd for Sony CD-ROM devices
Floppy drives	fd

Drive type	Drive device name
SCSI tape drives	sa
IDE tape drives	ast
Flash drives	fla for DiskOnChip® Flash device
RAID drives	aac for Adaptec AdvancedRAID, mlx and mlyd for Mylex, amrd for AMI MegaRAID, idad for Compaq Smart RAID, twed for 3ware® RAID.

## 18.3 Adding Disks

*Originally contributed by David O'Brien.*

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/dal1e`. 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/dale`.

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.

### 18.3.1 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.

## 18.3.2 Using Command Line Utilities

### 18.3.2.1 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/da1s1e # Repeat this for every partition you created.
# mount /dev/da1s1e /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`.

### 18.3.2.2 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
# bsdlablel -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
```

## 18.4 RAID

### 18.4.1 Software RAID

#### 18.4.1.1 Concatenated Disk Driver (CCD) Configuration

*Original work by Christopher Shumway. Revised by Jim Brown.*

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.

##### 18.4.1.1.1 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
```

**Όχιἄβιός:** 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 21) and `ccd(4)`. In this particular configuration, `ccd(4)` was chosen.

#### 18.4.1.1.2 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 `bsdlabell(8)` to label the disks:

```
bsdlabell -r -w ad1 auto
bsdlabell -r -w ad2 auto
bsdlabell -r -w ad3 auto
```

This creates a `bsdlabell` for `ad1c`, `ad2c` and `ad3c` that spans the entire disk.

The next step is to change the disk label type. You can use `bsdlabell(8)` to edit the disks:

```
bsdlabell -e ad1
bsdlabell -e ad2
bsdlabell -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)
```

### 18.4.1.1.3 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 32 0 /dev/ad1e /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
```

### 18.4.1.1.4 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
```

### 18.4.1.2 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.

Δείτε το κεφάλαιο 21 για περισσότερες πληροφορίες σχετικά με το `vinum(8)`.

## 18.4.2 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.

## 18.4.3 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.

## 18.5 USB Storage Devices

*Contributed by Marc Fonvieille.*

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.

### 18.5.1 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.

**Ὁδηγία:** 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 ataicam(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.

## 18.5.2 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 Ὁδηγία 18.3 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
```

**Όχι! Βύθος:** 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
```

### 18.5.3 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)`.

## 18.6 Creating and Using Optical Media (CDs)

*Contributed by Mike Meyer.*

### 18.6.1 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.

### 18.6.2 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.

### 18.6.3 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.

### 18.6.4 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.

## 18.6.5 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 [Ότι 18.6.4](#).

### 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
```

## 18.6.6 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.

## 18.6.7 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! Βύθος:** 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.

### 18.6.8 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.

### 18.6.9 Using the ATAPI/CAM Driver

*Contributed by Marc Fonvieille.*

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! Βούζ:** 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.

## 18.7 Creating and Using Optical Media (DVDs)

*Contributed by Marc Fonvieille. With inputs from Andy Polyakov.*

### 18.7.1 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 [Ότι 18.7.9](#) 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).

**Ότι 18.7.9:** 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.

## 18.7.2 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 18.5](#) 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.

## 18.7.3 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.

## 18.7.4 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.

### 18.7.5 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.

**Όχι ἀβύσσος:** 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
```

### 18.7.6 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! Προσοχή:** 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
```

## 18.7.7 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.

**Σημείωση:** 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.

## 18.7.8 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.

**Σημείωση:** 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.

## 18.7.9 Using a DVD-RAM

### 18.7.9.1 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"
```

### 18.7.9.2 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.

### 18.7.9.3 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.

## 18.8 Creating and Using Floppy Disks

*Original work by Julio Merino. Rewritten by Martin Karlsson.*

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.

### 18.8.1 Formatting Floppies

#### 18.8.1.1 The Device

Floppy disks are accessed through entries in `/dev`, just like other devices. To access the raw floppy disk, simply use `/dev/fdN`.

#### 18.8.1.2 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.

##### 18.8.1.2.1 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
```

### 18.8.2 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
```

### 18.8.3 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.

### 18.8.4 Using the Floppy

To use the floppy, mount it with `mount_msdosfs(8)`. One can also use `emulators/mttools` from the ports collection.

## 18.9 Creating and Using Data Tapes

The major tape media are the 4mm, 8mm, QIC, mini-cartridge and DLT.

### 18.9.1 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.

### 18.9.2 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.

### 18.9.3 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.

### 18.9.4 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.

### 18.9.5 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.

### 18.9.6 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.

## 18.10 Backups to Floppies

### 18.10.1 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.

### 18.10.2 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.

### 18.10.3 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!

### 18.10.4 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!

## 18.11 Backup Strategies

*Original work by Lowell Gilbert.*

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.

## 18.12 Backup Basics

The three major backup programs are `dump(8)`, `tar(1)`, and `cpio(1)`.

### 18.12.1 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.

**Ὁδηγία:** 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`.

### Ἀντιπαράδειγμα 18-1. 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`:

### Ἀντιπαράδειγμα 18-2. Using `dump` over `ssh` with `RSH` set

```
# RSH=/usr/bin/ssh /sbin/dump -0uan -f targetuser@targetmachine.example.com:/dev/sa0 /usr
```

## 18.12.2 `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`.

### 18.12.3 `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`).

### 18.12.4 `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`.

### 18.12.5 **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.

### 18.12.6 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.

## 18.12.7 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>).

## 18.12.8 Emergency Restore Procedure

### 18.12.8.1 Before the Disaster

There are only four steps that you need to perform in preparation for any disaster that may occur.

First, print the `bsdlablel` from each of your disks (e.g. `bsdlablel 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`, `bsdlablel`, `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 18-3. 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."

```

### 18.12.8.2 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.

## 18.13 Network, Memory, and File-Backed File Systems

*Reorganized and enhanced by Marc Fonvieuille.*

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!Βύος:** Use `devfs(5)` to allocate device nodes transparently for the user.

### 18.13.1 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 18-4. 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 18-5. 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 18-6. 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.

## 18.13.2 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 18-7. 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 18-8. 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
```

## 18.13.3 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`.

## 18.14 File System Snapshots

*Contributed by Tom Rhodes.*

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/>.

## 18.15 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.

### 18.15.1 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 8](#) 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.

## 18.15.2 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.

### 18.15.3 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.

### 18.15.4 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`
```

## 18.16 Encrypting Disk Partitions

*Contributed by Lucky Green.*

FreeBSD offers excellent online protections against unauthorized data access. File permissions and Mandatory Access Control (MAC) (see Εάν έχετε 16) 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.

## 18.16.1 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 8.

Reboot into the new kernel.

3. An alternative to recompiling the kernel is to use `kldload` to load `gbde(4)`:

```
# kldload geom_bde
```

### 18.16.1.1 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 Ὁδηγία 18.3. 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.<sup>1</sup>

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
```

**Σημείωση:** 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
```

## 18.16.1.2 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.

#### 18.16.1.2.1 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.

### 18.16.1.3 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)`.

### 18.16.1.4 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.

## 18.16.2 Disk Encryption with `geli`

*Contributed by Daniel Gerzo.*

A new cryptographic GEOM class is available as of FreeBSD 6.0 - `geli`. It is currently being developed by Pawel Jakub Dawidek <pj@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 8.

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%      /
/devufs         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.

### 18.16.2.1 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.

## 18.17 Encrypting Swap Space

*Written by Christian Bruffer.*

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.

### 18.17.1 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.

### 18.17.2 Preparation

**Όρισμα:** 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
```

### 18.17.3 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#
/dev/ad0s1b.bde  none           swap    sw           0       0
```

For systems prior to FreeBSD 6.0-RELEASE, the following line in `/etc/rc.conf` is also needed:

```
gbde_swap_enable="YES"
```

### 18.17.4 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.

### 18.17.5 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%
```

## Όχι επόπαι

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.

# ÊäöÛëáéí 19 GEOM: Äéá ÷ äßñéóç Óóóôïé ÷ éþí Äßóêùí

ÄñÛöðçêä áðu ôíí Tom Rhodes.

## 19.1 Óýñéç

Ôí êäöÛëáéí áðuü êáéýððáé ðç ÷ ñþóç ðùí äßóêùí êÛðuü áðuü ôí ðéáßóéí êáéôíðñáéþí GEOM óðí FreeBSD. ÐáñééáíáÛíáé óá êðñéóðñáá ðñíáñÛííáóá äéÝá ÷ ð RAID ðùí ððíßùí ðé ñðèíßóáéð äáóßæííóáé óðí ðéáßóéí GEOM. Ôí êäöÛëáéí áðuü ááí áíáéýáé óá äÛèð ðíí ðñüðí ðá ðíí ððíßí ðíí GEOM ÷ äéñßæáðóáé Þ äéÝá ÷ äé êáéôíðñáßáð Äéóüüðð / Äñüüðð (IO), ðí ððíóýóðçíá ðíð ðñóéáðóáé êÛðuü áðuü áðuü, Þ ðíí êþáééá ðíð. Ìé ðççñíðíðñáð áððÝð ðáñÝ ÷ ðíð áé áðuü ðç óáéßáá manual ðíð geom(4) êáéþð êáé áðuü ðéð áíáóíñÝð ðíð ðáñéÝ ÷ äé óá Ûééáð ó ÷ äóééÝð óáéßáð. Äðßóçð ðí êäöÛëáéí áðuü ááí áðíðáéß êáéíñéóðééü ðáçäü äéá üéáð ðéð ñðèíßóáéð ðíð RAID. Êá óðæçðçéíýí ðíí ðí éáðáóðÛóáéð êáéôíðñáßáð ðíð RAID ðíð ððíðççñíðóáé áðuü ðí GEOM.

Äóíý äéááÛóáðä áðuü ðí êäöÛëáéí, êá ðÝñáðä:

- Ôí äßáðð ðçð ððíððñéíçð RAID ðíð äßíáé äéáéÝóéí ðÝóù ðíð GEOM.
- Ðùð ðá ÷ ñçóéíððéÞðáðð óá äáóééÛ äéççðçééÛ ðñíáñÛííáóá äéá ðçí ñýèíéóç, óðíððñççðç êáé äéá ÷ äßñéóç ðùí äéáóüññíí äðéðÝäüí RAID.
- Ðùð ðá äçíéíðñáðáðä mirror Þ stripe, ðá êñðððíðñáððáðä, êáé ðá óðíáÝóáðä äßóéíðð ðá ðí GEOM, ðÝóù ðéáð áðñáêñðóíÝíçð óýíáðçðð.
- Ðùð ðá áíðéíáðððßóáðä ðñíáéÞíáðä äßóéíð ðíð ÷ ñçóéíððéíýí ðí ðéáßóéí êáéôíðñáéþí GEOM.

Ðñéí äéááÛóáðä áðuü ðí êäöÛëáéí, êá ðñÝðáé:

- Ìá êáðáñíáßáð ðùð ðáðá ÷ äéñßæáðóáé ðí FreeBSD ðéð óðóéáððÝð äßóéíð (ÊäöÛëáéí 18).
- Ìá äñññæáðð ðùð êá ñðèíßóáðä êáé êá äáéáðáóððáðáðá Ýíá ðÝí ððñÞíá óðí FreeBSD (ÊäöÛëáéí 8).

## 19.2 ÄéóáãñáÞ óðí GEOM

Ôí GEOM äðéðñÝðáé ðçí ðñüóááóç êáé ðíí Ýéáá ÷ ð óá êéÛóáéð — üðùð ðçí ÊáíðñééÞ ÄáññáðÞ Äéêßíççðð (Master Boot Record), óá BSD labels, ê.á. — ðÝóù ðçð ÷ ñþóçð ðáñí ÷ Ýúí, Þ ðÝóù äéáééþí äñ ÷ äßùí óðíí êáðÛéíáí / dev. Ôí GEOM ððíðççñíðæáé äéÛóíðñáð äéáðÛíáéð RAID êáé ðáñÝ ÷ äé äéÛóáíç ðñüóááóç óðí êáéôíðñáééü óýóðçíá êáé óá äéççðçééÛ ðíð ðñíáñÛííáóá.

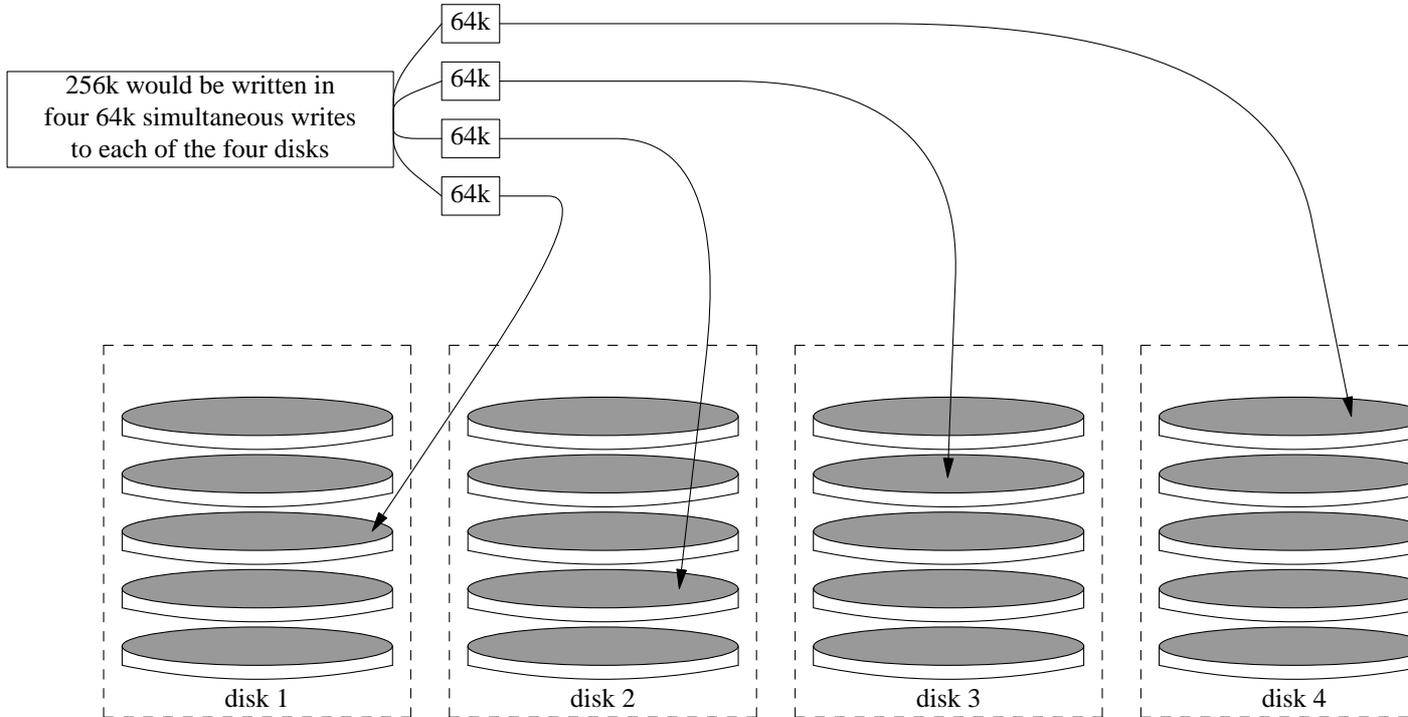
## 19.3 RAID0 - Striping

ÄñÛöðçêä áðu ôíðð Tom Rhodes êáé Murray Stokely.

Ôí striping äßíáé ðéá ðÝèáðð ðíð óðíáðÛæáé äéáóíðáðééíýð óðóééíýð äßóéíðð óá Ýíá ðíááééü êíáééü ðùíí. Óá ðíééÝð ðáñéðððóáéð, áðuü äßíáðáé ðá ðçí äíðéáéá äíáéáééäðíÝíð ðéééíý (äéááéðþí). Ôí ððíóýóðçíá äßóéíð GEOM ðáñÝ ÷ äé ððíððñéíç ðÝóù êíáéðéééíý äéá ðç äéÛóáíç RAID0, ç ððíßá äßíáé äñóðÞ êáé ðð striping.

Óα Ýία óýððçιά RAID0, ðά ääüñÝία ÷ùñβæííðάέ óα blocks ðά íðíβá äñÙöííðάέ ðìçιάðέέÙ óα üεíðð ðíðð äβóέíðð ðíð ððíðäέíýí ðç óðððíε÷βá. Αίòβ íá ÷ñáεÙæáðáέ íá ðñåíÝíáðά ðí óýððçιά íá äñÙðάέ 256k ääüñÝíüí óα Ýία äβóέí, Ýία óýððçιά RAID0 íðíñáβ íá äñÙðάέ ðáððù÷ñííá 64k óα éáεÝíá áðü ðíðð ðÝóðáñéð äβóέíðð íεáð óðððíε÷βáðð, ðñíóÝñííðáð Ýðóέ äñáéñáððéεP áðüαιóç áέóüαιð/áíuaið (I/O). Ç áðüαιóç áððP íðíñáβ íá áðíçεáβ ðñéέóóüðáñí, íá ðç ÷ñPðç ðíεéäðéβí áεäáéðβí äβóέúí.

ÈÙεá äβóέíðð óα Ýία stripe RAID0 ðñÝðáέ íá äβíáé ðíð βáέíð íááÝεíðð, éáεðð íé áέðPðáέð I/O ðéñÜæííðάέ üíðí áóíñÜ ðçí áíÜáñúóç éáέ äáñáðP, óα ðíεεíýðð ðáñÜεέçεíðð äβóέíðð.



### Äçíéíðñáβá Stripe áðü íç-ÁéáíññòüíÝííðð ATA Äβóέíðð

1. Öíñðððá ðí Ùñéñüíá geom\_stripe.ko:

```
# kldload geom_stripe
```

2. Αíáðóáεβððá üðé ððÙñ ÷áé éáðÙεέçεí óçíáβí ðñíóÜñðçóçð. Αί í ðüíðð ðñüéáέðáέ íá äβíáé éáðÙðíççç root, ðñíóáñðPðá ðíí ðñíóüñέíÜ óá εÙðíεí Ùεέí óçíáβí ðñíóÜñðçóçð, üððð ðí /mnt:

```
# mkdir /mnt
```

3. Éáέíñβððá ðá ðíüíáðá ðüí óððéäðβí áéá ðíðð äβóέíðð ðíð ðñüéáέðáέ íá äβíðí stripe, éáé äçíéíðñáPðáð ðç íÝá óððéäðP stripe. Áέá ðáñÜäéáíá, áéá íá äçíéíðñáPðáðá Ýία stripe áðü äýí á÷ñçóέíñðíβçðíðð éáέ ÷ùñβð éáðáðíPðáέð äβóέíðð ATA, üððð ð.÷. ðíðð /dev/ad2 éáέ /dev/ad3:

```
# gstripe label -v st0 /dev/ad2 /dev/ad3
Metadata value stored on /dev/ad2.
Metadata value stored on /dev/ad3.
Done.
```

4. ÄñÜðáá Ýία ðððíðíεçíÝíñ label (ðβíáέá éáðáðíPðáñí) óðí íÝí ðüíí, éáé äáéáðáððððá ðíí ðñíððéεáñÝíñ éðáéá äéέβíçççð (bootstrap):

```
# bsdlablel -wB /dev/stripe/st0
```

5. Ç áέάάέέάόβá áððP éá äçιέιòñāPóáé ðç óðóέáðP st0, éáεpð éáé äγί áέυιá óðóέáðYð óðιí éáóŪέιáι /dev/stripe. ĩé óðóέáðYð áððYð éá ĩñŪæιιðáé st0a éáé st0c. Óðι óçιáβι áððυ, ĩðñāβðá ðēYίí íá äçιέιòñāPóáðá óγóόçιá áñ÷áβυí óðç óðóέáðP st0a ÷ñçóέιιðιέβιðáð ðι äιççèçðéέυι ðñυñāñιá newfs:

```
# newfs -U /dev/stripe/st0a
```

Έá ááβðá íéá ĩāŪέç óáέñŪ áñέèιβι íá ðāñŪ āñPāñá áðυ ðçι ĩέυιç óáð, éáé ĩáðŪ áðυ έβāá äáððāñυέáððá ç áέάάέέάόβá éá Y÷áé ĩέιέεçñèέáβ. ĩ ðυιιð éá Y÷áé äçιέιòñāçéáβ éáé éá áβιáé Yðιέιιð áéá ðñιóŪñðçóç.

Άέά íá ðñιόáñðPóáðá ÷áέññέβιçóá ðι stripe ðιð äçιέιòñāPóáðá:

```
# mount /dev/stripe/st0a /mnt
```

Άέá íá áβιáðáé áððυιáðá ç ðñιóŪñðçóç áððιγ ðιð óðóðPιáðιð áñ÷áβυí éáóŪ ðçι áέάάέέάόβá áέέβιçóçð, ðιðιέáðPðáð ðéð ðεçñιòññáð ðιð ðυιιð óðι áñ÷áβι /etc/fstab. Άέá ðι óέιðυ áððυ, äçιέιòñāγιá Yίá ĩυιέιι óçιáβι ðñιóŪñðçóçð, ðι stripe:

```
# mkdir /stripe
# echo "/dev/stripe/st0a /stripe ufs rw 2 2" \
  >> /etc/fstab
```

Óι Ūñèñυιá geom\_stripe.ko éá ðñYðáé íá ðñιðPιáðáé áððυιáðá éáóŪ ðçι áέέβιçóç ðιð óðóðPιáðιð. ΆέðáéYóðá ðçι ðāñáέŪðυ áíðιέP, áέá íá ðñιóέYóáðá ðçι éáóŪέέççç ñγέιέóç óðι /boot/loader.conf:

```
# echo 'geom_stripe_load="YES"' >> /boot/loader.conf
```

## 19.4 RAID1 - Mirroring

Óι mirroring (έáέñāðééοιυð) áβιáé íéá ðá÷ñιέιāβá ðιð ÷ñçóέιιðιέáβðáé áðυ ðιέéYð áðáέññáð éáé ĩéééáέιγð ÷ñPðóáð áéá íá áóóáέβοιρι óá äāñYίá ðιðð ÷ññð áéáέιðYð. Óá íéá äéŪðáιç mirror, ĩ áβóέιð Á áβιáé áðεpð Yίá ðεPñáð áίðβāñáοι ðιð áβóέιð Á. <sup>1</sup> ĩðñāβ ĩé áβóέιé Ā+Ā íá áβιáé áίðβāñáðá ðυι áβóέυι A+B. ¶ó÷áðá ĩá ðçι áέñéáP äéŪðáιç ðυι áβóέυι, ðι óçιáίóέέυι áβιáé υðé ĩé ðεçñιòññáð áñυð áβóέιð P ĩéáð éáóŪðιççóçð áίðéāñŪοιιðáé óá Ūέέιðð. ĩé ðεçñιòññáð áððYð ĩðñāβ áñāυðāñá íá áðιέáðáóóáέγιí ĩá áγέιέι ðñυðι, P íá áίðéāñáοιγί ÷ññβð íá ðñιέéçðéáβ áέáέιðP óðéð ððçñāóβáð ðιð ĩç÷áιPιáðιð P óðçι ðñυðááóç ðυι äāñYίñι. ĩðñιγί áέυιá éáé íá ĩáðáóāññέγί éáé íá ððéá÷έιγί óá Ūέέι, áóóáéYð ĩYñιð.

Άέá íá ĩáέέιPðáðá, äāááέυèέáβðá υðé ðι óγóóçιá óáð Y÷áé äγί óέéçñιγð áβóέιðð βáέιð ĩāYέιðð. Óðá ðāñāááβāñáðá ĩáð éāññιγίá υðé ĩé áβóέιé áβιáé óγðιð SCSI (áðáðéáβáð ðñυóááóçð, da(4)).

### 19.4.1 Mirroring óðιðð Ááóéέιγð Άβóέιðð

ÓðιέYðιιðáð υðé ðι FreeBSD Y÷áé äáéáðáóóáéáβ óðιð ðñPðι áβóέι da0, éá ðñYðáé íá ñðέιβóáðá ðι gmirror(8) íá áðιéçéáγóáé áéáβ óá ááóéέŪ äāñYίá ðιð.

ðñέι äçιέιòñāPóáðá ðι mirror, áñāñāñιέPðáð ðçι áðιáðυðçðá äιðŪιέóçð ðāñéóóυðāñυι éáððññāñéβι (ðιð ĩðñāβ íá óáð äιççèPοιρι óá ðāñβððυðç ðñιáéPιáðιð) éáé áðéðñYððá ðçι áðáðéáβáð ðñυóááóç óðç óðóέáðP áβóέιð. Άέá ðι óέιðυ áððυ èYóðá ðç ĩáðááéççP kern.geom.debugflags ðιð sysctl(8) óðçι ðāñáέŪðυ ðέιP:

```
# sysctl kern.geom.debugflags=17
```

Ἰðññáβðá ðññá íá äçìéíðñáÐóáðá ðì mirror. ἸáέéíÐóóá ðç äéááééáóβá áðñέçéáññíðáð ðá ìáðá-ääññÝíá (meta-data) óðñí ááóééú äβóéì, äçìéíðñáÐíóáð ððóéáóðééÛ ðç óðóéáðÐ /dev/mirror/gm. ×ñçóéñíðñéÐóóá ðçí ðáñáéÛðù áíðñéÐ:

**Ðññáéáñðñçóç:** Ç äçìéíðñáβá mirror óðñí äβóéì áéêéβíçóçò ìðññáβ íá Ý÷-áé ùð áðñéçéáóíá ðçí áðβéáéá äääññÝíúí, áí ðáéáððáβñò ðññÝáð ðñò äβóéñò Ý÷-áé Ðáç ÷ñçóéñíðñéçéáβ. Ç ðééáíùðçðá áððβ ἄβñáé ðñéý ìéêñùðáñç áí ðì mirror äçìéíðñáçéáβ áíÝóùð ìáðÛ áðù ìéá íÝá äáéáðÛðóáóç ðñò FreeBSD.

```
# gmirror label -vb round-robin gm0 /dev/da0
```

Óñ óýóðçíá éá áíðáðñéñééáβ ìá ðñ ðáñáéÛðù ìÐñíá:

Metadata value stored on /dev/da0.  
Done.

Ἄñ ÷éñíðñéÐóóá ðì GEOM. Ç ðáñáéÛðù áíðñéÐ éá ðññðβóáé ðì ὐñññúíá /boot/kernel/geom\_mirror.ko óðñí ððñβíá:

```
# gmirror load
```

**Óçñáβùòç:** ìá ðçí áðéðð÷Ð áéðÝéáóç áððβð ðçð áíðñéÐð, äçìéíðñáβðáé ç óðóéáðÐ gm0 ìÝóá óðñí éáðÛéññí /dev/mirror.

ἈññáññíðñéÐóóá ðì ðññðùíá ðñò áññññáðñð geom\_mirror.ko éáðÛ ðçí áéêéβíçóç ðñò óðóðÐñáíð:

```
# echo 'geom_mirror_load="YES"' >> /boot/loader.conf
```

Ἀðñáññááóðáβðá ðì áñ ÷áβñ /etc/fstab, áíðééáééóðβñóáð ðéð áíáðññÝð ðéðð ðáééÝð ððóéáðÝð da0 ìá ðéð áíðβóðñé ÷áð éáéññéáð gm0 ðñò áíðéðññíóùððáññí ðì mirror.

**Óçñáβùòç:** Ἄí ÷ñçóéñíðñéáβðá ðì vi(1), ìðññáβðá íá áéññéðèβóáðá ðá ðáñáéÛðù áβñáðá áéá íá ðñééççñβóáðá áýéñéá áððβ ðç äéááééáóβá:

```
# vi /etc/fstab
```

Óðñí vi(1), éñáðβóðá áíðβáññáðñí áóðáéáβáð ðñò ðññÝ ÷ññíðñò áñ ÷áβññò fstab ðéçéðññéñáβñóáð :w /etc/fstab.bak. ðáéðá áíðééáðáóðβðá ùéáð ðéð áíáðññÝð ðéðð ðáééÝð ððóéáðÝð da0 ìá ðéð ìÝáð gm0 áñÛññíðáð :%s/da/mirror/gm/g.

Óñ fstab ðñò éá ðññéçýðáé, éá ðñéÛæáé ìá ðñ ðáñáéÛðù. Ἄáí Ý÷-áé óçñáóβá áí ðñ äβóéñé Ððáí áñ ÷éÛ SCSI Ð ATA, ç óðóéáðÐ RAID éá Ý÷-áé ðÛñíðá ðñ ùññá gm.

# Device	Mountpoint	FStype	Options	Dump	Pass#
/dev/mirror/gm0s1b	none	swap	sw	0	0
/dev/mirror/gm0s1a	/	ufs	rw	1	1
/dev/mirror/gm0s1d	/usr	ufs	rw	0	0
/dev/mirror/gm0s1f	/home	ufs	rw	2	2
#/dev/mirror/gm0s2d	/store	ufs	rw	2	2
/dev/mirror/gm0s1e	/var	ufs	rw	2	2

```
/dev/acd0          /cdrom            cd9660            ro,noauto 0          0
```

ἈθάíáέέείPóðά ðι óγóðçιά:

```
# shutdown -r now
```

Ἐὰὸὔ ðçι ἄέέβίçóç ðιð óðóðPιáðιð, εά ðñÝðáέ ðεÝíι íá ÷ñçóέιιðιέáβóáέ ç óðóέáðP gm0 áίðβ ἄέά ðçι da0. Ἰὰὸὔ ðι ÓÝεìð ðçð ἄέέβίçóçð, ìðñáβðά íá ἄεÝáíáðά úέε úεά εάέðιðñáιγí óúóðὔ, ἄíáðὔεííðáð ðçι Ýíñáι ðçð áίðιεPð mount:

```
# mount
```

Filesystem	1K-blocks	Used	Avail	Capacity	Mounted on
/dev/mirror/gm0s1a	1012974	224604	707334	24%	/
devfs	1	1	0	100%	/dev
/dev/mirror/gm0s1f	45970182	28596	42263972	0%	/home
/dev/mirror/gm0s1d	6090094	1348356	4254532	24%	/usr
/dev/mirror/gm0s1e	3045006	2241420	559986	80%	/var
devfs	1	1	0	100%	/var/named/dev

Ç Ýíñáìð óáβíáðáέ óúóðP, ùððð áíáíáíúóáí. Óáέέὔ, ἄέά íá íáέείPóáέ ðι óðá÷ññίέóìùð, ἄέóὔááðά εάέ ðçι óðóέáðP da1 ðοí mirror, ÷ñçóέιιðιέPíðáð ðçι ἄέüεìðèç áίðιεP:

```
# gmirror insert gm0 /dev/dal
```

Ἐὰὸὔ ðç ἄέὔñέάέá ðιð óðá÷ññίέóìγ ðιð mirror, ìðñáβðά íá ááβðά ðçι ðññáι ðçð ἄέάáέέáóβáð ìá ðçι ðáñáέὔðù áίðιεP:

```
# gmirror status
```

Ἰὰὸὔ ðι ðÝεìð ðçð áüìçóçð ðιð mirror, εάέ áóγÝ Ý ÷ìð óðá÷ññίέóðáβ úεά ðá ááññÝíá, ç Ýíñáìð ðçð ðáñáðὔíù áίðιεPð εά ñέὔæáέ ìá ðçι ἄέüεìðèç:

Name	Status	Components
mirror/gm0	COMPLETE	da0
		dal

Αί ððὔñ÷ìð ðññáέPιáðά, P áí ðι mirror ἄñβóέáðáέ ἄέüìá óçç ἄέάáέέáóβá óðá÷ññίέóìγ, ðι ðáñὔááέáìá εά ááβ÷íáέ DEGRADED áίðβ ἄέά COMPLETE.

## 19.4.2 ΑίðέìáðPðέóç ðññáέçìὔðùι

### 19.4.2.1 Οί óγóðçιά ἄñíáβðáέ íá íáέείPóáέ

Αί ðι óγóðçιά óáð óðáíáðὔáέ óá ðéá ðññóññìð ðιð ñέὔæáέ ìá ðçι ðáñáέὔðù:

```
ffs_mountroot: can't find rootvp
Root mount failed: 6
mountroot>
```

ἈθάíáέέείPóðά ðι óγóðçιά óáð ðÝóù ðιð ἄέáέüððç ðññíáíóβáð P ðιð ðεPèðñìð reset. Óðι ìáñγ ἄέέβίçóçð, ἄðέε Ýíðá ðι (6). Ἰá ðιí ðññðì áððù εá ἄñáèáβðά óðçí ðññìðñìð ðιð loader(8). ΟίñðPóðá ÷áέññίέβίçóá ðι ὔñèñùìá ðοίí ððñPíá:

```
OK? load geom_mirror
```







```
# glabel label rootfs /dev/ad0s1a
GEOM_LABEL: Label for provider /dev/ad0s1a is label/rootfs
# glabel label var /dev/ad0s1d
GEOM_LABEL: Label for provider /dev/ad0s1d is label/var
# glabel label usr /dev/ad0s1f
GEOM_LABEL: Label for provider /dev/ad0s1f is label/usr
# glabel label tmp /dev/ad0s1e
GEOM_LABEL: Label for provider /dev/ad0s1e is label/tmp
# glabel label swap /dev/ad0s1b
GEOM_LABEL: Label for provider /dev/ad0s1b is label/swap
# exit
```

Ç äέέβιçóç έά όóíá÷έόóáβ έάíííέέÛ έάέ όι όýóóçíá έά Ýέέáέ όά έάóÛóóáóç ðíέέáðέβι ÷ñçóðβι (multi-user). ÌáðÛ όι όÝέíò çðç äέέβιçóçð, áðáíáñááóóáðóá όι áñ÷áβι /etc/fstab έάέ áέέÛíóá όá όóíááóέέÛ ííúíáóá óóóέáðβι ìá óέó áíóβóóιέ÷áð áóέέÝóáð. Óι óáέέέυι áñ÷áβι /etc/fstab έá ñέÛáέέ ìá όι ðáñáέÛóù:

# Device	Mountpoint	FStype	Options	Dump	Pass#
/dev/label/swap	none	swap	sw	0	0
/dev/label/rootfs	/	ufs	rw	1	1
/dev/label/tmp	/tmp	ufs	rw	2	2
/dev/label/usr	/usr	ufs	rw	2	2
/dev/label/var	/var	ufs	rw	2	2

Ìðñáβóá ðβñá íá áðáíáέέέβιβóáð όι όýóóçíá. Άí úέá ðβááí έάέÛ, ç äέέβιçóç έá áβíáέ έάíííέέβ, έάέ ç áíóíέβ mount έá äáβíáέ:

```
# mount
/dev/label/rootfs on / (ufs, local)
devfs on /dev (devfs, local)
/dev/label/tmp on /tmp (ufs, local, soft-updates)
/dev/label/usr on /usr (ufs, local, soft-updates)
/dev/label/var on /var (ufs, local, soft-updates)
```

Ìáέέβιçóç áðú όι FreeBSD 7.2, όι glabel(8) ððíóçñβáέέ Ýíá íÝí áβáñð áóέέÝóáð áέá óóóðβíáóá áñ÷áβúí UFS, ðíò ááóβáέáóέ όá Ýíá ñííáέέáβι áíááññέóóέέέυι όíòð, όι ufsid. Ìέ áóέέÝóáð áóóÝð áñβóέííóáέ óóíí έáóÛέíáí /dev/ufsíd, áçíέíòñáñýíóáέ áóóúíáóá έáóÛ ðçí äέέβιçóç ðíò óóóðβíáóíð έάέ áβíáέ áóíáóúí íá ÷ñçóέííðíέçέíñýí áέá ðçí ðñíóÛñóçç έáóáóìβóáùí íÝóù όíò /etc/fstab. Ìðñáβóá íá ÷ñçóέííðíέβóáðá ðçí áíóíέβ glabel status áέá íá έÛááðá íέá έβóóá ðúí óóóðçíÛóùí áñ÷áβúí ìá óέó áíóβóóιέ÷áð ufsid áóέέÝóáð όíòð:

```
% glabel status
Name Status Components
ufsíd/486b6fc38d330916 N/A ad4s1d
ufsíd/486b6fc16926168e N/A ad4s1f
```

Óοι ðáñáðÛíú ðáñÛááέάíá, όι ad4s1d áíóέðñíóúðáγáέ όι όýóóçíá áñ÷áβúí /var, áñβ όι ad4s1f áíóέðñíóúðáγáέ όι όýóóçíá áñ÷áβúí /usr. ×ñçóέííðíέβíóáð óέó óέíÝð ufsid ðíò óáβíñíóáέ, ç ðñíóÛñóçç áóðβι ðúí έáóáóìβóáùí ìðñáβ íá áβíáέ ìá óέó ðáñáέÛóù έáóá÷ùñβóáέð óóí /etc/fstab:

/dev/ufsíd/486b6fc38d330916	/var	ufs	rw	2	2
/dev/ufsíd/486b6fc16926168e	/usr	ufs	rw	2	2

Ìðíέááβðíóá έáóÛóιçóç áέáέÝóáέ áíááññέóóέέέυι ufsíd ìðñáβ íá ðñíóáñóçέáβ ìá όíí βáέí ðñúðí, ÷ùñβð íá ððÛñ÷áέ ðέÝíí áíÛáέç íá áçíέíòñáçέáβ ìúíέιç áóέέÝóá ÷áέñíέβιçóá. Ç ðñíóÛñóçç íÝóù áóέέÝóáð ufsíd, ðáñÝ÷áέ όι ðέáñÝέóçíá ðçð áíáíáñóçóβáð áðú όι úññá óóóέáðβð, όι íðíβι ðáñÝ÷íóí έάέ íέ ìúíέíáð áóέέÝóáð.

## 19.7 UFS Journaling ἸΎού GEOM

Όζι Ψέαιός 7.0 οἷο FreeBSD οέιθιέάβθαέ αέα δñþοç öñÙ ç ἱΎά (έάέ áδὺ θιέειΎο áίáiáíúíáιç) άοίáóúøçόά αέα ÷ñþοç çíññιíāβιò (journal) οοί ογόοçιά άñ÷άβυί UFS. Ç οέιθιβçος δάνΎ÷άοάέ ἸΎού οἷο οθιόόόθιáοιò GEOM έάέ ἰθιñáβ ἱά ñòèιέόάβ áγέιέά ἸΎού οἷο áιçøçόέειΎ δñññÙññáοιò gjournal(8).

Όέ άβίάέ οἷ journaling; Όἷ journaling άθιέçέáγáέ οά Ἰίá άñ÷άβι έάόάññáòþò (log, çíññιíúáiει, þ άðέþò journal) οέò οοίάέέάΎò οἷο οόóóþιáοιò άñ÷άβυί. δάνÙáάέáñά οοίάέέάþò άβίάέ ἱέ áέέάáΎò οἷο άδαέοιγίόάέ αέα ἱέα δέþñç έάέάέέάóá áāñáòþò οοί άβóει. óé, οοί log άθιέçέáγίíόάέ ἱέ áέέááΎò οóά ἱáóá-άάññΎίá (meta-data) έάέ οóά βáέά óά άñ÷άβá, δñέι άβίάέ ç δάέέέþ (έáññιέέþ) άθιέþέáόøç οἷòð οοί άβóει. Όἷ άñ÷άβι έáόάáñáòþò ἰθιñáβ άññúδάñά ἱά ἱáίá÷ñçόέιθιέçέáβ þóδá ç οοίáέέάáþ ἱά άβίáέ áδὺ øçι άñ÷þ, áíáóóáέβáειíόáð ἱά áóòυ οἷι δññυθι ἡóέ οἷ ογόοçιά άñ÷άβυί έά δάñáñáβίáέ οá οóάέáñþ έáóÙóóáóç.

δññúέάέόάέ ἱóóéáóééÛ αέα ἱέα áέυιá ἱΎέηαι δññöγέáιçò áδὺ άðþέáέá ááññΎίúι έάέ áóοίΎðάέáð οοί ογόοçιά άñ÷άβυί. Όá áíòβέáóç ἱά óá Soft Updates óά ἰθιβá áίóιðβáειθι έάέ οðι÷ñáþñιò øçι Ûñáóç ááññáòþ ουι ἱáóá-άάññΎίúι, έάέ ουι óóéáñιéíøγðυι (Snapshots) óά ἰθιβá άβίáέ áέέυιáð οἷο οόóóþιáοιò άñ÷άβυί οá ἱέα ááññΎίç óóéáñþ, οἷ log άθιέçέáγáόάέ οá ÷þñι οἷο Ύ÷áέ áê÷ññçáβ áέάέéÛ αέα áóòυ οἷ óειθυ, έάέ οá ἱáñéέΎò δáñéððóáéò ἰθιñáβ ἱά άθιέçέáγáόάέ οá áíòáεþò áέáοιñáóééυ άβóει.

Όá áíòβέáóç ἱά οέιθιέþóáéò journaling οá Ûέéá οόóóþιáóá άñ÷άβυί, ç ἱΎέηαιò gjournal ááóβááóáέ οá blocks, έάέ áái οέιθιέáβóáέ ἡò ἱΎñιò οἷο οόóóþιáοιò άñ÷άβυί, áέéÛ ἱιιñ ἡò άðΎέóáóç οἷο GEOM.

Άέα áíáññáññιβçος øçò οθιόóþñέιçð gjournal, έá δñΎðáέ ἱά οðÛñ÷áέ ç δáñáέÛòυ άðέέειāþ οοίí δðñþíá οἷο FreeBSD. Ç άðέέειāþ áóðþ οðÛñ÷áέ áδὺ δññíáðέέειāþ óóá οόóóþιáóá 7.x:

```
options UFS_GJOURNAL
```

Άί ÷ñáέÛáóáέ ἱά δññíóáñòþιóáέ óυιιέ ἱá journaling έáóÛ øçι áέέβιçος, έá δñΎðáέ áðβóçò ἱά οἷñòþíáóáέ áóòυἱáóá έάέ οἷ Ûñññιá δðñþíá geom\_journal.ko. Άέα οἷ óειθυ áóòυ, δññιéΎóóá øçι δáñáέÛòυ áñáñþ οοί άñ÷άβι /boot/loader.conf:

```
geom_journal_load="YES"
```

ΆíáέéáέóééÛ, ç έάέοιθñάβá áóðþ ἰθιñáβ ἱά áíóυἱáóòéáβ οá Ἰίá δññíóáññιóίΎñ δðñþíá, ἱá øçι δññιéþéç øçò δáñáέÛòυ áñáñþò οοί áíòβóóιέ÷ι άñ÷άβι ñòèιβóáυí:

```
options GEOM_JOURNAL
```

Ç äçιέíθñάβá journal οá Ἰίá áéáγέáññι ογόοçιά άñ÷άβυί, ἰθιñáβ øþñά ἱά άβίáέ ἱá óά áέυειθéá áþιáóá, έáññþíóáð ἡóé ç óóééáðþ da4 άβίáέ Ἰίáð ἱΎιò άβóειò SCSI:

```
# gjournal label /dev/da4
# gjournal load
```

Όοί øçιáβι áóòυ έá οðÛñ÷áέ ἱέα óóééáðþ /dev/da4 έáέþò έάέ ἱέα óóééáðþ /dev/da4.journal. Όòç óóééáðþ áóðþ ἰθιñáβóá øþñά ἱά äçιέíθñάþóáóá ογόοçιά άñ÷άβυί:

```
# newfs -O 2 -J /dev/da4.journal
```

Ç δάñáðÛñ áίòιéþ έá äçιέíθñάþóáέ Ἰίá ογόοçιά άñ÷άβυί UFS2 έάέ óáóòυ÷ññιά έá áíáññáññιéþóáέ οἷ journaling.

Ἰθιñáβóá ἱá ÷ñçóέññιéþóáóá øçι áίòιéþ mount αέα ἱά δññíóáñòþóáóá øçι óóééáðþ οοί άðέéðιçòυ øçιáβι δññιòÛñòçòçò, ἡðυò óáβíáóáέ δáñáέÛòυ:



# ΕὰοÛεάεί 20 ÕðìóòÞñείç ÓóóôçìÛòùí Áñ÷âßùí

ÃñÛôçêá áðu òìí Tom Rhodes.

## 20.1 Óýñïç

Ôá óðóðÞιάόά áñ÷âßùí áðìòáείγí áíáðuòðáóòì òìÞιά εÛεá εάεòìòñáεείγ óðóðÞιάòìð. ÁðεòñÝðìòì óòìòð ÷ ñÞóóáð ñáçìεìòñáγí εάε íá áðìεçεάγíòì áñ÷âßá, ðáñÝ÷ìòì ðñùóááóç óá áááñÝíá, εάε òóóεéÛ áíεìðìείγí òìòð óεεçñìγò ãßóεìòð. ÁεάóìòñáóεéÛ εάεòìòñáεéÛ óðóðÞιάόά ÷ ñçóεìòðìείγí óòìÞεùð áεάóìòñáóεéÛ ááááíÞ óðóðÞιάόά áñ÷âßùí. Õì óýóóçιά áñ÷âßùí òìò FreeBSD áßιάέ òì Fast File System Þ FFS, òì ðìòìßì ðñìÞεéá áðu òì áñ÷εéù óýóóçιά áñ÷âßùí òìò Unix™, áñùóòù áðßóçð εάε ùð UFS. Áóòù áßιάέ εάε òì ááááíÝð óýóóçιά áñ÷âßùí òìò FreeBSD, òì ðìòìßì ÷ ñçóεìòðìεάßóáé óòìòð óεεçñìγò ãßóεìòð εάε ðñìóóÝñáε ðñùóááóç óóá áááñÝíá.

Õì FreeBSD ðñìóóÝñáε áðßóçð ðεçεÞñá áεάóìòñáóεéÞì óðóóçìÛòùí áñ÷âßùí, Þóóá íá ðáñÝ÷ìé òìðéεÞ ðñùóááóç óá áááñÝíá ðìò Ý÷ìòì áçìεìòñáçεáß áðu Ûεεá εάεòìòñáεéÛ óðóðÞιάόά, ð. ÷. áááñÝíá ðìò áñßóεìòçάé óá òìðééÛ USB áðìεçεάóðóééÛ ñÝóá, ñáçáìγò flash, εάε óεεçñìγò ãßóεìòð. ÕðÛñ÷áé áðßóçð óðìóóðñείç áεá Ûεεá, ñç-ááááíÞ óðóðÞιάόά áñ÷âßùí, ùðuð òì Extended File System (EXT) òìò Linux εάεÞð εάε òì óýóóçιά Z File System (ZFS) òçð Sun.

Õì FreeBSD ðáñÝ÷ìé áεάóìòñáóεéù áðßðááì òðìóóðñείçð áεá εÛεá óýóóçιά áñ÷âßùí. Áεά ñεóìÝíá εá ÷ ñáεáóóáß íá òìòðéáß εÛðìεì Ûñεñùíá óòìò ðòñÞιά, áñÞ áεá Ûεεá εá ðñÝðáε íá ááεάóáóóáείγí εÛðìεá áñááéáßá. Õì εάοÛεάεί áóòù Ý÷ìé ó÷áεάóóáß íá áñçεÞóáé òìòð ÷ ñÞóóáð òìò FreeBSD íá áðìεòÞóìòì ðñùóááóç óá Ûεεá óðóðÞιάόά áñ÷âßùí óòì óýóóçιά òìòð, ñáεéÞìðáð áðu òì Æ File System òçð Sun.

Áóìγ áεάáÛóáðá áóòù òì εάοÛεάεί, εá áññßáεáð:

- Õç áεάóìòÛ ñáóáγ òùí ááááíÞì εάε òùí òðìóóçñεáùíáñùí óðóóçìÛòùí áñ÷âßùí.
- ðìεá óðóðÞιάόά áñ÷âßùí òðìóóçñßáεìòçάé áðu òì FreeBSD.
- ðùð íá áñáñáðìεÞóáðá, íá ñòεìßóáðá, íá áðìεòÞóáðá ðñùóááóç εάε íá ÷ ñçóεìòðìεÞóáðá ñç-ááááíÞ óðóðÞιάόά áñ÷âßùí.

ðñεί áεάáÛóáðá áóòù òì εάοÛεάεί, εá ðñÝðáε:

- Íá εάóáñíáßóá ááóééÝð Ýñíεáð òìò UNIX εάε òìò FreeBSD (ΕὰοÛεάεί 3).
- Íá áßóðá áñεéáεùíÝñò ñá óεð ááóééÝð áεάáεéáóáð ñγέìεóçð εάε ááεáðÛóáóçð ðñìóáñìòìÝñò ðòñÞιά (ΕὰοÛεάεί 8).
- Íá áεóéÛíáóóá Ûíáðá ñá òçì ááεáðÛóáóç áóáñìáÞì ðñßòìò εάóáóéáðáóðÞ òòì FreeBSD (ΕὰοÛεάεί 4).
- Íá áßóðá áñεéáεùíÝñò ñá òìòð ãßóεìòð, óá ñÝóá áðìεÞεáðóçð, εάε óá áíòßóòìε÷á ññùíáðá óðóéáðÞì òòì FreeBSD (ΕὰοÛεάεί 18).

## 20.2 Õì Óýóóçιά Áñ÷âßùí Z (ZFS)

Õì óýóóçιά áñ÷âßùí Z, áíáðòγ÷εçεá áðu òçì Sun, εάε áßιάέ ñεá ñÝá ðá÷ñεìáßá ðìò ó÷áεéÛóðçεá áεá íá ðáñÝ÷ìé áðìεÞεáðóç ñÝóò òçð ñáεùíò pool. Áóòù óçιάßιάé ùðε ùεìò ñáεáγεáñìò ÷ Þñìò áεάóðεáðáé ùð áðuεáìá, εάε áεáÝíáðáé áðìáéεÛ óá εÛεá óýóóçιά áñ÷âßùí áíÛεìáá ñá óεð áíÛáεáð áðìεÞεáðóçð áááñÝñùí. ÷ áé áðßóçð

ó÷ââéáóóâβ áéá òç ìÝáéóðç áéâñáéιúçðá äâññÝíιι éáé òδιδόçñβæáé óðéâιέιúðððá (snapshots) äâññÝíιι, ðíééáðéὺ áιðβññáóá éáé áèñιβóιáóá äéÝã÷ìò äâññÝíιι (checksums). ÷âé áéιιá ðñιόðâéâβ Ýíá íÝι ιιíóÝèι áéá òç áéáðΠñçóç áιðéâñὺòιι òιι äâññÝíιι, áιιúóðι ùð RAID-Z. Ὀι ιιíóÝèι RAID-Z âβιáé ðáñιιιèι ιâ òι RAID5 áééὺ âβιáé ó÷ââéáóιÝιι ιá ðáñÝ ÷âé ðñιόðáóβá òιι äâññÝíιι éáóὺ òçι äâññáðð òιòð.

### 20.2.1 Ἀâéðéóòιðιβçóç òιò ZFS

Ὀι òδιδόçðçιá ZFS ÷ñçóéιιðíéâβ áñéâðιγð ðñιιòð òιò óðóðΠιáðιò. Ἀâéðéóòιðíéβιðáð ðéð ñðèιβóáéð òιò óðóðΠιáðιò óáð, éá áðéóγ÷âð òç ìÝáéóðç áðιιáιòç óóçι éáèçιâñéιP ÷ñPóç. Έáèðð òι ZFS âβιáé áéιιá óá ðáéñáιáðééι òóὺâéι òιι FreeBSD, áðòι βòòð áééὺÝιáé ιâéèιðééὺ. ὺòòιι, áéá òçι πñá, óðιβóðáðáé ιá áéιèιòèPóáðá óá ðáñáéὺðò âΠιáðá:

#### 20.2.1.1 ΙίΠιç

Ὀι óðíééèὺ ìÝáâéιò ιίΠιçð òιò óðóðΠιáðιò ðñÝðáé ιá âβιáé òιòéὺ÷éóòιι Ýíá gigabyte, áπð òι óðíééðβιáñι ìÝáâéιò âβιáé äγι gigabytes P éáé ðáñéóóòιðáñι. Ὀá ùéá óá ðáñáââβâιáóá ðιò óáβιιúðáé äâð, òι óγóðçιá Ý÷âé Ýíá gigabyte ιίΠιçð éáé Ý÷ìòιá áðβóçð äâéðéóòιðíéβιðáé ðéð ñðèιβóáéð òιò.

ΙñéóιÝíé ÷ñPóðáð òáβιáðáé ιá óá éáóáóÝññιòι éáé ιâ ééâιðáñι áðιι Ýíá gigabyte ιίΠιçð, áééὺ ιâ òÝòιèòð ðáñéιñéóιγð òðóéèPð ιίΠιçð, âβιáé áñéâðὺ ðééáíι ιá äçèιòñâçèâβ panic éὺòι áðιι ááñý òιòðβι ãñááóβáð, áιáéóβáð áιὺíðèççð òçð.

#### 20.2.1.2 Νýèιéóç òιò ÐòñΠιá

Ὀóιβóðáðáé ιá áóáéñÝóáðá óá ðññáñὺιιáóá ιâβççðð éáé ðéð áðééιãÝð ðιò äáι ÷ñçóéιιðíéâβðá áðιι òι äñ÷âβι ñðèιβóáιι òιò ðòñΠιá. Έáèðð ιé ðáñéóóòιðáñιè ιãçñιβ òðóéâðβι áéáððèáíóáé áðβóçð éáé óá ιñòP áñéñιιὺòιι, ιðññáβðá áðéὺ ιá òιòð òιñòPóáðá ÷ñçóéιιðíéβιðáð òι äñ÷âβι /boot/loader.conf.

Ιé ÷ñPóðáð òçð äñ÷éðâéðíéèPð 1386 éá ðñÝðáé ιá ðñιòéÝòιòι òçι ðáñáéὺðò äðééιãP òòι äñ÷âβι ñðèιβóáιι òιò ðòñΠιá òιòð, ιá òιι áðáιáιáðáâéèððòβòιòι éáé ιá áðáιáèééιPóιòι òι óγóðçιá òιòð:

```
options KVA_PAGES=512
```

Ç áðééιãP áðòP éá áéáðñγιáé òçι ðáñéι÷P áéáððéγιόáιι òιò ðòñΠιá, áðéòñÝðιιðáð Ýðóé òçι áγιççç ðéιPð òçð ñðèιéóðéèPð ιâðáâèççòPð vm.kvm\_size ðÝñá áðιι òι òñÝ÷ìò òιò 1 GB (2 GB áéá ðòñΠιáð PAE). Ἀéá ιá áñáβðá òçι éáðáéèççèððáñç ðéιP áéá áðòP òçι áðééιãP, áéáéñÝóðá òι áðééòιçòιι ìÝáâéιò òçð ðáñéι÷Pð áéáððéγιόáιι ιâ òι òÝóóáñá (4). Ὀçι ðáñβððòç áðòP, Ý÷ìòιá 512 áéá ìÝáâéιò 2 GB.

#### 20.2.1.3 Νðèιβóáéð óðéð ΙáðáâèççòÝð òιò Loader

Έá ðñÝðáé ιá áðιçèâβ ç ðáñéι÷P áéáððéγιόáιι kmem óá ùéâð ðéð äñ÷éðâéðíééÝð òιò FreeBSD. Ὀòι äñééιáðééèὺ ιáð óγóðçιá, ιâ Ýíá gigabyte òðóéèPð ιίΠιçð, áβ÷âι áðéðð÷çιÝιι áðιòÝéáóιá ÷ñçóéιιðíéβιðáð ðéð áéιèιòèâð áðééιãÝð òòι äñ÷âβι /boot/loader.conf éáé áðáιáèééβιðáð òι óγóðçιá ιáð:

```
vm.kmem_size="330M"
vm.kmem_size_max="330M"
vfs.zfs.arc_max="40M"
vfs.zfs.vdev.cache.size="5M"
```

Ἀéá áιáéòðééèὺòáñáð ñðèιβóáéð ó÷âðéèὺ ιâ òçι äâéðéóòιðιβççóç òιò ZFS, äâβðá òι <http://wiki.freebsd.org/ZFSTuningGuide>.

## 20.2.2 ×ñζοείιιδιέπιδάο οι ZFS

Οδΰñ÷άε Ύιάδ ιζ÷άιέοιυδ άέέβιζόζδ οϊδ άδέονΎδάέ οοϊ FreeBSD ίά δñιόάνδΠοάέ ZFS pools έάδΰ όζ άέΰñέάέ όζδ άέέβιζόζδ οϊδ οδδδΠιαδιδ. Άέά ίά οϊδ ñέιβδδάδ, άέδάεΎδδά δεδ άέυειδεδάδ άίδιδέΎδ:

```
# echo 'zfs_enable="YES"' >> /etc/rc.conf
# /etc/rc.d/zfs start
```

Οϊ οδυειδιδι άοδιδι οϊδ έάειΎιñ οδιδέΎδάέ υδεδ Ύ÷άδδ άέάεΎοείδδδ δñάεδ SCSI άβδεδδδ, έάέ υδεδ δά ιñιιάδδ οδδεδάδπιδ οϊδδ άβιάέ da0, da1 έάέ da2. Ύδιδέ άέάεΎοιδι άβδεδδδ IDE έά δñΎδάέ ίά ÷ñζοείιιδιέπιδοιδι οδδέάδΎδ οϊδ ογδιδδ ad άίδδβ άέά δεδ άίδδβδιδέ÷άδ SCSI.

### 20.2.2.1 Pool ιά ίά ιυñι Άβδεδι

Άέά όζι άζιείδñάβδ άιυδ ZFS pool ιά Ύιά ιυñι άβδεδι (÷ññβδ άδιδάδδδζδδ άι÷Πδ οδδάειΰδουί), ÷ñζοείιιδιέπιδά όζι άίδιδέΠ zpool:

```
# zpool create example /dev/da0
```

Άέά ίά άάβδδδ οϊ ρΎι pool, άιδδΰδδδ όζι Ύιñι όζδ άίδιδέΠδ 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 Ύιñιδδ άδδΠ άάβ÷ιάέ έάέάνΰ υδεδ οϊ example pool υ÷έ ιυñι Ύ÷άέ άζιείδñάζεδάβ, άέέΰ Ύ÷άέ άδβδζδδ δñιόάνδζεδάβ έέυεδδ. Άβιάέ άδβδζδδ άέάεΎοείι υδ έάιñιέευ ογδδζιά άñ÷άβυί, ιδñιάβδδ ίά άζιείδñάβδδδδ άñ÷άβδ δά άδδδ, έάέ ΰέειέ ÷ñΠδδδδδ ιδñιñι άδβδζδδ ίά οϊ άιδι, υδδδδ οάβιδάδέ οοιδ δάñάέΰδδ δάñΰάέάι:

```
# 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
```

Άδδδδδ÷Πδ άδδδδ οϊ pool άάι ÷ñζοείιιδιέάβ έΰδιδιέ άδδ δά δέάιñάέδΠιαδδδ οϊδ ZFS. Άζιείδñάβδδδ Ύιά ογδδζιά άñ÷άβυί δά άδδδδ οϊ pool έάέ άίñιñιιδιέπιδδδδ δά άδδδδ όζ οδιδβδδζδ:

```
# zfs create example/compressed
# zfs set compression=gzip example/compressed
```

Οϊ ογδδζιά άñ÷άβυί example/compressed άβιάέ δέΎι Ύιά οδιδέάοιΎιñι ZFS ογδδζιά. Άιέειΰδδδ ίά άιδέάνΰδδδδ ιάñέέΰ ιάάΰέά άñ÷άβδ δά άδδδδ, άδδδεδάβδδδ οοιδ έάδΰειñι /example/compressed.

Ιδñιάβδδδ δπñά ίά άδιδάñιñιιδιέπιδδδδδ όζ οδιδβδδζδ άñΰοιιδδδ:

```
# zfs set compression=off example/compressed
```

Άέά ίά άδιδñιόάνδΠόάά οι όγόόγια άν÷άβυί, άέόάεΎόά όγι άέυειόδς άίόιεΠ έάέ άδάεçέάγόάά οι άδιόΎέάοία ίΎού όιό άιççέόέειϋ δñιάνΰιιάόιό 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
```

ΔñιόάόδΠόάά ίάίΰ οι όγόόγια άν÷άβυί, πόάά ίά άβίαέ έάέ δΰέε δñιόάΰόειι, έάέ άδάεçέάγόάά οι ÷ñçέιιδieiπiόάό üδùò έάέ δñεί, όγι άίόιεΠ 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
```

Ίδινάβόά άδβόçò ίά άάβόά οι pool έάέ οι όγόόγια άν÷άβυί άίάόΰάειίόάό όγι Ύίπαι όçò άίόιεΠò 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)
```

¼δùò δανάόçñιγιά, οι όγόόγια άν÷άβυί ZFS ίδινάβ ίά ÷ñçέιιδieiçέαβ ùò έieiϋ όγόόγια άν÷άβυί ίάόΰ όç άçieiϋñάβά όιό. ΰόούοί, άέάέΎόάέ δieiϋδ άέυια έάέόιονάβάδ. Όόι δανάέΰδù δανΰάάέαια άçieiϋñαιγιά Ύία ίΎι όγόόγια άν÷άβυί, οι data. έά άδιεçέάγόίόια όçίάίόέέΰ άάάνΎία όά άόδù, έάέ Ύόόέ οι ñεiiβieiϋiά πόάά ίά έñάόΰάέ άγί άίόβñάάά άδù έΰέά ίδειε άάάνΎιι:

```
# zfs create example/data
# zfs set copies=2 example/data
```

Ίδινγιά όπñά ίά αιγιά όά άάάνΎία έάέ όγι έάόáiΰέùòç ÷βñiϋ άβñiϋόάό ίάίΰ όγι άίόιεΠ 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
```

Διαγράψτε τον χώρο που έχει δημιουργηθεί με την εντολή `zfs create` χρησιμοποιώντας την εντολή `zfs destroy`. Η εντολή `zfs destroy` μπορεί να χρησιμοποιηθεί για να διαγραφούν οι `zfs` που έχουν δημιουργηθεί με την εντολή `zfs create`. Η εντολή `zfs destroy` μπορεί να χρησιμοποιηθεί για να διαγραφούν οι `zfs` που έχουν δημιουργηθεί με την εντολή `zfs create`. Η εντολή `zfs destroy` μπορεί να χρησιμοποιηθεί για να διαγραφούν οι `zfs` που έχουν δημιουργηθεί με την εντολή `zfs create`.

```
# zfs destroy example/compressed
# zfs destroy example/data
# zpool destroy example
```

Εάν θέλετε να διαγράψετε τον χώρο που έχει δημιουργηθεί με την εντολή `zfs create` χρησιμοποιώντας την εντολή `zfs destroy`, τότε πρέπει να διαγράψετε τον χώρο που έχει δημιουργηθεί με την εντολή `zfs create` χρησιμοποιώντας την εντολή `zfs destroy`. Η εντολή `zfs destroy` μπορεί να χρησιμοποιηθεί για να διαγραφούν οι `zfs` που έχουν δημιουργηθεί με την εντολή `zfs create`.

### 20.2.2.2 ZFS RAID-Z

Η εντολή `zpool create` μπορεί να χρησιμοποιηθεί για να δημιουργηθεί ένας `zpool` RAID-Z. Η εντολή `zpool create` μπορεί να χρησιμοποιηθεί για να δημιουργηθεί ένας `zpool` RAID-Z. Η εντολή `zpool create` μπορεί να χρησιμοποιηθεί για να δημιουργηθεί ένας `zpool` RAID-Z.

```
# zpool create storage raidz da0 da1 da2
```

**Όχι! Προσοχή:** Η εντολή `zpool create` μπορεί να χρησιμοποιηθεί για να δημιουργηθεί ένας `zpool` RAID-Z. Η εντολή `zpool create` μπορεί να χρησιμοποιηθεί για να δημιουργηθεί ένας `zpool` RAID-Z. Η εντολή `zpool create` μπορεί να χρησιμοποιηθεί για να δημιουργηθεί ένας `zpool` RAID-Z.

Εάν θέλετε να διαγράψετε τον χώρο που έχει δημιουργηθεί με την εντολή `zfs create` χρησιμοποιώντας την εντολή `zfs destroy`, τότε πρέπει να διαγράψετε τον χώρο που έχει δημιουργηθεί με την εντολή `zfs create` χρησιμοποιώντας την εντολή `zfs destroy`. Η εντολή `zfs destroy` μπορεί να χρησιμοποιηθεί για να διαγραφούν οι `zfs` που έχουν δημιουργηθεί με την εντολή `zfs create`.

```
# zfs create storage/home
```

Η εντολή `zfs create` μπορεί να χρησιμοποιηθεί για να δημιουργηθεί ένας `zfs` που έχει δημιουργηθεί με την εντολή `zfs create`. Η εντολή `zfs create` μπορεί να χρησιμοποιηθεί για να δημιουργηθεί ένας `zfs` που έχει δημιουργηθεί με την εντολή `zfs create`.

```
# zfs set copies=2 storage/home
# zfs set compression=gzip storage/home
```

Εάν θέλετε να διαγράψετε τον χώρο που έχει δημιουργηθεί με την εντολή `zfs create` χρησιμοποιώντας την εντολή `zfs destroy`, τότε πρέπει να διαγράψετε τον χώρο που έχει δημιουργηθεί με την εντολή `zfs create` χρησιμοποιώντας την εντολή `zfs destroy`.

```
# cp -rp /home/* /storage/home
# rm -rf /home /usr/home
# ln -s /storage/home /home
# ln -s /storage/home /usr/home
```

Ὁά αάñÝíá δὺί ÷ñçóðñí èá áδìèçèáyííóáé ðññá óðì íÝí óγóóçìá áñ÷άβὺί /storage/home. Ἄέá íá ðì áδáέçèáyóáðá, áçìείðññáðóáá Ýíá íÝí ÷ñπóðç èáé áέóÝèèáðá óðì óγóóçìá íá ðì íÝí èíááñéáóìì.

ἌìèèìÙδὺί íá áçìείðññáðóáá Ýíá óδèáìéùδòðì (snapshot) óðì ìðìβì èá ìðìñáβðá íá áðáíÝèèáðá áñáùδóñá:

```
# zfs snapshot storage/home@08-30-08
```

Ὁçìáèðóðá ùδé ç áðèèíáπ áçìείðññáðó óδèáìéùδòðì èáέðìòñááβ ìùíí óá ðñááìáδéèù óγóóçìá áñ÷άβὺί, èáé ù÷é óá èÙðìείí ìáìíùíÝíí èáδὺέíáí π áñ÷άβì. Ἰ ÷áñáέðπñáð @ ÷ñçóèìðìέáβðáé ùð áέá÷ññéóðéèù ìáðáíý ðìò óðóðπíáðìò áñ÷άβὺί èáé ðìò ìììáðìò óìììò. Ἀí èáðáóðñáóáβ ì èáδὺέíáí ááññÝíùí èÙðìείíò ÷ñπóðç áðìέáóáððóðá ðìí ìá ðçí áíðìèπ:

```
# zfs rollback storage/home@08-30-08
```

Ἄέá íá ááβðá ìέá èβðóá ðὺí áέáéÝóèìì óδèáìéùδòðì, áèðáéÝóðá ðçí áíðìèπ ls óðìí èáδὺέíáí .zfs/snapshot ðìò óðóðπíáðìò áñ÷άβὺί. Ἄέá ðáñÙááéáíá, áέá íá ááβðá ðì óδèáìéùδòðì ðìò áçìείðññáðóáá ðñìçáíòìÝíùð, áèðáéÝóðá ðçí ðáñáéÙδὺí áíðìèπ:

```
# ls /storage/home/.zfs/snapshot
```

Ἀβίáé áðìáðὺí íá áñÙðáðá èÙðìείí script ðìò íá áçìείðññáá ìçìέáβá óδèáìéùδòðá ðὺí ááññÝíùí ðὺí ÷ñçóðñí. Ὑððὺí, ìá ðçí ðÙñíáí ðìò ÷ñìììò, óá óδèáìéùδòðá èá èáðáíáèðñíò ìááÙèí ðìòíóðù ðìò ÷ññìò óðì áβðèí. Ἰðìñáβðá íá áέáññÙðáðá ðì ðñìçáíýíáíí óδèáìéùδòðì ÷ñçóèìðìέáβðáð ðçí ðáñáéÙδὺí áíðìèπ:

```
# zfs destroy storage/home@08-30-08
```

Ἀáí ððÙñ÷áé èùáíò, ìáðÙ áðù ùèáð áððÝð ðèð áìèèíÝð, íá èñáððñíòìá ðì /storage/home ðóçí ðáññýóá èáðὺðóáóç ðìò. ἸáðáðñÝððá ðì ðìò ðñááìáδéèù óγóóçìá áñ÷άβὺί /home:

```
# zfs set mountpoint=/home storage/home
```

×ñçóèìðìέáβðáð ðèð áíðìèÝð df èáé mount èá áíýíá ùδé ðì óγóóçìá ÷áèñβæáðáé ðèÝíí áððù ðì óγóóçìá áñ÷άβὺí ùð ðì ðñááìáδéèù /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
```

Ἀáπ ìèèèçññíáðáé ç ñýèìέóç ðìò RAID-Z. Ἄέá íá áÝ÷áðá áíáññÝð èáðὺðóáóçð ð÷áðéèÙ ìá óá óðóðπíáðá áñ÷άβὺί èáðὺ ðç ìðèðáñéíπ áèðÝèáóç ðìò periodic(8), áðóðá ðçí ðáñáéÙδὺí áíðìèπ:

```
# echo 'daily_status_zfs_enable="YES"' >> /etc/periodic.conf
```

### 20.2.2.3 Αίτια του RAID-Z

Εάν θέλετε να διαβάσετε το βιβλίο αυτό, μπορείτε να το αγοράσετε από τον εκδοτικό οίκο. Το RAID-Z είναι ένας τύπος RAID που χρησιμοποιεί τον κώδικα ελέγχου παραμένει (parity) για να προστατεύσει τα δεδομένα. Το RAID-Z είναι ένας τύπος RAID που χρησιμοποιεί τον κώδικα ελέγχου παραμένει (parity) για να προστατεύσει τα δεδομένα.

```
# zpool status -x
```

Αν όλα τα pools είναι υγιή, τότε η έξοδος θα είναι:

```
all pools are healthy
```

Αν κάποιο από τα disks είναι offline, τότε η έξοδος θα είναι:

```
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
```

Αν κάποιο από τα disks είναι offline, τότε η έξοδος θα είναι:

```
# zpool offline storage da1
```

Αν θέλετε να διαβάσετε το βιβλίο αυτό, μπορείτε να το αγοράσετε από τον εκδοτικό οίκο. Το RAID-Z είναι ένας τύπος RAID που χρησιμοποιεί τον κώδικα ελέγχου παραμένει (parity) για να προστατεύσει τα δεδομένα.

```
# zpool replace storage da1
```

Αν θέλετε να διαβάσετε το βιβλίο αυτό, μπορείτε να το αγοράσετε από τον εκδοτικό οίκο. Το RAID-Z είναι ένας τύπος RAID που χρησιμοποιεί τον κώδικα ελέγχου παραμένει (parity) για να προστατεύσει τα δεδομένα.

```
# 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

¼δουδ οάβιάδσάε οοί δάνΰάεάιá, οά δΰίόá οάβιάδσάε ίá εάεοιõñáíýí οοόεíεíáεΰ.

### 20.2.2.4 ΆδσάεΠεάδός ΆáññÝíυί

¼δουδ áíáσÝñáíá δñίçáíõíÝíυδ, οί ZFS ÷ñçόεííδíεáβ checksums (áεññíβοίáδóá áεÝã÷íõ) áεá ίá áδσάεçεáýόáε οçί áεáñáεúδçόá ουί áδíεçεáσõíÝíυí áááññÝíυí. Óá áεññíβοίáδóá áεÝã÷íõ áíáñáñíδíεíýíδóá áδδóυíáδóá εáδΰ οçί áçíεíõñáβá ουί οδóδçíΰδουί áñ÷άβυί, εáε ίδññíýí ίá áδáíáñáñíδíεçεíýí ίÝόυδ οçδ άδñíáíçδ άíδíεΠδ:

```
# zfs set checksum=off storage/home
```

Άδδου ááí áβίáε ááíεεΰ εάεΠ εáÝá, εάεΠδ οá checksums εáδóáεáíáΰíυí áεΰ÷εόοί áδíεçεáδδóεεú ÷πñí, εáε áβίáε δíεý δεí ÷ñΠσέíí ίá οá Ý÷íõíá áíáñáñíδíεçíÝíá. Άδβόçδ ááí οάβιάδσάε ίá δñíεáεíýí εΰδíεá οçíáíδεεΠ εáεδóδÝñçόç Π áδεáΰñδóίç. Ιá οá checksums áíáñáñíδíεçíÝíá, ίδññíýíá ίá æçδΠσóíõíá áδñ οί ZFS ίá áεÝãíáε οçί áεáñáεúδçόá ουί áááññÝíυí ÷ñçόεííδíεΠδóδ οá áεá áδσάεΠεάδός. Ç áεááεéáδóá áδδΠ áβίáε áíυδδΠ υδ “scrubbing.” Άεá ίá áεÝãíáδóá οçί áεáñáεúδçόá áááññÝíυí οíõ pool storage, ÷ñçόεííδíεΠδóδ οçί δáñáεΰδου άíδíεΠ:

```
# zpool scrub storage
```

Ç áεááεéáδóá áδδΠ ίδññáβ ίá δΰñáε áñεáδΠ πñá, áíΰεíáá ίá οçί δíóυδçόá ουί áδíεçεáσõíÝíυí áááññÝíυí. Άδβόçδ ÷ñçόεííδíεáβ δΰñá δíεý οί áβóεí (I/O), ουοί πóδá οá εΰεá áááññÝíç óδεáñΠ ίδññáβ ίá áεδóáεáβδóá ίυíí ίεá οÝόíεá áεááεéáδóá. Ιáδΰ οçί íεíεεΠñυδç οíõ scrub, εá áíáíáυδεáβ εáε ç áíáçíñΰ εáδΰδóδóçδ, οçί ίδñíá ίδññáβδóá ίá ááβδá æçδΠδóδ οçί ίá οçί δáñáεΰδου άíδíεΠ:

```
# 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

Óοί δάνΰάεάιá ίáδ áíοáíβæáδóáε εáε ç ÷ñííεεΠ óδεáñΠ δíõ íεíεεçñπεçεá ç áíδíεΠ scrub. Ç áοíáδουδçόá áδδΠ ίáδ áíáδóáεβæáε áεáñáεúδçόá áááññÝíυí οá ίááΰεí áΰεíδ ÷ññíυδ.

Óδΰñ÷íõí δíεεÝδ áεúíá áδεéíáÝδ áεá οί óýδóçíá áñ÷άβυί Å. Άáβδóá δεδ óáεβááδ manual zfs(8) εáε zpool(8).





**Ó÷Pia 21-1. ἸñāŪiùçç ÓoiÝiùççò**

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 ἀíáεεάέδóεεὐδὸ οññδiðò áðièPεάδóççò, áβiάέ ἰά ÷ ùñέóðáβ ç ðáñéi÷P áéáðéyíóáñi óá ἰέéññúðáñá òiPiaðá βóιð ἰááÝéiðò óá ἰðiβá ἰá áðièççéáýiíðáέ óáέñéáéŪ óá áéáðññáðééÝð óðóéáðÝð. Άέá ðáñŪááéáiá, ἰé ðñpðié 256 òññáβð ἰðññáβ ἰá áβiάέ áðièççéáðiÝñiέ óðñi ðñpði áβóéi, ἰé áðññáñiέ 256 óðñi áðññáñi áβóéi, é.i.é. ἸáðŪ òçí ÷ñPðç éáé òið óáéáððáβið áβóéið, ç áéááééáðá áðáíáéáñáŪiáðáé ἰÝ÷ñé ἰá áññβóιði úeie ἰé áβóéiέ. Άððç ç ἰÝeññð ññŪæáðáé *striping* P RAID-0. <sup>1</sup> Ōi striping áðáéðáβ éŪðñð ðáñéóóñðáñç ðññiðŪéáéá áéá òñi áíoiðéoiñ òññ ááññÝññi éáé ἰðññáβ ἰá ðññéáéÝóáé ἰáááéyðáññi òññðβñ I/O ùðáí ἰéá ἰáðáðññŪ éáðáñÝññáðáé óá ðñeéáðéyíðò áβóéiðð, áééŪ áðñ òçí Ūééçç áðéðá÷Ūiáé ἰáááéyðáññi óðáéáñññ òññðβñ óá éŪéá áβóéi. Ōi Ó÷Pia 21-2 ááβ÷iáé òç óáéñŪ ἰá òçí ἰðññáβ ÷ñçóéññðñiέyíðáé ἰé ññŪááð áðièPεάδóççò óá ἰéá ἰñáŪiùçç ðýðið stripe.

**Ó÷Pia 21-2. 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





### 21.5.3 ἘΎίαόά Ἀδὺαῖόçð

Ὀῖ Vinum ðεῖðιεάβ δὺοῖ οὐΎίϋόç ùοῖ έάέ striping οά ἀδβδᾶῖ plex:

- ἴά plex οὐΎίϋόçð (concatenated) ÷ ñçόεῖðιεάβ ðçῖ δᾶñεί ÷ ϐ ἀέαδὲΎίόαὺῖ εὐέᾶ ðδῖαβόεῖρὸ ἰᾶ ðç οάέñṼ.
- ἴά striped plex ᾶñṼοᾶέ οά ᾶᾶñΎία οά εὐñβᾶᾶð (stripes) ðῖρ έάόαΎίϋίόᾶέ οά εὐέᾶ ðδῖαβόεῖρ. ¼εῖρῖ ἰέ ðδῖαβόεῖρ ḍñΎḍᾶέ ἰά Ύ ÷ ῖοῖ ðῖ βᾶεῖ ἰΎᾶᾶεῖð έάέ ḍñΎḍᾶέ ἰά ḍḍṼñ ÷ ῖοῖ ðῖ ῖεṼ ÷ έόοῖρ ᾶΎῖ ḍδῖαβόεῖρῖ, ᾶέᾶ ἰά ἰᾶ ÷ ùñβᾶεῖρὸ οά ο ÷ Ṽόç ἰᾶ ðῖ plex οὐΎίϋόçð.

### 21.5.4 Ἀβᾶç ἸñᾶṼίϋόçð Plex

Ç Ṽέᾶῖόç ðῖρ Vinum ðῖρ δᾶñΎ ÷ ᾶόᾶέ ἰᾶ ðῖ FreeBSD 8.0 ðεῖðιεάβ ᾶΎῖ ᾶβᾶç plex:

- Ὀᾶ plex οὐΎίϋόçð ḍñῖόδΎñῖοῖ ðç ἰᾶᾶᾶέΎόᾶñç ᾶδᾶᾶεῖρῖᾶ: ἰðῖñῖῖ ἰᾶ δᾶñέΎ ÷ ῖοῖ ῖðῖεῖρᾶβðῖρὸᾶ ᾶñέῖṼῖ ḍδῖαβόεῖρῖ, έάέ ἰέ ḍδῖαβόεῖρῖ ᾶδὸῖβ ἰðῖñᾶβ ἰᾶ ᾶβῖᾶέ ᾶέᾶοῖñᾶδὲέῖρῖ ἰᾶᾶΎεῖρὸð. Ὀῖ plex ἰðῖñᾶβ ἰᾶ ᾶðᾶέοᾶᾶᾶβ ḍñῖρὲΎοῖρὸᾶð ḍᾶñέοοὺḍᾶñῖρὸð ḍδῖαβόεῖρὸð. ×ñᾶέṼᾶεῖρὸᾶέ έᾶᾶṼḍᾶñῖ ÷ ññῖñ CPU οά ο ÷ Ṽόç ἰᾶ οᾶ stripes, ᾶῖ έάέ ç ᾶέᾶοῖñṼ ὄðç ÷ ñβόç ðçð CPU ᾶᾶῖ ᾶβῖᾶέ ἰᾶðñβόεῖρῖ. ἈðṼ ᰇçῖ Ṽέᾶç ἰᾶñέṼ, ᾶβῖᾶέ ðεῖ ᾶðῖñᾶβðρ οᾶ ἰç-έοῖññῖðçῖΎῖç έᾶέοῖρñᾶβᾶ, Ṽðῖρ Ṽῖᾶð ᾶβόεῖρὸ ᾶβῖᾶέ ðῖεΎ ᾶῖᾶñᾶṼð έάέ ἰέ ḍðṼεῖρῖðῖῖ ᾶᾶᾶñῖῖ.
- Ὀῖ ἰᾶᾶᾶέΎḍᾶñῖ ðᾶᾶῖΎέðçῖᾶ ḍῖρ stripes (RAID-0), ᾶβῖᾶέ Ṽðé Ύ ÷ ῖοῖ ðεῖ έοῖññῖðçῖΎῖç έᾶέοῖρñᾶβᾶ: ᾶðῖέΎᾶῖρὸᾶð ðῖ οὺόοṼ ἰΎᾶᾶεῖð εὐñβᾶᾶð (ðᾶñβðῖρ 256 kB), ἰðῖñᾶβḍᾶ ἰᾶ ᾶῖέοῖññῖðρὸᾶðᾶ ðῖ οῖñḍβῖ οᾶ εὐέᾶ ᾶβόεῖρ ḍῖρ plex. Ὀᾶ ἰᾶέῖρᾶέðῖᾶᾶᾶ ᾶððρð ðçð ἰᾶεṼᾶῖρὸ ᾶβῖᾶέ (ᾶέᾶðñṼ) ðεῖ ðῖεΎðῖεῖρὸð έρᾶέᾶð έάέ δᾶñέῖρῖέοῖβ ὄοῖρð ḍδῖαβόεῖρὸð: ḍñΎḍᾶέ Ṽεῖρῖ ἰᾶ ᾶβῖᾶέ ḍῖ βᾶεῖ ἰΎᾶᾶεῖð έάέ ç ᾶðΎέðᾶόç ᾶῖṼð plex ἰᾶ ḍñῖρὲβç ḍᾶñέοοὺḍᾶñῖ ᾶβόεṼῖ ᾶβῖᾶέ ḍῖοῖρ ðῖεΎðῖεῖρç ðῖρ ðç ᾶᾶñΎῖç ὄέᾶἰρ ḍῖ Vinum ᾶᾶῖ ᰇçῖ ðεῖðιεάβ. Ὀῖ Vinum ᾶðβόçð ᾶðῖᾶṼέᾶέ Ṽῖᾶ ᾶεṼῖᾶ ᾶðῖῖᾶṼῖ ḍᾶñέῖρῖέοῖṼ: Ṽῖᾶ plex ὄΎðῖρ stripe ḍñΎḍᾶέ ἰᾶ ᾶέᾶέΎḍᾶέ ḍðῖ ÷ ñᾶṼðέῖṼ ᾶΎῖ ḍῖῖεṼ ÷ έόοῖρ ḍδῖαβόεῖρὸð, ᾶέᾶοῖñᾶδὲέṼ ᾶβῖᾶέ ᾶᾶΎῖᾶḍῖ ἰᾶ ḍῖ ἰᾶ ÷ ùñβᾶῖρὸῖᾶ ᾶðṼ Ṽῖᾶ plex οὐΎίϋόçð.

Ἰ ðβῖᾶᾶð 21-1 ᾶᾶβ ÷ ἰᾶέ ḍᾶñέᾶçððḍḍῖṼ ὄᾶ ðᾶῖῖᾶᾶðῖᾶᾶᾶ έάέ ἰᾶέῖρᾶᾶðῖᾶᾶᾶ εὐέᾶ ᾶβῖᾶῖð ἰñᾶṼίϋόçð plex.

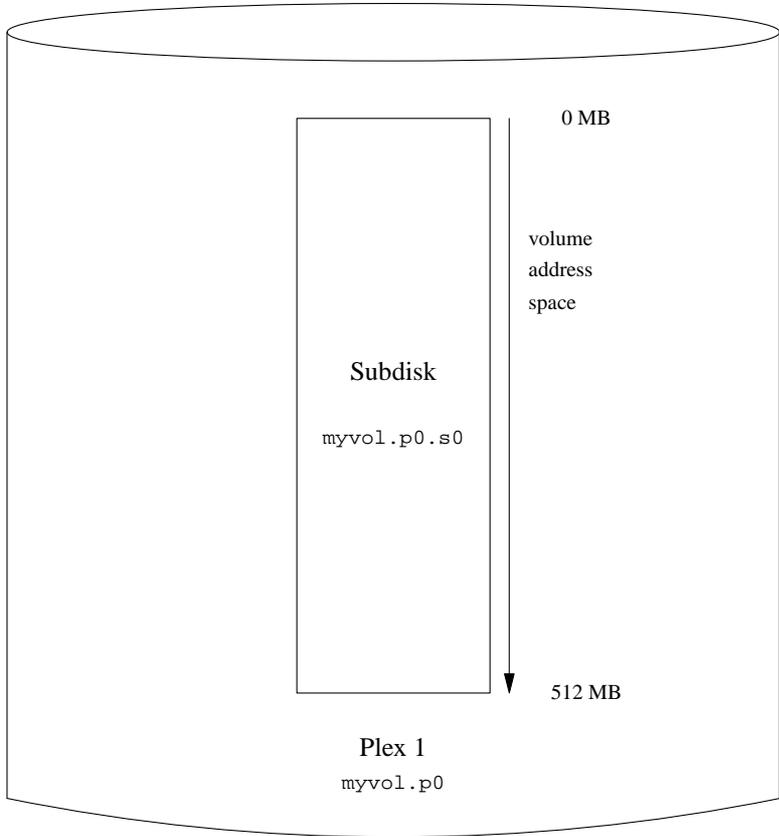
#### ðβῖᾶᾶð 21-1. Ἀβᾶç ἸñᾶṼίϋόçð Vinum Plex

ὈΎðῖρ plex	ἈέṼ ÷ έόοῖ ðεβῖρὸ ḍδῖαβόεῖρῖ	ἈὸῖᾶḍṼḍḍḍḍḍḍḍḍḍ ḍñῖρὲβçð ḍδῖαβόεῖρῖ	Ἰέ ḍδῖαβόεῖρῖ ḍñΎḍᾶέ ἰᾶ ᾶβῖᾶέ βᾶέῖρὸ ἰᾶᾶΎεῖρὸð	Ἀὸᾶñῖᾶβ
οὐΎίϋόçð (concatenated)	1	ἰᾶέ	Ṽ ÷ έ	Ἀðῖρᾶᾶðḍḍḍḍ ἰᾶᾶṼεῖρὸ Ṽᾶᾶῖρὸ ᾶᾶñΎῖῖ ἰᾶ ἰΎᾶέόðç ᾶðᾶᾶεῖρῖᾶ ὄοῖρ ḍñṼðῖ έᾶόᾶῖñρð έάέ ἰΎðñῖᾶ ᾶðṼᾶῖρç.
striped	2	Ṽ ÷ έ	ἰᾶέ	Ὀðçᾶρ ᾶðṼᾶῖρç οᾶ ὄοῖᾶḍᾶḍḍḍḍ ἰᾶ ðῖεΎ έᾶέΎð ὄᾶ ÷ Ṽόçðᾶð ὄᾶ έᾶόᾶḍḍṼḍᾶέð ðῖῖᾶᾶðᾶð ḍñṼḍᾶᾶçð.



Ç ᾖαἦἰδῦῖ Ὑῖἦἰὸ ÷ ἦçøεῖῖᾖεἰἰ Ὀç ῖἦἦἦ Ὀδῖὸἦᾖὖῖ Ὑῖç ἕβῶᾖᾗ Ὀῖỵ ḡvinum(8). Ç ἠἦἦεἰᾖ ᾖᾖἕεῖῖεἰç Ὀᾖβῖᾗᾖἕ Ὀδῖ Ὀ÷ᾖᾗ 21-4.

Ὀ ÷ ᾖᾗ 21-4. ἰᾗᾖ Ἀᾖεῖᾖ Ὀὐῖỵ Vinum



Ὀδῖ Ὀ ÷ ᾖᾗ ἰᾖᾖỵ (εἰεβῶ εἰε Ὀᾖ ἰᾖᾖỵ ᾖῖỵ ἰεῖῖεῖῖῖῖ) Ὀᾖᾖᾖ ÷ ἰε ç ἰἰᾖᾖᾗᾗᾗᾗᾗç ἰᾖᾖỵ Ὀῖỵ ᾖᾖỵ ÷ ἰε Ὀᾖ plex, Ὀᾖ ῖᾖῖᾖ ἰᾗ Ὀç Ὀἰεἦᾗ Ὀῖỵỵ ᾖᾖỵ ÷ ῖỵῖ Ὀῖỵỵ Ὀᾖᾖᾖᾖᾖỵ. Ὀᾖ ἰᾖᾖỵ Ὀῖ ἰᾖỵᾖᾖᾖᾖᾖỵῖ ᾖᾖỵ ᾖᾖỵ ÷ ἰε Ὑῖᾗ plex, Ὀᾖ ἰᾖᾖỵ ᾖᾖỵ ᾖᾖỵ ἕεἰᾖᾖᾖᾖ ἰᾖᾖ ÷ ᾖỵ Ὀἰᾖᾖᾖᾖᾖỵ. Ὀῖ plex ᾖᾖỵ ÷ ἰε ᾖᾖᾖᾖ Ὑῖᾗ Ὀᾖᾖᾖᾖỵ, εἰε ὙὈἰᾖ ἰᾖᾖ ᾖᾖᾖ ÷ ἰε ἰεᾖᾖᾖᾖᾖ Ὀᾖçῖ ἕᾗᾖᾖᾖᾖ ᾖᾖᾖ Ὀᾖ Ὀ ÷ ὙὈç ἰᾗ ἰεᾖ Ὀῖᾖᾖᾖᾖᾖ ἕᾗᾖᾖᾖᾖᾖ. Ὀᾖᾖᾖ ᾖᾖᾖᾖᾖᾖ ἰᾖᾖᾖᾖᾖ ἕᾗ ἰᾖᾖᾖᾖᾖᾖ ἰεᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖ.

Ἰ Ὀῖỵỵ ἰᾖᾖỵ ἰᾖᾖ ᾖᾖᾖ ἕᾗ ἕᾗᾗᾗᾗᾗᾗ Ὀᾖᾖᾖᾗ ᾖᾖᾖᾗᾗᾗᾗᾗ Ὀᾖ Ὀ ÷ ὙὈç ἰᾗ ἰεᾖ Ὀῖᾖᾖᾖᾖᾖᾖ ἕᾗᾗᾗᾗᾖᾖᾖ ᾖᾖᾖᾖᾖᾖ. ᾖᾖỵ ÷ ἰε Ὑῖᾗ ἰᾖᾖᾖ plex, Ὑᾖᾖ ἰᾖᾖ ᾖᾖᾖ ἕᾗᾗᾗᾗᾗ ἕεἰᾖᾖᾖᾖ ἰᾖᾖ ÷ ᾖỵ Ὀἰᾖᾖᾖᾖᾖᾖỵ. Ὀῖ plex ᾖᾖỵ ÷ ἰε ᾖᾖᾖᾖ Ὑῖᾗ Ὀᾖᾖᾖᾖỵ, εἰε ὙὈἰᾖ ἰᾖᾖ ᾖᾖᾖ ÷ ἰε ἰεᾖᾖᾖᾖᾖ Ὀᾖçῖ ἕᾗᾗᾖᾖᾖ ᾖᾖᾖ Ὀᾖ Ὀ ÷ ὙὈç ἰᾗ ἰεᾖ Ὀῖᾖᾖᾖᾖᾖ ἕᾗᾗᾗᾗᾖᾖᾖᾖ. Ὀᾖᾖᾖ ᾖᾖᾖᾖᾖᾖ ἰᾖᾖᾖᾖᾖ ἕᾗ ἰᾖᾖᾖᾖᾖᾖ ἰεᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖ.

21.6.2 Ἀὖçῖᾖᾗç Ἀῖῖᾖᾖᾗᾖᾖᾖ: Mirroring

Ç ἰεῖᾖᾖᾖᾖᾖ ἰᾖᾖỵ ἰᾖᾖᾖᾖ ἰᾖ ἰᾖᾖᾖᾖᾖ ῖᾖᾖ Ὀῖỵ mirroring (εἰεᾖᾖᾖᾖᾖᾖᾖ). Ὑᾖᾖᾖ Ὀ ÷ ἰᾖᾖᾖᾖᾖ Ὑῖᾗ Ὀῖỵ Ὀῖỵ ῖᾖᾖᾖ ἕᾗ ᾖᾖᾖᾖ mirroring, ᾖᾖᾖᾖ Ὀçῖᾖᾖᾖᾖ ἰᾖ ἰᾖᾖᾖᾖᾖᾖᾖᾖ ἰᾖᾖ ῖᾖ Ὀᾖᾖᾖᾖᾖ Ὀᾖ ἕᾗᾗ ᾖᾖᾖ ᾖᾖᾖ Ὀᾖ ἰεᾖᾖᾖᾖᾖᾖᾖᾖ ῖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖᾖ.

Þóðá ç äðíðð÷Þá áíüð äßóëíð íá íçí ðñíéáéÝóáé ðáýóç ääéðíðñáßáð éáé óóá äýí plex. Õí ðáñáéÜòú ðáñÜäáéáíá äáß÷íáé ðüð ìðñáß 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 ðáñÜäáéáíá áðòü, äáí Þóáí áðáñáßóçðí íá éáéñéóôáß íáíÜ Ĩ äçãäüð a, éáèÞð ðí Vinum äéáéÝóáé Þäç ðéð áíóßóðíé÷ð äóáá÷ññßóáéð óðç áÜóç äáññÝíúí íá ðéð ñðèíßóáéð ðíð. ĨáoÜ ðçí äðáíñááóßá ðúí ðáñáðÜíü ññéóíÞí, ç ñýèíéóç ĨéÜæáé íá ðçí ðáñáéÜòú:

```
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%)

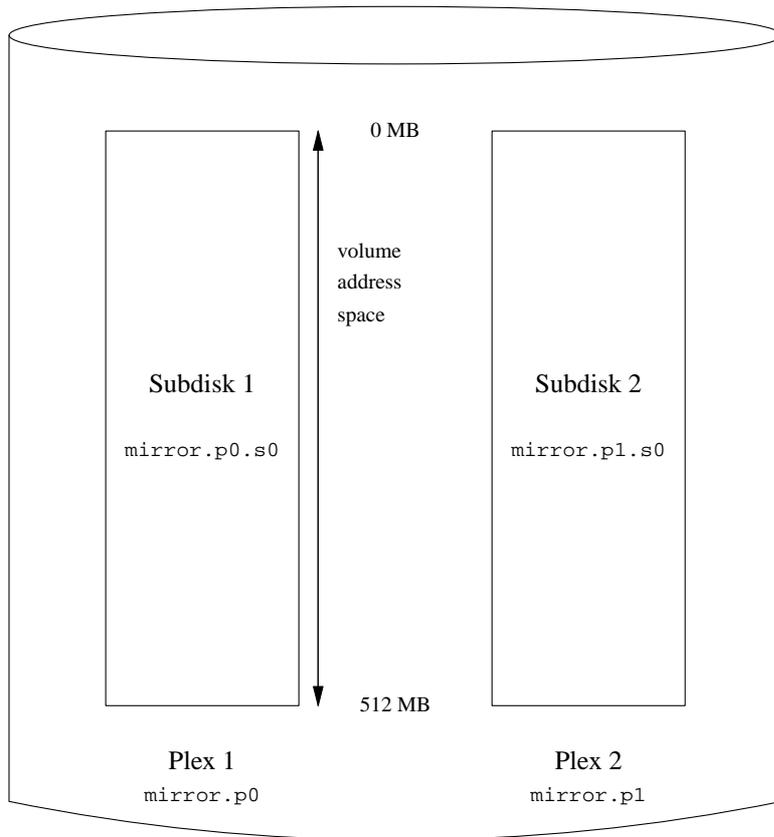
V myvol          State: up      Plexes:           1 Size:           512 MB
V mirror         State: up      Plexes:           2 Size:           512 MB

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 21-5 áíáðáñéóðÜ áððÞ ðç äñÞ äñáóééÜ.

Ó÷ Ðιά 21-5. Jáò Mirrored Ôüüü Vinum



Ôðí ðáñÛááέαιά áóòü, έÛεά plex ðáñέÛ÷άέ óçí ðεÐñç ðáñέí÷Ð áεάòέýíóáüí, ìááÛέíòò 512 MB. ¼ðùò έάέ óòí ðñíçáíýáíñ ðáñÛááέαιά, έÛεά plex ðáñέÛ÷άέ Ûía ñíááέέü ððíáβέí.

21.6.3 Āέέóέóüðíέíρíóáò óçí Āðüäíóç

Ï mirrored óüüüò ðíò ðñíçáíýáíñò ðáñáááβáíáíóíð ðáñíóóέÛεάέ ìáááέýóðáñç áñí÷Ð óóáέìÛóüí óá ó÷ Ûóç ìá Ûía óüüü ðíò ááí ÷ñçóέíðíέáβ mirror, áέέÛ ç áðüäíóç ðíò áβíaέ ìέέñüðáñç: έÛεά áááñáòÐ óòí óüüü ðñÛáέ ìá áβíaóáέ έάέ óíòò áýí áβóέíòò, ÷ñçóέíðíέíρíóáò Ûóέ ìáááέýóðáñí ðíóíóóü ðíò áέáέÛóέíòò áýñíòò æρíçð. Ìέ áðáέðÐóáέð ðíò áíáá÷ñÛúð Û÷íðíá áέá áðüäíóç, áðáέóíýí áέáóíñáðέέÐ ðñíóÛááέóç: áíòβ ìá ÷ñçóέíðíέíρíóíá mirror, ìðñíýá ìá áçíέíñáβóíóíá èññááò áðíèÐεáóçò (stripes) óá üóí ðí áóíáóüí ðáñέóóüðáñíòò áβóέíòò. Ç ðáñáέÛóü ñýèíέóç ááβ÷íáέ Ûía óüüü óòí ðíðíðí ðí plex Û÷άέ áβíaέ stripe óá ðÛóóáñéð 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
```

¼ðùð éáé ðñīāōīÝñùð, āāí ÷ñāéÜæāðáé íá ĩñβōīōīā íáíÜ òīōð āβōēīōð ðīō āβīáé Pāç āñūōōīB óōī Vinum. ĩāðÜ òçí āðāīāñāāóBā òīō ðāñāðÜñū ĩñéōīñý, ç ñýèìéóç éá ĩéÜæāé ĩā òçí ðāñāéÜðù:

```
Drives:      4 (4 configured)
Volumes:     3 (4 configured)
Plexes:      4 (8 configured)
Subdisks:    7 (16 configured)
```

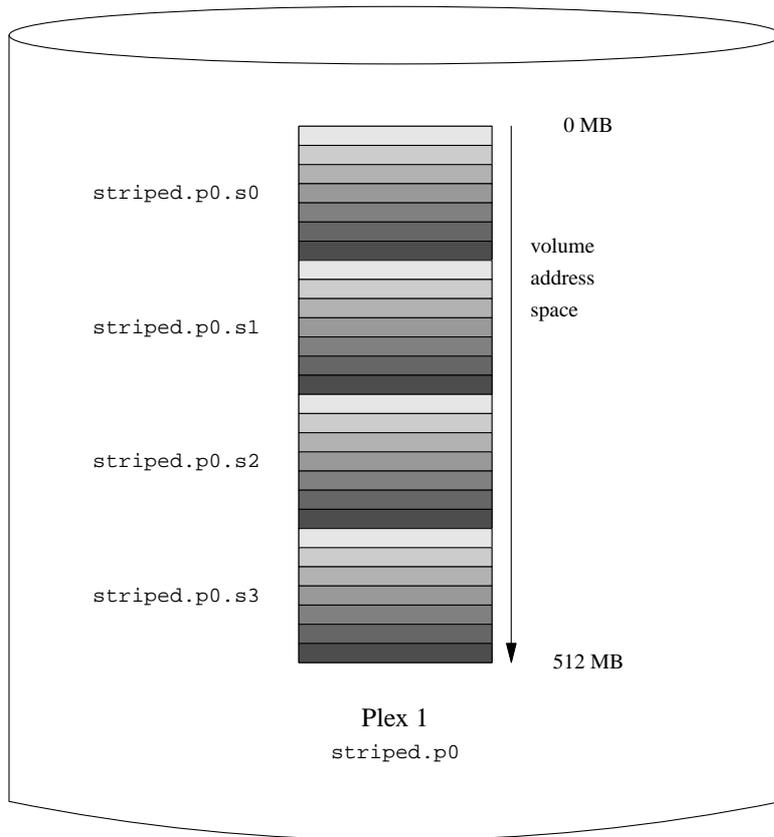
```
D a          State: up      Device /dev/da3h      Avail: 1421/2573 MB (55%)
D b          State: up      Device /dev/da4h      Avail: 1933/2573 MB (75%)
D c          State: up      Device /dev/da5h      Avail: 2445/2573 MB (95%)
D d          State: up      Device /dev/da6h      Avail: 2445/2573 MB (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÷Ðíá 21-6. Íáo Striped Ôüüò Vinum**



Άδοüò ì òüüò áíáðáñβóðάάέ ãñáöéÛ óóí Ó÷Ðíá 21-6. Ç áðü÷ñüòç òçð èññβááð áíðéðñíóüððáγάέ òç èÝόç òçð ìÝόά óðçí ðáñéí÷Ð áεάðéγíóáüí ðíò plex: ìé áñé÷ðü÷ñüòð èññβááð áβίάé ìé ðñρòáð, ìé óéíñü÷ñüòð áβίάé ìé óáέáðóáβáð.

**21.6.4 Άίείðéóòβά έάé Άðüäíόç**

Ìá ðí έáðÛεεçéí òεééü, áβίάé áðíáðüí ìá áçíεíòñáçεíγí òüüíé ìé ìðíβíé ìá ðáñíðóέÛεíòí òüóí ìááÛεç áñí÷Ð óá óðÛεíáóá, üóí έáé áóιçìÝίç áðüäíόç óá ó÷Ýόç ìá ðéð ðððíðíεçìÝíáð έáðάðíÐóáέð ðíò UNIX. Íá ðððééü áñ÷áβí ñðεíβóáñí έá ìéÛεáé ìá ðí ðáñάέÛðü:

```

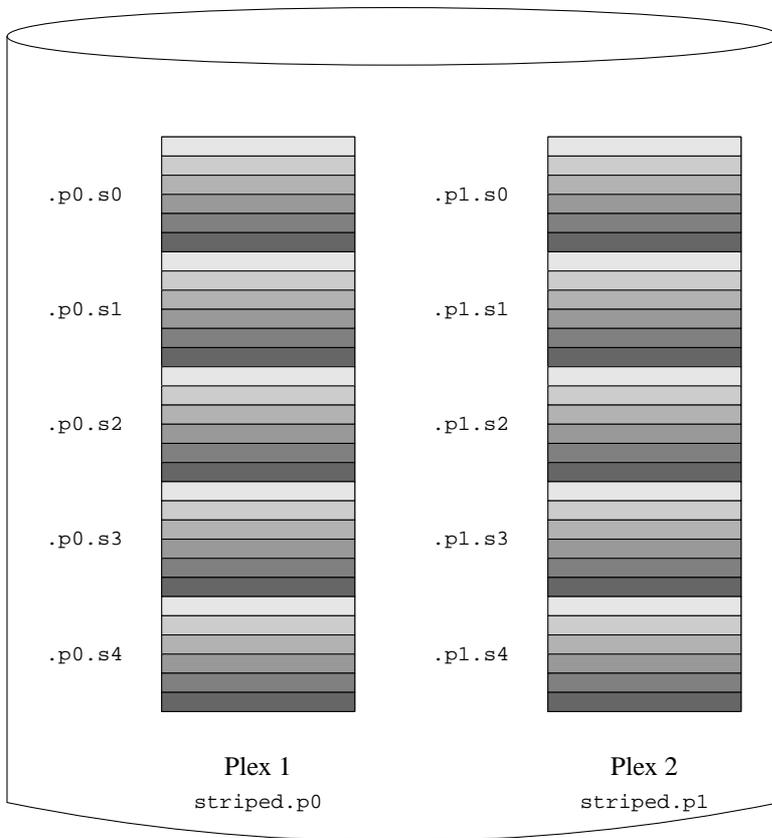
volume raid10
  plex org striped 512k
    sd length 102480k drive a
    sd length 102480k drive b
    sd length 102480k drive c
    sd length 102480k drive d
  
```

```
sd length 102480k drive e
plex org striped 512k
sd length 102480k drive c
sd length 102480k drive d
sd length 102480k drive e
sd length 102480k drive a
sd length 102480k drive b
```

Ἰέ οδτὰβόετρε οττò äáýðãñò plex Ἰ ÷ττòττἰ äòäóäæâß éäóŪ äýττἰ ττãçττἰýð óã ó÷ Ἰόç τã äðòττἰýð οττò δñττðττἰð plex: áððú äττἰäóäæβæäé ττòé τé äããñãóŸð äãττἰ äβñττἰóäé óðττἰðò βæττἰττἰðð οδττἰαβóεττἰðð, áéττἰã ääé äττἰ τεã äòäóäττἰmŪ ÷ñçóεττἰðττἰéãß éäé οττἰðð äýττἰ äβóεττἰðð.

Ōττἰ Ō÷Δττἰã 21-7 áττἰäðãñέóðŪ äñãóééŪ ðç äñP äðòττἰýð οττò ðüττἰð.

**Ō÷Δττἰã 21-7. ττãð Mirrored éäé Striped Ōüüüð οττἰð Vinum**



## 21.7 Ἰῖνιάσά ΑἰόέεἰΥίυί

¼ðυὸ δᾱῖᾱῖῖῖῖῖ δᾱῖᾱῖῖῖ, ðí Vinum ἀδῖῖῖῖῖ δῖῖῖῖῖῖῖ Ἰῖῖῖῖ ὀᾱ plex ἑᾱέ ὀδῖῖῖῖῖῖ, ᾱί ἑᾱέ ὀδῖῖῖῖῖ ÷ ᾱέ ϸ ᾱὀῖᾱὀῖὀᾱ ῖᾱ ὀᾱ δᾱῖᾱῖῖῖῖῖ. Ἀὀδῖῖ ὕὀδῖὀῖ ᾱᾱ ὀὀῖὀὀὀᾱᾱ: ϸ ᾱῖδᾱῖῖῖῖ ὀῖὀ Ἰ ÷ ῖὀῖᾱ ᾱδῖῖ ὀῖ ᾱἑᾱ ÷ ᾱἑῖῖὀὀ ὀῖῖῖ Ἰ VERITAS (ῖ ῖὀῖῖὀ ᾱδἑὀῖῖ ἑᾱἑ ᾱἑᾱᾱῖᾱ ᾱδῖῖῖὀᾱ ῖῖῖῖὀῖ ὀᾱ ᾱῖὀἑἑᾱῖᾱῖᾱ) Ἰ ÷ ᾱἑ ᾱᾱῖᾱἑ ὕὀἑ ᾱὀδῖῖ ὀῖὀ ᾱḆᾱῖὀ Ḇ ᾱὀᾱἑῖḆᾱ ᾱῖ ὀῖὀὀἸῖᾱἑ ὀᾱῖὀὀἑἑḆ ὀἑῖῖῖᾱὀἰᾱὀᾱὀᾱ, ἑᾱἑ ῖὀῖᾱḆ ῖᾱ ὀῖῖῖᾱἑ Ἰὀᾱἑ ὀῖᾱ ÷ ὀὀᾱ.

Ὁᾱ ῖῖῖῖῖῖ ῖὀῖᾱḆ ῖᾱ δᾱῖᾱῖῖ ÷ ῖὀῖ ῖὀῖῖῖᾱḆ ὀἑὀᾱ ῖḆ-ἑᾱῖῖ ÷ ᾱῖᾱὀὀῖᾱ, ᾱἑἑḆ ὀὀῖὀὀὀᾱᾱ ῖᾱ δᾱῖῖῖῖὀὀᾱḆ ὀὀᾱ ὀὀᾱ ÷ ῖḆὀᾱ ᾱῖᾱῖḆὀῖῖ, ᾱῖἑῖḆῖ ἑᾱἑ ὀḆ ἑḆὀῖὀῖ ὀᾱῖᾱὀ. Ὁᾱ ῖῖῖῖῖῖ ὀῖῖ ὀῖῖῖῖ, ὀῖῖ plex ἑᾱἑ ὀῖῖ ὀδῖῖῖῖῖῖ ῖὀῖᾱḆ ῖᾱ ᾱῖῖᾱἑ ῖḆ ÷ ῖἑ 64 ÷ ᾱῖᾱὀὀῖᾱὀ, ᾱῖḆ ὀᾱ ῖῖῖῖῖῖ ὀῖῖ ᾱḆὀῖῖ ῖὀῖᾱḆ ῖᾱ ᾱῖῖᾱἑ ῖḆ ÷ ῖἑ 32 ÷ ᾱῖᾱὀὀῖᾱὀ.

Ὁᾱ ᾱῖ ÷ ᾱῖᾱ ὀὀἑᾱὀῖ ὀῖὀ Vinum ᾱḆῖὀῖὀῖῖῖὀᾱῖ ὀὀῖῖ ἑᾱὀḆῖῖῖ /dev/gvinum. Ἰᾱ ὀἑὀ ῖὀἑῖḆὀᾱὀὀ ὀῖὀ ὀᾱῖῖῖὀᾱἑ δᾱῖᾱὀḆῖῖ, ὀῖὀ Vinum ἑᾱ ᾱḆῖὀὀῖᾱḆὀᾱἑ ὀᾱ δᾱῖᾱἑḆὀῖ ᾱῖ ÷ ᾱῖᾱ ὀὀἑᾱὀῖḆῖ:

- 
- ὈḆῖᾱḆὀᾱὀᾱ:** Ὁῖ δᾱῖᾱἑḆὀῖὀ ἑὀ ÷ ῖᾱἑ ῖῖῖ ὀὀᾱ ὀᾱἑἑḆ ὀἑῖὀῖḆḆὀᾱ ὀῖὀ Vinum.

Ἰἑ ὀὀἑᾱὀḆῖὀ ᾱἑ Ḇᾱ ÷ ῖὀ ὀὀᾱᾱᾱᾱᾱᾱᾱ /dev/vinum/control ἑᾱἑ /dev/vinum/controld, ὀῖὀ ÷ ῖḆḆὀῖῖὀἑῖῖῖὀᾱἑ ᾱδῖῖ ὀῖ gvinum(8) ἑᾱἑ ὀῖ ᾱᾱῖῖῖᾱ ὀῖὀ Vinum ᾱῖὀḆὀἑ ÷ ᾱ.

- Ἐᾱὀᾱ ÷ ὕḆὀᾱὀὀ ὀὀἑᾱὀῖ ᾱἑᾱ ἑḆἑᾱ ὀῖῖῖ. ἈὀὀḆḆ ᾱῖῖᾱἑ ἑᾱἑ ῖἑ ἑῖῖᾱὀ ὀὀἑᾱὀḆῖὀ ὀῖὀ ÷ ῖḆḆὀῖῖὀἑᾱḆ ὀῖὀ Vinum. Ἰᾱ ὀἑὀ ῖὀἑῖḆὀᾱὀὀ ὀῖὀ ᾱᾱῖῖᾱῖᾱ δᾱῖᾱὀḆῖῖ, ἑᾱ Ἰ ÷ ῖὀῖᾱ ὀἑὀ ὀὀἑᾱὀḆῖὀ: /dev/gvinum/myvol, /dev/gvinum/mirror, /dev/gvinum/striped, /dev/gvinum/raid5 ἑᾱἑ /dev/gvinum/raid10.

- 
- ὈḆῖᾱḆὀᾱὀᾱ:** Ὁῖ δᾱῖᾱἑḆὀῖὀ ἑὀ ÷ ῖᾱἑ ῖῖῖ ᾱἑᾱ ὀᾱἑ ὀᾱἑἑḆ ὀἑῖὀῖḆḆὀᾱ ὀῖὀ Vinum.

ῖᾱὀ ἑᾱὀḆῖῖῖὀ /dev/vinum/drive Ἰᾱ ἑᾱὀᾱ ÷ ὕḆὀᾱὀὀ ᾱἑᾱ ὀῖῖ ἑḆἑᾱ ᾱḆὀἑῖ. Ὀὀᾱ ὀῖᾱῖᾱῖὀἑἑὀὀᾱὀ, ᾱὀὀḆῖὀ ῖἑ ἑᾱὀᾱ ÷ ὕḆὀᾱὀὀ ᾱῖῖᾱἑ ὀὀῖᾱῖỌῖῖῖ ᾱὀὀῖḆ ὀῖῖὀ ὀᾱ ὀῖᾱῖᾱῖὀἑἑḆ ᾱῖ ÷ ᾱῖᾱ ὀὀἑᾱὀῖḆῖ ὀῖῖ ᾱḆὀἑῖῖ.

- ¼ἑῖἑ ῖἑ ὀῖῖῖỌ ᾱἑᾱἑ Ḇὀῖὀῖ ᾱδᾱὀἑᾱḆᾱὀ ἑᾱὀᾱ ÷ ὕḆὀᾱὀὀ ὀὀῖῖ ἑᾱὀḆῖῖῖ /dev/gvinum/.
- Ἰἑ ἑᾱὀḆῖῖῖỌ /dev/gvinum/plex ἑᾱἑ /dev/gvinum/sd, ὀῖὀ δᾱῖᾱῖῖ ÷ ῖὀῖ ὀᾱ ᾱῖ ÷ ᾱῖᾱ ὀὀἑᾱὀῖḆῖ ᾱἑᾱ ἑḆἑᾱ plex ἑᾱἑ ὀδῖῖῖῖῖῖ ᾱῖὀḆὀἑ ÷ ᾱ.

Ἰᾱἑᾱ δᾱῖᾱḆᾱỌᾱῖᾱ, ἑᾱὕḆὀᾱὀ ὀῖ δᾱῖᾱἑḆὀῖὀ ᾱῖ ÷ ᾱῖῖ ῖὀἑῖḆὀᾱῖ:

```
drive drive1 device /dev/sdlh
drive drive2 device /dev/sd2h
drive drive3 device /dev/sd3h
drive drive4 device /dev/sd4h
volume s64 setupstate
plex org striped 64k
sd length 100m drive drive1
sd length 100m drive drive2
sd length 100m drive drive3
```

```
sd length 100m drive drive4
```

Ἰὰὸὺ ὁçí ἁδἁἁἁἁἁἁἁἁ ἁδὀϋ ὀἰὸ ἁἁ ÷ ἁἁἁ, ὀἰ gvinum(8) εἁ ἁçἁἁἁἁἁἁἁ ὁçí ἁεἁἁἁἁἁ ἁἁἁ ὀἰἁ ἁἁὀἁἁἁ /dev/gvinum:

```
drwxr-xr-x  2 root  wheel           512 Apr 13 16:46 plex
crwxr-xr--  1 root  wheel    91,   2 Apr 13 16:46 s64
drwxr-xr-x  2 root  wheel           512 Apr 13 16:46 sd

/dev/vinum/plex:
total 0
crwxr-xr--  1 root  wheel    25, 0x10000002 Apr 13 16:46 s64.p0

/dev/vinum/sd:
total 0
crwxr-xr--  1 root  wheel    91, 0x20000002 Apr 13 16:46 s64.p0.s0
crwxr-xr--  1 root  wheel    91, 0x20100002 Apr 13 16:46 s64.p0.s1
crwxr-xr--  1 root  wheel    91, 0x20200002 Apr 13 16:46 s64.p0.s2
crwxr-xr--  1 root  wheel    91, 0x20300002 Apr 13 16:46 s64.p0.s3
```

Ἀἰ εἁε ὀἰβὸἁἁἁ ἁ ἁ ἁçἁἁἁἁ ὀἁἁἁἁἁἁἁ ἸἈ ἁἁἁἁἁ ὀἁ ἁἁἁ ἁεἁ ὀἰὸ ὀδἁἁἁἁἁἁ, εἁ δἁἁἁ ἁ ἁἁἁἁ ἁἁἁἁἁ ὀἰὸ ἁἁἁἁἁ ὀἰὸ Vinum. ἸἈ ὀἰ ὀἁἁἁ ἁἁἁ, ἁ ἁἁἁἁ ἁἁἁἁἁἁἁἁἁἁ ἁἁἁἁἁἁ ἁἁἁ ἁεἁ ἁἁ ἁἁἁἁἁ ἁἁἁ. Ὀἁ ἁἁἁἁἁ ὀἰἁ ἁἁἁἁἁ ἁἁἁ ἁ ἁἁ ἁἁἁἁἁ ἁἁἁ ἁἁἁ 32 ÷ ἁἁἁἁἁἁἁ.

### 21.7.1 Ἀçἁἁἁἁἁ Ὀἁἁἁἁἁ ἸἈ ÷ ἁἁἁ

Ἰε ὀἰἁἁ ἁἁἁ ÷ ἁἁἁ ἁἁἁἁ ἁ ὀἰὸ ἁἁἁἁἁ ἁἁ ἁἁἁἁ ὀἰ ὀἁἁἁἁ, ἁ ἁἁ ἁἁἁἁἁ. Ἀἁἁἁἁἁ ἁ ὀἰὸ ἁἁἁἁἁ ὀἰὸ UNIX, ὀἰ Vinum ἁἁ ἁçἁἁἁἁἁ ἁἁἁἁἁἁἁ ὀἰὸ ὀἁἁἁἁ, εἁε Ἰὀἁ ἁἁἁἁἁἁ ἁἁ ἁἁἁἁἁ ἁ ἁἁἁἁἁἁἁἁ ἁἁἁἁἁ ἁἁἁἁἁἁἁ. Ἀἁἁ ἁἁἁἁἁ ὁçí ὀἁἁἁἁἁἁἁ ἁἁἁἁἁ ἁἁἁἁἁἁἁἁἁ ἁἁἁἁἁἁ ἁἁ ἁἁἁἁἁἁἁ ὀἰὸ newfs(8), ὀἰ ἁἁἁ ὀἁἁἁ ὀἁἁἁ ἁἁἁἁἁἁἁ ὀἁἁἁἁἁἁ ὀἰ ὀἁἁἁἁἁἁἁ ἁ ἁἁἁἁἁἁἁ ἁἁἁἁἁ ἁἁἁἁἁ ἁἁἁἁἁ ἁἁἁἁἁἁ ἁἁἁἁἁ /dev/ad0a ἁ /dev/da2h. Ὀἁ ἁἁἁἁἁ ἁἁἁ ἁἁἁἁἁἁἁἁἁ ὁçí ὀἁἁἁἁ ἁἁἁἁἁἁἁ (a) ὀἁἁ ὀἁἁἁἁ ἁἁἁἁ IDE (ad) εἁε ὁçí ἁἁἁἁ ἁἁἁἁἁἁἁ (h) ὀἁἁ ὀἁἁἁ (2) SCSI ἁἁἁἁ (da) ἁἁἁἁἁἁἁἁἁ. Ὀἁ ἁἁἁἁἁ, ἸἈ ὀἁἁἁ ὀἰ Vinum ἁἁἁἁ ἁ ἁἁἁἁἁἁἁ /dev/gvinum/concat, ὀἰ ἁἁἁἁ ἁἁ ἸἈ ἁἁἁἁ ὀἁἁἁἁ ἁἁἁἁ ἁ ἁἁἁ ἁἁἁἁ ἁἁἁἁἁἁἁἁἁ. Ἀεἁ ὀἁἁἁἁἁἁἁ, ὀἰ newfs(8) ἁἁἁἁἁἁ ὀἰ ἁἁἁ ὀἰ ἁἁἁἁἁ ἁἁ ἁ ἁἁἁἁἁἁἁ ἁ ἁἁ ἁἁἁἁἁ ἁ ὀἁἁἁἁἁἁἁ. Ἀεἁ ὀἁἁἁἁἁἁἁ:

```
# newfs /dev/gvinum/concat
newfs: /dev/gvinum/concat: can't figure out file system partition
```

Ἀεἁ ἁ ἁçἁἁἁἁἁἁ ἸἈ ὀἁἁἁἁ ἁἁ ÷ ἁἁἁ ὀἁ ἁἁἁ ὀἁἁ ὀἁἁἁ, ÷ ἁçἁἁἁἁἁἁἁ ὁçí newfs(8):

```
# newfs /dev/gvinum/concat
```

**Ὀçἁἁἁἁἁ:** Ὀἁ ἁἁἁἁἁἁἁ ὀἰ FreeBSD ὀἁἁ ἁἁ ὁçí 5.0, ç newfs(8) ἁἁἁἁἁ ὁçí ὀἁἁἁἁἁἁ ἁἁἁἁἁ -v εἁε ὀἁἁ ὀἁἁἁ ὀἁἁἁ ἁἁἁἁἁἁ ὀἁἁ ὀἁἁἁἁἁἁ:

```
# newfs -v /dev/vinum/concat
```



ἀβίάε ἀδουιάδὸ Ἰέά ÷ ἰδ (ἰΎού ὄτδ fsck(8)) ἐάε δῆρὸῦῆδὸτδ ὄι ὄδδὸτδ Ὀύι ἄñ ÷ ἄβὺ ὄι ἄῆβδῆῆῆδῆ ὄ ἄ ὄύῆδὸ Vinum.

¼δῆ ἰἄέείῦδῶ ὄι Vinum ἰ ἄ ὄτδ ἄῖῑῑP vinum start, ὄι Vinum ἄέἄῦᾷᾷ ὄτδ ἄῦὄτδ ἄἄἄῆῦῖ ἰ ἰδῆῖβῶῖ ἄδῦ Ἰῖἄ ἄβδῆ ὄι ἄῆβδῆἄὄ ὄδῦ ὄῖ Ἰέἄ ÷ ἰ ὄῖ. Εῦδῦ ἄδῦ ὄδῆῆῆῆᾷᾷᾷ ὄ ὄῖῑῑᾷᾷ, εῦᾷ ἄβδῆῖ δᾷῆῦ ÷ ἄε Ἰῖἄ ὄῖῑ ἄῖὄῑᾷὄῖ ὄτδ ἄῦὄτδ, Ἰὄὄ ἄἄ Ἰ ÷ ἄε ὄτῖὄὄ ἄδῦ ὄῖῑ ἄβδῆῖ ἄ ἄβῖᾷ ὄ ἄῖῦἄῖὄτδ. Ὀὄὄὄῖ, ἰἄὄῦ ἄδῦ εῦὄῖῑ ἄδῦὄῖ ὄἄῖὄὄὄὄὄὄ ἄέὄὄὄῆᾷᾷ, ὄι Vinum ἄ ὄῆῦὄᾷ ἰ ἄ ἄἄῖῆῆῆὄᾷ ὄῖῑὄ ἄβδῆῖ Ὀ ἄ ὄῖ ὄῖ ὄῆὄὄὄὄὄ ἄῖὄῑᾷὄῖ ἄἄ ἰ ἄ ἄἄἄῦὄᾷ ἄδῦ ἄἄᾷ ὄὄὄ ἰδῆῖβῶᾷὄ. ἰἄὄῦ ἄ ἄῖῆῆῑὄᾷ (ἄ ἄ ÷ ἰᾷῦᾷᾷᾷᾷ) ὄὄὄ ἰδῆῖβῶᾷὄ ἄἄ ὄὄὄὄ ὄὄῖῑῑὄὄὄ ἄβδῆῖὄ.

## 21.9 × ἡβὸτ ὄῖὄ Vinum ὄῖῖ Ἠέᾷᾷᾷ Ὀὔὄὄτῖ Ἄñ ÷ ἄβὺ

Ὀἄ Ἰῖἄ ἰτ ÷ Ὀῖῖῖ ὄὄῖ ἰδῖῖῖ Ἰ ÷ ἄε ἄβῖᾷ ὄᾷᾷ mirror ὄὄ ὄὄὄὄῖὄὄ ἄñ ÷ ἄβὺ ἰ ἄ ὄτδ ÷ ἡβὸτ ὄῖὄ Vinum, ἄβῖᾷ ὄὄῖᾷᾷ ἄὄᾷὄὄὄ ἰ ἄ ἄβῖᾷ mirror ἄἄ ὄὄῖ ἡᾷᾷᾷ (root) ὄὔὄὄὄ ἄñ ÷ ἄβὺ. Ç ἡὔᾷὄτ ἄὄὄᾷ ἄἄ ἄβῖᾷ ὄὄὄὄ ἄὄᾷ ὄὄᾷ ὄ ὄ Ἰῖἄ ἰδῖῑῑᾷᾷὄὄ ὄὔὄὄὄ ἄñ ÷ ἄβὺ, ἄὄᾷᾷᾷ:

- Ὀῖ ἡᾷᾷᾷ ὄὔὄὄὄ ἄñ ÷ ἄβὺ ὄῆῦὄᾷ ἰ ἄ βῖᾷ ἄἄᾷᾷὄῖ ἄδῦ ὄῖῑ ῖῆῆὄ ἄὄὄὄ ὄτδ ἄἄᾷᾷὄὄὄ ἄἄᾷᾷὄὄὄ, Ἰὄὄ ἄβῖᾷ ἄὄἄᾷᾷὄὄὄ ἰᾷ ὄὄῖᾷῖῖ ὄ ὄῖὄ Vinum ἰ ἄ βῖᾷ ἄὄὄὄὄ ἄἄᾷᾷὄὄὄ ὄτδ ἄἄᾷ ὄὄᾷᾷ
- Ἰ ὄὄῖὄ ὄῖὄ ὄᾷῆῦ ÷ ἄε ὄῖ ἡᾷᾷᾷ ὄὔὄὄὄ ἄñ ÷ ἄβὺ ὄᾷῆῦ ÷ ἄε ἄὄὄὄὄ ἄἄ ὄῖῖ ἑῖᾷᾷᾷ ἄἄᾷᾷὄὄὄ (bootstrap) ἄἄ ὄῖῖ ὄὄῆᾷᾷ, ἰ ἰδῖῖὄ ἄ ὄῆῦὄᾷ ἰ ἄ βῖᾷ ὄῆῖὄὄὄὄ ἄδῦ ἄἄὄᾷᾷ ὄῆῖᾷῖῖῖῖῖῖ ὄῖὄ ὄὄὄὄῖὄὄὄ (ὄ. ÷. ὄῖ BIOS ὄ ἰτ ÷ ἄῖὄὄὄ ὄὔὄὄὄ PC), ὄ ἰδῖῖᾷ ἄἄ ἄῖῆῆᾷῑὄῖ ἄἄ ἄἄ ἰδῖῖῖῖ ἰ ἰῦῑὄῖ ὄὄὄ ἄὄὄὄ Ἰ ἰᾷᾷᾷ ὄῖὄὄὄὄ ὄῖὄ Vinum.

Ὀὄὄ ἄὄὄὄᾷᾷ ἄῖὄὄὄὄ, ἰ ὄῖὄ "ἡᾷᾷᾷ ὄὄῖὄ" ÷ ἡῖὄῖῖὄῖᾷᾷ ἄἄῖᾷᾷ ἄἄ ἰ ὄᾷῆᾷῖᾷᾷ ὄῖ ὄὄῖ ὄῖὄ Vinum ὄῖὄ ὄᾷῆῦ ÷ ἄε ὄῖ ἡᾷᾷᾷ ὄὔὄὄὄ ἄñ ÷ ἄβὺ. Ἄβῖᾷ ἄἄῖᾷᾷ ἄἄᾷ ἄἄῖᾷ ἰ ἄ ÷ ἡῖὄῖῖὄῖᾷᾷ ὄῖ ὄῖᾷ "root" ἄἄ ἄὄὄ ὄῖ ὄὄῖᾷ, ἄἄῦ ἄὄὄ ἄἄ ἄὄὄᾷᾷ ὄ ÷ ἰᾷᾷ ἄὄᾷᾷὄὄὄ. ¼ἄ ὄ ὄᾷᾷᾷᾷᾷᾷ ἄῖὄῑᾷ ὄὄὄ ὄᾷᾷᾷᾷ ἄῖὄὄὄὄ ÷ ἡῖὄῖῖὄῖᾷᾷ ὄῖ ὄᾷᾷᾷᾷ ÷ P.

### 21.9.1 Ἀἄᾷᾷὄτ ὄῖὄ Vinum Ἀῆᾷᾷ ἰῆῆὄ ἄἄ ὄῖ Ἠέᾷᾷᾷ Ὀὔὄὄὄ Ἄñ ÷ ἄβὺ

Ἀὄὄ ἰδῖῖᾷ ἰ ἄ ἄὄὄὄ ÷ ἄᾷ ἰ ἄ ἄῦὄῖῖὄὄ ὄῆὄὄὄ:

- Ὀῖ Vinum ὄῆῦὄᾷ ἰ ἄ βῖᾷ ἄἄᾷᾷὄῖ ὄὄῖ ὄὄῆᾷᾷ ἄὄὄὄ ὄῖ ἄἄᾷᾷὄὄ. Ἀἄ ὄῖ ἄᾷᾷ ἄὄὄ, ὄ ἰῦῑῖῖὄ ἄὄὄὄὄὄ ἄἄᾷᾷὄὄ ὄῖὄ ὄᾷῆᾷῖᾷᾷᾷ ὄὄῖ Ὀῖᾷ 21.8.1.1 ἄἄ ἰδῖῖᾷ ἰ ἄ ÷ ἡῖὄῖῖὄῖᾷᾷ ὄ ἄ ἄὄὄ ὄῖ ὄᾷῆᾷὄὄὄ ἄἄ ὄ ὄᾷῖᾷὄὄὄὄ start\_vinum ἄἄ ἄ ὄῆῦὄᾷ ἰ ἄ ὄᾷᾷ ὄὄᾷ ÷ ἡῖὄῖῖὄῖᾷᾷ ὄ ὄᾷᾷᾷὄὄ ἄῦὄὄὄ. ἰἄ ὄἄᾷᾷ ἄὄᾷᾷᾷ ἄβῖᾷ ἰ ἰἄὄᾷᾷὄὄὄὄὄ ὄὄᾷᾷ ὄὄᾷᾷᾷ ὄῖ Vinum ὄὄῖ ὄὄῆᾷᾷ ἰὄὄ ἰ ἄ βῖᾷ ἄἄᾷᾷὄῖ ὄῖὄὄ, ἄἄῦ ἄὄὄ ὄὄῖᾷᾷ ἄἄ ἄβῖᾷ ἄὄᾷᾷὄὄὄ. Ὀὄῖ ÷ ἄἄ ἰἄ ἄἄᾷ ἄἄᾷᾷὄῖ ἄὄᾷᾷᾷ, ἰ ἡῆὄὄ ἰ ἄ ὄῖὄῖᾷᾷᾷ ὄῖ Ὀῖᾷ ἰῦὄ ὄῖὄ /boot/loader (Ὀῖᾷ 12.3.3) ὄῆῖ ὄῖ ἄἄᾷᾷὄὄ ὄῖὄ ἄἄῖὄ ὄῖὄ ὄὄῆᾷᾷ. Ἀὄὄ ἰδῖῖᾷ ἰ ἄ ἄὄὄὄ ÷ ἄᾷ ἰ ἄ ὄτδ ἄᾷᾷᾷᾷ:

```
geom_vinum_load="YES"
```

ὄὄῖ ἄñ ÷ ἄβῖ /boot/loader.conf.

•

**ὄῖᾷᾷὄὄ:** Ὀὄῖ *Gvinum*, ὄỪ ὄ ἄἄᾷᾷὄὄὄ ἄἄᾷᾷὄὄὄ ἄῖᾷᾷᾷ ἄὄὄὄὄὄ ἰἄὄὄ ὄῖ ὄῖᾷᾷὄὄ ὄῖὄ ἄᾷᾷᾷᾷὄὄ ὄὄῆᾷᾷ, Ἰὄὄ ὄ ἄἄᾷᾷὄὄὄ ὄῖὄ ὄᾷῆᾷῖᾷᾷᾷ ὄᾷᾷᾷᾷ ἄβῖᾷ ἄἄ ὄ ἰῖῖ ὄῖὄ ἄὄᾷᾷᾷᾷᾷ. Ὀῖ ὄᾷᾷᾷᾷᾷ ἄᾷᾷᾷᾷ ὄᾷῆᾷῖᾷᾷᾷ ὄỪ ὄὄῖᾷᾷὄὄὄ ὄỪ ὄᾷᾷᾷᾷ Ἰἄῖὄὄ ὄῖὄ Vinum, ἄἄ ὄῖ ὄᾷῆᾷὄὄὄ ὄῖὄ ὄῖ ÷ ἡῖὄῖῖὄῖᾷᾷ ὄ ἄ ἄὄᾷᾷ ὄᾷᾷᾷ ὄὔὄὄὄὄ.

Όι Vinum εά δñÝðάέ ίά άñ÷έέιðίέçðάβ ίùñβδ, έάεðδ εά δñÝðάέ ίά δάñÝ÷άέ ήί ήύύ ήιð ñέέέίγ όóóðίάόιð άñ÷άβύι. Άδύ δñίáðέέίð, ήι ήιðίá ήίð Vinum ήίð άέðáέάβδάέ ήίð δδñðίá, άάί άίέ÷ίáyáέ άβδέιðδ ήίð δάñέÝ÷ίóί ðέçñίòññβάð Vinum ιÝ÷ñέ άβδά ñέά÷άέñέόδδδ, άβδά εÛ ήίέί άδύ ήά script άέέβίçóçδ ίά άέðάέÝόιð ήçί άίόιέð vinum start.

**Όçίάβύόç:** Ίέ áεúείòεάð δάñŪάñάόίέ, δάñάέÝόιð ήά άβίáðά ήίð άðάέóίγίáέ άδύ ήι FreeBSD.

Όιðíεάðβίáð ήç άñάίñð:

```
vinum.autostart="YES"
```

ήóι /boot/loader.conf, άβίáðάέ ç řäçāβά ήóι Vinum ίά άέðάέÝόáέ άίβ÷ίáð ήç úεùι ήύί άβδέύι áέά ðέçñίòññβάð Vinum, ήð ήιðίá ήçð áέάάέέάóβáð άέέβίçóçδ ήίð δδñðίá.

Όçίáέððά úðέ άάί άβίáέ άðάñάβδçήι ίά άίçìāñðáð ήιð δδñðίá áέá ήçί ήιðíεάóβá ήίð ñέέέίγ όóóðίáόιð άñ÷άβύι. Όι /boot/loader άίέ÷ίáyáέ ήι úññά ήçð ñέέέéðδ όóóéάðδ ήóι /etc/fstab εάέ ίáðáóŸñáέ άðð ήçί ðέçñίòññβά ήóιð δδñðίá. ¼ήάί Ÿñέάέ ç ðñá ίá άβίáέ δñίóŪñδçóç ήίð ñέέέίγ όóóðίáόιð άñ÷άβύι, ñ δδñðίáð áίáάññβάέ άδύ ήι úññά ήçð όóóéάðδ ήίέ δñúāñáíá řäðçóçδ έά δñÝðάέ ίá ñùððóáέ áέá ίά άέðáέÝόáέ ήç ίáðŪñáόç ήóι άóùðāñέέú áίáάññέóóέέú (ID) ήçð όóóéáðδ (άñέέññ ñáçóçδ).

### 21.9.2 Άçίέίðñáβά Ñέέέέίγ Όύύύ Vinum ίá Άóίáóúδçóá ðñúááόçδ άδύ ήí Ęðáέέá Άέέβίçóçδ (Bootstrap).

Έáεðδ ñ δñÝ÷ίðάð έðáέέáð άέέβίçóçδ ήίð FreeBSD Ý÷άέ ιÝáάέιð ίúñí 7.5 KB, εάέ άβίáέ ðäç άðέóññόέóίÝíð ίá ήçί άίŪáíúδç άñ÷άβύι (úðúð ήι /boot/loader) άδύ ήι όýóδçíá άñ÷άβύι UFS, άβίáέ δñáέééÛ ááyíáήί ίá āññβáέέ έάέ ήέð άðáέóιγíáíáð áóúðāñέéŸδ āñŸδ ήίð Vinum ðóðá ίá ίðññáβ ίá āñçířáýóáέ ήέð άίðβδήίέ÷ ðð ðέçñίòññβάð ñýέíέçδ έάέ ίá ιŪέάέ ήέð έáððñŸñáέáð ήίð ήύύúð άέέβίçóçδ. Άέá ήι εúāι άðð, ÷ñáέŪæáðáέ ίá ÷ñçóέίðíéðóίðíá εÛ ήίέá ήá÷ίŪóíáðá ðóðá ίá άðíðíá ήóιð έðáέέá άέέβίçóçδ ήçί ήáðāάβðèçóç ýðáññçð ίέáð έáñíééðð έáðŪðìçóçδ "a" ήίð ίá δāñέÝ÷άέ ήι ñέέέéú όýóδçíá άñ÷άβύι.

Άέá ίá έáðáóðáβ áððú áóíáðú, έá δñÝðάέ ίá ðέçñίγíáέά ήáððú÷ñíá úέáð ίέ δάñάέŪðú δñíúðñέÝóáέð úήí áóññŪ ήí ήύύú άέέβίçóçδ:

- Ἴ ήύúð άέέβίçóçδ ááί έá δñÝðάέ ίá άβίáέ stripe ð RAID-5.
- Ἴ ήύúð άέέβίçóçδ ááί έá δñÝðάέ ίá δāñέÝ÷άέ δāñέóóúðāññòð άδύ Ýίá óíáíùιŸíðδ ððñáβδéιðð άíŪ plex.

Όçίáέððά úðέ άβίáέ ήóιðέððð άðέéðççðú έάέ áóíáðú ίá ððŪñ÷ίðí ðíέéáðέŪ plex, έάέÝίá άδύ ήά ίðñíβá ίá άβίáέ άίðβāñáήί ήίð ñέέέίγ όóóðίáόιð άñ÷άβύι. Ç áέááέéáóβá άέέβίçóçδ έá ÷ñçóέίðíéðóáέ úððúήί ίúñí Ýίá άδύ áððŪ ήá άίðβāñáðá áέá ίá āñáέ ήí έðáέέá άέέβίçóçδ έάέ úέá ήá άñ÷άβá, ιÝ÷ñέ ίá άβίáέ ðáέέέŪ ç δñίóŪñδçóç ήίð ñέέέίγ όóóðίáόιð άñ÷άβύι άδύ ήí βáέί ήíð δδñðίá. ÈŪέá íñíáέέúð ððñáβδéιð ιŸóá ήá áððŪ ήá plex, έá ÷ñáέáóðáβ ίá áέάέÝόáέ ήç áέéð ήíð ήáððí-έáðŪðìçóç "a" ðóðá ç όóóéáðð ίá άβίáέ áέέέίðóέιç. Άáí άβίáέ άðáñάβδçήι εÛέá ίέá άδύ áððŸð ήέð ήáððí-έáðáðíðóáέð ίá āñβóέάðáέ ήçί βáέá εŸóç ιŸóá ήçί όóóéáðð, ήá ó÷Ýóç ίá Ūέέáð όóóéáðŸð ήίð δāñέÝ÷ίðí plex ίá ñέέέéú όýóδçíá άñ÷άβύι. Άβίáέ úúð ááίέéŪ έáéð έáÝá ίá άçίέíðñáðóáðά ήίðð ήύύúð ήíð Vinum ίá ðŸðíéí ðñúðí, ðóðá ίέ όóóéáðŸð mirror ήίð δñíéýððíήί ίá άβίáέ ήóñíáðñέéŸð áέá ίá áðíýγááðá ήç όýā÷ðç.







έάδὺέαεί δὶδ Vinum δὶδδὺ ÷έόδὶί έάδὺ 4 KB πὸά ίά ίγί δδὺñ ÷άέ όγέññίόόό ίάδάίγ όçδ άδέέάδδέβääδ δὶδ Vinum έάέ δὶδ έπääέά άέέβίçόçδ.

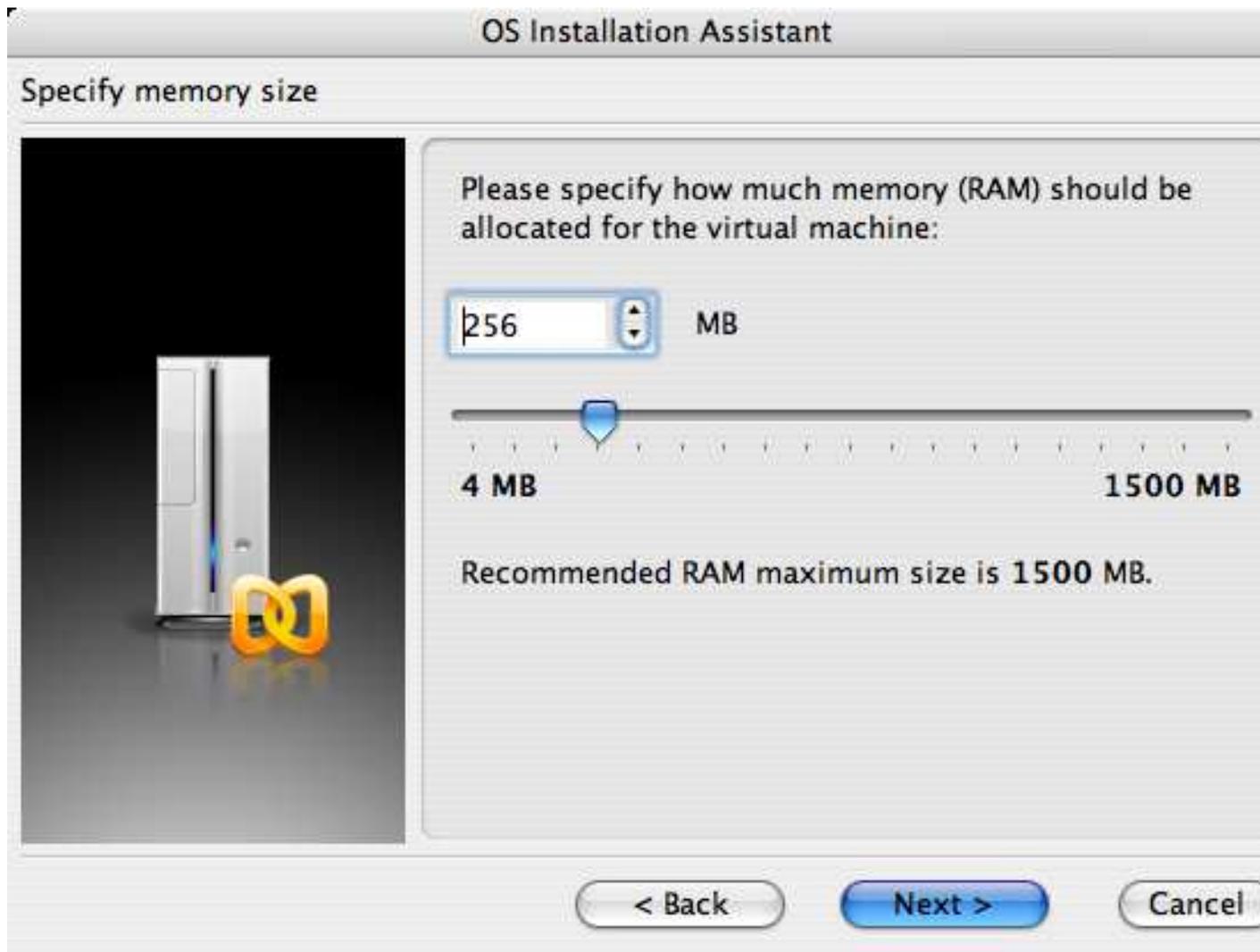
## Ὀçìάέπὸάέδ

1. Ὀί RAID όçìάβίάέ *Redundant Array of Inexpensive Disks* έάέ δάνΎ ÷άέ άέὺδὶñάδ ïñδΎδ άί ÷δὸ όά όδὺέιάόά, άί έάέ όόçί δάνάδὺί ÷ñδόç ï ïñδ άβίάέ έὺδὺδ δάνάδέάίçόέέδδ: δὶ RAID-0 άάί δάνΎ ÷άέ έάίέὺ δΎδὶέά δñίόάόβά άääñΎί.



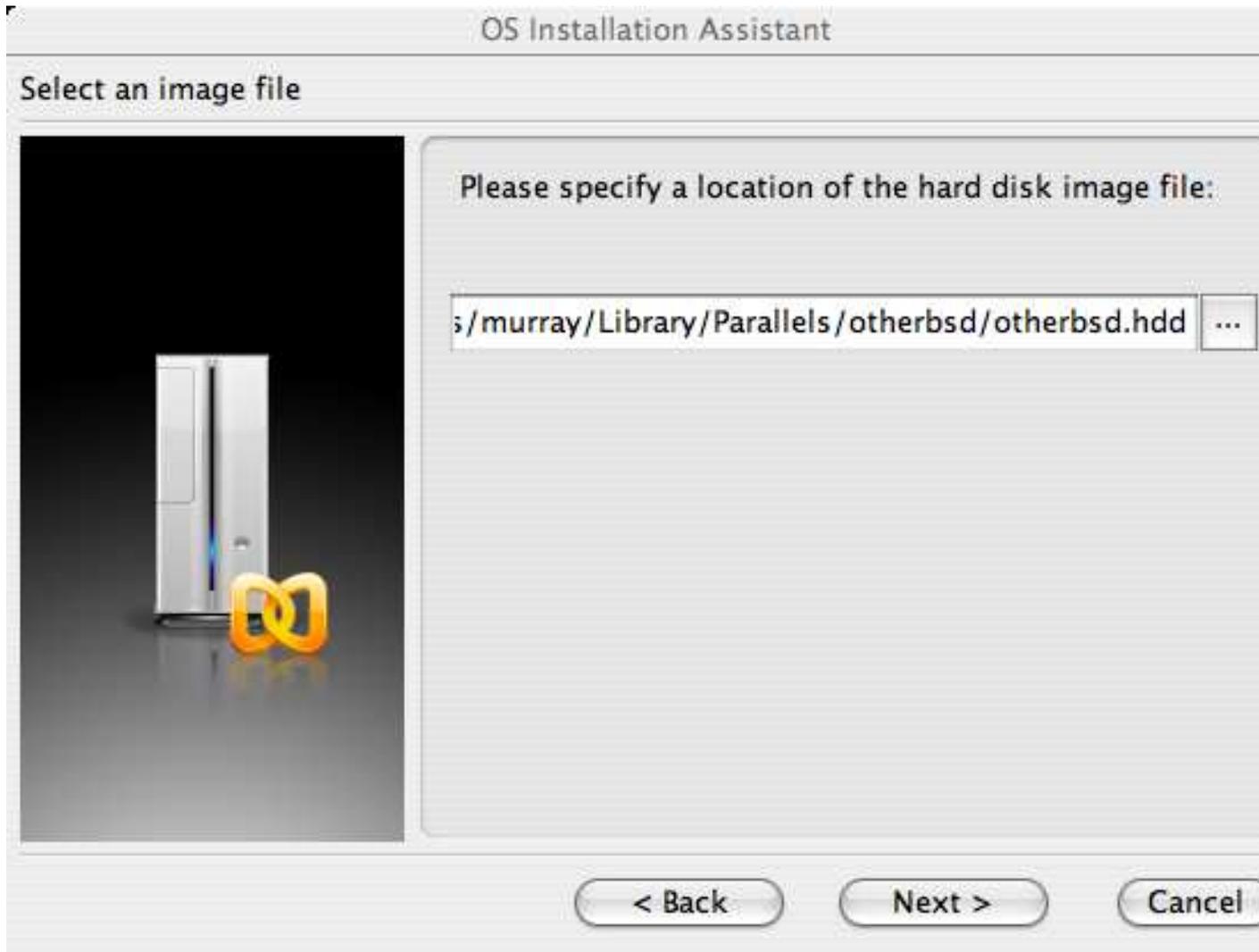


Ἰνβόδα Ἰία εἰαέεῦ ἸἸααεῖο αβόεῖο εἰε Ἰβζόθ θῖο Ἰά αἰδαθῖεῖθῖαδαε ὁδα ὁ ÷ Ἰαεἰά θῖο Ἰ ÷ ἰδα ἰεἰ ὁζῖ ἰεῖῖεῖθῖβζός θῖο FreeBSD. 4GB ἰβόεῖο εἰε 512MB Ἰβζόθ ἰῖῖεἰῖῖῖῖ Ἰεἰ ÷ ἰῖῖ ἰεἰ ὁῖθδ ὁἰῖεῖοῖῖῖῖῖῖῖ ÷ ἰβζόθδ ὁῖθ FreeBSD Ἰῖῖῖ ἰῖ ἰ **Parallels**:

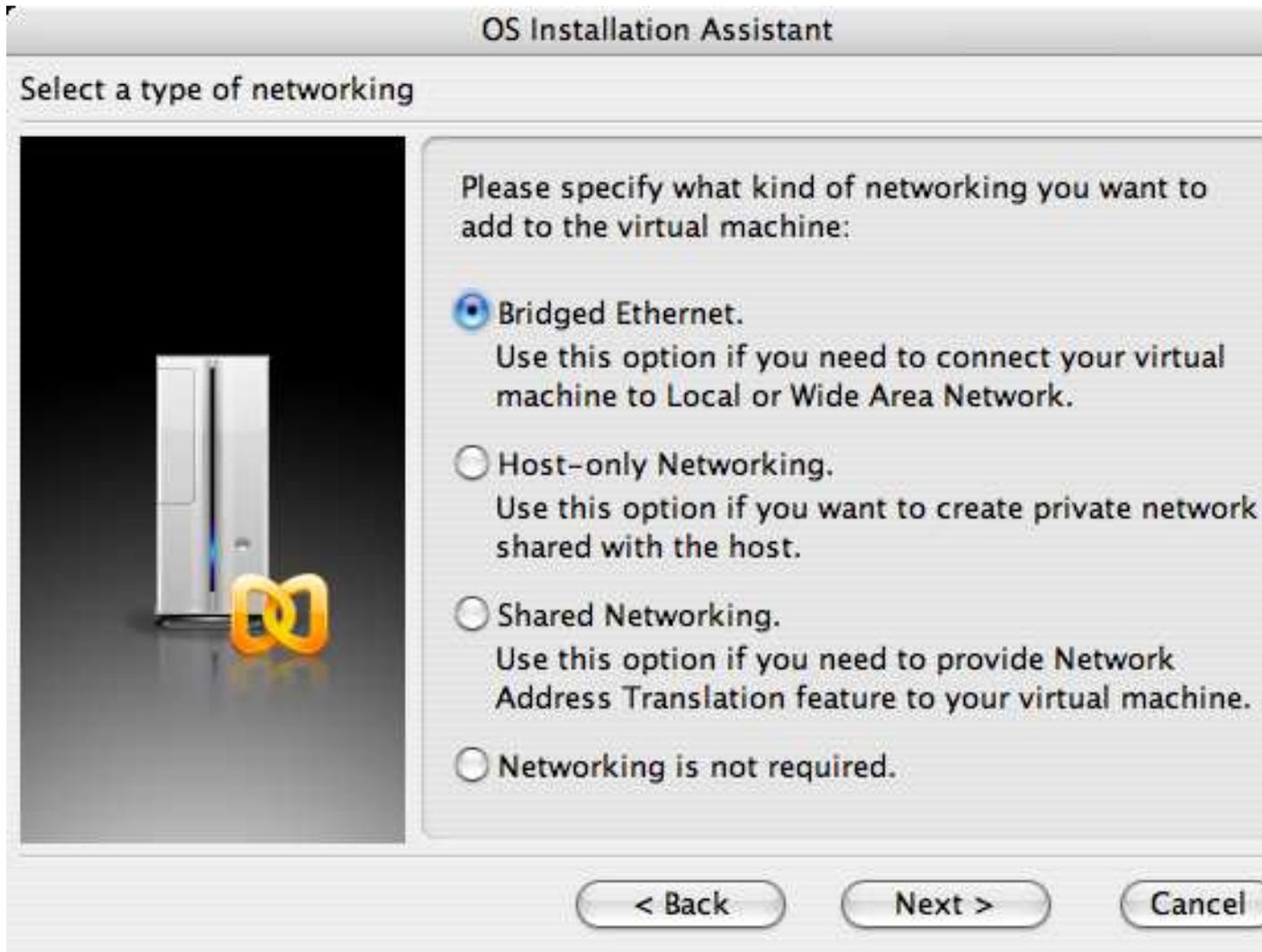








Αδέσ Υιόα οίι ογδι αέέδύοζο έάέ οίι οηιόάνηα Υά αέέδύιό:



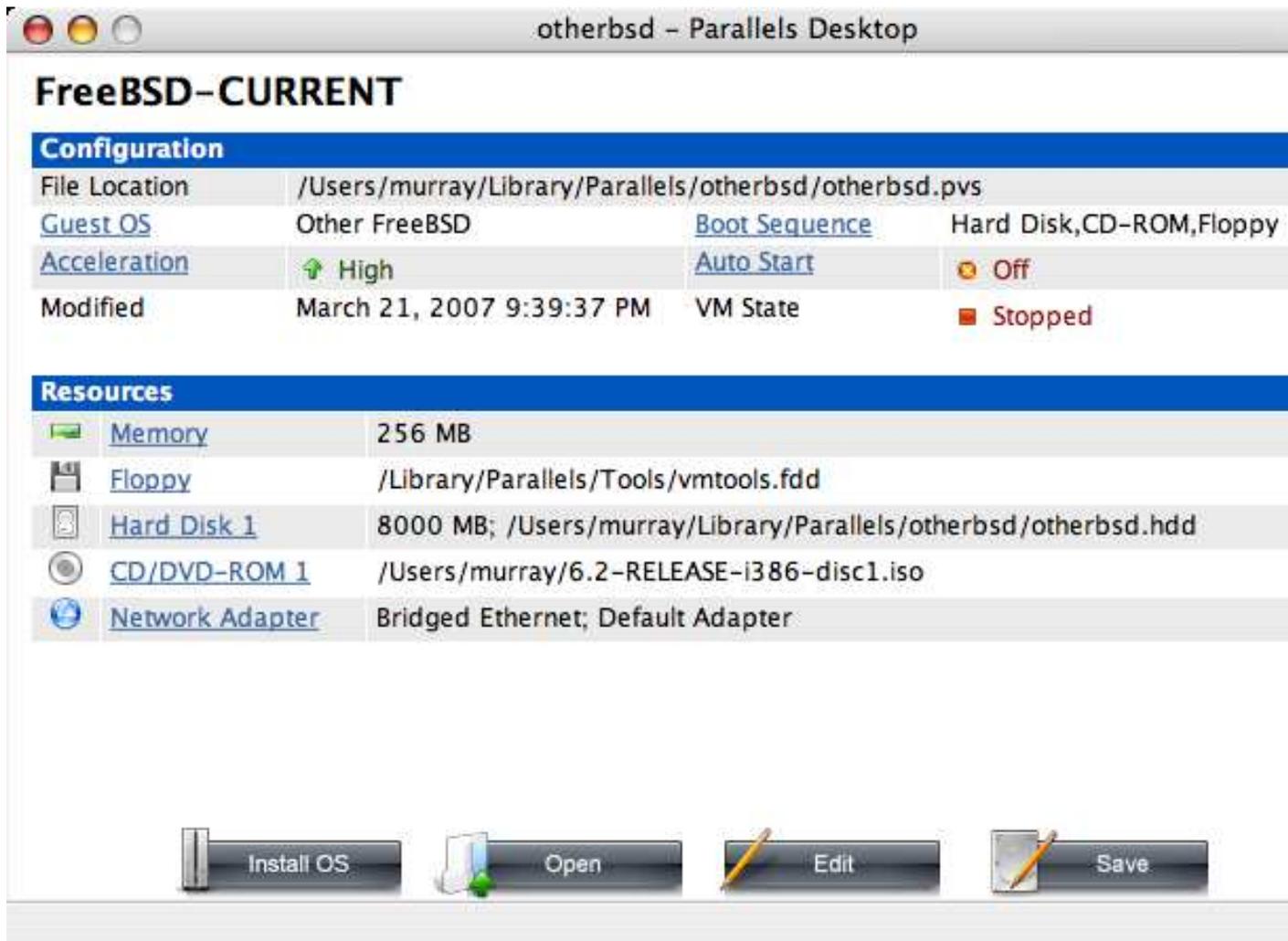


Άδιεπέασός έάέ οΰεο ούί ηόειβόάι:

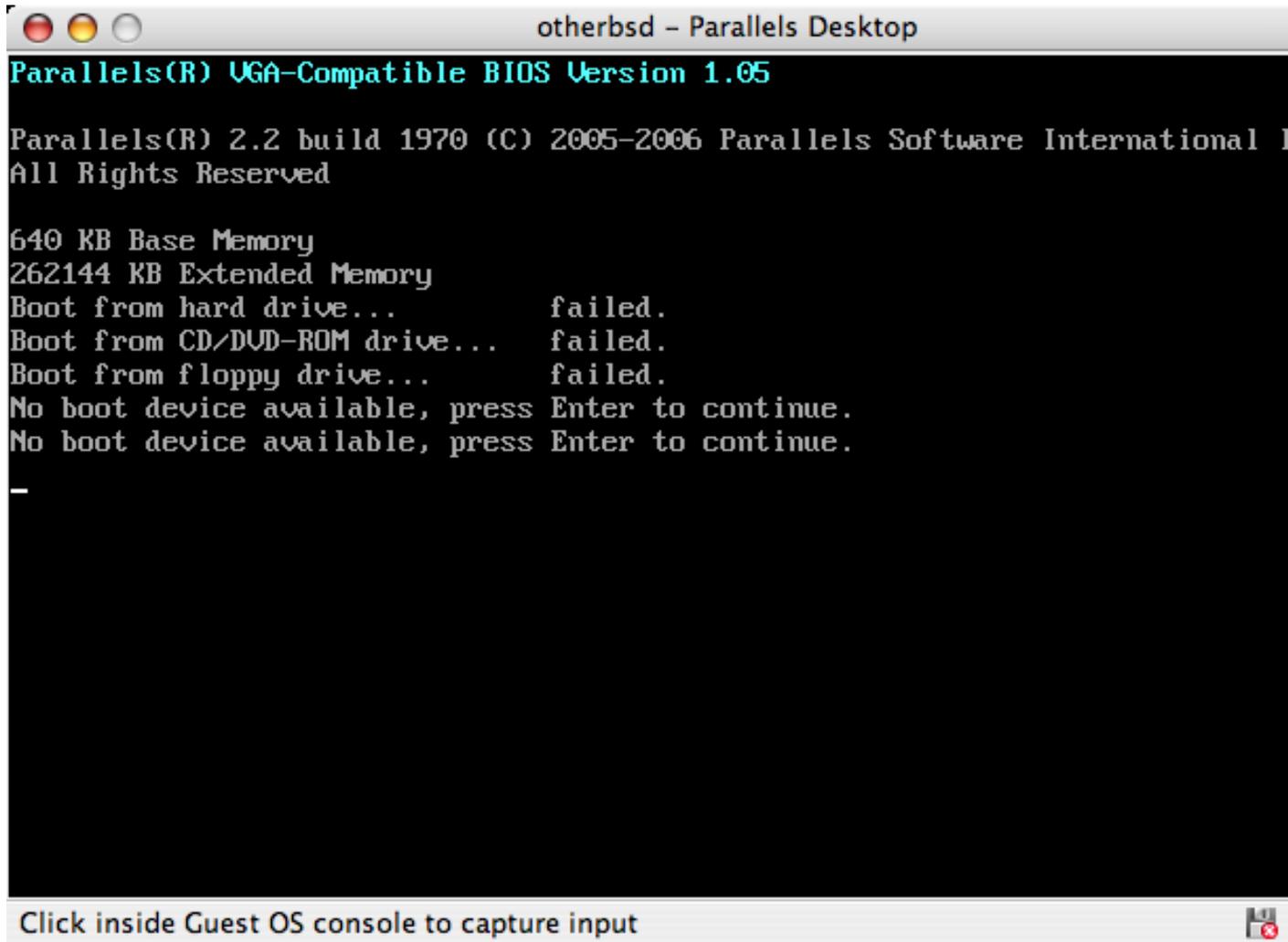




¼ôáí ðí áέéíéέéù óýóðçιά Ý ÷-áé äçíéíðñāçèâ, èá ÷-ñāéáóðâß íá äāéáóáóðPóââ ðí Bāéí ðí FreeBSD. Ī éáέýóðññò ðñüðñò āéá íá āβíáé ç āāéáóÛóóáóç āβíáé íâ ðí āðβóçñ FreeBSD CD-ROM P íâ èÛðñéí āñ ÷-âβí ISO, éáóââáóíÝñ áðü ðñ āðβóçñ FTP ðñðñ. ¼ôáí Ý ÷-âðâ ðí éáóÛéççñ ISO óðñ óéççññü óáð, P ðí CD-ROM óðñ íāçäü CD, áíñññðñéPóââ íâ ðí ðñðβéé ðí áééííBāéí ðñ CD óðñ èÛðñ äññ ñÝññò ðçð ðèññçð ðñ **Parallels**. Īâ áððññ ðñ ðññðñ èá ðññÝóâð íá ðñBóââ ðçí ðçāP ðçð äāéáóÛóóáóçð. Īðññâðâ íá ðñBóââ ðí CDROM P èÛðñéí äéáéÝóéñ ISO āñ ÷-âβí.



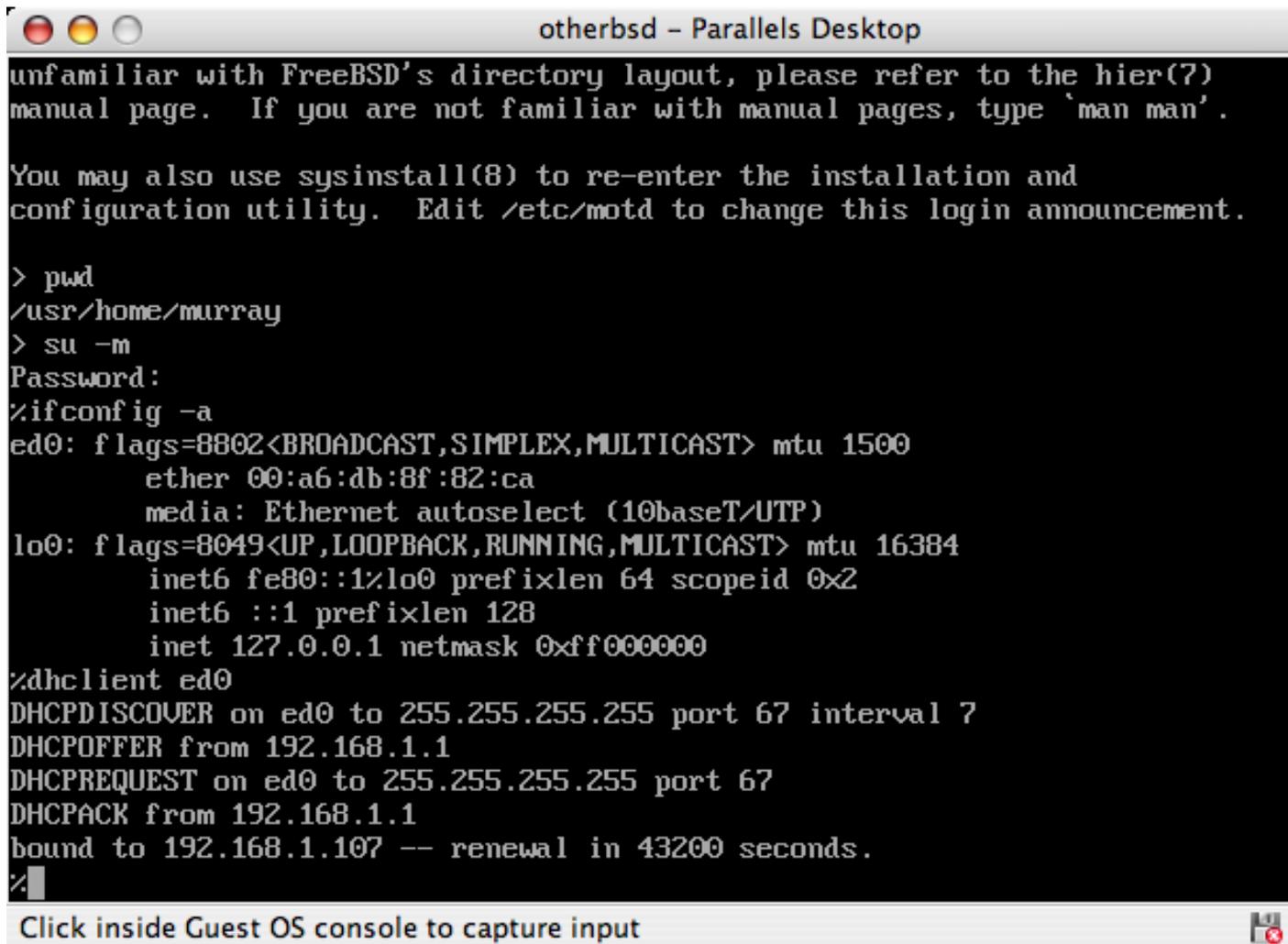
¼οάι Ý ÷ ðòà áíóέóοίε ÷ Ροάέ ος δçãP ããéáòÛοόάόçò, ãðáíáέέέίΡοόά οι áέέίτέέυ όγόόçíá ðáðπρίάó áðέÛ οι έίτíðβ όçò ãðáíáέέέβίççò (reboot) ðίò **Parallels**. Το **Parallels** έá íáέέίΡοάέ íá Ýíá áέάέέυ BIOS ðí íðíβí ðñπóá ãέÝã ÷ áέ ãÛí ððÛñ ÷ áέ áέáέÝóέίí έÛðίέí CD-ROM, ùðòò έÛíáέ έάέ Ýíá ðóóέίτíáέέέυ BIOS.



Óå áððð ðç ðåñβððùός εά åñåέ ðί ιΎόί ååέάóÛόόάόçð ðιò FreeBSD έάέ εά ιåέείβόάέ ðί **sysinstall** ùðùò ðåñέåñÛόåόάέ óοί ÊäöÛεάεί 2. Ìðñåβðå íå ååέάόάóðβόåðå ðί X11, åέεÛ ιç åñέείÛόåðå íå ñòέιβόåðå áððð ðç óóέåìð.



40áí ðáèáερ0á0á íá ðçí ááèá0Ü00á0ç, εÜí0á íéá áðáíáèèβíç0ç 00í 0ñÝ0èí áéèíéèü FreeBSD.



### 22.2.1.2 ἸὰόάεçðÝð ðιò boot loader ðι FreeBSD ðοι Mac OS X/Parallels

Ἀόιγ Ý ÷ áε ἀάέάόάόάέαβ ἀδέð ÷ ðò ðι FreeBSD ðοι Mac OS X ιὰ ðι **Parallels**, ððÛñ ÷ ιοι ιἀñέÛ ἀΠιάόά áέιιç ðιò ιðιιιγί ιά óád ἀιçèΠοιρι ιά ñòèιβóαð ðι áέείιέέι óád óγóçιά.

#### 1. ΙὰόάεçðÝð ðιò boot loader

Οι ðιεί óçιáιόέέι ἀΠιá áβιáε ιá ιáεΠóáð ðι ιÝááειò ðιò kern.hz ðñιέáειÝιιò ιá áίείðιέΠóáð ðç CPU ιÝόά áðu ðι **Parallels**. Ἀóου ιðιιιáβ ιá áβιáε ιá ðι ιá ðñιόέÝóáð ðçι áέιιέιðèç ãñáιιΠ ðοι /boot/loader.conf:

```
kern.hz=100
```

×ùñβð áðð ðç ñγέιέóç, Ýιá áãñáιÝð FreeBSD ðοι **Parallels** éá éáóáιáεΠιáε ðι 15% ðçð CPU áιιð ιιιðγñçιιò ιMac@. ΙáðÛ áðu ðçι áέéááΠ, ç éáóáιÛέιòç éá ðÝóáé éιιðÛ ðοι 5%.

#### 2. Ἀçιέιðñáβá ιÝιò áñ ÷ áβιò ñòèιβóáιι ðιò ðòñΠιá

Ιðιιιáβóá ιá áóáέñÝóáðá ιέáð ðιòð ιäçãιγð áέá SCSI, FireWire, éáé USB óóóéáðÝð. Οι **Parallels** ðáñÝ ÷ áé Ýιá áέείιέέι ðñιόáñιιáÝá áέéðγιò ι ιðιιβιò ÷ ñçóέιιðιέáβóáé áðu ðιι ιäçãü ed(4), ιðuðá ιέιέ ιé ιäçãιβ áέá áέéðóáéÝð óóóéáðÝð áéúòð ðιι ed(4) éáé miibus(4) ιðιιγί ιá áóáέñáειγί áðu ðιι ðòñΠιá.

### 3. Νýετέόζ áέέόýτò

Ç ðετ áðêP ñýετέόζ áέέόýτò εÙτáέ ÷ñPόζ ôτò DHCP áέá τά óóτááεáβ ôτ áέέττεέττ óáò óýóòçτá óòτ βáετ ôτðέεττ áβέòòτ τá ôττ Mac. Άòòτ τðττáβ áýετεά τά áβτáέ τά ôτ τά ðττòεÝóáòá ôç áττáτττ ifconfig\_ed0="DHCP" óòτ /etc/rc.conf. Ðττòðεττεέττòáττò ñòετβóáέò áέέόýτò ðáττεáττÙòττòáέ óòτ εáοÙεάετ ΕὰοÙεάετ 31.

## 22.2.2 FreeBSD τά Xen™ óòτ Linux

*ÓòτáέóòτττÙ ðτò Fukang Chen (Loader).*

Óτ Xen hypervisor áβτáέ Ýτá ðττúττ ðáττá-άέέττεέττβζόζò (paravirtualization) áττε ÷ ôτý εpáέéá ôτ τðτβτ ðòτòóçñβæáòáέ áðτ ôçτ áòáέττáβá XenSource. Óá óέεττáττýττáá εáέóττòττáέέÙ áβτáέ áττòòÙ óáτ domU domains, εáέ τ τáτέóòðò óáτ dom0. Óτ ðττòτ áPτá áέá τά ðττÝτáòá Ýτá áέέττεέττ óýóòçτá FreeBSD τÝóá áðτ ôτ Linux áβτáέ τά ááέáóáòòPóáòá ôτ Xen áέá Linux dom0. Άτáβò ÷ñçóέτττðττεPóáτá τð τáτέóòð ôçò áέáτττ Slackware Linux.

### 22.2.2.1 ΆάέáòÙóóáóç Xen 3 óá Linux dom0

#### 1. ΕάòÝááóτá Xen 3.0 áðτ XenSource

ΕάòááÙóóá xen-3.0.4\_1-src.tgz ([http://bits.xensource.com/oss-xen/release/3.0.4-1/src.tgz/xen-3.0.4\\_1-src.tgz](http://bits.xensource.com/oss-xen/release/3.0.4-1/src.tgz/xen-3.0.4_1-src.tgz)) from <http://www.xensource.com/>.

#### 2. ΙάðáέáòÙττáòá ôτ tarball

```
# cd xen-3.0.4_1-src
# KERNELS="linux-2.6-xen0 linux-2.6-xenU" make world
# make install
```

**Óçτáβòóç:** Άέá τά τáòááέττòòβóáòá τáτÙ ôττ ðòτβτá áέá ôτ dom0:

```
# cd xen-3.0.4_1-src/linux-2.6.16.33-xen0
# make menuconfig
# make
# make install
```

ÐáέέÝò áέáüóáέò ðτò Xen βóòò ÷ñáέÙæτττòáέ τά τττεóòáβ ôτ make ARCH=xen menuconfig

#### 3. ÐττòεPεç óòç εβóóá ôτò Grub menu.lst

Άðáττáττáóóáβòá ôτ /boot/grub/menu.lst εáέ ðττòεÝóóá ðέò ðáττáέÙòττ áττáττÝò:

```
title Xen-3.0.4
root (hd0,0)
kernel /boot/xen-3.0.4-1.gz dom0_mem=262144
module /boot/vmlinuz-2.6.16.33-xen0 root=/dev/hda1 ro
```

#### 4. ΆðáττáέέέττPóóá ôτ óýóòçττÙ óáò εáέ öττòPóóá ôτ Xen

Άτ ÷έέÙ, áðáττáττáóóáβòá ôτ /etc/xen/xend-config.sxp, εáέ ðττòεÝóóá ðέò ðáττáέÙòττ áττáττÝò: (network-script 'network-bridge netdev=eth0')

Óòç óòτÝ ÷áέá, τðτττáá τά ðττÝτττá ôτ Xen:

```
# /etc/init.d/xend start
```

```
# /etc/init.d/xendomains start
```

```
Ôí dom0 ðñÝ÷:áé:
```

```
# xm list
```

Name	ID	Mem	VCPUs	State	Time(s)
Domain-0	0	256	1	r-----	54452.9

### 22.2.2.2 FreeBSD 7-CURRENT domU

ÊäöÛäáëí ðí FreeBSD domU kernel áéá ðí **Xen 3.0** éáé ðçí áééúíá äβóëí (disk image) áðú <http://www.fsmware.com/>

- kernel-current (<http://www.fsmware.com/xenofreebsd/7.0/download/kernel-current>)
- mdroot-7.0.bz2 (<http://www.fsmware.com/xenofreebsd/7.0/download/mdroot-7.0.bz2>)
- xmexample1.bsd (<http://www.fsmware.com/xenofreebsd/7.0/download/config/xmexample1.bsd>)

Ôíðíäöððá ðí áñ÷:áβí ñðèíβóáúí xmexample1.bsd ìÝóá óóí /etc/xen/ éáé áéëÛíá ðá óóíé÷:áβá ðíð ó÷:áöβæíðáé ìá ðí ðíð ãñβóéáðáé ì ðñÞíáð éáé ç áééúíá äβóëíð. Êá ðñÝðáé ìá ñéÛæáé ìá ðí ðáñáéÛò:

```
kernel = "/opt/kernel-current"
memory = 256
name = "freebsd"
vif = [ " ]
disk = [ 'file:/opt/mdroot-7.0,hda1,w' ]
#on_crash = 'preserve'
extra = "boot_verbose"
extra += ",boot_single"
extra += ",kern.hz=100"
extra += ",vfs.root.mountfrom=ufs:/dev/xbd769a"
```

Ôí áñ÷:áβí mdroot-7.0.bz2 èá ðñÝðáé ìá áβíáé áðíóòíðéáóíÝí

Óðç óóíÝ÷:áéá, ðí \_\_xen\_guest ðíð ãñβóéáðáé óóí kernel-current ðñÝðáé ìá áéëÛíáé áéá ìá ðñíóáèáβ ðí VIRT\_BASE ðíð áðáéðáβ ðí **Xen 3.0.3**:

```
# objcopy kernel-current -R __xen_guest
# perl -e 'print "LOADER=generic,GUEST_OS=freebsd,GUEST_VER=7.0,XEN_VER=xen-3.0,BSD_SYMTAB,VIRT_BASE=0xC0000'
# objcopy kernel-current --add-section __xen_guest=tmp

# objdump -j __xen_guest -s kernel-current

kernel-current:      file format elf32-i386
```

```
Contents of section __xen_guest:
0000 4c4f4144 45523d67 656e6572 69632c47  LOADER=generic,G
0010 55455354 5f4f533d 66726565 6273642c  UEST_OS=freebsd,
0020 47554553 545f5645 523d372e 302c5845  GUEST_VER=7.0,XE
0030 4e5f5645 523d7865 6e2d332e 302c4253  N_VER=xen-3.0,BS
0040 445f5359 4d544142 2c564952 545f4241  D_SYMTAB,VIRT_BA
0050 53453d30 78433030 30303030 3000      SE=0xC0000000.
```

Ôðñá áβíáóðá Ýóíéíé ìá äçíéíðñáÞóíðíá éáé ìá áéëéíÞóíðíá ðí domU:

```
# xm create /etc/xen/xmexample1.bsd -c
Using config file "/etc/xen/xmexample1.bsd".
Started domain freebsd
WARNING: loader(8) metadata is missing!
Copyright (c) 1992-2006 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 7.0-CURRENT #113: Wed Jan  4 06:25:43 UTC 2006
  kmacy@freebsd7.gateway.2wire.net:/usr/home/kmacy/p4/freebsd7_xen3/src/sys/i386-xen/compile/XEN
WARNING: DIAGNOSTIC option enabled, expect reduced performance.
Xen reported: 1796.927 MHz processor.
Timecounter "ixen" frequency 1796927000 Hz quality 0
CPU: Intel(R) Pentium(R) 4 CPU 1.80GHz (1796.93-MHz 686-class CPU)
  Origin = "GenuineIntel"  Id = 0xf29  Stepping = 9
  Features=0xbfebfbff<FPU,VME,DE,PSE,TSC,MSR,PAE,MCE,CX8,APIC,SEP,MTRR,PGE,MCA,CMOV,PAT,PSE36,CLFLSH,
  DTS,ACPI,MMX,FXSR,SSE,SSE2,SS,HTT,TM,PBE>
  Features2=0x4400<CNTX-ID,<b14>>
real memory = 265244672 (252 MB)
avail memory = 255963136 (244 MB)
xc0: <Xen Console> on motherboard
cpu0 on motherboard
Timecounters tick every 10.000 msec
[XEN] Initialising virtual ethernet driver.
xn0: Ethernet address: 00:16:3e:6b:de:3a
[XEN]
Trying to mount root from ufs:/dev/xbd769a
WARNING: / was not properly dismounted
Loading configuration files.
No suitable dump device was found.
Entropy harvesting: interrupts ethernet point_to_point kickstart.
Starting file system checks:
/dev/xbd769a: 18859 files, 140370 used, 113473 free (10769 frags, 12838 blocks, 4.2% fragmentation)
Setting hostname: demo.freebsd.org.
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
  inet6 ::1 prefixlen 128
  inet6 fe80::1%lo0 prefixlen 64 scopeid 0x2
  inet 127.0.0.1 netmask 0xff000000
Additional routing options:.
Mounting NFS file systems:.
Starting syslogd.
/etc/rc: WARNING: Dump device does not exist.  Savecore not run.
ELF ldconfig path: /lib /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 usbld.
usb: Kernel module not available: No such file or directory
Starting local daemons:.
Updating motd.
Starting sshd.
Initial i386 initialization:.
Additional ABI support: linux.
Starting cron.
Local package initialization:.
Additional TCP options:.
```

Starting background file system checks in 60 seconds.

Sun Apr 1 02:11:43 UTC 2007

FreeBSD/i386 (demo.freebsd.org) (xc0)

login:

Ôi domU εά ðñÝðáε íá ðñÝ÷:áε ôii ððñÞíá FreeBSD 7.0-CURRENT:

```
# uname -a
FreeBSD demo.freebsd.org 7.0-CURRENT FreeBSD 7.0-CURRENT #113: Wed Jan 4 06:25:43 UTC 2006
kmacy@freebsd7.gateway.2wire.net:/usr/home/kmacy/p4/freebsd7_xen3/src/sys/i386-xen/compile/XENCON
```

ÔÞñá ððñÝá íá ððñÞíá εάε ôi áβεðði ôôii domU. Ôi FreeBSD domU εά εÛíáε ÷ñÞóç áíùð áεáεéíÝ ðñiðáññáÝá ðá ùññá xn0:

```
# ifconfig xn0 10.10.10.200 netmask 255.0.0.0
# ifconfig
xn0: flags=843<UP,BROADCAST,RUNNING,SIMPLEX> mtu 1500
    inet 10.10.10.200 netmask 0xff000000 broadcast 10.255.255.255
    ether 00:16:3e:6b:de:3a
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
    inet6 ::1 prefixlen 128
    inet6 fe80::1%lo0 prefixlen 64 scopeid 0x2
    inet 127.0.0.1 netmask 0xff000000
```

Ôôii dom0 Slackware, εÛðíεá network interfaces ðið áíáñðÞiðáε áðu ôi **Xen** εά ðñÝðáε ðÞñá íá áβíáε áεáεÝóεiá:

```
# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:07:E9:A0:02:C2
          inet addr:10.10.10.130 Bcast:0.0.0.0  Mask:255.0.0.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:815 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1400 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:204857 (200.0 KiB)  TX bytes:129915 (126.8 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:99 errors:0 dropped:0 overruns:0 frame:0
          TX packets:99 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:9744 (9.5 KiB)  TX bytes:9744 (9.5 KiB)

peth0     Link encap:Ethernet  HWaddr FE:FF:FF:FF:FF:FF
          UP BROADCAST RUNNING NOARP  MTU:1500  Metric:1
          RX packets:1853349 errors:0 dropped:0 overruns:0 frame:0
          TX packets:952923 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2432115831 (2.2 GiB)  TX bytes:86528526 (82.5 MiB)
          Base address:0xc000 Memory:ef020000-ef040000
```

```
vif0.1  Link encap:Ethernet  HWaddr FE:FF:FF:FF:FF:FF
        UP BROADCAST RUNNING NOARP  MTU:1500  Metric:1
        RX packets:1400 errors:0 dropped:0 overruns:0 frame:0
        TX packets:815 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0
        RX bytes:129915 (126.8 KiB)  TX bytes:204857 (200.0 KiB)

vif1.0  Link encap:Ethernet  HWaddr FE:FF:FF:FF:FF:FF
        UP BROADCAST RUNNING NOARP  MTU:1500  Metric:1
        RX packets:3 errors:0 dropped:0 overruns:0 frame:0
        TX packets:2 errors:0 dropped:157 overruns:0 carrier:0
        collisions:0 txqueuelen:1
        RX bytes:140 (140.0 b)  TX bytes:158 (158.0 b)

xenbr1  Link encap:Ethernet  HWaddr FE:FF:FF:FF:FF:FF
        UP BROADCAST RUNNING NOARP  MTU:1500  Metric:1
        RX packets:4 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0
        RX bytes:112 (112.0 b)  TX bytes:0 (0.0 b)
```

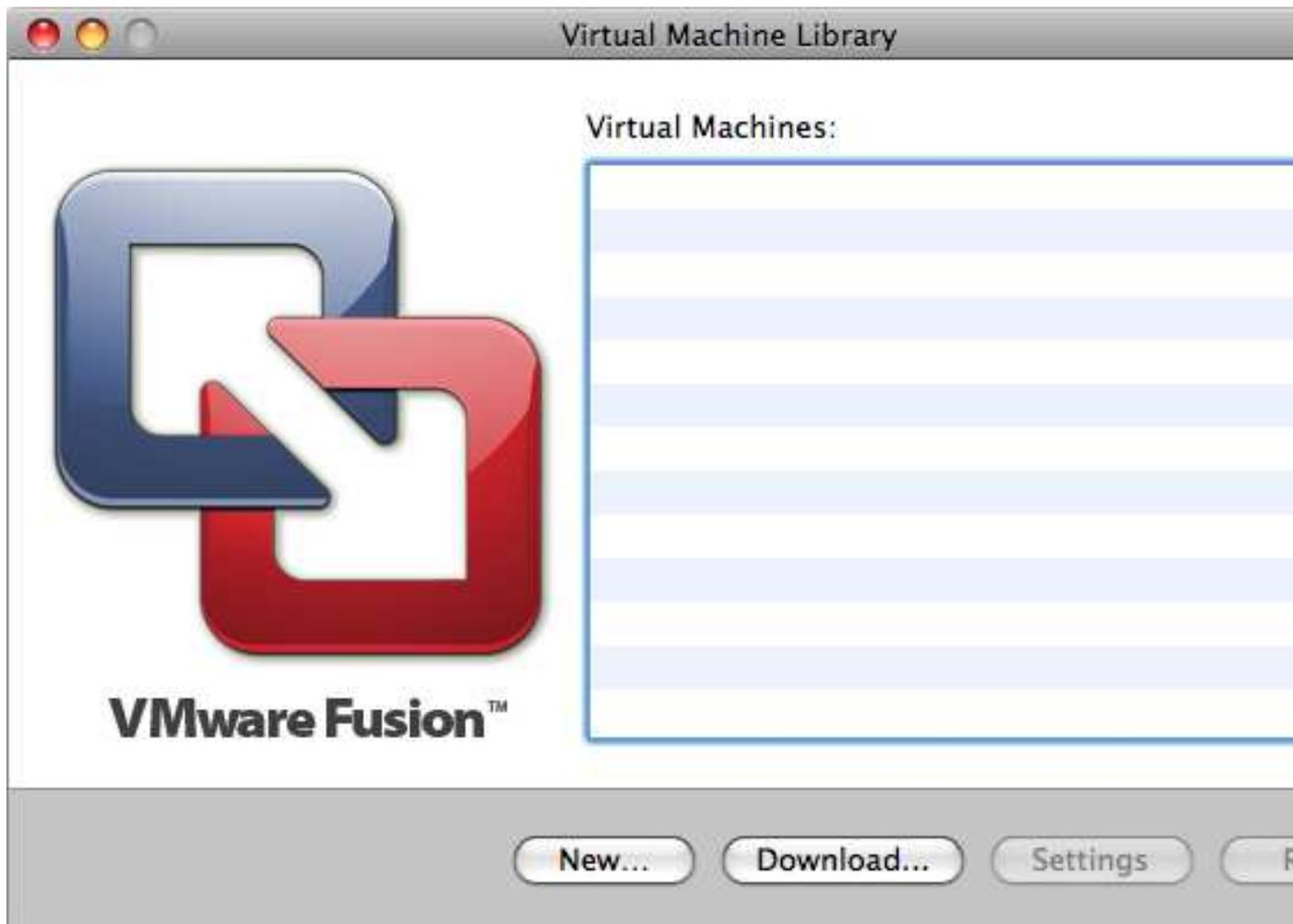
```
# brctl show
bridge name      bridge id          STP enabled      interfaces
xenbr1           8000.feffffffffff no                 vif0.1
   peth0
   vif1.0
```

### 22.2.3 Οι VMware ος MacOS

Οι **VMware Fusion** αεί Mac αβίάέ Υία αιδίνεέυ δνυάνάιιά. ΟδΥν÷ αέ αείέΥόέιι αεί δδτειαέόδΥδ Apple Mac αñ÷ έδαέοιίέέPδ Intel δτδ δñΥ÷ ιοί Mac OS 10.4.9 P εÜδτεά δεί δνυόόάόç Υέαιόç. Οι FreeBSD δδτδόçñβαάόάέ δεPñδδ ùδ όέειññγίññ (guest) έαέότδñάέέυ. Ιύέέδ τετεέçñνέάβ ç αάέάÜόόάόç οτδ **VMware Fusion** όοί Mac OS X, δñΥδάέ ίά ñέιβόάόά ίέά αείίίέέP ιç÷ άίP έάέ ίά αάέάόάόδPόάόά οτδ όέειññγίññ έαέότδñάέέυ όύόόçίά.

#### 22.2.3.1 ΑάέάÜόόάόç οτδ FreeBSD όοί VMware/Mac OS X

Άñ÷ έέÜ ίάέείPόάόά οτδ VMware Fusion, έάέ έά öñδPόάέ ç ÓόέετδP ΑέέίίέέP Ιç÷ άίP. ΑδέέΥίτδ "New" αεί ίά äçιέτδñβόάόά ίέά ίΥά αείίίέέP ιç÷ άίP:



Èá äåβåå íá öïñåðíáέ öï New Virtual Machine Assistant, öï äïçέçåöéü ðñüññåíå äçιέιðñåβåð íεåð íΰåð åέέιέέεðð ìç÷-áfðð. Άðέεΰίðå Continue åέá íá öóíå÷-βåååå:



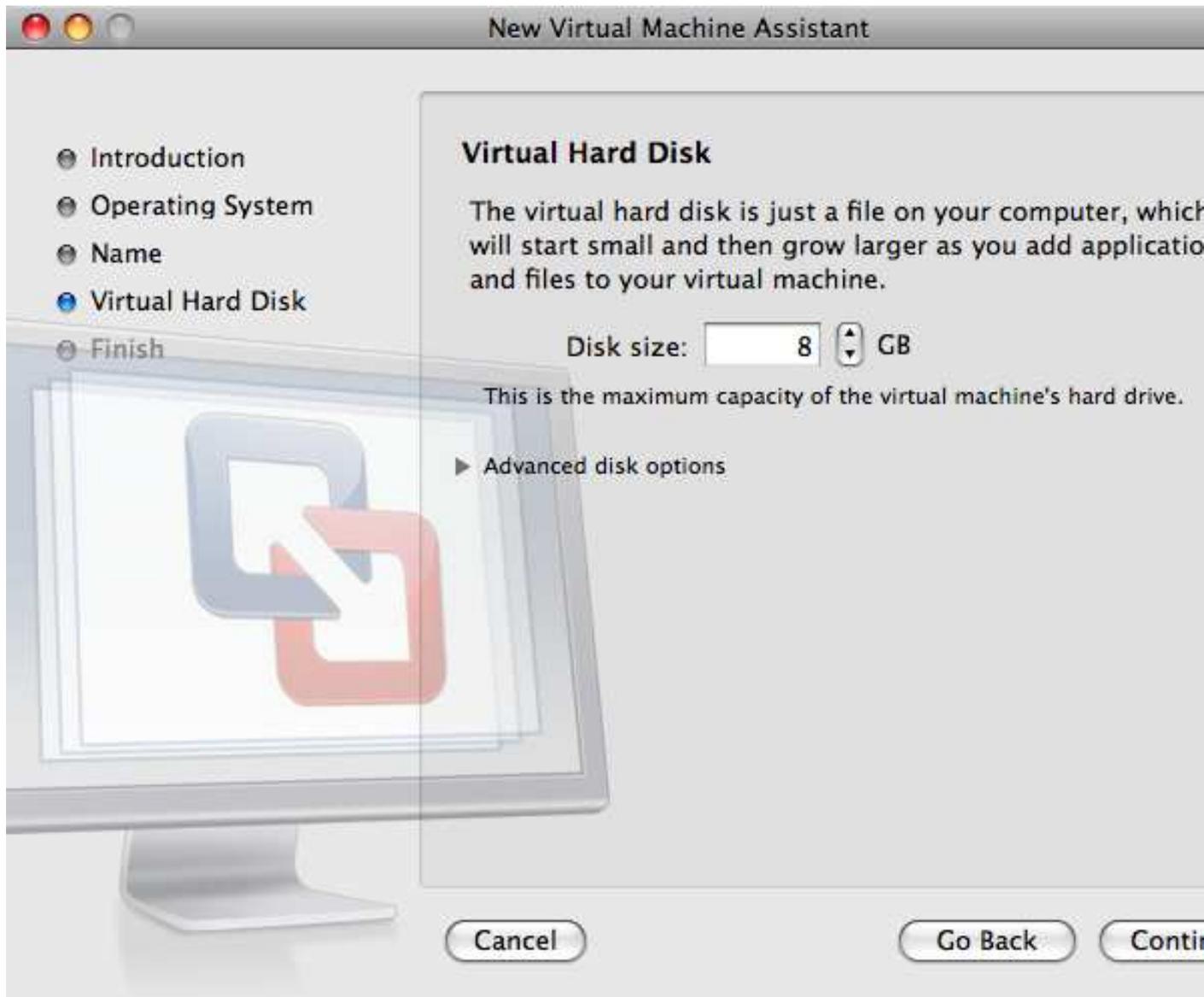
Όχι αδειάει εαέοιναέεγύ οδοδΠιάοιò äéäéÝîä Other äéé ùð Ýäüíóç ääéοιñäééγύ οδοδΠιάοιò äéäéÝîä FreeBSD  
P FreeBSD 64-bit (áfÜëiäá iä öi áí èÝäòä ðñíóðñéiç äéä 64-bit äóäñiäÝò P ü÷-é):



Άπότã Ýía úññã ãέα ôñ VM Image êάé ñðèìβóðã ôñ êáðÛεñññ óôñ ððñβñ èÝεãðã íá áðñççããðèãβ:



Νοείται ότι η Υπηρεσία Αρχειοθέτησης είναι σε λειτουργία:



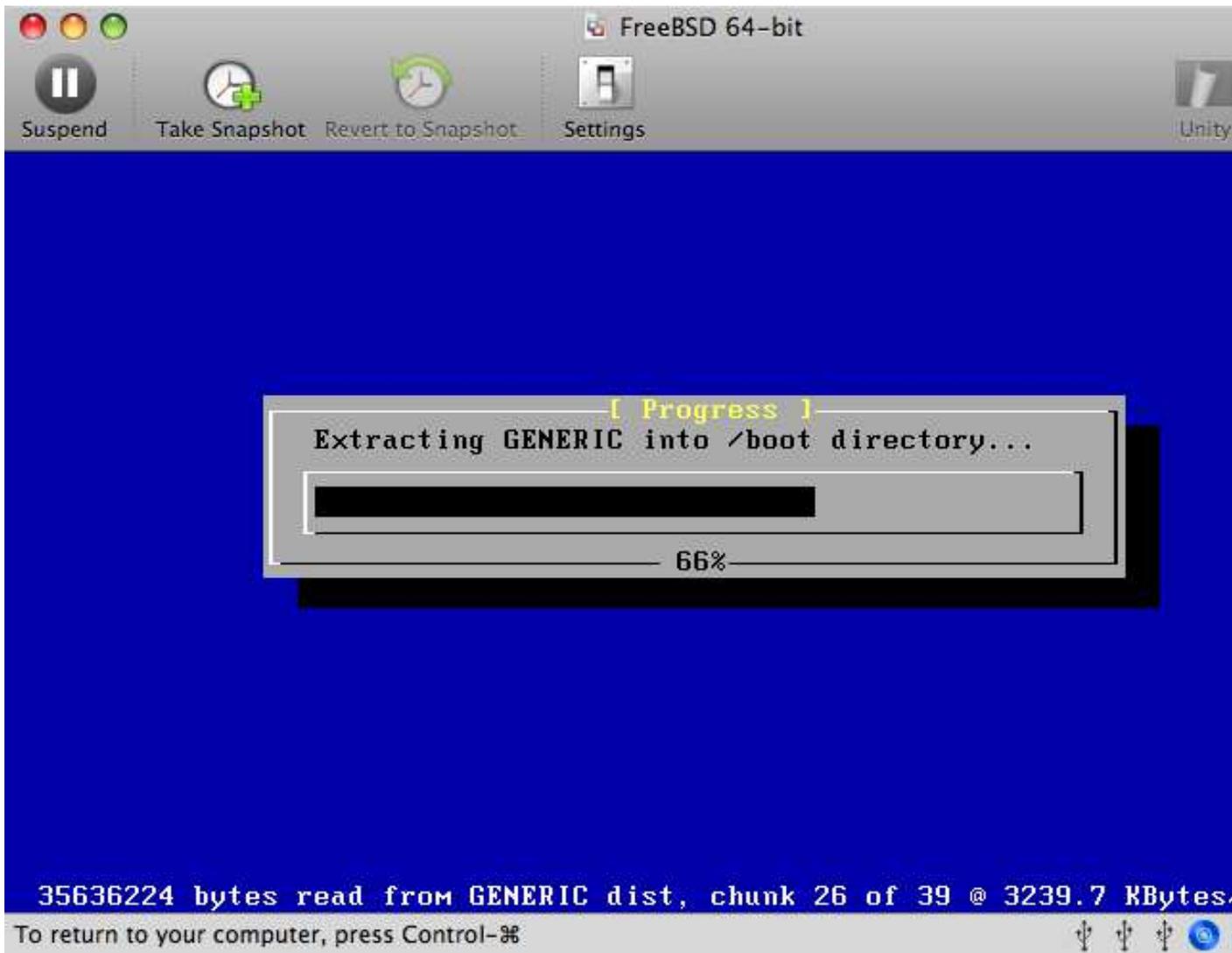
Αδελφοί μου, για να δημιουργήσετε ένα νέο εικονικό δίσκο, ακολουθήστε τα παρακάτω βήματα: 1. Κάντε κλικ στο κουμπί 'Go Back' για να επιστρέψετε στην προηγούμενη οθόνη. 2. Εισαγάγετε το μέγεθος του εικονικού δίσκου (π.χ. 8 GB) στο πεδίο 'Disk size'. 3. Κάντε κλικ στο κουμπί 'Continue' για να προχωρήσετε στην επόμενη οθόνη.



Τέλεος ἀέέΎάόά Finish, ς ἀέήίέêP ις ÷ άίP εά ίάέήPόάέ ός äέääέέάόβά äêêBίςόò (boot):

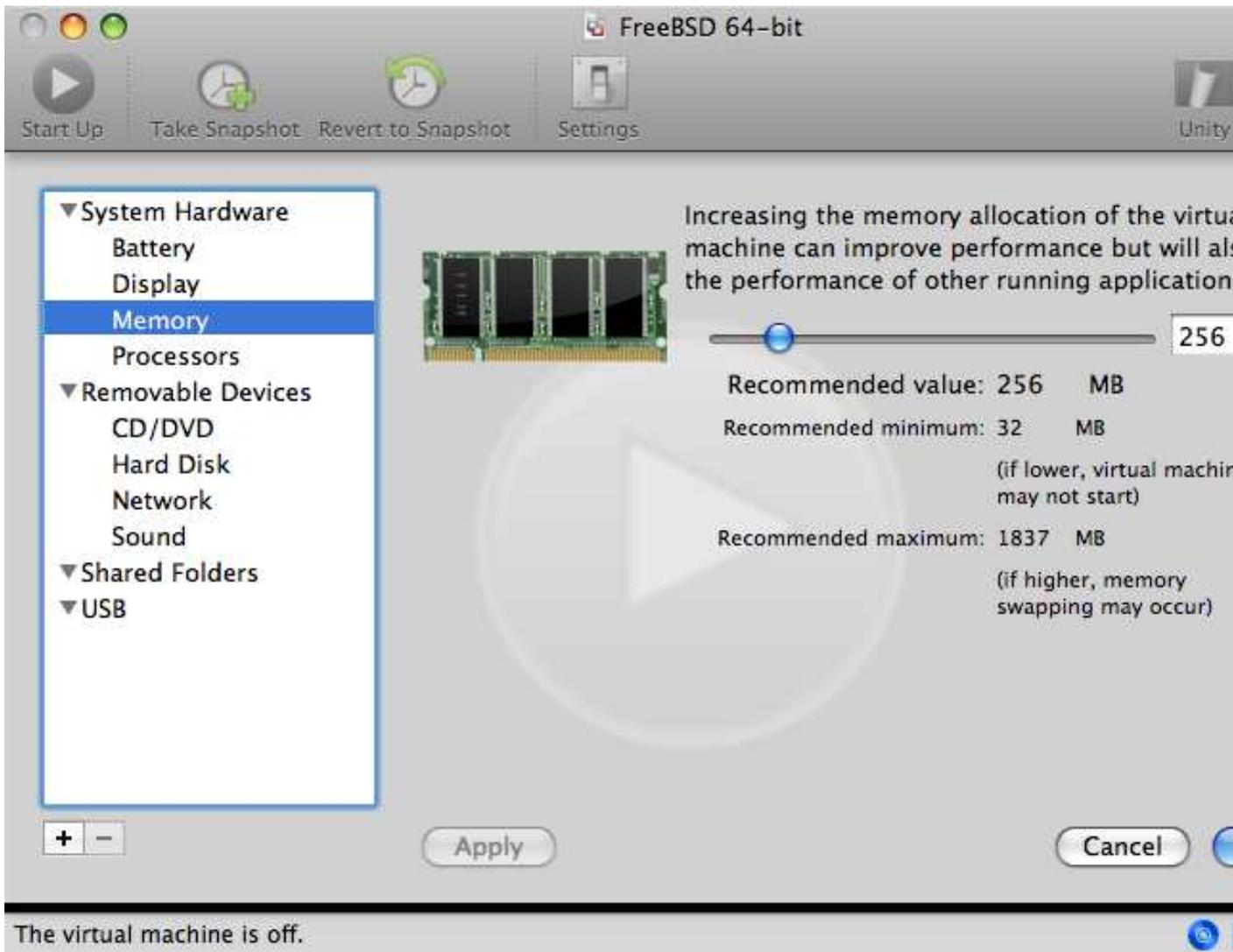


Áäéáóáóðóá òí FreeBSD ùðù èá êÛíáðá éás óá ïðíéíäðíóá Ûéíí òðíéíäéóð, ð áéííðéðíóáð óéð ïäçáðò áðí òí ÊäöÛäáí 2:



Τὸ ἐξῆς κῆρυξ ἀπὸ τὸν ἀποσπασμὰς, ἰδὲν ἀποσπασμὰ ἰὰ ἀεὶ ἰσχυρὰ ὁ ἐπὶ πᾶσι βόσ ἀπὸ ἀεὶ ἰσχυρὰ ἰς τὸν ἀποσπασμὰ, ὑπὸ δὲ δ. ÷. οἱ ἰσχυρὰ ἰδὲν ἀπὸ τὸν ἀποσπασμὰ ἰς τὸν ἀποσπασμὰ:

**Ὁξιάβυος:** ἰς τὸν ἀποσπασμὰ ὁ ἐπὶ πᾶσι ἰσχυρὰ ἀπὸ ἀεὶ ἰσχυρὰ ἰς τὸν ἀποσπασμὰ ἰδὲν ἀπὸ τὸν ἀποσπασμὰ ὑπὸ δὲ δ. ÷. ἀπὸ ἀποσπασμὰ ἀπὸ ἀεὶ ἰσχυρὰ ἰς τὸν ἀποσπασμὰ.



Ίδιναβόα, áέιιζ, ίά ηόειβόαόά οίί ανέειυ ούί άάαιάναάόοίί οίτοδ ίδιβίτοδ άδεόηΰδαόάέ ίά ÷ ηζόείιδιέΠοάέ άόδΠ ζ άέειίέΠ ιζ ÷ άίΠ:



οόυò Ý ÷ áε ίυçιά, áδβόçò, ίά áεεÛíâðâ òí áñ ÷ âβí Þ òç óðóεâðÞ ðíð òâβíâðáε ùò CD-ROM ίÝóá óðçí áέείíεêÞ ίç ÷ áíÞ. ÓòíÞεùò ίðíñâβòâ ίά áðíóóíáÝóâðâ òí CD-ROM Þ òí ISO image áðu òçí áέείíεêÞ ίç ÷ áíÞ, áóíý ââ ÷ ñâεÛæâðáε ðεÝíí ùòáí Ý ÷ áε ίεíεεçñùεâβ ç ââεâðÛóðáóç òíð FreeBSD:



Ἴσχύει ὅτι ὁ δῶδεκάεδρος ἰσοπέδισμός ἀπὸ τῆς ὁμοιογένειας καὶ τῆς ἀνισοτροπίας. Ἐὰν τὸ ἰσοπέδισμὸς εἶναι ὁμοιογενὴς καὶ ἀνισοτροπικὸς, τότε τὸ ἰσοπέδισμὸς εἶναι ἰσοτροπικὸς καὶ ἰσομοιογενὴς. Ἐὰν τὸ ἰσοπέδισμὸς εἶναι ἰσομοιογενὴς καὶ ἀνισοτροπικὸς, τότε τὸ ἰσοπέδισμὸς εἶναι ἰσοτροπικὸς καὶ ἰσομοιογενὴς. Ἐὰν τὸ ἰσοπέδισμὸς εἶναι ἰσοτροπικὸς καὶ ἰσομοιογενὴς, τότε τὸ ἰσοπέδισμὸς εἶναι ἰσομοιογενὴς καὶ ἀνισοτροπικὸς. Ἐὰν τὸ ἰσοπέδισμὸς εἶναι ἰσομοιογενὴς καὶ ἰσοτροπικὸς, τότε τὸ ἰσοπέδισμὸς εἶναι ἰσομοιογενὴς καὶ ἀνισοτροπικὸς.



Το εικονίδιο που εμφανίζεται στην οθόνη του υπολογιστή, δηλαδή το εικονίδιο του FreeBSD, είναι οπτικά διαφορετικό από το εικονίδιο του FreeBSD που είναι οπτικά διαφορετικό από το εικονίδιο του FreeBSD.

### 22.2.3.2 Νόμιμοποίηση του FreeBSD για ομοίωση Mac OS X/VMware

Αυτό το κεφάλαιο αφορά στην ομοίωση του FreeBSD σε ένα περιβάλλον ομοίωσης Mac OS X ή VMware. Το εικονίδιο του FreeBSD είναι διαφορετικό από το εικονίδιο του FreeBSD που είναι οπτικά διαφορετικό από το εικονίδιο του FreeBSD.

#### 1. Νόμιμοποίηση του boot loader

Στην ομοίωση του FreeBSD, η ομοίωση του boot loader είναι διαφορετική από την ομοίωση του boot loader που είναι οπτικά διαφορετική από την ομοίωση του boot loader. Το εικονίδιο του FreeBSD είναι διαφορετικό από το εικονίδιο του FreeBSD που είναι οπτικά διαφορετικό από το εικονίδιο του FreeBSD.

```
kern.hz=100
```

× ùñβò áòòÐ ðç ñýèιέόç Ýίá öéññáñýíáñ FreeBSD ðίò òñÝ÷:áέ ιÝóá óá VMware ìðìñáß íá ÷ ñçóέιιðίέáß ιÝ÷ ñέ έάέ 15% òίò áðáíáñáóóòÐ áñυò iMac. ÌáòŪ áðu áòòÐ ðç ñýèιέόç ç ÷ ñÐόç òίò áðáíáñáóóòÐ ìðìñáß íá áβίάέ ìέέñυòáñç áðu 5%.

2. ΆçìέιòñáÐóòá Ýίá ιÝí áñ÷:áβι ñòèìβóáυí ðòñÐíá

Ìðìñáßòá íá áóáέñÝóáòá υέáò ðέò ðóóέáòŪð FireWire έάέ USB. Ōί **VMware** ðáñÝ÷:áέ ìέά áέέιíέέÐ έŪñóá áέέóγίò, ç ìðìβá áβίάέ ðóíááòÐ ìá òίí ìáçáυ em(4), ìðuòá ìðìñáßòá íá áóáέñÝóáòá υέáò ðέò ððuέιέðáò έŪñóáò áέέóγίò áðu òίí ðòñÐíá óáò.

3. Ñòèìβóóá òί áβέòòι

Ì ðέι áýέíεíò òñυðìò íá ñòèìβóóáòá òί áβέòòι ðçò áέέιíέέðò ìç÷:áíðò áβίάέ íá óóíááέáβòá ìÝóυò DHCP ìá òί òιðέέυι áβέòòι, ÷ ñçóέιιðίέíðáò ðç áέáýέòίóç MAC òίò ìáίέóòÐ. Άóòυ ìðìñáß íá áβίάέ ðñιòέÝοιíóáò ðç áñáñìÐ ifconfig\_em0="DHCP" óòι áñ÷:áβι /etc/rc.conf. Άέά ðáñέóóυòáñáò ðέçñιòιñβáò έάέ ðέι ðñι÷:úñçιÝíáò ñòèìβóáέò áέέóγίò, ááβòá òί ΈáòŪέάέι 31.

## 22.3 Ōί FreeBSD ùò ÌáίέóòÐò (Host)

Άέά áñέáòŪ ÷ ñυíέά, έáíÝíá áðu óá ðáέÝóá áέέιíέέιðίβçóçò ááí ððιόòÐñέæá áðβόçιά òί FreeBSD ùò ìáίέóòÐ. ΈŪðίέιέ ÷ ñÐóòáò ÷ ñçóέιιðίέíýóáí ðáέέÝð έάέ έáòŪ áŪóç ááέáóáέáέέέιιÝíáò áέáυóáέò òίò **VMware** (úðuò òί emulators/vmware3), ìέ ìðìβáò ÷ ñçóέιιðίέíýóáí ðç ðóíááòúòçòá áέòÝέáóçò ðñιíáñáìŪòυí Linux. Έβáι ìáòŪ ðç ðáðβόçιç έòέέιòιñβá òίò FreeBSD 7.2, Ýáέíá áέάέÝóέιç óðç ŌðέέιíáÐ òυí Ports ç Ýέáιόç Áíίέέòιý Έðáέέá (OSE, Open Source Edition) òίò **VirtualBox™** ðçò Sun. Ç ðóáñιíáÐ áòòÐ áέòáέáβóáέ ùò ááááíÝò ðñυíáñáìá òίò FreeBSD.

Ōί **VirtualBox** áβίάέ Ýíá ðéññáò ðáέÝοι áέέιíέέιðίβçóçò òί ìðìβι áñβóέáòáέ óá áέáñéÐ áíŪðòòιç. Άβίάέ áέáέÝóέιι áέá óá ðáñέóóυòáñá έáέòιòñáέέŪ óòóòÐíáòá, óòιðáñέέáíáññÝíυí òυí Windows, Mac OS, Linux έάέ FreeBSD. ÷:áέ ðç áðíáòúòçòá íá áέòáέáß òί βáέι έáέŪ òυóι έáέòιòñáέέŪ òýðίò Windows υóι έάέ UNIX. ñ÷:áòáέ óá áýí áέáυóáέò: áíίέέòιý έάέ έέáέóóιý έðáέέá. Άðu ðç ìáñέŪ òίò ÷ ñÐόç, βóυò ì ìáááέýóáñιò ðáñέíñέóιυò ðçò Ýέáιόçò áíίέέòιý έðáέέá áβίάέ ç Ýέέáέøç ððιόòÐñέíçò óòóέáòðí USB. Ìðìñáßòá íá ááβòá υέáò ðέò áέáòιñÝð óðç óáέβáá “Editions” òίò **VirtualBox** wiki, óðç òιðίέáòβá <http://www.virtualbox.org/wiki/Editions>. Ōç áááñÝíç óòέáìÐ, ìυíι ç Ýέáιόç OSE áέáòβέáòáέ áέá òί FreeBSD.

### 22.3.1 ΆáέáòŪóóáóç òίò VirtualBox™

Ōί **VirtualBox** áβίάέ áέáέÝóέιι ùò FreeBSD port óòι emulators/virtualbox-ose, έάέ ìðìñáßòá íá òι ááέáóáòòÐóáòá ìá ðέò ðáñáέŪòú áíòιέÝò:

```
# cd /usr/ports/emulators/virtualbox-ose
# make install clean
```

Ìέá ÷ ñÐóέιç áðέέιíáÐ ðίò áιòáίβæáòáέ óòι áέŪέíáí ñòèìβóáυí, áοιñŪ ðç ìáέáòŪóóáóç òυí ðñιíáñáìŪòυí GuestAdditions. Ōá ðñιíáñŪííáòá áòòŪ ðáñÝ÷:íοι ìέά óáέñŪ áðu ÷ ñÐóέíáò έáέòιòñáßáò óóá öéññáñýíáñá έáέòιòñáέέŪ, úðuò ç áέŪóáιç έáέòιòñáßá òίò ááβέòç ðιíòέέέíý (áðέòñÝðáέ óοι ðιíòβέέ íá έέíáβóáέ áέáýέáñá ìáòáίý òίò ìáίέóòÐ έάέ òίò öéññáñýíáñιò έáέòιòñáέέíý, ÷ ùñβò íá áðáέòáβòáέ ç ÷ ñÐόç έŪðίέιò áέáέέíý ðéβέòñιò áέá áíáέéááÐ) έáέðò έάέ óá÷:ýòáñç áñáòέéÐ áðáέέυιέóç, áέáέέŪ óá έáέòιòñáέέŪ Windows. Ìðìñáßòá íá áñáβòá óá guest additions óòι ìáñý Devices, υòáí ìεíέçñðóáòá ðç ìáέáòŪóóáóç òίò öéññáñýíáñιò έáέòιòñáέέíý.



### 22.3.2 Άδειες Άδειες Άδειες

Όσον αφορά τις άδειες διανομής για ελεύθερο λογισμικό οι **Xen** υπό δαπάνη διανομής αρέσει οι FreeBSD.

# ÊäöÛëáéí 23 ÔïðéêÝò Ñõèìβóáéò - ×ñΠός êáé ñýèìéός I18N/L10N

ÓõíáéóõĩÛ ðĩò Andrey Chernov. ÆñÛðçêá íáíÛ áðu ðĩí Michael C. Wu.

## 23.1 Óýĩñç

Ôĩ FreeBSD áβíáé Ýíá éáéáβðáñá áðĩéáíññĩÛ Ýĩí Ýñáĩ ìá ÷ñΠόðáð êáé áðéáĩíóÝò óá ãëüèççñĩ ðĩí èüóĩĩ. Óõĩ êäöÛëáéĩ áððu óðæçðĩýĩóáé ãé áõĩáðuðçðáð ðĩðéêþĩ êáé áéáéĩþĩ ñðèìβóáéù ðĩò FreeBSD, ãé ãðĩβáð áðéóñÝðĩóĩ óá ÷ñΠόðáð ãèüóóþĩ áéðuð ðçð Áããééêþð ãá áéðáéÝóĩóĩ ðñáñáíáðéêþ ãñááóβá. ÒðÛñ ÷ĩóĩ ðĩéëĩβ ðáñÛáĩíóáð óðçĩ ðèĩðĩβççç ðĩò ðéáéóβĩò ì18n, ðüóĩ óá áðβðáãĩ óðóðβĩáðĩò, ùóĩ êáé áóáñĩãþĩ, êáé áéá ðĩ èüáĩ áððu, ùðĩò ÷ñáéÛæáðáé, ðáñáðÝĩðĩòĩá ðĩí áíááĩþóçç óá ðéĩ óðáéáéñéĩÝĩáð ðçãÝð ðáèĩçñβùçð.

Áóĩý áéááÛóáðá áððu ðĩ êäöÛëáéĩ, éá ãÝñáðá:

- Ðùð èüáééĩðĩéĩýĩóáé ãé ãþóðáð êáé ãé ðĩðéêÝò ñðèìβóáéð óðá óýã ÷ñĩíá éáéóĩðñáééÛ óðóðβĩáðá.
- Ðùð ãá áÛéáðá ðĩðéêÝò ñðèìβóáéð óðĩ éÝèðüò óáð (login shell).
- Ðùð ãá ñðèìβóáðá ðççĩ èĩíóüéá áéá ãþóðáð áéðuð ðçð Áããééêþð.
- Ðùð ãá ÷ñçóéĩðĩéβóáðá áðĩðáéáóĩáðééÛ ðĩ óýóççĩá X Windows ìá áéáóĩñáðééÝò ãþóðáð.
- Ðĩò ãá ãñáβðá ðáñéóóüðáñáð ðççñĩóĩñβáð áéá ðç óðáãñáðþ áóáñĩãþĩ óóĩááðþĩ ìá ðĩ ðñüðððĩ ì18n.

Ðñéĩ áéááÛóáðá áððu ðĩ êäöÛëáéĩ, éá ðñÝðáé:

- ãá áññβæáðá ðùð ãá ááéáðáóðóáðá ðñüóéáðĩ éĩáéóĩéèü ðñβðĩò éáðáóéáðáóðþ (ÊäöÛëáéĩ 4).

## 23.2 ÁáóéêÝò Áĩþóáéò

### 23.2.1 Ôé Áβíáé ðĩ I18N/L10N;

Ëé ñÛáð áíÛððóçð éĩáéóĩééĩý áçĩéĩýñáçóáĩ ðĩí ùĩñ I18N, ùð óóĩóüìáðçç ðçð éÝĩçð “internationalization” (áéáèĩðĩβççç), ìáðñĩóáð áðþð óá ãñÛĩáðá ðçð éÝĩçð áíÛĩáðá óõĩ ðñþðĩ êáé ðĩ ðáéáððáβĩ. Ì ùññð L10N Ý÷áé ðñĩéýøáé ìá ðĩí βáéĩ ðñüðĩ, áððþ ðç ðĩñÛ áðu ðç éÝĩç “localization” (ðĩðééĩðĩβççç, þ áðþð ðĩðéêÝò ñðèìβóáéð). ÓóĩáðÛéáĩóáð ìáðáĩý ðĩòð ðéð ìáèüáĩòð, óá ðñüóüéĩééá, êáé ðéð áóáñĩãÝò ðĩò óóĩáááβéĩóĩ ìá óá I18N/L10N, ãé ÷ñΠόðáð ìðĩñĩýĩ ãá ÷ñçóéĩðĩéβóĩóĩ ðéð ãþóðáð ðçð áðééĩãþð ðĩòð.

Ëé áóáñĩãÝò I18N ðñĩãñáñĩáðáβéĩóáé ìá ðç áĩðéáéá ãñááéáβüĩ (kits) êáé áéáééĩçèçþĩ. ÁðéóñÝðáðáé Ýðóé óõĩòð ðñĩãñáñĩáðéóðÝò ãá ãñÛóĩóĩ Ýíá áðèü ãñ ÷áβĩ êáé ãá ìáðáðñÛóĩóĩ óá ìáñĩý êáé óá éáβĩáíá ðĩò áðáééĩβæáé ç áóáñĩãþ, óá èÛéá ãþóðá ðĩò áðáéðáβðáé. Óðĩéóóĩýĩá Ýéáñĩá óóĩòð ðñĩãñáñĩáðéóðÝò ãá áéĩéĩóéĩýĩ ðçç ðáñáðÛĩù óýĩááçç.

### 23.2.2 Áéáðβ ÐñÝðáé ãá ×ñçóéĩðĩéβóü ðá I18N/L10N;

Óá I18N/L10N ÷ñçóéĩðĩéýĩóáé èÛéá ðĩñÛ ðĩò áðéèðĩáβðá ãá ááβðá, ãá áéóÛááðá, þ ãá áðáĩãñááóðáβðá ááãñÝíá óá ãþóðáð áéðuð ðçð Áããééêþð.

### 23.2.3 Διδέαδ Ἀερόοάδ Ὀδιόδζηβειίόάέ οδι 118N;

Ὀι 118N εάέ οι L10N αάι ἀβιάε ἀεάέεῦ ὀδεάαι Ὡία αέα οι FreeBSD. Ὀζι αάαι Ὡίζ οδέαι Π, ὀδιόδζηβειίόάέ ιέ δᾶνεόου ὀαῆαδ αῖυόό Ὡδ ἀερόοάδ, ὀδιδᾶνεεαῖα αῖα Ὡίυι οῖ: Ἐείαεεερί, Ἀᾶηιαιεερί, Ἀεάδῦι Ὡεεεῦι, Ἐῖηαάοεερί, Ἀεεεερί, Ἴυόεερί, Ἀεάοιᾶι Ὡεεεῦι, ε.ά.

### 23.3 ×ñΠόζ οῖ Ὀιδέει Ἴδὲιβόαῖ

Ὀι 118N ἀβιάε οόζι δᾶαῖα ὀεεῖυόζ οῖα ιέα ούιᾶαόζ, εάέ αῖι Ὡ ÷ ἀε ἀζιέιῶηαζεᾶβ ἀδιέεαόδεεῦ αέα οι FreeBSD. Ἀδεεῖοῖηῖα ὀζ αῖΠεᾶεά οάδ ἰοόᾶ οι FreeBSD ιά ἀεῖῖοεᾶβ ἀδδΠ ὀζ ούιᾶαόζ.

Ἴε οιδέει Ὡδ Ἴδὲιβόαέδ ἀαόβειίόάέ οᾶ ὀηᾶεδ ἀαόεεῖυδ ὑηῖοδ: Ἐῦᾶεεῦ Ἀερόοάδ, Ἐῦᾶεεῦ ×ἰᾶᾶδ εάέ Ἐῦᾶεεῖδῖβζόζ. Ὀᾶ ἰῖιῖαόᾶ οῖι οιδέει Ἴδὲιβόαῖ δᾶηέυδ οῖοῖ ᾶδῦ οῖοδ δᾶᾶᾶὩῖῦ ὑηῖοδ, ιᾶ οῖι ὀηῦδῖ δῖο δᾶᾶεᾶὩῖοᾶε δᾶᾶᾶὩῖοδ:

*Ἐῦᾶεεῖυδ Ἀερόοάδ\_Ἐῦᾶεεῖυδ ×ἰᾶᾶδ . Ἐῦᾶεεῖδῖβζόζ*

#### 23.3.1 Ἐῦᾶεεῖβ Ἀεῦοόπι εάέ × ὑηῖ

Ἀεά ιά ÷ ηζοεῖῖδῖεζεῖυῖ ιέ οιδέει Ὡδ Ἴδὲιβόαέδ αεά ιέα ὀδᾶεᾶεᾶεῖ Ὡίζ ἀερόοᾶ οᾶ Ὡία ούόζζια FreeBSD (Π οᾶ Ὡεεῖ ούόζζια ούδῖο UNIX δῖο ὀδιόδζηβειίόάέ οῖ δᾶῖοδῖ 118N), ἰ ÷ ηΠόζοζ εᾶ δᾶᾶᾶε ιά ᾶᾶε οῖοδ Ἐῦᾶεεῖυδ ὀζδ ὀδᾶεᾶεᾶεῖ Ὡίζδ ÷ ἰᾶᾶδ εάέ ἀερόοᾶδ (ιέ Ἐῦᾶεεῖβ ÷ ὑηῖ ἔαεῖαζαῖῖι ὀεδ ᾶὀᾶᾶῖᾶ Ὡδ ο ÷ ᾶδεεῦ ιᾶ ὀζ ἀεῦᾶεᾶεῖ ὀζδ ἀερόοᾶδ δῖο δᾶᾶᾶε ιά ÷ ηζοεῖῖδῖεζεᾶβ). ΔᾶᾶᾶὩῖᾶοᾶ ὑδῦδ ὀδᾶεῖᾶᾶὀηζδ Ὡδ, ᾶῖδδζᾶᾶὀζδ Ὡδ εόδῖοᾶεβᾶῖ, ᾶῖδδζᾶᾶὀζδ Ὡδ SMTP/POP εεδ. δᾶβᾶᾶῖ ᾶδβζόζ εῦδῖεᾶδ ἀδῖοὩῖοᾶεδ δῖο ᾶῖᾶᾶᾶῖοᾶε ᾶδῦ οῖοδ Ἐῦᾶεεῖυδ ἀδῖοῖδ. ΔᾶᾶᾶὩῖοδ ὀᾶβῖῖοᾶε ἰᾶᾶεῦ δᾶᾶᾶᾶβᾶῖᾶοᾶ ᾶεῦοόπι ÷ ὑηῖ:

Ἐῦᾶεεῖυδ Ἀερόοᾶδ/×ἰᾶᾶδ	Δᾶᾶεᾶᾶὀβ
en_US	Ἀᾶεεεῦ - Ḷῖῖῖῖᾶδ Δῖεεὀᾶβᾶδ
ru_RU	Ἴπρόεεᾶ - Ἴῦοβᾶ
zh_TW	Δᾶᾶᾶῖοᾶεῦ Ἐεῖ Ὡεεεᾶ - Ὀᾶῦᾶῦῖ

#### 23.3.2 ἘῦᾶεεῖδῖεΠόαέδ

Ἐῦδῖεᾶδ ἀερόοᾶδ ÷ ηζοεῖῖδῖεῖυῖ ἘῦᾶεεῖδῖεΠόαέδ δῖο αῖι ἀβιάε ASCII, ἀεεῦ δᾶᾶε Ὡ ÷ ῖοῖ ÷ ᾶᾶεδΠᾶδ 8-bit, wide, Π multibyte (ᾶᾶβδᾶ ὀζ ὀᾶεβᾶᾶ manual multibyte(3) αεά δᾶᾶεόου ὀαῆαδ δεζᾶῖοῖᾶβᾶδ). Ἴε δεῖ εᾶεῖῖᾶεᾶδ ᾶὀᾶᾶῖᾶ Ὡδ ὀοῖΠεῦδ ᾶῖᾶῖῖᾶβειῖοῖ οῖοδ ÷ ᾶᾶεδΠᾶδ 8-bit. Ἀῖῖῖῖᾶ ιᾶ ὀζῖ δεῖδῖβζόζ, ιέ ÷ ηΠόζοζ ἰδῖᾶᾶβ ιά ÷ ηᾶεῦᾶὀᾶε ιά ἰᾶὀᾶᾶεῦδὀβῖοῖοῖ ιέα ᾶὀᾶᾶῖᾶβ ιᾶ ὀδιόδΠᾶεῖζ ÷ ᾶᾶεδΠᾶῖ wide Π multibyte, Π ιά δᾶῖοᾶᾶῖῖοῖοῖ ὀεδ Ἴδὲιβόαέδ οῖοδ δᾶᾶᾶὩῖᾶοῖδ. Ἀεά ιά Ὡ ÷ ᾶδᾶ ὀζῖ εεᾶῖῖὀζδᾶ ιά ᾶεόὩᾶὀᾶ εάέ ιά ᾶδᾶᾶᾶᾶᾶᾶᾶ ÷ ᾶᾶεδΠᾶδ multibyte, ζ Ὀὀεῖῖᾶβ οῖι Ports οῖο FreeBSD (<http://www.FreeBSD.org/ports/index.html>) αεάε Ὡὀᾶε δᾶᾶᾶὩῖᾶοᾶ αεά εῦεᾶ ἀερόοᾶ. Ἀᾶβδᾶ ὀζῖ δᾶεῖζᾶβῦζ αεά οῖ 118N οῖο ᾶῖδβὀῖε ÷ ῖ Port οῖο FreeBSD.

Ἀεᾶεεῖυδᾶᾶ, ἰ ÷ ηΠόζοζ ÷ ηᾶεῦᾶὀᾶε ιά αεᾶᾶὩὀᾶε ὀζῖ δᾶεῖζᾶβῦζ ὀζδ ᾶὀᾶᾶῖᾶβδ, αεά ιά ἀδῖοᾶὀᾶε δῦδ δᾶᾶᾶε ιά ὀζ Ἴδὲιβόαε οῖοδ Π δῦδ ιά δᾶᾶὩὀᾶε ὀεδ οῖοδ Ὡδ δεῖ Ὡδ ὀοῖ configure, οῖ Makefile Π οῖι ἰᾶὀᾶᾶεῦδὀεὀδΠ.

Ἐᾶ δᾶᾶᾶε ιά Ὡ ÷ ᾶδᾶ εᾶὀῦ ἠῖο εῦδῖεᾶ δᾶᾶᾶᾶοᾶ:

- Ὀᾶδ ÷ ᾶᾶεδΠᾶῖ δῖο ᾶῖᾶᾶᾶῖοᾶε ᾶδῦ ὀζ ἀερόοᾶ (single C chars character set, ᾶᾶβδᾶ ὀζῖ multibyte(3)), δ. ÷. ISO8859-1, ISO8859-15, KOI8-R, CP437.

- ΈùääèιðιέΠόάέο Wide P multibyte, ð.÷. EUC, Big5.

Ìðñáβòá íá äáβòá òçí áíññáΠ έβóóá òυí óáò ÷áñáέòΠñυí óοι Ìçòñþι IANA (<http://www.iana.org/assignments/character-sets>).

**Όçíáβùόç:** Õι FreeBSD ÷ñçóειιðιέάβ áέα óέο òιðέέΎò ñῶειβóáέο èùääèιðιέΠόάέο óοιááòΎò ìá òι X11.

### 23.3.3 ΆóáññιáΎò I18N

Όòι óύóόçíá ðáέΎòυí έάέ ports òιò FreeBSD, ìέ áóáññιáΎò ðιò ó÷áòβáειíóáέ ìá òι I18N Ύ÷ιòι óοι υíñíá ðιòò òç èΎίç I18N þóòá íá íáíáíññβáειíóáέ áýειéá. Ùóóóυι, ìðñáβ íá ìçí ðòιòðçñβáειíοι ðΎιòιòá òç äèþóóá ðιò ÷ñáέΎæáóòá.

### 23.3.4 ÕιðέέΎò Νῶειβóáέο

Άβίáέ óοιΠèùð áñêáòυι íá áβίáέ export ç ðειΠ ìá òçí ìññáóáá òçð ððέèðιçðò ðιðέέΠð ñýèιέόçð, ìΎóυ òçð ìáóááèçðòð ðáñéáΎεειíòð LANG óοι èΎεòοιò áέóυáιò. Άòòυ ìðñáβ íá áβίáέ óοι áñ÷áβι ~/ .login\_conf òιò ÷ñΠόç, Π óοι áñ÷áβι áέέβιççòð ðιò éáέýοιòð ðιò ÷ñΠόç (~/.profile, ~/.bashrc, ~/.cshrc). Άáí áβίáέ áíΎáèç íá èΎóáòá έάέ óέο ððυειéðáð ìáóááèçòΎð òυí òιðέéþι ñῶειβóáυι, υðυð ìέ LC\_CTYPE, LC\_CTIME. Άέá ðáñέóóυðáñáð ðεçññοιñβáð, áέááΎóòá òçí ðáèιçñβùóç òιò FreeBSD ðιò ó÷áòβæáóáέ ìá òçí ððιòðΠñειç òçð ððέèðιçðòð äèþóóáð. Έá ðñΎðáέ íá èΎóáòá óέò áýι ðáñáέΎòυ ìáóááèçòΎð ðáñéáΎεειíòð, óóá áñ÷áβá ñῶειβóáυι:

- Όçí LANG áέα èáέòιòñáβáð ðιò áíΠειíοι óóçí ìέειáΎίáέá POSIX setlocale(3)
- Όçí MM\_CHARSET áέα òι óύííει ÷áñáέòΠñυí MIME òυí áóáññιáþι.

Õι ðáñáðΎíυ ðáñέéáíáΎίáέ òçí ñýèιέόç òιò éáέýοιòð ÷ñΠόç, òçí ñýèιέόç áέα ìέα óóæáèñéιΎίç áóáññιáΠ, έάέ òç ñýèιέόç áέα ðá X11.

#### 23.3.4.1 ÌΎειáιέ ΆέéááΠò Õιðέéþι Νῶειβóáυι

ÕðΎñ÷ιòι áýι ìΎειáιέ áέα òçí áέéááΠ òυí òιðέéþι ñῶειβóáυι, óέò ìðιβáð έάέ ðáñéáñΎοιòιá ðáñáέΎòυ. Ç ðñþç (òçí ìðιβá έάέ óòιέóòιγíá) ðειðιέáβóáέ èΎοιíóáð ðειΎð óóέò ìáóááèçòΎð ðáñéáΎεειíòð óοι login class, έάέ ç ááýðáñç áέéΎæειíóáð óέò ðειΎð òυí ìáóááèçòþι ðáñéáΎεειíòð óοι áñ÷áβι áέέβιççòð òιò éáέýοιòð òιò ÷ñΠόç.

##### 23.3.4.1.1 ÌΎειáιò ΈéΎóáυι Άέóυáιò (Login Class)

Ç ìΎειáιò áòðΠ áðέòñΎðáέ íá áβίáέ ç ñýèιέόç òυí ìáóááèçòþι ðáñéáΎεειíòð ìέα òñΎ áέα èΎεá èΎεòοιò, áίòβ íá ÷ñáέΎæáóáέ íá ðáειγí óðæáèñéιΎíáð ðειΎð óοι áñ÷áβι áέέβιççòð ðιò éáέáíυð ÷ññέóòΎ. Ìέ Νῶειβóáέò óá Άðβðááι ×ñΠόç ìðñιγí íá áβñιòι áðu òιí βáει òι ÷ñΠόç, áñþ ìέ Νῶειβóáέò óá Άðβðááι Άέá÷áέñέóòΠ áðáέòιγí ðññιυιέá ððáñ÷ñΠόç.

##### 23.3.4.1.1.1 Νῶειβóáέò óá Άðβðááι ×ñΠόç

Õι ðáñáέΎòυ áðευ ðáñΎááéáíá, ááβ÷íáέ Ύίá áñ÷áβι .login\_conf óοιí éáðΎειáι èΎðιέιò ÷ñΠόç óοι ìðιβι έάέ ìέ áýι ìáóááèçòΎð Ύ÷ιòι ðáèáβ áέα èùääèιðιβççç Latin-1:

me:\

```
:charset=ISO-8859-1:\
:lang=de_DE.ISO8859-1:
```

ΔάναέÛòù äéÝðáðá Ýία .login\_conf óοι ιðίβι ιé ιάοάάεçðÝð Ý ÷ ιοι óäèáß äéá ΔάναάιιόεάÛ ÈéíÝæééá óá èùäééιðιβçç BIG-5. ΔάναόçñΠόόά üóé Ý ÷ ιοια èÝóáé ðιéý ðáñέóóüóáñáð ιάοάάεçðÝð, éáèðò èÛðιέáð áóáñιãÝð ääι óÝáιιόáé óúóðÛ óéð ιάοάάεçðÝð äéá ÈéíÝæééá, ΆέáðùιÝæééá éáé ÈιñáÛóééá.

```
#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
```

Άέá ðáñέóóüóáñáð ðεçñιοιñβáð, äáβðá óéð Ñðειβόάέο óá Άðβðáäι Άέá ÷ äéñέóðΠ éáé óçι login.conf(5).

### 23.3.4.1.1.2 Ñðειβόάέο óá Άðβðáäι Άέá ÷ äéñέóðΠ

Άάάéèèáβðá üóé Ý ÷ äé ιñέóóáß ç óúóðΠ äéΠóóá óóçι èèÛóç ðιð ÷ ñΠόç, óοι áñ ÷ áβι /etc/login.conf. Óοι áñ ÷ áβι áðòù éá ðñÝðáé ιá ððÛñ ÷ ιοι ιé ðάναέÛòù ñðειβόάέο:

```
language_name|Account Type Description:\
:charset=MIME_charset:\
:lang=locale_name:\
:tc=default:
```

Ìá áÛóç òι ðñιçáιγíáιι ðáñÛááéäιá ιáð ðιð ÷ ñçóéιιðιéΠóáιá Latin-1, òι áñ ÷ áβι éá ιιéÛæáé ιá òι ðάναέÛòù:

```
german|German Users Accounts:\
:charset=ISO-8859-1:\
:lang=de_DE.ISO8859-1:\
:tc=default:
```

Δñéι èÛíáðá áééáãÝð óóéð ÈèÛóáéð Άέóüäιð (Login Classes) ðùι ÷ ñçóðΠι, äéðáéÝóðá óçι ðάναέÛòù áιòιèΠ:

```
# cap_mkdb /etc/login.conf
```

Πóðá ιá áíáñäιðιéçèιγí óοι óýóççιá ιé áééáãÝð ðιð èÛíáðá óοι /etc/login.conf.

### ΆέéáãΠ ÈèÛóáιí Άέóüäιð ιÝóù óçð vipw(8)

×ñçóéιιðιéΠóóá óçι vipw äéá ιá ðñιóéÝóáðá ιÝιð ÷ ñΠóðáð, éáé èÛíóá óçι éáðá ÷ ðñέóç ιá ιιéÛæáé ιá óçι ðάναέÛòù:

```
user:password:1111:11:language:0:0:User Name:/home/user:/bin/sh
```

### Άέέάαβ Εέΰόάυί Άέούάιῶ ιΎού όçò adduser(8)

×ñçόειἰδιέΠρόά όçί adduser áέά ίά δñιόεΎόάόά ίΎῖῖδ ÷ñΠόάο, έάέ Ύδάέόά áειεἰῖεΠρόά όέο δάñάέΰόυ ἱάçáβáð:

- ΕΎόά όἰ defaultclass = language όἰἱ /etc/adduser.conf. Ιά Ύ ÷ áðá ððüøç óáð ἱόέ óá áððΠ όçί δáñβððóç, έά δñΎδάέ ίά ἱñβóáðá ίέά έεΰόç default áέά ἱεἰῖδ όἰῖδ ÷ñΠόάο ΰέεἰἱ áεἰóóḡἱ.

- Ιέά áíáέέάέδéεΠ έýόç, áβίάέ ίά áðáίóΰόά εΰεά όἰñΰ όόçί áñḡόç

```
Enter login class: default []:
```

```
ἰῖῖ àìóáíβæáðάέ áðἱ όçί adduser(8).
```

- Άέἰἱά ίέά áíáέέάέδéεΠ έýόç, áβίάέ ίά ÷ñçόειἰδιέΠρόάόά όἰ δάñάέΰόυ óá εΰεά ÷ñΠόόç ἰῖῖ εΎέáðá ίά δñιόεΎόάόά έάέ ἱ ἰῖἱβἱð ÷ñçόειἰδιέáβ áέάóἰñáðééΠ áεḡóóá:

```
# adduser -class language
```

### Άέέάαβ Εέΰόάυί Άέούάιῶ ιΎού όçò pw(8)

Άί ÷ñçόειἰδιέáβáð όçί pw(8) áέά ίά δñιόεΎόάόά ίΎῖῖδ ÷ñΠόάο, έάέΎόά όçί ἱá όἰἱ δάñάέΰόυ όñἱἰἱ:

```
# pw useradd user_name -L language
```

#### 23.3.4.1.2 ΙΎεἰἱῖῖ Ἄñ÷ áβἱί Ἄέέβίçόçò Εάέýἰῖῖ

**Όçίáβἱόç:** Ç ιΎεἰἱῖῖ áððΠ ááί όἰίβóðáðάέ, έάεḡó áðáέðáβ áέάóἰñáðééΎò ηῶεἰβóáέò áέά εΰεά áέάóἰñáðééἱ ðñἱñáἱίá έáέýἰῖῖδ ἰῖῖ ÷ñçόειἰδιέáβáð. ΔñἰéἰῖΠóáά έáέýðáñá όçί ιΎεἰἱῖ όἰἱ Εέΰόάυί Άέούάιῶ.

Άέά ίά δñιόεΎόάόά όέο όἰδééΎð ηῶεἰβóáέð έάέ όἰ óáð ÷áñáέðΠñἱἱ MIME, ηῶεἰβóáά áðεḡó όέο áýἱ ἱáðááεçðΎð δáñéáΰεἰἱῖῖδ ἰῖῖ óáβἱἱóáέ δáñάέΰόυ όἰἱ áñ÷ áβἱ /etc/profile Π/έάέ όἰἱ /etc/csh.login. Εά ÷ñçόειἰδιέΠóἰἰá óá Ἄáñáíééΰ ἱð áεḡóóá áέά όἰ δάñάέΰόυ δáñΰááέáíá:

Όἰἱ /etc/profile:

```
LANG=de_DE.ISO8859-1; export LANG
MM_CHARSET=ISO-8859-1; export MM_CHARSET
```

<sup>1</sup> όἰἱ /etc/csh.login:

```
setenv LANG de_DE.ISO8859-1
setenv MM_CHARSET ISO-8859-1
```

Άíáέέáέðééΰ, ἱðñáβáð ίά δñιόεΎόάόά όέο δáñáðΰἱἱ ἱáçáβáð όἰἱ /usr/share/skel/dot.profile (áíðβóðíé÷á ἱá όέο ἱáçáβáð áέά όἰ /etc/profile ἰῖῖ áβááíá δáñáðΰἱἱ), Π όἰἱ /usr/share/skel/dot.login (áíðβóðíé÷á ἱá όέο ἱáçáβáð áέά όἰ /etc/csh.login ἰῖῖ áβááíá áðβóçò δáñáðΰἱἱ).

Άέά όἰ X11:

Όἰἱ \$HOME/.xinitrc:

```
LANG=de_DE.ISO8859-1; export LANG
```

1.

```
setenv LANG de_DE.ISO8859-1
```

ΆίÛείάά ίά οί εÛέοοιò ðιò ÷ñçóειιðιεάβόά (άάβόά ðάñάðÛίù).

### 23.3.5 Ñòειβόάέο άέά οçί Έίίούέά

Άέά üéá óá single C óάò ÷άñάέòΠñùí, ίðñάβόά ίά εÛóάòά óέò ãñáñιáοιíóáέñÛò óçò είίούέάò óοι /etc/rc.conf áέά οçί άðέέðιçòΠ äεβóόά, ãñÛοιíóάò:

```
font8x16=font_name
font8x14=font_name
font8x8=font_name
```

Õι font\_name ääð ðñιέÿðóáέ áðu οί áίòβóοιέ÷í ãñ÷áβι ðιò έάóάέüüäïò /usr/share/syscons/fonts, áóάέñÞíóáò óçί έάóÛέçíç .fnt.

Άί ÷ñάέÛæáóáέ, ÷ñçóειιðιεΠóάò óçί έάóÛέçççç áίόέóοιβ÷çόç ðεçέðñιέíáβιò (keymap) έάέ ίèùíçð áέά οί óάò ÷άñάέòΠñùí single C ðιò ÷ñçóειιðιεάβόά, ιÛóù ðιò sysinstall. Ìüéέò áέóάέÛóάòά οί **sysinstall**, άðέέÛίíóá οί **Configure**, έάέ Ûðáέóά οί **Console**. ΆίάέέάέóέέÛ, ίðñάβόά ίά ðñιόέÛóάòά οί ðáñάέÛòù óοι /etc/rc.conf:

```
scrnmap=screenmap_name
keymap=keymap_name
keychange="fkey_number sequence"
```

Óóçί ðáñβðòùóç áóòΠ, ðι screenmap\_name ðñιÛñ÷áóáέ áðu Ûίά ãñ÷áβι ðιò έάóάέüüäïò /usr/share/syscons/scrnmaps, ÷ùñβò óçί έάóÛέçççç .scm. Ç áίόέóοιβ÷çόç ίèùíçð ίάæβ ίά óçί áίόβóóιέ÷çç ãñáñιáοιíóáέñÛ, ÷ñçóειιðιεάβóάέ óοιΠèùð áέά óçί άðÛέóάóç οίò 8ïò bit óοι 9ο, áέά έÛñòáð VGA ðιò ÷ñçóειιðιείÿί ίΠðñά ÷άñάέòΠñùí ίά 8 óðΠéáð.

Άί Û÷áóá áίáñáñιðιεçíÛñι οίí äáβιííá **moused** óοι ãñ÷áβι /etc/rc.conf:

```
moused_enable="YES"
```

έάέü έá áβίάέ ίά áíáòÛóáòά óέò ðεçñιοιñβáð ó÷áóéέÛ ίά οίí ãññÛά ðιò ðιíóέέέÿ ðιò àìóáíæιíóáέ óóçί ðáñάέÛòù ðáñÛáñáοι.

Ï ðñιáðέέááñÛñò ãññÛάò οίò ðιíóέέέÿ ðιò ÷ñçóειιðιεάβóάέ áðu οί ðñüãñáñιá íäΠáçóçð syscons(4), έάóάέáíáÛίáέ óέò εÛóάέò 0xd0-0xd3 οίò óοιüéïò ÷áñάέòΠñùí. Άί áóòΠ ç ðáñέí÷Π ÷áñάέòΠñùí äáí áβίάέ áέάέÛóέιç óóç äεβóóά ðιò ÷ñçóειιðιεάβóá, έá ðñÛðáέ ίά ίáóáέέίΠóáòά óçί ðáñέí÷Π ðιò ãññÛά Ûíù áðu áóòΠí. Άέά ίά äβίάέ áóòù óοι FreeBSD, ðñιόέÛóáòά óçί áέüéïðεç ãñáñιΠ óοι /etc/rc.conf:

```
mousechar_start=3
```

Õι keymap\_name ðñιÛñ÷áóáέ áðu Ûίά ãñ÷áβι ðιò έάóάέüüäïò /usr/share/syscons/keymaps, ÷ùñβò óçί έάóÛέçíç .kbd. Άί äáí áβóóá óβáιòñιò áέά óçί áίόέóοιβ÷çόç ðεçέðñιέíáβιò ðιò ÷ñάέÛæáóáέ ίá ÷ñçóειιðιεΠóáòά, ίðñάβóá ίá ÷ñçóειιðιεΠóáòά οί kbdmap(1) áέά ίá έÛίáòá äιέέíÛò óá äéÛοιñáð áίόέóοιέ÷βóáέò, ÷ùñβò ίá ÷ñάέÛæáóáέ ίá έÛίáòá äðáíáέέβίççç.

Ç éáέóìòñāβά keychange ÷ ñçόέììðìéáβóáé óóìÐεùð áéá òìì ðñìāñāììáóέóìì òìì ðεÐέòñìì éáέóìòñāέπí (function keys), βóðā íá óáέñέÛæìòí ìā òìì áðέέāñÝíí òýðì òāñìáóέέìý, éáέβð íé áέììòεβāð òìì ðεÐέòñìì éáέóìòñāέπí āāì ìðñììý íá éáέììέóóììý óóέð áíóέóóììé÷βóáέð ðεççéòñììèìāβìò.

Āāāáéùèāβóā áðβóçð ùóé Ý ÷ āðā ñðèìβóáé òì òúóóìì òýðìò òāñìáóέέìý óóì /etc/ttyś áéá üèāð òéð éáðā÷ ùñβóáέð ttyv\*. Óç āāāñÝíç óóέāìÐ, íé ðñìèáέììέóììÝíāð áíóέóóììé÷βāð āβíáé:

Óáó × āñāéòÐñìì	Óýðìò Óāñìáóέέìý
ISO8859-1 Ð ISO8859-15	cons2511
ISO8859-2	cons2512
ISO8859-7	cons2517
KOI8-R	cons25r
KOI8-U	cons25u
CP437 (ðñìāðέέāñÝíí VGA)	cons25
US-ASCII	cons25w

Āéá āεβóóāð ìā ÷ āñāéòÐñāð wide Ð multibyte, ÷ ñçόέììðìéβóáð òì òúóóìì FreeBSD port óóìì éáðÛεìāñ /usr/ports/language. ĬāñέéÝð éýñāð āìòāìβæììóáé ùð éììóüéā, āñβ òì óýóóçíā òéð āéÝðāé ùð óáέñéáéÛ vtty, éáé Ýóóé ðñÝðāé íá ðāñāéñāðβóáðā āñéāðÛ vtty, óüóìì áéá òì X11 ùòì éáé āéā òçí ρāðòü-óáέñéáéÐ éììóüéā. ÐāñāéÛòù èā āñāβóā ìéā ìāñέέβð áíçìāñììÝíç éβóóā áéá ÷ñÐόç Ûéèùì āεùóóβí óóçí éììóüéā:

Āεβóóā	Óìðìèáóβā
ÐāñāāìóéáéÛ ÉéíÝæééā (BIG-5)	chinese/big5con
ĀéāðùìÝæééā	japanese/kon2-16dot Ð japanese/mule-freewnn
ĒìñāÛóééā	korean/han

### 23.3.6 Ñýèìέόç òìò X11

Áí éáé òì X11 āāì āβíáé ìÝñìð òìò FreeBSD Project, èā āβóìòìā āāβ éÛðìéāð ÷ ñβóέìāð ðεççñììòññβāð áéā ùíóìð òì ÷ ñçόέììðìéììý óóì FreeBSD. Āéá ðāñέóóúðāñāð ðεççñììòññβāð, āāβóā òçí áééðóāéÐ òìðìèáóβā òìò Xorg (<http://www.x.org/>), Ð òìò āìððçñāðçðÐ X11 ðìò ðñìèáéóáé íá ÷ ñçόέììðìéβóáðā.

Óóìì āñ÷āβì ~/.xresources, ìðññāβóā áðέðñìùóéāðā íá áééÛíāðā éáé Ûéèāð ñðèìβóáέð ðìò ó÷ āðβæììóáé ìā òì 118N (ð.÷. āñāñāìòìóáέñÝð, ìāñýç, é.é.ð.).

#### 23.3.6.1 Áðāééüìέόç Āñāìáóìóáéñβí

Āāéāðāóðβóáð òìì āìððçñāðçðÐ Xorg (x11-servers/xorg-server) Ð òìì āìððçñāðçðÐ XFree86 (x11-servers/XFree86-4-Server), éáé Ýðāéóā āāéāðāóðβóáð òéð āñāñāìáóìóáéñÝð TrueType áéā òçí áðέéðìççðÐ āεβóóā. Ĭā òéð óúóóÝð òìðééÝð ñðèìβóáέð, èā ìðññāβóā íá āāβóā òçí áðέéāñÝíç āεβóóā óóā ìāñýç éáé óā ìçíýìáðā òìò āñāóééìý ðāñéāÛéèìò.

#### 23.3.6.2 Āéóāāùāβ ìç-Āāāéééπí × āñāéòÐñìì

Ç ìÝεìāìò áéóúāìò X11 (XIM, X11 Input Method), āβíáé Ýíā ìÝì ðñìòððì áéá üèìòð òìòð ðāéÛðāð X11. ¼éāð íé

áðáññáÝð ðïð X11 éá ðñÝðáé íá ãñÛïñíóáé ùð ðáéÛðáð ðïð XIM, éáé íá éáñáÛíñïí áβóññáí áðu áñðççñáðçðÝð áéóúññï XIM. ÕðÛñ ðïñí áéáéÝóçñé áéÛïñíé áñðççñáðçðÝð XIM, áéá áéáóññáðééÝð áëþðóáð.

### 23.3.7 Ñýèìéóç ÁêôððùòÞ

ËÛðñéá óáð ð-áñáéðÞñúí single C áβíáé óðñèùð áñóñíáðùíÝíá óðñè ðáéñí ðñ ðéééù ðñí áêôððùòÞñ. Óá óáð ð-áñáéðÞñúí óýðñï wide Þ multibyte áðáéóñíýí áéáééÝð ññèìβóáéð, éáé óðñéóóñíýíá íá ð-ñçóçññðñéÞðóáðá ðñ **apsfilter**. Ìðññáβðá áðβóçð íá ðáðáðñÝðáðá ðñ Ýáñáñóñí óáð óá PostScript Þ PDF, ð-ñçóçññðñéÞñóáð áñááéáβá áéáééÛ ððéáñíÝíá áéá ðç óðáéêññéñíÝíç áëþðóá.

### 23.3.8 ÐññÞñáð éáé ÕðóòÞñáðá Áñð-áβùí

Ïñ óýóçðçíá áñð-áβùí FFS (fast filesystem) ðïð FreeBSD ððññáβ íá áéá ð-áéñéóðáβ ññíñáðá áñð-áβùí ðñï áñÞèñïí óá óáð single C (áβíáé 8-bit clean, ááβðá éáé ðñ multibyte(3)), áééÛ ááí áðñèçéáýáé ðñ óáð ð-áñáéðÞñúí ðñï ð-ñçóçññðñéáβðáé. Ìá Ûééá èüáéá, áβíáé 8-bit áééÛ ááí áñññáéáé ðβðñíðá áéá ðçñ èùáééñðñíβçðç ðñí ð-áñáéðÞñúí. Áðβóçðçíá, ðñ FFS ááí ððñíðççñáéáé áéñíá óáð ð-áñáéðÞñúí wide Þ multibyte. ÕðÛñ ðïñí ðóðùóñí ËÛðñéá áñáíÛñðçðá patches áéá ðñ FFS ðñï ððñíðççñáéñïí áððÝð ðéð áñíáðùðçðáð. Ðññéáéóáé ñññí áéá ðññíóññéñÝð éáé ðç ðáðáðÝññóçíáð éýóáéð Þ hacks, éáé Ýð-ñïíá áðñíáðóáé íá ðçñí óá ðáñééÛáññíá óðñí éáññééù áÝíðññí ðççááβñï èþáééá. Ááβðá ðéð éóðñíáéβááð ðñí áñíðóðñéð-ùí áéùòðñí áéá ðáñéóóúðáññáð ðççññíññáð éáé áéá íá áñáéðÞðóáðá óá áðáñáβðçðá áñð-áβá.

Ïñ óýóçðçíá áñð-áβùí MS-DOS óðñ FreeBSD Ýð-áé ðçñ áðñíáðùðçðá íá ññèìéóðáβ þðóá íá ðáðáðñÝðáé ðáðáýý ðñí óáð ð-áñáéðÞñúí Unicode, ðñï MS-DOS, éáé ðñï óáð ð-áñáéðÞñúí ðñï Ýð-áé áðééáááβ áéá ðñ óýóçðçíá áñð-áβùí ðñï FreeBSD. Áéá ðáñéóóúðáññáð éáððññÝññáéáð, ááβðá ðç óáéβáá manual mount\_msdosfs(8).

## 23.4 ðáðááëþðóéóç ÐñññáñáíÛðùí 118N

ÐñééÛ ports ðñï FreeBSD áéáéÝóññí ððñíðÞñéñç 118N. Óá ðáñééÛ áðu áððÛ, ðñ -118N áβíáé ðÝññð ðñï ññíñáðñð ðñïð. Óá ðñññáññíáðá áððÛ, éáé ðñééÛ ðáñéóóúðáññá, Ýð-ñïí áñóñíáðùíÝíç ððñíðÞñéñç áéá 118N éáé ááí ð-ñáéÛáññíðáé Ûééáð áéáééÝð ññèìβóáéð.

Ûððùóñí, óá ËÛðñéáð áðáññáÝð ùððð ç **MySQL**, éá ðñÝðáé íá ññèìéóðáβ ðñ `makefile` ðá ðñ áðééðìçðùí óáð ð-áñáéðÞñúí. Áððù óðñèùð áβñíáðáé ðáññññíðáð ðéá ðéñÞ óðñ **configure** óðññ ðççááβñï èþáééá, Þ áééÛáññíðáð ðñ ðáéñí ðñ `Makefile`.

## 23.5 ÕïðééÝð Ññèìβóáéð áéá ÕðáéêññéñíÝíáð Áëþðóáð

### 23.5.1 Ñþðéêç Áëþðóá (Ëùáééñðñíβçðç KOI8-R)

*Áñð-éèÞ ððñíáéóðññÛ ðñï Andrey Chernov.*

Áéá ðáñéóóúðáññáð ðççññíññáð óð-áðééÛ ðá ðçñ èùáééñðñíβçðç KOI8-R, ááβðá ðéð ÁñáññÝð Õð-áðééÛ ðá ðñ Óáð ×áñáéðÞñúí KOI8-R (Ññóééù Óýññéñ ×áñáéðÞñúí) (<http://koi8.pp.ru/>).

### 23.5.1.1 ÒιδέεÛò Ñòειβόάεò

ÒιδέεαòΠόαò óεò áεüειòεαò ãñáñÛò óòι áñ÷áβι óαò ~/.login\_conf:

```
me:My Account:\
:charset=KOI8-R:\
:lang=ru_RU.KOI8-R:
```

Άέά ðáñáááβáñιάόá ðιò ó÷áòβæιíóáέ ιá óεò ÒιδέεÛò Ñòειβόάεò, ááβòá ðñιçäÿιáíáð áíυòçòáð óá áòòυ ðι έáòÛεάει.

### 23.5.1.2 Ñýèιέόç Êιíóυέáò

- ÐñιόεÛòá ðçι áεüειòεç ãñáñΠ óòι áñ÷áβι /etc/rc.conf:
 

```
mousechar_start=3
```
- ×ñçóειιðιεΠόáò áðβόçò óεò ðáñáέÛòυ ñòειβόάεò óòι /etc/rc.conf:
 

```
keymap="ru.koi8-r"
scrnmap="koi8-r2cp866"
font8x16="cp866b-8x16"
font8x14="cp866-8x14"
font8x8="cp866-8x8"
```

- Άέά έÛεá έáóá÷þñέόç ttyv\* óòι áñ÷áβι /etc/ttys, ðñçóειιðιεΠόáò ðι cons25r υò óýðι ðáñιáóέειý.

Άέά ðáñáááβáñιάόá ðιò ó÷áòβæιíóáέ ιá ðçι ñýèιέόç ðçò έιíóυέáò, ááβòá ðñιçäÿιáíáð áíυòçòáð áóòιý ðιò έáòáέáβιò.

### 23.5.1.3 Ñýèιέόç Άέòòðυòþ

Έáεþò ιέ ðáñέóóυòáñιέ áέòòðυòÛò ðιò áέάέÛòιòι Ñυóέειýð ðñáέòþñáò Û÷ιòι áιóυιáòυιÛιç ðçι έυáέειíóáεβáá CP866, έá ðñáέáóóáβòá áέáέευ ðβέòñι áíυäò áέá ιá ιáóáòñÛòáð áðυ ðι KOI8-R óòι CP866. Òι ðβέòñι áóòυ ááέáεβóóáóáέ áðυ ðñιáðέειäþ óòι /usr/libexec/lpr/ru/koi2alt. Ç έáóá÷þñέόç áέá Ûιá Ñþóέει áέòòðυòþ óòι /etc/printcap έá ιιέÛæáέ ιá ðçι ðáñáέÛòυ:

```
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:
```

Άáβòá ðι printcap(5) áέá ðει έáðòñáñþ ðáñéãñáòþ.

### 23.5.1.4 Óýóççιá Άñ÷áβυι MS-DOS έάέ Ñþóέéá ιιυιáóá Άñ÷áβυι

Òι ðáñáέÛòυ ððυááέáñι έáóá÷þñέόç óòι fstab(5) áíáñáñðιεáβ ðçι ððιóðþñέιç áέá Ñþóέéá ιιυιáóá áñ÷áβυι óá ðñιáñòçιÛιá óòóðþιáóá áñ÷áβυι óýðιò MS-DOS:

```
/dev/ad0s2 /dos/c msdos rw,-Wkoi2dos,-Lru_RU.KOI8-R 0 0
```

Ç áðέειäþ -L áðέéÛááé óéò ðιδέεÛò ñòειβόάεò ðιò έá ðñçóειιðιεçèιýι, έάέ ç -w ιñβæáέ ðιι ðβιáέá ιáóáòñιðþ ðñáέòþñυι. Άέá ιá ðñçóειιðιεΠόáòá ðçι áðέειäþ -w ááááέυέáβòá υóέ Û÷ιá ðñιόáñòþóáέ ðçι έáðÛòιçóç /usr ðñέι ðçι έáðÛòιçóç MS-DOS, έáεþò ιέ ðβιáέáð ιáóáòñιðþ ãñβóέιíóáέ óòι /usr/libdata/msdosfs. Άέá ðáñέóóυòáñáð ðεçñιòñιáð, ááβòá ðç óáεβáá manual ðιò mount\_msdosfs(8).

### 23.5.1.5 Ñýèìέόç X11

1. ΆέοάεÛόοά ðñþóá óέò ááíέéÛò ðιðέéÛò ñðειβόάεò ðιò Û÷ιòιá Παç ðáñéáñÛόáé.
2. Άί ÷ñçóéιιðιέáβóá ðιí áιòðçñáóçòΠ **Xorg**, ááéáóáóòΠóóá ðι ðáéÛóι x11-fonts/xorg-fonts-cyrillic.

ΆέÛáιòá ðçι áιúòçóá "Files" óðι áñ÷áβι /etc/X11/xorg.conf. Έá ðñÛðáé íá ðñιόéÛόóá ðçι ðáñáéÛóò ãñáñΠ ðñέι áðu ðιέέáΠðιòá Ûéç éáóá÷ñéόç FontPath:

```
FontPath "/usr/local/lib/X11/fonts/cyrillic"
```

**Όçιáβύόç:** Άáβóá óóçι ÓðéèιáΠ ðυι Ports áéá ðáñéóóóòáñáò éðñéééééÛò áñáιιáðιόáéñÛò.

3. Άέá ðçι áιáñáñιðιβçóç ðιò ÑùóééÛý ðéçéðñιéιáβιò, ðñιόéÛόóá óέò ðáñáéÛóò ãñáñÛò óóçι áιúòçóá "Keyboard" ðιò áñ÷áβιò xorg.conf:

```
Option "XkbLayout" "us,ru"
Option "XkbOptions" "grp:toggle"
```

Άáááéúéáβóá áðβçò ùðé ç áñáñΠ xkbDisable áβιáé áιáñáñáΠ (íáñéáñéóιÛιç ùò ó÷ιééι).

Άί ÷ñçóéιιðιέβóáðá ðιí grp:toggle ç áιáééááΠ RUS/LAT éá áβιáóáé íá ðι **Άáιέυ Alt**, áιþ áι èÛóáðá grp:ctrl\_shift\_toggle, ç áιáééááΠ éá áβιáóáé íá ðι **Ctrl+Shift**. Άέá grp:caps\_toggle, ç áιáééááΠ RUS/LAT éá áβιáóáé íá ðι **CapsLock**. Ç éáñιέéΠ éáéðιòñáβá ðιò **CapsLock** áιáéιéιòéáβ íá áβιáé áéáéÛóéιç ìÛóò ðιò óðιáóáóιÛý ðéΠéðñιí **Shift+CapsLock** (ιúñι óá éáðÛóóáóç LAT). Õιí grp:caps\_toggle áéá éÛðιéι Ûáιúóðι éúáι, ááι éáéðιòñááβ óðι **Xorg**.

Άί ðι ðéçéðñιéιúáéι óáð áéáéÛóáé ðéΠéðñá "Windows", éáé Û÷áðá ðáñáóçñΠóáé ùðé éÛðιéá áðu óá ìç-áéöáñééιçóééÛ ðéΠéðñá Û÷ιò éÛéιò áιðéóðιβ÷çóç ùðáι áβóóá óá éáðÛóóáóç RUS, ðñιόéÛόóá ðçι ðáñáéÛóò ãñáñΠ óðι áñ÷áβιò xorg.conf:

```
Option "XkbVariant" ",winkeys"
```

**Όçιáβύόç:** Õι Ñþóééι ΧΚΒ ðéçéðñιéιúáéι βóóð ááι éáéóιòñááβ íá áóáñιáÛò ðιò ááι Û÷ιòι áðéá÷ðáβ áéá óέò áιðβóðιé÷áò ðιðέéÛò ñðειβόάεò.

**Όçιáβύόç:** Ìé áóáñιáÛò ðιò ðçñιýι óέò áéÛ÷éóóáð ðñιáéááñáóÛò ðιðééþι ñðειβóáυι, éá ðñÛðáé íá éáéιýι áðu ìññβ ðç óðιÛñðçóç XtSetLanguageProc (NULL, NULL, NULL); ìÛóá óðιí éþáééá ðιòð.

Άáβóá ðι KOI8-R áéá ðι óýóðçιá X Window (<http://koi8.pp.ru/xwin.html>) áéá ðáñéóóóòáñáò ìáçáβáð ó÷áðééÛ ìá ðçι áçιéιòñáβá áóáñιáþι X11 ðιò ìá ÷ñçóéιιðιéιýι ðιðέéÛò ñðειβόάεò.

### 23.5.2 ÔïðééÝð Ñöèìßóáéð áéá ÐáñáäïóéáéÛ ÊéíÝæééá ÔáúáÛí

Ôï FreeBSD-Taiwan Project Ý÷áé äçíéíõñãÞóáé Ýíá HOWTO áéá óá ÊéíÝæééá óóï FreeBSD, òï ïðïßì ïðñãáßðá íá ãñãáßðá óóç áéáýèðéíóç <http://netlab.cse.yzu.edu.tw/~statue/freebsd/zh-tut/>, ÷ñçóéíïðéíðéíðáð ðéèÛ ÊéíÝæééá ports. Ì òñÝ÷úí óðíðÛèðçð òïð ÊéíÝæééíð 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 ÊéíÝæééç Óðéèíã FreeBSD (CFC) (<http://netlab.cse.yzu.edu.tw/~statue/cfc/>) ÷ñçóéíïðéíðéíðáð óçí èùáééíðéíßçóç zh-L10N-tut òïð FreeBSD-ÔáÁáÛí. Óá ðáéÝðá éáé óá scripts áéáðßéáíðáé óóç áéáýèðéíóç <ftp://freebsd.csie.nctu.edu.tw/pub/taiwan/CFC/>.

### 23.5.3 ÔïðééÝð Ñöèìßóáéð áéá óçí ÆãñíáíééÞ ÆëÞóóá (áéá ¼éáð óéð ÆëÞóóáð ðïð Ááóßæííðáé 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 ãñãüíÝñð óóá ÆãñíáíééÛ éáé áéáðßéáðáé óóçí òïðéáóá <http://user.cs.tu-berlin.de/~eserte/FreeBSD/doc/umlaute/umlaute.html>.

### 23.5.4 ÔïðééÝð Ñöèìßóáéð áéá óçí ÆëçíééÞ ÆëÞóóá

Ì Nikos Kokkalis <nickkokkalis@gmail.com> Ý÷áé ãñÛðáé Ýíá ðéÞñáð Ûñèñí áéá óçí ððéóðÞñéíç ðçð ÆëçíééÞð ãëÞóóáð óóï FreeBSD. Ôï Ûñèñí áððü áéáðßéáðáé ùð ìÝñð ðçð áðßççð ÆëçíééÞð óáéìçñßùóçð òïð FreeBSD, óóçí òïðéáóá [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) ([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)).

### 23.5.5 ÔïðééÝð Ñöèìßóáéð Áéá ÆéáðùíÝæééá éáé ÊíñáÛðééá

Áéá ÆéáðùíÝæééá, äãßðá óóçí òïðéáóá <http://www.jp.FreeBSD.org/>, áñÞ áéá ÊíñáÛðééá, äãßðá óóçí òïðéáóá <http://www.kr.FreeBSD.org/>.

### 23.5.6 Óáéìçñßùóç òïð FreeBSD óá ÆëÞóóáð Æêöùð óçð ÁããéééÞð

ÊÛðéíéé áèãéííóÝð òïð FreeBSD Ý÷íðí ìáðáñÛðáé òéÞíáðá ðçð óáéìçñßùóçð òïð óá Ûéèáð ãëÞóóáð. Ì é ìáðáñÛðáéð áðÝð áéáðßéáíðáé ìÝóù óðíáÝóíùí óóçí éýñéá áééððáéÞ òïðéáóá òïð FreeBSD (<http://www.FreeBSD.org/index.html>) Þ óóñí éáðÛéñí /usr/share/doc.

# ÊäöÛëääí 24 ÁίçìÝñùόç êääé ÁíáâÛèιέόç ôïö FreeBSD

ÁíáâÛÏêçêä, áíáâÛèιääíêçêä, êääé ðìΠιάόä ôïö áíáâÛêçêääí áðu ôïí Jim Mock. Áñ÷έêÏ óðíáέóöïñÛ áðu ôïöð Jordan Hubbard, Poul-Henning Kamp, John Polstra, êääé Nik Clayton.

## 24.1 Óýñιόç

Ôï FreeBSD ânβóέâóääé ððu óðíá÷Ï áíÝέéιç ιääóáíý ðùí áðβόçìùí äêäüóáùí ôïö. Ιñέέιβ Ûíèñùðíé ðñïóéιíý íá ÷ñçóéιιðíéιíý óéð áðβόçìää äêäüóáéð, áñ Ûέέιé ðñïóéιíý íá èñáðíýí ôï óýóόçíä ôïöð áίçìññùíÝíí ιä óéð ðääéäóäβâð áíäèβíáéð. Ûóóúïí, áéùíä êääé íé áðβόçìää äêäüóáéð áίçìññííóääé óð÷íÛ ιä áéíñèðóääé èñβóéιùí óóääéÛóùí êääé áóóääèβâð. ïðíéä Ýéäíóç êääé íá ÷ñçóéιιðíéÏóáðä, ôï FreeBSD ðáñÝ÷äé ùéä óá áðñáñβóçóä áñääéäβä áéä íá èñáðóóáðä ôï óýóόçíä óáð áίçìññùíÝíí, êääé áðβόçð óáð áðéóñÝðääé íá áíáääéιέóðäβðä áýéíéä óä èÛðíéä áðuíáίç Ýéäíóç. Ôï èäöÛéääéí áðóù éä óáð áίçèÏóääé íá áðíóáóβóáðä áí èÝéäðä íá ðáñáéíéιòéäβðä ôï óýóόçíä áíÛððóίçð, Ï áí éä ðñïóéιÏóáðä íá ðáñáíäβíáðä óä íéä áðu óéð ðááéùíÝííä äêäüóáéð. Èä ðáñíóóéÛóíòíä áðβόçð óä ááóééÛ áñääéäβä ðïö áðáéðíýíóääé áéä ðçí áίçìÝñùόç êääé áíáâÛèιέόç ôïö óðóðΠιάòò.

Áðíý äéääÛóáðä áðóù ôï èäöÛéääéí, éä íÝñáðä:

- Ðíéä áίçèçðééÛ ðñíññÛííáóä ιðñíáβðä íá ÷ñçóéιιðíéÏóáðä áéä íá áίçìññóáðä ôï óýóόçíä êääé ðçí ÓðééíäÏ ðùí Ports.
- Ðùð íá äéáðçñáβðä ôï óýóόçíä óáð áίçìññùíÝíí ιä óä ðñíññÛííáóä **freebsd-update** CVSup, CVS, Ï CTM.
- Ðùð íá óðäèñβíáðä ðçí éäðÛóóáóç áíùð ääéäáðóçìÝííò óðóðΠιάòò, ιä áíáöïñÛ Ýíá áñóóùí êääé äääóçìÝíá ðùðóù óýóόçíä.
- Ðùð íá äéáðçñÏóáðä ðçí ðääéιçñβùóç óáð áίçìññùíÝíç ιÝóù ôïö **CVSup** Ï ðùí ports ðçð ðääéιçñβùóçð .
- Óç äéáöïñÛ ιääóáíý ðùí áýí èéÛäùí ðïö ânβóέιíóääé óä áíÝέéιç: ôïö FreeBSD-STABLE êääé ôïö FreeBSD-CURRENT.
- Ðùð íá íáíáóóéÛíáðä êääé íá áðáíáäéäóáððóáðä íèùéèçñíí ôï ááóééù óýóόçíä ιä ðçí `make buildworld` (èèð).

Ðñéí äéääÛóáðä áðóù ôï èäöÛéääéí, éä ðñÝðääé:

- Íá ñòèìβóáðä óùóðÛ ðç óýíääóç óáð óðí äβéðòí (ÊäöÛéääéí 31).
- Íá áíññβæáðä ðùð íá ääéäáðóðÏóáðä ðññóéäðí éíäéòíéèù ðñβòíò éäðáóéäðóáðð (ÊäöÛéääéí 4).

**Óçìäβùóç:** Óðí èäöÛéääéí áðóù äβíáðääé óð÷íÛ ÷ñÏç ðçð áíðíèÏðð `cvsup` áéä ðçí áíÛèðçóç Ï áίçìÝñùόç ðùí áñ÷áβùí ðçääáβíò èðäééä ôïö FreeBSD. Áéä íá ðçí ÷ñçóéιιðíéÏóáðä, éä ðñÝðääé íá ääéäáðóðÏóáðä Ýíá ðáéÝòí Ï port ùðùð ðí `net/cvsup-without-gui`. Áí ÷ñçóéιιðíéäβðä FreeBSD 6.2-RELEASE Ï íáððáñí, ιðíñáβðä íá áíóééäðáððóáðä áðð ðçí áíðíèÏ ïä ðçí `csup(1)` ç íðíβä áíðèääé ðéÝíí óðí ááóééù óýóόçíä.



Ἐὰν ἡ ἀρχὴ τοῦ ἀρχειοθετημένου ἀποθετηρίου εἶναι ἀρκεῖ, ἐὰν εἰς αὐτὸ εἰσέλθῃ ἡ ἀρχὴ τοῦ ἀρχειοθετημένου ἀποθετηρίου, ἡ ἀρχὴ τοῦ ἀρχειοθετημένου ἀποθετηρίου εἶναι ἀρκεῖ.

```
# Paths which start with anything matching an entry in an IgnorePaths
# statement will be ignored.
IgnorePaths
```

Ὁ ἀποθετηρὸς ἀρχειοθετοῦντας τὸν ἀποθετηρὸν, ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ. ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ. ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ.

```
# 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
```

Ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ. ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ. ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ.

```
# 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/
```

Ὁ ἀποθετηρὸς ἀρχειοθετοῦντας τὸν ἀποθετηρὸν, ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ. ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ. ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ.

```
# Directory in which to store downloaded updates and temporary
# files used by FreeBSD Update.
# WorkDir /var/db/freebsd-update
```

Ὁ ἀποθετηρὸς ἀρχειοθετοῦντας τὸν ἀποθετηρὸν, ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ. ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ. ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ.

```
# 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
```

Ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ. ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ. ἡ ἀρχὴ τοῦ ἀποθετηρίου εἶναι ἀρκεῖ.



εάεάβδᾶñá ÷ñΠóεἰἰ ὑδᾶί óδἰóçñᾶβδᾶ ðἰεεᾶðεÛ óδóðΠᾶδᾶ, εάεðò óᾶð ᾶðéðñÛðᾶε ἰᾶ ᾶἰεἰἰᾶΠóᾶðᾶ ἰᾶ ἰεᾶ ἰᾶðéÛ óé ᾶἰçἰᾶñΠóᾶéð Û ÷ἰἰἰ ᾶᾶεᾶðᾶóðᾶεᾶβ ὀἰἰ εάéÛἰᾶ.

### 24.2.3 Αἰᾶᾶεἰβδᾶéð óᾶ ἰεéñÛð εάé ἰᾶᾶÛεᾶð Ἀεᾶὑδᾶéð

Ç ᾶεᾶᾶεᾶóβᾶ ᾶððΠ ἰᾶ ᾶðñᾶεñἰᾶé ὀᾶ ðᾶεéÛ ᾶñ ÷ ᾶβᾶ ᾶἰóεᾶεἰᾶἰεἰἰἰ ἠΠᾶεᾶ (object files) εάεðò εάé ðéð ðᾶεéÛð ᾶεᾶεἰεἰΠεᾶð, εÛἰἰἰóᾶð ðéð ðᾶñεóóὑðᾶñᾶð ᾶóᾶñἰᾶÛð ðñβδᾶἰ εᾶðᾶóεᾶðᾶóðᾶἰ ἰᾶ ἰç εᾶεðἰñᾶἰἰἰ. Óᾶð óἰεóðἰἰἰᾶ ᾶβδᾶ ἰᾶ ᾶðᾶᾶεᾶóᾶóðΠóᾶðᾶ ὑεᾶ ὀᾶ ᾶᾶεᾶðᾶóçἰÛἰ ports εάé ἰᾶ ὀᾶ ᾶᾶεᾶðᾶóðΠóᾶðᾶ ἰᾶἰÛ, Π ἰᾶ ὀᾶ ᾶἰᾶᾶεἰβδᾶðᾶ ᾶñᾶὑðᾶñᾶ, ÷ñçóεἰἰðἰεἰΠᾶð ðἰ ᾶἰçεçðééὑ ðñᾶᾶñᾶἰᾶ ports-mgmt/portupgrade. ἰε ðᾶñεóðὑἰᾶñἰε ÷ñΠóðᾶð εᾶ εÛεἰἰἰ ἰᾶ εÛἰἰἰἰ ἰεᾶ ᾶἰεἰᾶóðéεΠ ἰᾶðᾶᾶεἰΠððéóç ÷ñçóεἰἰðἰεἰΠᾶð ðçἰ ᾶεὑεἰἰðεç ᾶἰðἰεΠ:

```
# portupgrade -af
```

ἰᾶ ᾶððὑ ðἰἰ ðñᾶðἰ ᾶἰᾶóᾶεἰβδᾶéð ὑðé ὀᾶ ðÛἰἰᾶ εᾶ ᾶðᾶἰᾶᾶεᾶðᾶóðᾶεἰἰἰ óὑððÛ. ÓçἰᾶεἰΠᾶð ὑðé ᾶἰ εÛᾶðᾶ ðçἰ ἰᾶðᾶᾶεçðΠ ðᾶñεᾶÛεἰἰἰðἰ BATCH óðçἰ ðéἰΠ yes, ὑεᾶð ἰε ðεεᾶἰÛð ᾶñᾶðΠóᾶéð ðἰἰ εᾶ ᾶἰᾶἰεóðἰἰἰ εᾶðÛ ðç ᾶεᾶᾶεᾶóβᾶ, εᾶ ᾶðᾶἰóçεἰἰἰ ᾶððὑᾶἰᾶ ἰᾶ yes. ρóé ᾶἰ ððÛñ ÷ᾶé ðεÛἰ ᾶἰÛᾶεç ᾶεᾶ ðᾶñÛἰᾶᾶóç ὀἰἰ ÷ñΠóðç εᾶðÛ ðç ᾶεÛñεᾶéᾶ ðçð ᾶεᾶᾶεᾶóβᾶð ἰᾶðᾶᾶεἰΠððéóçð.

Αἰ ÷ñçóεἰἰðἰεᾶβδᾶéð ðñἰóᾶñἰἰἰἰÛἰ ððñΠᾶð, ç ᾶεᾶᾶεᾶóβᾶ ᾶἰᾶᾶÛεἰεóçð ᾶβἰᾶé ᾶεᾶðñÛ ðεἰ ðἰεÿðἰεἰç. Εᾶ ÷ñᾶεᾶóðᾶβδᾶ ἰᾶ ᾶἰðβᾶñᾶᾶἰ ὀἰἰ ððñΠᾶ GENERIC óðἰἰ εᾶðÛεἰᾶἰ /boot/GENERIC. Αἰ ᾶἰ ððÛñ ÷ᾶé Πᾶç ἰ ððñΠᾶð GENERIC óðἰ ὀἰóðçἰᾶ ὀᾶð, ἰðἰñᾶβδᾶ ἰᾶ ὀἰἰ ᾶἰᾶεðΠóᾶðᾶ ÷ñçóεἰἰðἰεἰΠᾶð ἰεᾶ ᾶðὑ ðéð ðᾶñᾶεÛðὑ ἰᾶεὑᾶἰðð:

- Αἰ ἰ ÷ᾶðᾶ ἰᾶðᾶᾶεὑððβδᾶéð ðñἰóᾶñἰἰἰἰÛἰ ððñΠᾶ ἰᾶἰ ἰεᾶ ὀἰñÛ, ἰ ððñΠᾶð óðἰἰ εᾶðÛεἰᾶἰ /boot/kernel.old ᾶβἰᾶé óðçἰ ðñᾶἰᾶἰᾶééὑðçᾶ ἰ GENERIC. ἈðἠΠ ἰᾶðἰñᾶÛðᾶ ὀἰἰ εᾶðÛεἰᾶἰ ὀᾶ /boot/GENERIC.
- Αἰ ἰ ÷ᾶðᾶ ὀðóéεΠ ðñὑδᾶᾶóç óðἰ ἰç ÷Ûἰçἰᾶ, ἰðἰñᾶβδᾶ ἰᾶ ᾶᾶεᾶðᾶóðΠóᾶðᾶ ἰᾶ ᾶἰðβᾶñᾶᾶἰ ὀἰἰ ððñΠᾶ GENERIC ᾶðὑ ὀἰ CD-ROM ðçð ᾶᾶεᾶðÛðᾶóçð. ÓἰðἰεᾶðΠóᾶð ὀἰ CD-ROM óðἰἰ ἰᾶçᾶὑ εάé ÷ñçóεἰἰðἰεἰΠᾶð ðéð ðᾶñᾶεÛðὑ ᾶἰðἰεÛð:

```
# mount /cdrom
# cd /cdrom/x.y-RELEASE/kernels
# ./install.sh GENERIC
```

ΑἰðéεᾶðᾶóðΠóᾶð ὀἰ x.y-RELEASE ἰᾶ ὀἰðð ðñᾶἰᾶἰðééἰἰð ᾶñεἰἰἰð ðçð ἰεᾶἰðçð ðἰἰ ÷ñçóεἰἰðἰεᾶβδᾶ. ἰ ððñΠᾶð GENERIC εᾶ ᾶᾶεᾶðᾶóðᾶεᾶβ ᾶðὑ ðñἰᾶðéεἰᾶΠ óðἰἰ εᾶðÛεἰᾶἰ /boot/GENERIC.

- Αἰ ᾶἰ ἰ ÷ᾶðᾶ εÛðἰεᾶ ᾶðὑ ðéð ðᾶñᾶðÛἰᾶ ᾶðéεἰᾶÛð, ἰðἰñᾶβδᾶ ἰᾶ ἰᾶðᾶᾶεὑððβδᾶðᾶðᾶ εάé ἰᾶ ᾶᾶεᾶðᾶóðΠóᾶðᾶ ὀἰἰ ððñΠᾶ GENERIC ἰÛðὑ ὀἰð ðçᾶᾶβἰð ἠΠᾶééᾶ:

```
# cd /usr/src/
# env DESTDIR=/boot/GENERIC make kernel
# mv /boot/GENERIC/boot/kernel/* /boot/GENERIC
# rm -rf /boot/GENERIC/boot
```

Ἄεᾶ ἰᾶ ᾶἰᾶᾶἰñεéóðᾶβ ᾶððὑð ἰ ððñΠᾶð ὑð GENERIC ᾶðὑ ὀἰ freebsd-update, ᾶἰ ἰᾶ ðñÛðᾶé ἰᾶ ἰ ÷ᾶðᾶ ᾶβἰᾶé ᾶεᾶᾶÛð óðἰ ᾶñ ÷ᾶβἰ ððεἰβδᾶἰ ὀἰἰ GENERIC. Óðἰβδᾶðᾶé ᾶðβóçð ç ἰᾶðᾶᾶεἰΠððéóç ἰᾶ ᾶβἰᾶé ÷ññβð Ûεεᾶð ᾶἰᾶεᾶéᾶðἰÛἰ ððεἰβδᾶéð (εᾶðÛ ðñἰóβἰççç ἰᾶ εᾶἰὑ ὀἰ /etc/make.conf).

Ἀᾶἰ ÷ñᾶεÛᾶðᾶé ðç ᾶᾶñÛἰç óðéᾶἰΠ ἰᾶ ᾶðᾶἰᾶεἰΠᾶðᾶ ἰᾶ ὀἰἰ ððñΠᾶ GENERIC.

Ἀβἰᾶé ᾶἰᾶðᾶÛð ἰε ᾶἰᾶᾶεἰβδᾶéð ðὑἰἰ ὀᾶ ἰεéñÛð ὑἰἰ εάé ὀᾶ ἰᾶᾶÛεᾶð ᾶεᾶὑδᾶéð, ᾶβἰἰἰᾶð óðçἰ ᾶἰðἰεΠ freebsd-update ὀἰἰ ᾶðééðἰçðὑ ᾶñεἰὑ ἰεᾶἰðçð. Ἄεᾶ ðᾶñÛᾶᾶεᾶἰᾶ, ç ᾶεὑεἰἰðεç ᾶἰðἰεΠ εᾶ ᾶἰᾶᾶεἰβδᾶé ὀἰ ὀἰóðçἰᾶ ὀᾶ FreeBSD 6.4:

```
# freebsd-update -r 6.4-RELEASE upgrade
```

ÌáöÛ óç èÞòç óçð áíóìèÞò, òì freebsd-update èá áíéíëíãÞòáé óçí êáóÛóðáóç òìö óðóðÞíáðìð êáé òìö áñ÷ áßìö ñòèìßóáùì òìö, óá ìéá áðùðáéñá íá ìáæÝðáé óéð áðáíáßóçòáð ðεçñìöìñßáð áéá óçí áíááÛèìéóç òìö óðóðÞíáðìð. Ìé ðεçñìöìñßáð ðìö áíé÷ íáÿεçéáí èá àìöáíéóðìÿí óóçí ìèùíç ìá óç ììñòÞ ìéáð èßóðáð ááéáðáóóçìÝíùì ðñìãñáìÛòùì. Áéá ðáñÛááéáíá:

```
Looking up update.FreeBSD.org mirrors... 1 mirrors found.
Fetching metadata signature for 6.3-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

Óðì óçìáßì áðòù, òì freebsd-update èá êáóááÛóáé ùéá óá áñ÷ áßá ðìö áðáéóìÿíóáé áéá óçí áíááÛèìéóç. Óá ìáñééÝð ðáñéððóðáéð, ì ÷ ñÞóóçð èá èεççéáß íá áðáíóÞòáé óá áñòðÞòáéð ó÷ áðééÛ ìá òì ðé èá ááéáðáóóáéáß Þ ðùð ðñÝðáé íá ðñì÷ ùñÞòáé ç áéááééáóá.

¼ðáí ÷ ñçóéìðìéáßðáé ðñìóáñìòìÝíò ððñÞíáð, òì ðáñáðÛù ãÞíá èá ðñìéáéÝóáé óçí àìöÛìéóç óçð ðáñáéÛòù ðñìéáéäìðßçóçð:

```
WARNING: This system is running a "MYKERNEL" kernel, which is not a
kernel configuration distributed as part of FreeBSD 6.3-RELEASE.
This kernel will not be updated: you MUST update the kernel manually
before running "/usr/sbin/freebsd-update install"
```

Ìðìñáßáð íá ááñÞòáðá áðòÞ óçí ðñìéáéäìðßçóç. Èá ÷ ñçóéìðìéáßðóìòìá òìí áíçìáñùÝí ððñÞíá GENERIC ùð áíáéÛìáóì áÞíá óóç áéááééáóá áíááÛèìéóçð.

Áóìÿ ìáðáóìñòùèìÿí ùéá óá patches óðì òìðééù óÿóóçìá, èá áßíáé êáé ç áðáñìãÞ òìð. Ç áéááééáóá áðòÞ Þóùð ðÛñáé èßãì ÷ ñùíì, áíÛèìá ìá óçí óá÷ÿóóá êáé òì òìñòßì òìö ìç÷ áíÞíáðìð. ðáéðá èá áßíáé ç óðã÷Þíáðóç òùì áñ÷ áßìì ñòèìßóáùì. Áðòù òì ìÝíò óçð áéááééáóáð áðáéðáß ðáñÝíááóç òìö ÷ ñÞóóç, èáèÞð óá èÛðìéá áñ÷ áßá èá ÷ ñáéáóðáß ç óðã÷Þíáðóç íá áßíáé ÷ áéñìèßçóá ìá óç àìÞèáéá èÛðìéìð óóìóÛèðç èáéìÝíò. Ì ÷ ñÞóóçð èá áíçìáñÞíáðáé áéá òì áðìðÝéáóíá èÛèá áðéðð÷çìÝíçð óðã÷Þíáðóçð èáèÞð áíáéßóðáðáé ç áéááééáóá. Óá ðáñððòùóç áðìðð÷çìÝíçð óðã÷Þíáðóçð (Þ áíùíçóçð óçð), ç áéááééáóá áíááÛèìéóçð èá áéáéìðáß. Áíáá÷ìÝíò ìá èÝéáðá íá èñáðÞòáðá áíóßáñáòì áóðáèáßáð òìö êáðáéùìò /etc êáé íá óðã÷ ùíáÿóáðá áñáùðáñá (÷ áéñìèßçóá) èÛðìéá óçìáíóééÛ áñ÷ áßá, ùðòð òì master.passwd Þ òì group.

**Óçìáßòùóç:** Óðì óçìáßì áðòù ááíÝ÷ áé áßíáé áéùìá èáìéÛ áééáãÞ óðì óÿóóçìá, èáèÞð ùεç ç áéááééáóá óçð áíááÛèìéóçð êáé óðã÷Þíáðóçð áßíáðáé óá áéáóìñáðééù êáðÛèìá. ¼ðáí áðáñìòóðìÿí áðéðð÷Þð ùéá óá patches êáé ìèìéεçñùèáß ìá áðéðð÷ßá ç áéááééáóá óçð óðã÷Þíáðóçð ùéùì òùì áñ÷ áßìì ñÿèìéóçð, ì ÷ ñÞóóçð èá ðñÝðáé íá áðéááééáèÞòáé óçí óáééèÞ ááéáðÛóðáóç.

Ïά οί öÛείö áöðö ç äεάάεέάöβάö, ç áίάάÛειέοç ìðñάβ ίά ðñöóεέιðιεçεάβ öðί äβöει, ìά öç ÷ ðñöç öçö áεüειöεçö áίöίεöð:

```
# freebsd-update install
```

Óöçί ðñöç öÛöç, εά äεεά÷εάβ ì ðöñöίáö εάε öá ö÷ äöεέÛ äññöίáö. Óöί öçìάβì áööü, εά ðñÛäε ίά äβίáε äðáíáεεβίçöç öίö ìç÷ áίöίáöìö. Óά ìç÷Ûίçίá ìά ðñίöáñììöίÛί ðöñöίá, ÷ ðñöείìðιεöðá öçί áίöίεöð nextboot(8) þöðά ίά εÛöáöð öίì ðöñöίá äεά öçί äðñìáíç äεεβίçöç ööίì /boot/GENERIC (ì ðίöβìö Û÷ äε þäç áίάάäειέöáöβ):

```
# nextboot -k GENERIC
```

**ðñίáεäìðίöβçöç:** ðñεί äðáíáεεέίöóáöð ìά öίì ðöñöίá GENERIC, äääáεüεάöβöä üöε ðáñéÛ÷ äε üεä öá ðñìäñÛììáöá ìäöäçöçö ðίö äðáεöίγίöáε äεά öçί äðεöð÷ö äεεβίçöç öίö öðöðöίáöìö öáö (εάε öç εάεöίöñάöá öίö äεεöγίö, áί áίάάäειöæäöä εÛðιεί äðñáεñöóίÛί ìç÷Ûίçίá). Äεäεüöäñá, áί ì ðñίçäìγìáìö ðñίöáñììöίÛί ðöñöίáö ðáñéáö÷ ä εάεöίöñάöá öίö öóìöεüö ðáñÛ÷ììöáε äðü äññöίáöá (modules), äääáεüεάöβöä üöε öñìöðöóáöá ίά öìñöüεìγί ðñίöüñείÛ ööίì ðöñöίá GENERIC ÷ ðñöóéìðιεöίáö öéö äöíáöüöçöðá öίö äñ÷ äβìö /boot/loader.conf. ööüö äðöçöç ίά εÛεäöð ίά äðáíáñäìðιεöðáöä öðçñáöóöáö, ðñίöáñöðöóáεö äöóεüì εάε äεεöγίö ε.ε.ð. ðίö äáí äβίáε äðáñáöçöðáö, ìÛ÷ ðε öçί ðεìεöðñùöç öçö äεάάεέάöβάö áίάάÛειέöçö.

Ïðñάöðά ίά ÷ ðñöóείìðιεöðáö öçί áεüειöεç áίöίεöð äεά ίά äðáíáεεέίöóáöð öί ìç÷Ûίçίá ìά öίì ìÛί ðöñöίá:

```
# shutdown -r now
```

Ïüεéö öί öýööçίá äðáíÛεεäε öá εάεöίöñάöá, εά ðñÛäε ίά äεöäεÛöáöá ìáíÛ öί freebsd-update. Ç ðñίçäìγìáíç εάεöίöñάöá Û÷ äε äðιεçεäöεäβ, εάε Ûöóé öί freebsd-update äáí εά ìáεéíöóáε äðü öçί äñ÷ö, äεεÛ εά äðñáεñγíáε üεäö öéö ðáεεÛö ειείü ÷ ðñöóáö äεäεείεöεäö εάε öá äñ÷ äβá áίöεεäεíáιείÛ εþáεεá. Äεά ίά ööíá÷ö öóáöð öá äööü öί ööÛáεί, äþöðá öçί áεüειöεç áίöίεöð:

```
# freebsd-update install
```

**Óçìáöüöç:** ΑίÛεíäá ìά öί áί öðöñíáí äεεäáÛö ööίöð äñεεìγö äεäüöáüì öüì äεäεείεçεþì, ööüö ίά öðÛñ÷ìöì ìüì äγì öÛöáεö ääεäöÛöðáöçöç áίööβ äεά öñáεö.

¼εί öί εíäεöίεεü öñööìö εáöáöεäöóöð εά ðñÛäε öþñá ίά ìáöáεüöðöεöáöβ εάε ίά äðáíáεεäöáöóöáεäβ äðü öçί äñ÷ö. Áööü äðáεöáöáε εáεðö öί ääεäöáööçìÛί εíäεöίεεü ööüö áíáñöÛöáε äðü äεäεείεöεäö ìε ðίöβáö áöáεñÛεçεáí εáöÛ öç äεάάεέáöβá öçö áίάάÛειέöçö. Ïðñάöðά ίά ÷ ðñöóείìðιεöðáöä öçί áίöίεöð ports-mgmt/portupgrade äεά ίά äöðñáöìðιεöðáöä áöðö öç äεάάεέáöβá. Äεά ίά ìáεéíöóáöá, äþöðá öéö ðáñáεÛöü áίöίεÛö:

```
# portupgrade -f ruby
# rm /var/db/pkg/pkgdb.db
# portupgrade -f ruby18-bdb
# rm /var/db/pkg/pkgdb.db /usr/ports/INDEX-*.db
# portupgrade -af
```



Ἐπιπλέον αὐτὸ ὄχι τὸ FreeBSD δὲν ἀρτὴν ἔχει ἀπὸ τῆς ἀρχῆς αὐτὴν τὴν ἀρθρογραφίαν ἐπὶ τῆς FreeBSD ἐπεὶ τὸ δὲν ἔχει ἐπιπλέον αὐτὸ ὄχι τὸ FreeBSD δὲν ἀρτὴν ἔχει ἀπὸ τῆς ἀρχῆς αὐτὴν τὴν ἀρθρογραφίαν ἐπὶ τῆς FreeBSD ἐπεὶ τὸ δὲν ἔχει

## 24.3 Portsnap: Ἡ ἀρθρογραφία τῆς FreeBSD ὄχι τῆς FreeBSD

Ἡ ἀρθρογραφία αὐτὴ τῆς Tom Rhodes. Ἀρθρογραφία αὐτὴ τῆς Colin Percival.

Ὁι ἀρθρογραφία αὐτὴ τῆς FreeBSD δὲν ἀρτὴν ἔχει ἀπὸ τῆς ἀρχῆς αὐτὴν τὴν ἀρθρογραφίαν ἐπὶ τῆς FreeBSD ἐπεὶ τὸ δὲν ἔχει ἐπιπλέον αὐτὸ ὄχι τὸ FreeBSD δὲν ἀρτὴν ἔχει ἀπὸ τῆς ἀρχῆς αὐτὴν τὴν ἀρθρογραφίαν ἐπὶ τῆς FreeBSD ἐπεὶ τὸ δὲν ἔχει

```
# 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.
```

Ὁι ἀρθρογραφία αὐτὴ τῆς FreeBSD δὲν ἀρτὴν ἔχει ἀπὸ τῆς ἀρχῆς αὐτὴν τὴν ἀρθρογραφίαν ἐπὶ τῆς FreeBSD ἐπεὶ τὸ δὲν ἔχει ἐπιπλέον αὐτὸ ὄχι τὸ FreeBSD δὲν ἀρτὴν ἔχει ἀπὸ τῆς ἀρχῆς αὐτὴν τὴν ἀρθρογραφίαν ἐπὶ τῆς FreeBSD ἐπεὶ τὸ δὲν ἔχει

Ἡ ἀρθρογραφία αὐτὴ τῆς FreeBSD δὲν ἀρτὴν ἔχει ἀπὸ τῆς ἀρχῆς αὐτὴν τὴν ἀρθρογραφίαν ἐπὶ τῆς FreeBSD ἐπεὶ τὸ δὲν ἔχει ἐπιπλέον αὐτὸ ὄχι τὸ FreeBSD δὲν ἀρτὴν ἔχει ἀπὸ τῆς ἀρχῆς αὐτὴν τὴν ἀρθρογραφίαν ἐπὶ τῆς FreeBSD ἐπεὶ τὸ δὲν ἔχει

```
# portsnap extract
/usr/ports/.cvsignore
/usr/ports/CHANGES
/usr/ports/COPYRIGHT
/usr/ports/GIDS
/usr/ports/KNOBS
/usr/ports/LEGAL
/usr/ports/MOVED
/usr/ports/Makefile
/usr/ports/Mk/bsd.apache.mk
/usr/ports/Mk/bsd.autotools.mk
/usr/ports/Mk/bsd.cmake.mk
...
```

Ὁι ἀρθρογραφία αὐτὴ τῆς FreeBSD δὲν ἀρτὴν ἔχει ἀπὸ τῆς ἀρχῆς αὐτὴν τὴν ἀρθρογραφίαν ἐπὶ τῆς FreeBSD ἐπεὶ τὸ δὲν ἔχει ἐπιπλέον αὐτὸ ὄχι τὸ FreeBSD δὲν ἀρτὴν ἔχει ἀπὸ τῆς ἀρχῆς αὐτὴν τὴν ἀρθρογραφίαν ἐπὶ τῆς FreeBSD ἐπεὶ τὸ δὲν ἔχει

```
# portsnap update
```



Ἄρα ὁ ἀναστροφὴ τοῦ ὅρου ὅτι ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD  
× ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ CVSup.

### 24.4.3 Ἀντιμετώπιση τοῦ Ἐπιπέδου τοῦ Ἀντιμετώπισης

Ὅτι ἀντιμετώπιση τοῦ ἀντιμετώπισης CVSup ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD  
× ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD

```
# cvsup -h cvsup.FreeBSD.org -g -L 2 /usr/share/examples/cvsup/doc-supfile
```

Ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD

Ὅτι ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD

Ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD

Ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD

```
# cd /usr/doc
# make update
```

Ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD

```
SUP_UPDATE= yes
SUPHOST?= cvsup.freebsd.org
DOCSUPFILE?= /usr/share/examples/cvsup/doc-supfile
```

Ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD

### 24.4.4 Ἀντιμετώπιση τοῦ Ἐπιπέδου τοῦ Ἀντιμετώπισης

Ὅτι ἀντιμετώπιση τοῦ ἀντιμετώπισης CVSup ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD ἄρα ὁ ἄνθρωπος ἔστω ἐν τῇ ἐκκλησίᾳ τοῦ FreeBSD



## 24.4.6 × η̄ςόέιῑδῑε̄πί̄οάο οά Ports ος̄ο Ὀά̄εῑγ̄η̄βὺς̄ος̄ο

ΆάόέοιΥίι οά ἀ̄η̄άόβ̄α οἰο Marc Fonvieille.

Ὀδ̄ῑ ο̄η̄ῑᾱρ̄ῑάῑς άίῑος̄οά, δ̄ᾱη̄ῑο̄έ̄Υοά̄ῑά ῑέα ῑΥε̄ῑαῑ έάέ ο̄ς̄ῑ άίῑῑῩη̄ο̄ς̄ ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο οἰο FreeBSD ῑῩοὺ οἰο δ̄ς̄ᾱβ̄ῑο έ̄π̄αέέα. Ὑ̄ο̄ο̄ῑοι, ῑέ άίῑῑᾱη̄β̄οάέο δ̄ῑο άάόβ̄αῑοάέ ο̄ο̄ῑ δ̄ς̄ᾱβ̄ῑο έ̄π̄αέέα ῑδῑη̄ᾱβ̄ ῑά ῑς̄ῑ ά̄β̄ῑάέ ά̄οῑάοῩο P δ̄η̄άέοέέῩο άέα έ̄Ῡε̄ά ο̄γ̄ο̄ς̄ῑά FreeBSD. Ḷ έέαάέέαόβ̄α ῑάόά̄ε̄π̄ο̄δ̄έος̄ο δ̄ῑο δ̄ς̄ᾱβ̄ῑο έ̄π̄αέέα ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο άδ̄άέο̄ᾱβ̄ ο̄÷άοέέῩο ῑά̄ᾱῩε̄ῑ ά̄η̄έ̄ῑῑ ά̄η̄άέ̄ᾱβ̄ῑ έάέ ά̄ῑς̄έ̄ς̄ο̄έ̄ε̄πῑ δ̄η̄ῑᾱη̄ά̄ῑῩο̄ῑ, ά̄ῑῡο̄̄Ῡ η̄ο̄ ά̄η̄άάέ̄ᾱβ̄α ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο. Άδ̄άέο̄ᾱβ̄ άδ̄β̄ος̄ο έάέ ῑέα ο̄÷άοέέP ά̄η̄έέ̄ᾱβ̄ῑος̄ο ῑά οἰο CVS έάέ ος̄ έέαάέέαόβ̄α ά̄Ῡέ̄ος̄ος̄ο ο̄ῡῑ ά̄η̄÷ά̄β̄ῑ άδ̄ῡ ά̄ο̄ο̄ῑ, έά̄ε̄η̄ο̄ έάέ ῑέα οά̄ε̄η̄Ῡ άδ̄ῡ ά̄β̄ῑάόά άέα ος̄ ῑάόά̄ε̄π̄ο̄δ̄έος̄ οἰο έ̄π̄αέέα. Ὀδ̄ῑ ά̄ῑῡο̄ς̄οά άδ̄οP δ̄η̄ά̄ε̄ᾱη̄Ῡο̄ῑο̄ῑά Ῡῑά ά̄ῑάέέ̄αέ̄οέέ̄ῡ ο̄η̄ῡδ̄ῑ άίῑῑῩη̄ο̄ς̄ο ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο δ̄ῑο ά̄άέ̄ᾱβ̄οάόάέ ῑάε̄β̄ ῑά οἰο FreeBSD. Ḷ ῑΥε̄ῑαῑο άδ̄οP ÷ η̄ς̄όέῑῑδ̄ῑέ̄ᾱβ̄ ο̄ς̄ῑ Ὀδ̄έ̄ῑᾱP ο̄ῡῑ Ports έάέ ά̄β̄ῑάέ οέο δ̄ᾱη̄άέῩο̄ῑ ά̄οῑά̄ο̄ῡος̄ο̄:

- ΈάοῩάαοῑά έάέ ά̄άέ̄ᾱο̄Ῡο̄ο̄άος̄ο δ̄η̄ῑ-ῑάόά̄ε̄ῡο̄δ̄έο̄ῑῩῑῡῑ ο̄δ̄έ̄ᾱῑέ̄ῡο̄δ̄ο̄δ̄ῡῑ ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο, ÷̄η̄η̄β̄ο ῑά άδ̄άέο̄ᾱβ̄οάέ έά̄ῑέ̄Ῡο οἰοδ̄έ̄P ῑάόά̄ε̄π̄ο̄δ̄έος̄ο (ά̄ῑάέ̄ᾱβ̄οῑο̄ῑάόά Ῡο̄οέ έάέ ο̄ς̄ῑ ά̄Ῡάε̄ς̄ ά̄άέ̄ᾱο̄Ῡο̄ο̄άος̄ο ῡέ̄ῡῑ ο̄ῡῑ ά̄η̄άέ̄ᾱβ̄ῑ ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο).
- ΈάοῩάαοῑά οἰο δ̄ς̄ᾱβ̄ῑο έ̄π̄αέέα ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο έάέ ῑάόά̄ε̄π̄ο̄δ̄έος̄ο οἰο ῑῩοὺ ο̄ῡῑ ά̄οῑά̄ο̄ῑο̄P ο̄ῡῑ δ̄ῑο δ̄ᾱη̄Ῡ÷ῑοῑ οά ά̄η̄άέ̄ᾱβ̄α ο̄ῡῑ ports (άδ̄ε̄ῑδ̄ῑε̄πί̄οάο ῑά ά̄ο̄ο̄ῑ οἰο ο̄η̄ῡδ̄ῑ ος̄÷ά̄ε̄η̄ῑε̄β̄ῑος̄ο έέαάέέαόβ̄α ά̄Ῡέ̄ος̄ος̄ο έάέ ῑάόά̄ε̄π̄ο̄δ̄έος̄ο).

Άδ̄ο̄Ῡο ῑέ ά̄γ̄ῑ ῑΥε̄ῑαῑέ άίῑῑῩη̄ο̄ς̄ο ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο οἰο FreeBSD ο̄δ̄ῑο̄ς̄γ̄η̄β̄αῑοάέ άδ̄ῡ ῑέα οά̄ε̄η̄Ῡ άδ̄ῡ ports ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο οά ῑδ̄ῑβ̄ά άίῑῑᾱη̄β̄ῑοάέ έ̄Ῡε̄ά ῑP ῑά άδ̄ῡ ο̄ς̄ῑ η̄ῑῩάά Ά̄η̄÷έ̄ο̄ά̄ε̄ο̄ῑέ̄ε̄P ο̄ς̄ο Ὀά̄εῑγ̄η̄βὺς̄ος̄ο <doceng@FreeBSD.org>. Ὀδ̄ς̄ Ὀδ̄έ̄ῑᾱP ο̄ῡῑ Ports, έά οά ά̄η̄άβ̄οά έ̄Ῡο̄ῑ άδ̄ῡ ο̄ς̄ῑ έάδ̄ς̄ᾱη̄β̄ά docs (<http://www.freshports.org/docs/>).

### 24.4.6.1 ῑάόά̄ε̄π̄ο̄δ̄έος̄ο έάέ Ά̄άέ̄ᾱο̄Ῡο̄ο̄άος̄ο ο̄ῡῑ Ports ος̄ο Ὀά̄εῑγ̄η̄βὺς̄ος̄ο

Ὀά ports ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο ÷ η̄ς̄όέῑῑδ̄ῑέ̄ρ̄ῑά οέο ά̄οῑά̄ο̄ῡος̄ο̄ ά̄όά̄ε̄π̄ο̄δ̄έος̄ο δ̄ῑο δ̄ᾱη̄Ῡ÷άέ οἰο ο̄γ̄ο̄ς̄ῑά ο̄ῡῑ ports η̄ο̄ά ῑά έέ̄ᾱδ̄ε̄ῑέ̄ρ̄ῑοῑ ος̄ έέαάέέαόβ̄α ά̄ς̄ῑέ̄ῑο̄η̄ᾱβ̄αδ̄ ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο. Ῑά ά̄ο̄ο̄ῑ οἰο ο̄η̄ῡδ̄ῑ ος̄ῑ ά̄Ῡέ̄ος̄ος̄ο οἰο δ̄ς̄ᾱβ̄ῑο έ̄π̄αέέα ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο ά̄β̄ῑάόάέ ά̄δ̄ο̄ῑῑάόά ῑά ο̄ς̄ῑ ά̄έ̄ο̄Ῡε̄ᾱος̄ος̄ο make(1) έάέ οέο έάο̄Ῡε̄ς̄έ̄ᾱο η̄ο̄ε̄ῑβ̄οάέο οἰο δ̄ᾱη̄ά̄ε̄η̄ῑ. Ḷ ά̄άέ̄ᾱο̄Ῡο̄ο̄άος̄ο έάέ άδ̄ά̄άέ̄ᾱο̄Ῡο̄ο̄άος̄ο ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο ά̄β̄ῑάέ οἰο β̄ά̄ε̄ῑ ά̄γ̄ε̄ῑς̄ ῑά ο̄ς̄ῑ ά̄άέ̄ᾱο̄Ῡο̄ο̄άος̄ο ῑδ̄ῑε̄īο̄ά̄P δ̄ῑοά̄ Ὑ̄ε̄īο̄ port P δ̄άέ̄Ῡο̄ῑο οἰο FreeBSD.

**Ὀς̄ῑά̄β̄ος̄ο:** Ὀά δ̄ᾱη̄β̄δ̄ο̄ῡος̄ο οἰοδ̄έ̄ε̄P ῑάόά̄ε̄π̄ο̄δ̄έος̄ο ο̄ῡῑ ports ο̄ς̄ο ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο, άδ̄άέο̄ᾱβ̄οάέ έάέ ος̄ ά̄άέ̄ᾱο̄Ῡο̄ο̄άος̄ο ο̄ῡῑ *ά̄η̄άέ̄ᾱβ̄ῑ ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο*. Ὀά ά̄η̄άέ̄ᾱβ̄α άδ̄ο̄Ῡ ῡο̄ο̄ῡοῑ έά ά̄άέ̄ᾱο̄άο̄ά̄ε̄ῑγ̄ῑ ά̄δ̄ο̄ῑῑάόά.

Ḷ η̄η̄ά̄Ῡο̄ς̄ο ο̄ῡῑ ports ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο οάβ̄ῑάόάέ δ̄ᾱη̄άέῩο̄ῑ:

- Ὀδ̄Ῡη̄÷άέ Ῡῑά έ̄ᾱīōη̄έ̄ῡ “master port”, οἰο misc/freebsd-doc-en οἰο ῑδ̄ῑβ̄ῑ έέαέῩο̄άέ οά άδ̄ᾱη̄άβ̄ος̄οά ά̄η̄÷άβ̄ά έάέ ά̄δ̄īο̄ά̄ε̄ᾱβ̄ ο̄ς̄ῑ ά̄Ῡος̄ο ῡέ̄ῡῑ ο̄ῡῑ Ὑ̄ε̄īο̄ ports ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο. Άδ̄ῡ δ̄η̄īάδ̄έ̄ε̄īāP, οἰο port ά̄ο̄ο̄ῑ ῑάόά̄ε̄ῡο̄δ̄ε̄ᾱέ ῡīf̄ī ο̄ς̄ῑ Ά̄ά̄ε̄έ̄P ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο.
- Ὀδ̄Ῡη̄÷άέ Ῡῑά port “ῡέα οά Ῡῑά”, οἰο misc/freebsd-doc-all οἰο ῑδ̄ῑβ̄ῑ ῑάόά̄ε̄ῡο̄δ̄ε̄āέ έάέ ά̄άέ̄αέ̄ο̄δ̄Ῡ ῡε̄ς̄ ο̄ς̄ῑ ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο οά ῡε̄άδ̄ οέο έέαέῩο̄έ̄īάδ̄ ά̄ε̄η̄ο̄άδ̄.
- ὈῩε̄īο̄, οδ̄Ῡη̄÷άέ Ῡῑά “ά̄ῑά̄η̄ο̄β̄ῑά̄η̄ port” άέα έ̄Ῡε̄ά ῑά̄ο̄Ῡōη̄άος̄ο, δ̄.÷.: misc/freebsd-doc-el άέα ο̄ς̄ῑ Ά̄ε̄ς̄ς̄ί̄έ̄P ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο. ¼έα άδ̄ο̄Ῡ οά ports ά̄ῑά̄η̄ο̄β̄ῑάέ άδ̄ῡ οἰο master port έάέ ά̄άέ̄αέ̄ο̄δ̄ῑγ̄ῑ ο̄ς̄ῑ ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο δ̄ῑο Ῡ÷άέ ῑάόά̄ōη̄άο̄ά̄β̄ ο̄δ̄ς̄ῑ ά̄īōβ̄ο̄īē÷ς̄ ά̄ε̄η̄ο̄ά.

Άέα ῑά ά̄άέ̄ᾱο̄άο̄P οάδ̄ά Ῡῑά port ο̄ά̄εῑγ̄η̄βὺς̄ος̄ο άδ̄ῡ οἰο δ̄ς̄ᾱβ̄ῑο έ̄π̄αέέα, ά̄έ̄ο̄ά̄ε̄Ῡο̄ά οέο δ̄ᾱη̄άέῩο̄ῑο ά̄īōīε̄Ῡο (η̄ο̄ root):

```
# cd /usr/ports/misc/freebsd-doc-en
```



**Όχι:** Η διαδικασία είναι απλή, αλλά απαιτείται να εγκαταστήσετε το FreeBSD και να το ενημερώσετε.

Αν θέλετε να εγκαταστήσετε το FreeBSD, η διαδικασία είναι απλή, αλλά απαιτείται να εγκαταστήσετε το FreeBSD και να το ενημερώσετε.

```
# pkg_add -r el-freebsd-doc
```

**Όχι:** Η διαδικασία είναι απλή, αλλά απαιτείται να εγκαταστήσετε το FreeBSD και να το ενημερώσετε.

### 24.4.6.3 Αίτηση για Ports στο FreeBSD

Αν θέλετε να εγκαταστήσετε το FreeBSD, η διαδικασία είναι απλή, αλλά απαιτείται να εγκαταστήσετε το FreeBSD και να το ενημερώσετε.

```
# portupgrade -PP el-freebsd-doc
```

## 24.5 Διατήρηση του FreeBSD

Ο FreeBSD-CURRENT είναι ο πιο πρόσφατος κλάδος του FreeBSD, αλλά ο FreeBSD-STABLE είναι ο πιο σταθερός.

### 24.5.1 Διατήρηση του FreeBSD-CURRENT

Εάν θέλετε να εγκαταστήσετε το FreeBSD-CURRENT, η διαδικασία είναι απλή, αλλά απαιτείται να εγκαταστήσετε το FreeBSD και να το ενημερώσετε.

#### 24.5.1.1 Οφέλη του FreeBSD-CURRENT;

Ο FreeBSD-CURRENT είναι ο πιο πρόσφατος κλάδος του FreeBSD, αλλά ο FreeBSD-STABLE είναι ο πιο σταθερός.



Ç ëßóá svn-src-head (<http://lists.FreeBSD.org/mailman/listinfo/svn-src-head>) èá óáo àðéòñÝðáé íá äëÝðááòá òéð éáðá÷ ùñÞóáéð òðì commit log ãéá èÛèá äëéääÞ ðìö ãβíáðáé, èáèÞð èáé ðëçñìòìñßàð äéá ðééáíÝð ðáñáñÝñáééáð ðìö ìðìñáß íá Ý ÷ áé.

Áéá íá ãñáòòáßòá òá áððÝð, Þ òá ìðìéáòáÞðìòá áðü òéð òðÛñ ÷ ìòóáð ëßóáð, àðéóéäèèáßòá òçì òìðìéáòá <http://lists.FreeBSD.org/mailman/listinfo> èáé àðééÝìòá òç ëßóá òóçì ìðìßá èÝéäòá íá ãβíáðá òðìññçðÞð. Ìáçãáðð äéá òçì òðìèìéðç äéáéééáòá èá ãñáßòá àðéòùðìö. Áí óáo áíáéáòÝñáé íá ðáñáéìèèèáßòá òéð äééääÝð òá ùèì òì äÝìòñ ðçãáßìò èÞáééá, óáo òðìéóðìγìá íá äãáñáòáßòá òóç ëßóá svn-src-all (<http://lists.FreeBSD.org/mailman/listinfo/svn-src-all>).

2. ÁíáéòÞóáò òì ðçãáßì èÞáééá áðü Ýíá mirror site òìö FreeBSD. Áðü ìðìñáß íá ãβíáé ìá äýì òñùðìðð:

- a. ×ñçóèìðìéÞóáò òì ðñùãñáìá cvsup òá òðìáðáóìù ìá òì supfile ìá òçì ìñíáòá standard-supfile òì ìðìßì èá ãñáßòá òòì éáðÛèìäì /usr/share/examples/cvsup. ÁððÞ áβíáé èáé ç ðéÝì òðìéóðÞíáç ìÝèìäì, èáèÞð óáo àðéòñÝðáé íá áíáéòÞóáòá ùèç òç òðéèìäÞ ìá ìéá èβìçóç, èáé òðéð àðìùáíáð áíáíáÞóáéð èá ðáβñíáðá ìùñ òéð äééääÝð. Ðìèèìß ÷ ñÞóáòá àéðáèìγì òì cvsup ìÝòù òìö cron Þóðá íá èñáðÛíá òì ðçãáßì èÞáééá òì òðóðÞíáðì òìðð ðÛìóá áíáíáùÝñ áðòùíáðá. Èá ðñÝðáé íá ðñìóáñìùóáðá òì òðìáéèìá òìö supfile ðìö áβñìòá ðáñáðÛíù, èáé íá ñðèìßòáðá òì cvsup äéá òì ðáñéáÛèèì óáo.

**Òçìáßùóç:** Òì òðìáéèìá òìö áñ ÷ áßìò standard-supfile ðñìññæáðáé äéá ÷ ñÞóç ìá èÛðìéì òðáèèèèéìÝì èèÛáì áóòÛèáéáð (security branch) òìö FreeBSD, èáé ù ÷ é ìá òì FreeBSD-CURRENT. Èá ðñÝðáé íá àðáíáñáóòáßòá òì áñ ÷ áßì èáé íá áíéééáðáðóÞóáòá òçì ðáñáéÛòù ãñáìÞ:

```
*default release=cvs tag=RELENG_X_Y
```

ìá òçì áéùèìðèç:

```
*default release=cvs tag=.
```

Áéá ðáñéóòùðáñáð ðëçñìòìñßàð ò ÷ áðééÛ ìá ðá tags ðìö ìðìñáßòá íá ÷ ñçóèìðìéÞóáòá, ðáñáééèìγìá äéááÛòá òðì Áá ÷ áèñáéì òçì áíùóçðá ÁðééÝðáð (Tags) äéá òì CVS.

- b. ×ñçóèìðìéÞóáò òçì òðçñáòá **CTM**. Áí Ý ÷ áðá ðìèγ èáèÞ òðìáðéìùðçðá (ðççèù èùóðìð òγíááòçð Þ ðñùóááóç ìùñ ìÝòù email) òì **CTM** áðìòáèáß äéá óáo ìéá áíáééáðéðèÞ èγóç. Ìðìñáß ìóòùòì íá óáo áçìèìòñáÞóáé äéÛòìñá ðñíáèÞíáðá èáé íá èáðáèÞíáðá ìá ÷ áéáòìÝíá áñ ÷ áßá. Áéá òì èùäì áðòù, òì **CTM** ÷ ñçóèìðìéáßòáé òðÛíéá, èÛðé òì ìðìßì áðìÛíáé áèìùá ðáñéóòùðáñì òçì ðééáíÝðçðá íá ìç ãìðéáγáé òùóðÛ äéá ìááÛèá ÷ ñìèéÛ äéáòðÞíáðá. Óáo òðìéóðìγìá íá ÷ ñçóèìðìéÞóáòá òì **CVSup** áí äéáéÝðáðá modem 9600 bps Þ òá ÷ γðáñì.

3. Áí òèìðáγáðá íá áíáéòÞóáòá òì ðçãáßì èÞáééá äéá èáñìéèÞ ÷ ñÞóç (áèðÝèáóç) èáé ù ÷ é áðèÞð äéá íá òì äáßòá, òùðá áíáéòÞóáòá *reueççñì* òì FreeBSD-CURRENT èáé ù ÷ é èÛðìéá àðééääìÝíá òìÞíáðá. Óá äéáòìñáðéèÞ ðáñßðòùóç, áβíáé áñéáðÛ ðééáíù íá òðìáðÞóáòá ðñíáèÞíáðá, èáèÞð ðìèèÛ èñìÛðéá òì èÞáééá áíáòÞíóáé áðü áíáíáÞóáéð òá Ûèéá, èáé ááì ìðìñìγì íá ìáðáèùððéóðìγì áðòùñíá.

Ðñéì ìáðáèèèèèðáðá òì FreeBSD-CURRENT, äéááÛòá ðñìòáèèèèÛ òì Makefile òòì éáðÛèìäì /usr/src. Èá ðñÝðáé íá ìáðáèèèèèðáðá òì ððñÞíá èáé ùèì òì ááóéèù òγóðçíá (world) òçì ðñÞóç òìñÛ, ùð ìÝñìð òçð äéáéééáòáð áíááÛèìéóçð. ÁéááÛæìòáð òçì çéáèðñìèèèÞ ëßóá òçð Ýèäìóçð FreeBSD-CURRENT (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-current>) èáé òì /usr/src/UPDATING èá áßòá áíçìáñùìÝíé äéá ìÝáð äéáéééáòáð ùòì áòìñÛ òçì áèèβìçóç òòì ìÝíá óáo òγóðçíá. Ìé äéáéééáòáð áððÝð áβíáé òð ÷ ìÛ áðáñáßòçðáð ùòì ðëçóéÛæìòìá òá ìéá ìÝá áðÞóçìç Ýèäìóç.







Ἄλλοτε ἐὰν ὁ ἄνθρωπος εἴη ἄριστος οἷον FreeBSD. Ἐὰν ὁ ἄνθρωπος εἴη ἄριστος οἷον FreeBSD. Ἐὰν ὁ ἄνθρωπος εἴη ἄριστος οἷον FreeBSD.

**Ἄλλοτε ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD. Ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD.**

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Ἄλλοτε ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD. Ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD.

### 24.7.1 Ἄλλοτε ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD

Ἄλλοτε ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD. Ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD.

Ἄλλοτε ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD. Ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD.

Ἄλλοτε ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD. Ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD.

Ἄλλοτε ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD. Ὁ ἄνθρωπος οἷον ἄριστος οἷον FreeBSD.

Ïέ ðáñáέÛòù ðáñÛáñáοίέ ðáñέáñÛοίοι ðç εἰάέεP ìá ðçí ìðìá Û ÷ άέ ó ÷ άάέάóεáß ç ðñìðáέíùìáίç áέáάέέάóáá áíáάÛέιέóçð.

Ïέά áðέòò ÷ Pð áέáάέέάóáá áíáάÛέιέóçð ðñÛðάέ íá έάέÿθάέ ðìòεÛ ÷ έóòìí ðέò äÿí ðέí áάóέéÛ ð έάέάέðáñùðçðáð ìέάð áíáάÛέιέóçð áðu ðçάáßì έρπáέά:

- Ï ðάέέùð ìáðάάέùððέóóðð ðóòðPíáðìð ìðñáß íá áßíáέ áέάóÛέεçεìð áέá ìáðάáερððέóç ðìò íÛìð ððñPíá. (Éάέ ìέ ìáðάáέùððέóóÛ Û ÷ ðìò ìñέóìÛíáð òìñÛð ðñìáεPíáðά, ùðùð εÛέá Ûεεἰ εἰάέóίέέεù.) Ïðùðá ì íÛìð ððñPíáð ðñÛðάέ íá ìáðάáέùððέóóáß ìá ðìò íÛìð ìáðάáέùððέóóðP. Ðέí óðáέάεñέíÛíá, ì íÛìð ìáðάáέùððέóóðð ðñÛðάέ íá áíáάáέιέóðáß ðñέí áðu ðìò íÛìð ððñPíá. Áðòù áá óçíáßíáέ áÛάάέά ùέέ áðòùð ì íÛìð ìáðάáέùððέóóðð ðñÛðάέ íá ááέάðáóóðάéáß ðñέí ìáðάáέùððέóóáß ì íÛìð ððñPíáð.
- Óά íÛά áñáάέáßá ÷ ñPðóç áðu ðìò áάóέέù óÿóóçíá ðìò FreeBSD ìðñáß íá áíáñðPíðάέ áðu ðìò ðñùðì έáέóìðñááð ðìò íÛìð ððñPíá. Ïðùðá ì íÛìð ððñPíáð ðñÛðάέ íá ááέάðáóóðάéáß ðñέí áðu ðìò íÛìð áάóέέù óÿóóçíá.

ÁðòÛ ðá äÿí óçíáßá áßíáέ ìέ áάóέέìß εùáìέ áέá ðìòð ìðìßìðð ðñìðáßñìðáέ ðá έáíðñέÉÛ áPíáðά ìέáð áíáάÛέιέóçð, ðá áPíáðά buildworld, buildkernel, installkernel, έάέ installworld. Óðέð áðuìáíáð ðáñááñÛοίòð έá ðáñέáñÛòìá ðέí áíáέòðέέÛ áðòÛ ðá áPíáðά. ÓðÛñ ÷ ðìò έέ Ûεεἰε εùáìέ ùùð áέá ðìòð ìðìßìðð ÷ ñáέÛέáðáέ ðñìðì ÷ P ùòáí εÛíáðά ìέá ðÛìέά áíáάÛέιέóç. Ïáñέέìß áðu áðòìÿð áßíáέ ìέ áñPð:

- Óά ðάέέÛ áñáάέáßá ðìò áάóέέìÿ ðóòðPíáðìð ìðñáß íá ìçí ðñÛ ÷ ðìò òòóðÛ ìá ðìò íÛìð ððñPíá. Áέ áðòù ðñÛðάέ íá ááέάðáóóðάéáß ðìò áίçìáñùìÛíñ ááóέέù óÿóóçíá áìÛòùð ìáðÛ ðçí ááέάóÛóðάóç ðìò íÛìð ððñPíá.
- ÏáñέéÛ ðò ðñÛð ÷ ñáέÛέñðáέ áέέááÛð ðá áñ ÷ áßá ñðέìßðáùì ðñέí ááέάðáóóðάéáß ðìò íÛìð áάóέέù óÿóóçíá. ¶εέáð òìñÛð ç ááέáóÛóðάóç ùεùì ðùì áñ ÷ áßùì ñðέìßðáùì ìðñáß íá áçìέìðñáPðάέ ðñìáεPíáðά óðçí ááέáóÛóðάóç. Áέ áðòù Û ÷ ðìð ÷ ùñßóáέ ðçí áίçìáñùòç ðùì áñ ÷ áßùì ñðέìßðáùì óá äÿí ìá ÷ ùñέóðÛ áPíáðά.
- Óðçí ðáέέìθçðá ðùì ðáñέðððáùì ç áέááέέάóáá ááέáóÛóðάóçð áíðέέáέέóðÛ P ðñìðέÛðάέ áñ ÷ áßá ðìò òóòðPíáðìð· áá òáPíáέ έáíÛíá ððÛñ ÷ ðìò áñ ÷ áßì. Óά ìáñέéÛð ðáñέðððáéð áðòù ìðñáß íá áçìέìðñáPðάέ ðñìáεPíáðά. ìáðáí ððÛñ ÷ áέ ðÛìέά ðáñPðòùòç, ç áέááέέáóáá ááέáóÛóðάóçð ðððPíáέ áίçìáñùðέέÛ ìçìÿìáðá áέá ðá áñ ÷ áßá ðá ìðìá ðñÛðάέ íá óáçóòìÿ ÷ áέñìέßçðá. Áðòù ðìò áPíá ìðñáß íá áðòìáðìðìέçεáß óòì ìÛεεἰ.

÷ ðìðáð ùεáð áðòÛð ðέð έάέάέðáñùðçðáð ìέáð áíáάÛέιέóçð áðu ðçάáßì έρπáέά, έáðáέPíáñá óðçí ðáñáέÛòù áέááέέάóáá áíáάÛέιέóçð. ÏñέóìÛíáð òìñÛð ìðñáß íá ÷ ñáέÛέáðáέ íá ðñìðέÛðáðά εÛðìέá áPíáðά ðá áðòP ðç áέááέέάóáá. Óά áάóέέÛ áPíáðά ùùð ðáñáìÛíðìò ðá ßáέá, έέ áßíáέ ðá áñPð:

1. make buildworld

Áðòù ðìò áPíá ìáðάáέùððéáέ ðñPðά ìέá áίçìáñùìÛíç Ûέáñòç ðìò ßáέìð ðìò ìáðάáέùððέóóðP ðóòðPíáðìð έάέ ìáñέέPí áðáñáßðçðòùì áñáάέáßùì. òóððáñá, ÷ ñçóέìðìέPíðáð ðìò íÛìð ìáðάáέùððέóóðP, ðñìáðìέìÛέáέ ìέá íÛά Ûέáñòç ùεìð ðìò áάóέέìÿ ðóòðPíáðìð ðìò FreeBSD. Óά áίçìáñùìÛíá áέðáεÛóέíá, áέáέέìέPéáð έάέ áñ ÷ áßá ðñìáñáìíáðέóìÿ έáðáέPáñìò óòì έáðÛέìáì /usr/obj.

2. make buildkernel

Óά áíðßεáóç ìá ðáέέùðáñáð áέáάέέáóáð áíáάÛέιέóçð (ìέ ìðìßáð έáέἰÿóáí ÷ áέñìέßçðá ðìò config(8) έάέ ðìò make(1)) áðòù ðìò áPíá ìáðάáέùððéáέ ðìò ððñPíá ðìò FreeBSD ÷ ñçóέìðìέPíðáð ðìò áίçìáñùìÛíñ ìáðάáέùððέóóðP ðóòðPíáðìð áðu ðìò έáðÛέìáì /usr/obj. Áðòù óáð ðñìðáðáÿáέ áðu ðñìáεPíáðά áóðìááðùðçðáð ìáðáÿ ðìò ìáðάáέùððέóóðP έάέ ðìò ððñPíá.

3. make installkernel

ÁáέáóÛóðάóç ðìò íÛìð ððñPíá έáέ ðùì áñεñùìÛòùì ðìò óòì áßòέì ðìò ðóòðPíáðìð. ϱóέ ìðñáß ðέÛì ðìò óÿóóçíá íá ìáέέPðάέ ìá ðìò íÛìð, áίçìáñùìÛíñ ððñPíá.



Ἰδιότητα, ὁπότε ἀπαιτεῖται νὰ ἐκτελεσθῶν ἡ ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος γίνεται ὡς ἑξῆς:

```
# cd /usr/src
# make buildworld
# make buildkernel
# make installkernel
# shutdown -r now
```

**Σημείωση:** Ὁ ἰδιοκτήτης τοῦ συστήματος πρέπει νὰ ἐκτελέσῃ τὴν ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος γίνεται ὡς ἑξῆς:

Ἐν τῷ ὅτι ἀπαιτεῖται νὰ ἐκτελεσθῶν ἡ ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος, ἐὰν ὁ ἰδιοκτήτης τοῦ συστήματος ἐπιθυμῇ νὰ ἀναβαθμίσῃ τὸν FreeBSD, τότε πρέπει νὰ ἐκτελέσῃ τὴν ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος γίνεται ὡς ἑξῆς:

```
# adjkerntz -i
# mount -a -t ufs
# mergemaster -p
# cd /usr/src
# make installworld
# mergemaster
# reboot
```

**Ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος:** Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος γίνεται ὡς ἑξῆς:

### 24.7.2 Ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος

Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος γίνεται ὡς ἑξῆς:

**Σημείωση:** Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπὸ τὸν ἰδιοκτήτη τοῦ συστήματος γίνεται ὡς ἑξῆς:

### 24.7.3 ÄëÝäìðå ôì /etc/make.conf

ÄíáðÛóðå óå åñ÷åá /usr/share/examples/etc/make.conf èåé /etc/make.conf. Ôì ðñþì ðåñéÝ÷å éÛðñëåð ðñìðéëåñì Ýíåð åðååèçðÝð (defines), ìé ðåñéóóòðåñåð åðü ðéð ìðìåð åáíå ìò ó÷üëéå. Äéå íå óå ÷ñóéìðñåðóåðå ìóåí åðååèùððååðå ôì óýóóçíå óåð, ðñìðéÝóåð óå óðì /etc/make.conf. Íå Ý÷åðå ððüç óåð, ðòò ìðéåððñåðå ðñìðéÝóåðå óðì åñ÷åá /etc/make.conf ÷ñóéìðñåðåðå åððóçð éÛðå öìñÛ ðñì åðåååðåðå óçì åíðéåð make, Ýóéé åáíåå äåéÛéååð ååéåéåÝå íå Ýíåð åðååðå ðñì åáíååðå ðñì åáíååðå èñåééÝð åéå ôì óýóóçíå óåð.

Íåð ðððéëùð ÷ñðóçð èå èÝéåé ðééåíþð íå åíðéåñÛðåé ðéð åñåñÝð CFLAGS èåé NO\_PROFILE åðü ôì åñ÷åá /usr/share/examples/etc/make.conf óðì /etc/make.conf åðåññþåðåðå óåðòð÷ñìå èåé ôì óýìåíñè ðñì ó÷ìëðì.

ÄíáðÛóðå èåé ðéð Ûéëåð åðååèçðÝð (COPTFLAGS, NOPORTDOCS è.ì.é.) èåé åðñìåððóðå åí ó÷åðåñéíðåé ìå ôì åððéùçòù åéå óåð åðñìÝéåðìå.

### 24.7.4 Äíçìåñþóå óå Äñ÷åá óðì /etc

ÍéåðÛéñåð /etc ðåñéÝ÷å íååÛéñì Ýñìò ðùì ðéçñìñìñþì ñýëééóçð ôìò óðóðþíåðìò óåð, ìðò åððóçð èåé scripts ðñì åððåñéýíðåé èåðÛé óçì åéèþçóç ôìò óðóðþíåðìò. ÍåñéÛé åðü óå scripts åððÛé åéÛéñìò åðü Ýéåñóç óå Ýéåñóç ôìò FreeBSD.

ÍñéóìÝíå åðü óå åñ÷åá ñðéìþóåñì ÷ñóéìðñåñéýíðåé åððóçð èåðÛé óçì èåçìåñéåð ÷ñðóç ôìò óðóðþíåðìò. Ôì /etc/group åáíåé Ýíå åðü åððÛé.

÷ìñì ððÛññå ðåñéðððåðéð óðì ðåñåéëùì, ìðìò ôì make installworld åíÝíåéå åðü ðñéç óçì ýðåñéç óðååèñéåÝíéÝíé ìñìÛéñì ÷ñóðþì (usernames) þñìÛéñì (groups). ÈåðÛé óç åéååééåðåðå óçð åíååÛéñééóçð þóåí åñååðÛé ðééåñü åððìþ ìé ÷ñðóðåð þñìÛåð íå íçì ððþñ÷åé. Åðòù åçìéñòñåñýóå ðñìåþþíåðå óðçì åéååééåðåðå. Óå éÛðñëåð ðåñéðððåðéð, ôì make buildworld èå åéÝåíåé åí ððÛñ÷ìñì åððìþ ìé ÷ñðóðåð þñìÛåð.

Íéå ðÝðñéå ðåñþððòóç ðåññòéÛóççåð ìóåí ðñìóðÝèçåð ì ÷ñðóçð smmsp. Ç åéååééåðåðå åíååÛéñééóçð åðñìýå÷åíåé óå ðñéëýð ÷ñðóðåð, óç óðéåñþ ðñì ôìmtree(8) ðñìððåñýóå íå åçìéñòñåñþåé ðñì èåðÛéñåì /var/spool/clientmqueue.

Ç éýóç åáíåé íå åéðåéÝóåðå ôì mergemaster(8) óå èåðÛóðåç ðñì-ååéåðÛóðåçð, åþññåð óçì åðéñåþ -p. Åððþ èå óðåññþåé ìññì óå åñ÷åá ðñì åáíåé åðåñåþçðå åéå óçì åðéðð÷ååð ðå åððÝéåóçð ôìò buildworld þñì ìðð ìñññåé ìññì ðñì mergemaster ðñì Ý÷åðå åáíåé ðåéÛé èåé ååñ ððñóçñþååé ôì -p, ÷ñóéìðñåðåðå óçì Ýéåñóç åðü ôì åÝíðñì ðñì ðçååñò éþåéåð ìóåí óçì åéðåéÝóåðå åéå ðñþç öìñÛé:

```
# cd /usr/src/usr.sbin/mergemaster
# ./mergemaster.sh -p
```

**Óðùååéçç:** Äí åéóèÛíåðå èåéåððåñå ðåñåññìèùð, ìðñåñðå íå åéÝåíåðå ôì óýóóçíå óåð åéå íå ååðå ðñéå åñ÷åá åíðéñìò óçì ìÛåå ðñì åðñìñìÛæåðå þ åéåñÛóåðå:

```
# find / -group GID -print
```

Ç ðåñåðÛì ðñìåñéåð èå óåð ååññåé ìéå óå åñ÷åá óå ìðìþå åíðéñìò óçì ìÛåå *GID* (ìðñåñðå íå þþåðå ìññì þ åñéëçðéëù åíåññìñéóðéëù óçð ìÛååð).







```
# make -j4 buildworld
```

Ἡ ὁψιθιγενὴ ἀνάπτυξη τοῦ FreeBSD, ὡς make(1) εἶναι ἡ ἑξῆς ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD.

Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD.

### 24.7.7.3 × ἡ ἀνάπτυξη τοῦ FreeBSD

Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD.

### 24.7.8 ἡ ἀνάπτυξη τοῦ FreeBSD

Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD.

Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD.

Ὁ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD.

**Ὁψιθιγενὴ ἀνάπτυξη:** Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD.

```
# cd /usr/src
# make buildkernel KERNCONF=MYKERNEL
# make installkernel KERNCONF=MYKERNEL
```

Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD. Ἡ ἀνάπτυξη τοῦ FreeBSD εἶναι ἡ ἀνάπτυξη τοῦ FreeBSD.

## 24.7.9 ΆδαίάέέίΠρόα όά Έαόΰόόόç Έάέοιõñáβáò Άíυò × ñΠόóç

Έá ðñÝðáέ ίά áδαίάέέίΠρόα όά έáοΰόόόç έάέοιõñáβáò άíυò ÷ñΠόóç áέά ίά áðáçççáγóáòá ðç έάέοιõñáβá ðĩō ίΎίõ ðõñΠία. Άέά ðι óειðυ áóòυ, ÷ñçóειíðιεΠρόá ðέò ίαçãáβáò ðĩō άβáαίá óοι ΌιΠία 24.7.5.

## 24.7.10 ΆάέáóáóòΠρόá óά ίΎά ΆέòáēΎóείά ðĩō ÓóóòΠιáòĩò

Άί ίáóáēυòòβæáóá ίέά áñέáòΰ ðñυóóáóç Ύέαιóç ðĩō FreeBSD, ç ιðĩβá áέάēΎóάέ ðι target make buildworld, έά ðñÝðáέ ðñá ίά ÷ñçóειíðιεΠρόáò ðι installworld áέά ίά άáέáóáóòΠρόáò óά ίΎά άέòáēΎóείά ðĩō óóóòΠιáòĩò.

ΆέòáēΎóá ðέò ðánaēΰòυ άίòιēΎò:

```
# cd /usr/src
# make installworld
```

**Όçiáβυóç:** Άί Ύ÷áòá έáειñβóáέ ίáóááέçðΎò óóç áñáìñ άίòιēβί ðĩō make buildworld έá ðñÝðáέ ίά έáειñβóáòá ðέò βáέáò ίáóááέçðΎò έάέ óóçi áñáìñ άίòιēβί ðĩō make installworld. Άóòυ áái άβίáέ áðánaβóçóá áēβéáéá áέá ΰέέáò áðέειΎáΎò. Άέά ðánΰááέáίá, ç áðέέειäβ -j áái ðñÝðáέ ðĩōΎ ίά ÷ñçóειíðιεάβòá ίá ðι installworld.

Άέά ðánΰááέáίá άί άέòáēΎóáòá:

```
# make -DNO_PROFILE buildworld
```

Έá ðñÝðáέ ίά ááέáóáóòΠρόáò ðι áðĩòΎέáóίá ÷ñçóειíðιεβίóáò:

```
# make -DNO_PROFILE installworld
```

άέáοιñáóééΰ ðι make(1) έá ðñĩóðáέΠóáέ ίά ááέáóáóòΠóáέ άέáέειēβéáò ίá profiling, ðέò ιðĩβáò υíυò áái ίáóááέυòòβóáóá έáóΰ ðç áέΰñέáéá ðçò òΰóçò make buildworld.

## 24.7.11 Άίçiáñπóóá ¼óá Άñ ÷ áβá áái Άίçiáñβεçéái áðυ ðι make installworld

Ç áðáίáíáóááēβóðéóç ðĩō ááóέειγ óóóòΠιáòĩò áái έá άίçiáñπóáέ íñέóίΎίòð έáðáέυáιòð (άέάέέυòána ðĩòð /etc, /var έάέ /usr) ίá óά ίΎά Π áέέááίΎίá áñ÷áβá ñðειβóáυί.

Ί áðειγóóánaò ðñυðĩò áέá ίά άίçiáñπóáòá ðá áñ÷áβá áóòΰ áβίáέ ίά ÷ñçóειíðιεΠρόáòá ðι mergemaster(8), άί έάέ ίðñáβòá ίά ðι éΎíáðá έάέ ÷áέñιέβίçóá άί ðñιóειΰóá. ¶ó÷áòá áðυ ðιí ðñυðĩ ðĩò έá ðñιóειΠóáòá, áááάέυèáβòá υóέ Ύ÷áòá ðΰñáέ άίòβáñáοι áóóáέáβáò ðĩò /etc óá ðánβðòυóç ðĩò éΰóέ ðΰáέ óðñááΰ.

### 24.7.11.1 mergemaster

*Όòίáέóòĩñΰ ðĩò Tom Rhodes.*

Όι άιçççðééυ ðñυánaίía mergemaster(8) áβίáέ Ύίá Bourne script ðι ιðĩβι έá óáò άιççèΠóáέ ίά έáειñβóáòá ðέò áέάοιñΎò ίáóáίγ ðυí ááέáóáóóçιΎίυι óοι /etc áñ÷áβυí ñðειβóáυί, έάέ ðυí άίòβóòιέ÷υí óοι äΎίòñι ðççááβιò ēβáέέá óοι /usr/src/etc. Άðòβ áβίáέ έάέ ç óòιέóòβιáç éγóç áέά ίά άίçiáñπóáòá ðá áñ÷áβá ñðειβóáυί ðĩò óóóòΠιáòĩò ίá ðó÷υí áέέááΎò ðĩò Ύ÷ιòí áβίáέ óοιí ίΎί ðççááβι ēβáέέá.

Άέά ίά ίáέειΠóáòá, áðēβð áñΰòðá mergemaster óóçi ðñιòñιðβ óçò áñáìñð άίòιēβί έάέ ðánaēιēιòðéΠóóá óçi έáēβð έáέóιõñááβ. Όι mergemaster έá áçιέιòñáΠóáέ Ύίá ðñιóυñέψυ ðánaēΰέειñ root, áðυ ðι / έάέ éΰòυ, έάέ έá ðι ááiβóáέ



áíóéãñÛøðá õìí ððÛñ÷ííðá êáðÛëíáí /etc óá êÛðíëí áóðáéÿð ìÝñíð. ×ñçóëííðíëððá ìéá áíðíëð ùðùð ç ðáñáéÛðù:

```
# cp -Rp /etc /etc.old
```

Ç áðéëíãð -R ðñááíáðíðíéáß áíáãñíëéð áíóéãñáðð, áíð ç -p áéáðçñáß óá áééáéðíáðá, ðçí éáéíêðçðß, ðéð çíáñíçíßáð ðùí áñ÷áßùí, ê.í.ê.

éá ðñÝðáé íá äçíëíðñáððáðá ìéá øáððí-ãñð êáðáéùíáí áéá íá ááéáðáóðððáðá ðí íÝí êáðÛëíáí /etc êáé Ûëéá áñ÷áß. Ìéá ëíáéëð áðéëíãð áßíáé í êáðÛëíáíð /var/tmp/root, êáé êÛðù áðu áððùí, éá ðñÝðáé áðßðçð íá äçíëíðñáððáðá êáé ìéá ìëùéëçñç óáéñÛ áðu õìðð ððíéáðáéùíáíðð ðìð áðáéðíýíáé.

```
# mkdir /var/tmp/root
# cd /usr/src/etc
# make DESTDIR=/var/tmp/root distrib-dirs distribution
```

Ìé ðáñáðÛíù áíðíëÿð éá äçíëíðñáððíðí ðçí áðáéðíýíáç ãñð êáðáéùíáí êáé éá ááéáðáóðððíðí ðá áñ÷áß. ÌááÛëí ìÝñíð ðùí ððíéáðáéùíáí ðìð Ý÷íðí äçíëíðñáçèáß êÛðù áðu õìí /var/tmp/root áßíáé Ûááéíé, êáé ðñÝðáé íá áéáãñáðíýí. Ì áðéíýðáðñíð ðñùðíð áéá íá áßíáé áððù, óáßíáðáé ðáñáéÛðù:

```
# cd /var/tmp/root
# find -d . -type d | xargs rmdir 2>/dev/null
```

Áððù éá áéáãñáððáé ùëíðð õìðð Ûááéíðð ððíéáðáéùíáíðð. (Ç Ýíñáðð óðÛëíáðíð áíáéáðáððéçíáðáé óðí /dev/null þððá ìá çíí áìðáßíáíðáé óðçí ìëùç ðñíáéáíðíëððáéð áéá êáðáéùíáíðð ðìð ááí áßíáé Ûááéíé.)

Ïþñá, ì /var/tmp/root ðáñéÝ÷áé ùéá óá áñ÷áß ðìð éá ðñÝðáé íá ðíðíéáðçèíýí óá êáðÛëéççéáð èÿóáéð êÛðù áðu õìí /. Éá ðñÝðáé ðþñá íá áéáðñÝíáðá êáé Ýíá áðu áððÛ óá áñ÷áß, êáé íá éáéíñßðáðá ðùð êáé Ýíá áðu áððÛ áéáðÝñáé áðu ðí áíðßððíé÷í ððÛñ÷íí (ááéáðáóðçíÝíí) áñ÷áß.

Ïçíáéððá ùðé êÛðíéá áðu óá áñ÷áß óá ìðíßá Ý÷íðí ááéáðáóððáéáß óðíí /var/tmp/root Ý÷íðí ìéá áñ÷éëð “.”. Ïç óðéãñð ðìð ãñÛíðíáé áððÿð ìé ãñáíÿð, óá ìúíá áñ÷áß óðá ìðíßá óííááßíáé áððù áßíáé óá áñ÷áß áéëßççðð ðìð êáéçýíðð óðíí êáðÛëíáí /var/tmp/root/ êáé /var/tmp/root/root/, áí êáé ìðíñáß íá ððÛñ÷íðí êáé Ûëéá (áíÛëíáá ìá ðí ðùðá áéááÛáðá ðí êáßíáí). Ááááéùéáßðá ùðé ÷ñçóëííðíëáßðá ðçí áíðíëð ls -a áéá íá óá ááßðá ùéá.

Ì áðéíýðáðñíð ðñùðíð áéá íá óðáéñßíáðá äçí áñ÷áß, áßíáé íá ÷ñçóëííðíëððáðá ðçí áíðíëð diff(1):

```
# diff /etc/shells /var/tmp/root/etc/shells
```

Ç ðáñáðÛíù áíðíëð éá óáð ááßíáé ðéð áéáðíñÿð ìáðáíç ðìð áñ÷áßíð /etc/shells êáé ðìð íÝíð áñ÷áßíð /var/tmp/root/etc/shells. ×ñçóëííðíëððá ðéð áéáðíñÿð áððÿð áéá íá áðíðáóððáðá áí éá ðñÝðáé íá óðá÷íáçóðáðá ðéð áééááÿð ðìð Ý÷áðá êÛíáé, ð áðéðð íá áíóéãñáððá ðí ðáééù óáð áñ÷áß ðÛíù áðu ðí íÝí.

**Ðñíðéÿðá ðçí Çíáñíçíßá ððí ¼ííá ðìð ÍÝíð Root Êáðáéùíáíð, (/var/tmp/root) çðá íá ìðíñáßðá Áçéíéá íá Õðáéñßíáðá Áéáðíñáðééÿð Áéáùóáéð ìáðáíç ðìðð:** Áí ìáðááéùððßæáðá óð÷íÛ ðí ááóééù óýðçíá, éá ðñÝðáé áðßðçð íá áíçíáñþíáðá óð÷íÛ ðí êáðÛëíáí /etc, ðí ìðíßí ìðíñáß íá áßíáé áíí÷éçðééù.

Ìðíñáßðá íá áðéðá÷íáðá áððð ðç áéááééáóßá, ðçñþíðáð Ýíá áíðßáñáðí ðìð ðáéáððáßíð óáð áééááíÝíùí áñ÷áßùí óá ìðíßá óðá÷íáçóðá ððíí êáðÛëíáí /etc. Ç ðáñáéÛðù áéááééáóßá éá óáð áððáé ìéá éáÝá áéá ðí ðùð ìðíñáß íá áßíáé áððù:

1. Ἰσοπέδωση τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

```
# mkdir /var/tmp/root-19980214
# cd /usr/src/etc
# make DESTDIR=/var/tmp/root-19980214 \
  distrib-dirs distribution
```

2. Ὁλοκληρωμένη ἀρθρογραφία τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /var/tmp/root-19980214 καὶ οἱ ὑποκατηγορίες αὐτῆς.

3. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

4. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

```
# cd /var/tmp
# diff -r root-19980214 root-19980221
```

Ὁλοκληρωμένη ἀρθρογραφία τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

5. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

```
# rm -rf /var/tmp/root-19980214
```

6. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

```
# mkdir /var/tmp/root-`date +%Y%m%d`
```

### 24.7.12 Ἀρθρογραφία

Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

```
# shutdown -r now
```

### 24.7.13 Ἰσοπέδωση

Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ ὁλοκληρωμένου συστήματος. Ἡ ἀρχὴ τῆς ἐργασίας εἶναι ἡ ἀρθρογραφία τοῦ /etc καὶ οἱ ὑποκατηγορίες αὐτῆς.

```
# cd /usr/src/usr.bin/file
# make all install
```

### 24.7.14 Ἀντιθέσεις

1. Ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἐπεξεργασίας ἀρχείων;

Ἄρα τὸ `make all install` ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων.

```
src/games/cribbage/instr.c
src/games/sail/pl_main.c
src/release/sysinstall/config.c
src/release/sysinstall/media.c
src/share/mk/bsd.port.mk
```

Ὁ ἰατρικὸς ἀντικείμενος ἀνάπτυξης ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων.

Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων.

Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων.

2. Ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων;

Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων.

Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων.

Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων.

3. Ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων;

Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων.

Ὁ ἰατρικὸς ἀντικείμενος ἀνάπτυξης ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων. Ἄρα ἐπιβάλλεται ἡ ἀνάπτυξη τοῦ ἰατρικοῦ συστήματος ἀρχείων.

έάέ ðιέÿ ίύçιά, áñ áί ðιί óáßóáá ðά έá έáñáßóáá Ýía íááÛεί έñÛóε áεáÿεáñιò ÷ ðñιò (òçί ðáñιÿóá óóέáñß ðáñßðιò 340 MB).

¼ιùð, áί ίΥñáðá ðε εÛίáðá, ίðιñáßóá ίá ίäçáßóáðá ðι make buildworld ίá ðáñáέáßθάέ áðòυ ðι áßιά. Áðòυ έá áðέóá÷ÿίá έάέáßóáñá ðεò ίΥáð ίáóááεùðòßóáέò, έάεð ðá ðáñέóóυðáñá ðιßιάóá ðιò ðçááßιò εßάέέá ááί έá ÷ ðáεÛάείíóáέ ίáÛ ίáðááεðòéóç. Õι ίáείíÝέòçιά áßιάέ υέε ίñέοι Ýíáð ðιñÝð áιòáίßάείíóáέ ðñίáεßιάóá ðιò Ý ÷ ιòί ó ÷ Ýóç ίá ù ÷ ε έάέ ðυοί áιòáίáßð áίáñðßóáέò, έάέ ίðιñáß ίá ίäçáßóιòί óá ίòóðçñεßäç áðιòð ÷ ðá ðçð ίáðááεðòéóçð. ÕÝðιέά ðñίáεßιάóá ðð ÷ ίÛ äçιέίòñáιÿί “εùñòáι” ððéð εßóðáð ðιò FreeBSD, υóáί εÛðιέίð ÷ ðßóðçð ðáñáðιίέÝóáέ υέε ç ίáðááεðòéóç ðιò áðιòðá ÷ Ûίáέ, ÷ ùñßð ίá áίðέέáíáÛίáðáέ υέε áðòυ ιòáßεáðáέ óðçί ðñιòðÛεάέá ðιò ίá óοίòñáÿóáέ ðçί áέááέέáóáá.

4. Ìðιñß ίá óοίá ÷ ðóυ ίέá ίáðááεðòéóç ðιò áεÝέίθá;

Áðòυ áίáñòÛóáέ áðυ ðι ðυοί Ý ÷ áðá ðñι ÷ ùñßóáέ óðç áέááέέáóáá ίÝ ÷ ðε ðç óóέáñß ðιò áñßεáðá ðι ðñυáεçιά.

Õá ááίέέÝð áñáιιÝð (έάέ áðòυð ááί áßιάέ έáίιιáð ðιò έó ÷ ÿáέ ðÛίóá), ç áέáñááóáá ðιò make buildworld ίáðááεùðòßáεé ίÝá áίòßáñáóá ááóέεßί áñááέáßυί (υðυð óá gcc(1), έάέ make(1)) έάεð έάέ ðυί áέáέέίεçεßί óóóðßιάðιð. ðáέóá ááέáέéóðßίóáέ áðòÛ óá áñááέááá έάέ ίε áέáέέίεðεáð. Õá ίÝá áñááέááá έάέ áέáέέίεðεáð ÷ ðçóέίιðιέίÿίóáέ Ýðáέóá áέá ίá áðáίáíáðááεùðòðßοίòί ðιòð ááóðιÿð ðιòð, έάέ ááέáεßóðáίóáέ ίáÛ. Ìευέççñι ðι óÿóðçιά (ðι ιðιßι ðññá ðáñέéáíáÛίáέ έάέ óá óοίçέéοίÝía ðñιáñÛιιáðá ÷ ðßóðç υðυð ðι ls(1) ð ðι grep(1)) áðáίáíáðááεùðòßáεáðáέ ÷ ðçóέίιðιέίÿίóáð óá ίÝá áñ ÷ ááá ðιò óóóðßιάðιð.

Áί áñßóéáðá óοί ðáεáðóáßι óðÛáεί, ðι ιðιßι έá ðι áññáεáðá έιέðÛάείíóáð ðçί Ýíñáι ðιò Ý ÷ áðá áðιεçέáÿóáέ, áßιάέ ó ÷ áðéέÛ áóóáέÝð ίá εÛίáðá:

```
... fix the problem ...
# cd /usr/src
# make -DNO_CLEAN all
```

Ìá ðιί ðñυðι áðòυ ááί έá áίáέñÝóááðá ðçί áñááóáá ðιò Ý ÷ áé áßιάέ áðυ ðι ðñιçáιÿίáñι make buildworld.

Áί ááßóá ðι Ìßίòιά:

```
-----
Building everything..
-----
```

óðçί Ýíñáι ðçð áίðιεðð make buildworld, ðυðá áßιάέ ÌÛεείí áóóáέÝð ίá ðñι ÷ ùñßóáðá ίá áðòυ ðιí ðñυðι.

Áί ááί ááßóá áðòυ ðι Ìßίòιά, ð áί ááί áßóáá óßáιòñιð, ðυðá áßιάέ έáέÿðáñá ίá εÛίáðá ðεßñç ίáðááεðòéóç ðáñÛ ίá ίáðáίεßίáðá áñáυðáñá.

5. Ðυð Ìðιñß ίá áðέóá÷ÿίυ ðç ίáðááεðòéóç ðιò ááóέέίÿ óóóðßιάðιð;

- ÁέðáεÝóáá ðçί óá έáðÛóóáóç áíυð ÷ ðßóðç.
- ÁÛεðá ðιòð έáðáευáιòð /usr/src έáέ /usr/obj óá áέáóιñáðéέÛ óóóðßιάóá áñ ÷ áßυί óá ιðιßá áñßóέίιíóáέ έáέ óá áέáóιñáðéέίÿð óóóέίÿð áßóέίòð. Áί áßιάέ áοίáðυί, áÛεðá áóòιÿð ðιòð áßóέίòð óá ÷ ùñέóòιÿð áεááέðÝð.
- Áέυιá έáέÿðáñá, ñεñÛóóá áðòÛ óá óóóðßιάóá áñ ÷ áßυί óá ðιέεáðείÿð áßóέίòð, ÷ ðçóέίιðιέίÿίóáð ðι ðñυáñáíá íäßäçóçð ccd(4) (concatenated disk driver, íäßäçóçð óοίáíυìÝíυì áßóέυί).



```
# cd /usr/src
# make cleandir
# make cleandir
```

Íáé, εã ðñΥðãé íá áêðãêΥόãðã ðι make cleandir äýι òιñΥð.

ÅðáíãêéείΡòðã Υðãéóã üεç ðç äεããééãóβã, íãêéίΡιðãð íã ðι make buildworld.

Άί Υ ÷ãðã äéïíã ðñíãêΡιãðã, óðãβéðã ðι ίΡιòíã êÛείðò êãé ðçί Υíñãí ðιö uname -a ðçί çêãêðñíééêΡ εβòðã äãíéêΡι äñòðòΡóãùί ðιö FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>). Íá äβòðã ðñíãðιéíãóι Υíé íá áðáíòΡòðãã äðéðêΥίí äñòðòΡãéð ò ÷ãêéÛ íã ðçί äãéãðÛððãóç óãð!

## 24.8 Äεããééãóβã ãéã ÐιééãðêÛ ìç ÷ áίΡιãðã

*ÓðíãéóðιñÛ ðιö Mike Meyer.*

Άί Υ ÷ãðã ðñéããðêÛ ìç ÷ áίΡιãðã óðã íðιβã ðñüéãéðãé íã ÷ñçóείηðιéΡòðã ðι βãéí ãΥίòñι ðçããβιò êΡãééã, äβíãé óðãðÛêç ðñññι (äβóείò, äééðýíò êãé äðãíãñããóðòΡ) íá äðáíãéãíãÛíãðã óã üεã ðç äεããééãóβã áίÛéðçóçð êãé íãðããêΡððéóçð. Ç éýóç äβíãé íá ñβòãðã Υίã ìç ÷ Ûίçíã íá äéðãéãβ ðι íãããéýðãñι ìΥñò ðçð ãñããóβãð, äίΡ óã ððüéíéðã éã ìðιñýí íá ðçί áíãéðιýí ìΥóù NFS. Óçί áíúðçðã äðòΡ éã ðãñιòóéÛóίòíã Υίã ðññðι ìã ðιí ìðιβι ìðιñãβ íá äβíãé áðòü.

### 24.8.1 ÐñíéãðãñêééÛ

Ðñòðã áðü üεã, áíããññβòðã ðι óãð ðñι ìç ÷ áίçιÛððι óðã íðιβã óéιðãýãðã íã ÷ñçóείηðιéΡòðã ðã βãéã äéðãéΥóéíã. Êã ñññÛóίòíã äðòΡ ðçί ñÛãã óãð ìãðããêΡððéóçð. ÊÛεã ìç ÷ Ûίçíã ìðιñãβ íá Υ ÷ãé äééü ðιò ðñιóãññιóιΥñι ððñΡíã, äééÛ éã Υ ÷íòι üεã ðã βãéã äéðãéΥóéíã userland. Άðü ðι óãð áðòü, äðéé Υíòã Υíã ìç ÷ Ûίçíã ðι ìðιβι éã äβíãé ðι ìç ÷ Ûίçíã ìãðããêΡððéóçð. Êã äβíãé ðι ìç ÷ Ûίçíã óðι ìðιβι éã ìãðããéüðòβããðãé ðι äãóééü óýððçíã êãé ι ððñΡíãð. Óι éããíééü äβíãé íá äðéé Υíòã Υíã ãñΡãññι ìç ÷ Ûίçíã, óðι ìðιβι íá ððÛñ ÷ãé ãñéãòüð äεãýεãñιð ÷ñññðò óðιí äðãíãñããóðòΡ ãéã íá äéðãéãβ ðã make buildworld êãé make buildkernel. Êã ðñΥðãé äðβóçð íá äðéé Υíòã Υíã ìç ÷ Ûίçíã äñéêίΡι óðι ìðιβι éã ãñééÛããðã ðéð áίçιãñòðãéð εíãéóíééý ðñéí ðéð ìãðãýñãðã ðçί ðãñããñãΡ. ìðιñãβ íá äβíãé êãé ðι βãéí ðι ìç ÷ Ûίçíã ìãðããêΡððéóçð, äééÛ áðòü äãí äβíãé áðãñãβðçðι.

¼éã ðã ìç ÷ áίΡιãðã óðι óãð ìãðããêΡððéóçð ÷ñãéÛããðãé íá ðñιóãñòððíòι ðι /usr/obj êãé ðι /usr/src áðü ðι βãéí ìç ÷ Ûίçíã, êãé óðι βãéí óçιãβι ðññòÛñòçóçð. Óι éããíééü äβíãé áðòÛ ðã äýí óðóðΡιãðã ãñ ÷ãβñι íá ãñβóéííòãé óã äéãðñãðééü ððóééü äβóéí óðι ìç ÷ Ûίçíã ìãðããêΡððéóçð, äééÛ ìðιñãβòã íá ðã ðñιóãñòðòãðã ìΥóù NFS äéñíã êãé óã áðòü ðι ìç ÷ Ûίçíã. Άί Υ ÷ãðã ðñéããðêÛ óãð ìãðããêΡððéóçð, ðι /usr/src éã ðñΥðãé íá ãñβóéãðãé óã Υíã áðü ðã ìç ÷ áίΡιãðã ìãðããêΡððéóçð, êãé íá ðñιóãñòÛðãé óðã ððüéíéðã ìΥóù NFS.

ÓΥéìð, äãããééüéãβòã ðéð ðã ãñ ÷ãβã /etc/make.conf êãé /etc/src.conf ðã üεã ðã ìç ÷ áίΡιãðã ðιò óãð ìãðããêΡððéóçð, äβíãé βãéã ìã ðã áíòβòðιé ÷ã óðι ìç ÷ Ûίçíã ìãðããêΡððéóçð. Άðòü óçιãβíãé ðéð ðι ìç ÷ Ûίçíã ìãðããêΡððéóçð éã ðñΥðãé íá ìãðããéüðòβãé üεã ðã ðιΡιãðã ðιò äãóééý óðóðΡιãðιð ðã íðιβã éã äãéãðãóðãéýíí óã εÛεã ìç ÷ Ûίçíã ðιò óãð. Άðβóçð, óã εÛεã ìç ÷ Ûίçíã óðι óãð ìãðããêΡððéóçð éã ðñΥðãé íá ñéóðãβ ðι ðñíã ðιò äéééý ðιò ðñιóãññιóιΥñιò ððñΡíã ìΥóù ðçð ìãðããéççðð KERNCONF óðι /etc/make.conf, äίΡ êãé ðι ìç ÷ Ûίçíã ìãðããêΡððéóçð éã ðñΥðãé íá Υ ÷ãé ìéã εβòðã üéñι ðñι Ûééñι óðι KERNCONF, íãêéίΡιðãð áðü ðι äééü ðιò. Óι ìç ÷ Ûίçíã ìãðããêΡððéóçð, éã ðñΥðãé íá Υ ÷ãé ðã ãñ ÷ãβã ñýèíéóçð ðιò ððñΡíã üéñι ðñι Ûééñι ìç ÷ áίçιÛððι óðιí éãðÛéíãñ /usr/src/sys/arch/conf áí ðññüéãéðãé íá ìãðããéüðòβãé ðιòð ððñΡíãð ðιòð.

### 24.8.2 Οἱ Άάόέεü Ούόόçιά

·÷ιíόάð ðñáñáíáçιðιεΠρόάε ùεά όά ðáñáðΰíù, áβόόá Υόιειò ñ íáðááεüòðóβόáðά όά ðΰίόá. Ìáðááεüòðóβόáð ðιí ðòñΠíá έάέ ðιí ááόέεü òύόόçιά ùðùð ðáñεáñΰøáíá òòι ΟἱΠíá 24.7.7.2 ÷ñçóειñðιεΠíόáð ðιí ιç÷:ΰίçιά íáðááεððóέόçð, áεεΰ ιçí ááεάόáóðΠóáðά ðβðιόá. Ìáðΰ ðιí ðΥεíð òçð íáðááεððóέόçð, ÷ñçóειñðιεΠóáð ðιí ιç÷:ΰίçιά áñεείΠí έάέ ááεάόáóðΠóáð ðιí ðòñΠíá ðιò ùεέð áçιεíòñáΠóáðά. Αί ðιí ιç÷:ΰίçιά áðòü ðñιόáñðΰ ðιí /usr/src έάέ ðιí /usr/obj ñΥóù NFS, ùóáí ðιí áðáíáεέεíΠóáðά όá έáðΰóóáóç áñιùð ÷ñΠóóç, έá ÷ñáεáóóáβ íá áñáñáñιðιεΠóáðά ðιí áβεòòι έάέ íá óá ðñιόáñðΠóáðά. Ì áðεíεüòáññì ðñùðιò áεá áðòü, áβíáέ íá áεέεíΠóáðά όá έáðΰóóáóç ðιεεáðεΠí ÷ñçóðΠí έάέ Υðáέóá íá áεðáεΥóáðá shutdown now áεá íá íáðáááβðá όá έáðΰóóáóç áñιùð ÷ñΠóóç. Ìùεέð áβíáέ áðòü, ñðιñáβðá íá ááεάόáóðΠóáðά ðιí íΥι ðòñΠíá έάέ ðιí ááόέεü òύόόçιά, έάέ íá áεðáεΥóáðá ðιí mergemaster ùðùð έá εΰίáóá óóíΠεùð. ¼óáí ðáεáεðóáðά, áðáíáεέεíΠóáðά áðòü ðιí ιç÷:ΰίçιά óççí έáñιέεΠ εáεðιòñáβá ðιεεáðεΠí ÷ñçóðΠí.

¼óáí ááááεüεáβðá ùεé ùεá εáεóιòñáñιγí óóòðΰ ðòι ιç÷:ΰίçιά áñεείΠí, ÷ñçóειñðιεΠóáðά ðççí βáεá áεááεéáóáá áεá íá ááεάόáóðΠóáðά ðιí íΥι ειαεóιεéü όá εΰεá Υίá áðu όá ððυεíεðá ιç÷:áíΠíáðá ðιò óáð íáðááεððóέόçð.

### 24.8.3 Ports

Ìðιñáβðá íá ÷ñçóειñðιεΠóáðά ðεð βáεáð εáΥáð έάέ áεá ðιí áΥίòñι ðυí ports. Οἱ ðñΠòι εñβóεñí áΠíá áβíáέ íá ðñιόáñðΠóáðά ðιí /usr/ports áðü ðιí βáεí ιç÷:ΰίçιά, όá ùεá όá ιç÷:áíΠíáðá ðιò óáð íáðááεððóέόçð. Ìðιñáβðá Υðáέóá íá ðòεìβóáðά ðιí /etc/make.conf Πóðá íá áεáñιέñΰáñιðáέ όá distfiles. Έá ðñΥðáέ íá εΥóáðά ðιí DISTDIR όá Υίá ειεíü ÷ñçóòι έáðΰεíáñ, óðιí ñðιβιí έá áΠóáðά áεéεáΠíáðά áááñáðò òá ñðιεíáβðιðá ÷ñΠóóç Υ÷:áðá áçεΠóáέ ùð root óòι NFS. Οá εΰεá ιç÷:ΰίçιά έá ðñΥðáέ áðβóçð íá ñεéóáβ ç íáðááεççðP WRKDIRPREFIX Πóðá íá ááβ÷íáέ όá Υίá ðιðεéü έáðΰεíáñ. ΟΥεíð, áí óεíðáγáðá íá íáðááεüòðóβáðά έάέ íá áεáíΥíáðá Υóιεíá ðáεΥóá, έá ðñΥðáέ íá εΥóáðά ðççí íáðááεççðP PACKAGES όá Υίá έáðΰεíáñ, ùðùð εΰίáóá έάέ ñá ðççí DISTDIR.

## Οçíáεðóáέò

1. Áðòü áΥááέá ááñ áβíáέ áðυεòóá áεçεéü. Άáñ ñðιñιγíá íá óðíá÷βóιðíá íá ððιòçñβáεíðíá ðεð ðáεéΥð áεáυóáέð ðιò FreeBSD áεá ðΰίðá, áí έáέ ðεð ððιòçñβáεíðíá áεá ðιεεΰ ÷ññιέá. Άεá ðεΠñç ðáñεáñáðP òçð ðñΥ÷ιòóáð ðιεééεΠð ùóι áðιñΰ ðççí áóóΰεáέá ðυí ðáεεΠí áεáυóáñι ðιò FreeBSD, ááβðá <http://www.FreeBSD.org/security/>.

# ΕὰοÛεάεί 25 DTrace

ÃñÛöçêà áðu ôïí Tom Rhodes.

## 25.1 Óýñïç

Ôï DTrace, áñóóù áðβöçð ùð Dynamic Tracing, áβιάέ Ýíá áñááéáβï ôï ïðïβï áíáððý÷εçêà áðu ôçï Sun áéá ôïí áíóïðéóïù ðñïáεçïÛóùí áðuáïóçð óá óóóðïíáðá ðïð ðñïéáéóáé íá ÷ñçóéïðïðéçéïýí Þ ÷ñçóéïðïðéçéïýíáé Þαç óóçï ðáñááùãÞ. Ááï ðñïéáéóáé áéá áñááéáβï áðïóóáéïÛóóçð, áεεÛ áéá áñááéáβï áíÛεóóçð ðñááïáóééïý ÷ññïò, ïá ôï ïðïβï ïðïñïý íá áíóïðéóóïýí ðñïáεÞíáðá áðuáïóçð éáé Ûεéáð éáðáóóÛóáéð.

Ôï DTrace áβιάέ Ýíá éáðïÛóéï áñááéáβï profiling éáé áéáéÝðáé áíóððóóéáéù ðεÞεïð ÷áñáéðçñéóóééÞï áéá ôçï áεÛáñóç ðñïáεçïÛóùí ôïð óóóðïíáðáð. Ìðïñáβ áðβöçð íá ÷ñçóéïðïðéçéçáβ áéá íá áéóáéÝðáé áðu ðñéï Ýóïéïá scripts, ïá óá ïðïβá ïðïñáβóá íá áéïáóáééáðεáβóá éáéýðáñá óéð áðïáóóçðáð ôïð. Ìé ÷ñÞóðáð ïðïñïý áéùíá íá áñÛóïí éáé óá áééÛ óïðð áïçèçóééÛ ðñïáñÛïáðá, ÷ñçóéïðïðéçéïýáð ôçï ÆÞðóá D ðïð ðáñÝ ÷áé ôï DTrace, éáé íá ðñïóáññïóïí ïá áóðù ôïí ðñïðï ïï profiling óóéð áééÝð óïðð áíÛáéáð.

Áóïý áéááÛóáðá áóðù ôï éáðÛεάεί, éá áññβæáðá:

- Óé áβιάέ ôï DTrace éáé óé áðïáóóçðáð ðáñÝ ÷áé.
- Óéð áéáóïñÝð ðεïðïβççð ïáðáíý ôïð DTrace ôïð Solaris éáé ôïð FreeBSD.
- Ðùð íá áíáñáïðïðéçéïýáð éáé íá ÷ñçóéïðïðéçéïýáð ôï DTrace óðï FreeBSD.

Ðñéï áéááÛóáðá áóðù ôï éáðÛεάεί, éá ðñÝðáé:

- Íá éáðáñáβóá ááóééÝð Ýñéáð ôïð UNIX éáé ôïð FreeBSD (ΕὰοÛεάεί 3).
- Íá áβóðá áñééáéùÝñò ïá óéð ááóééÝð áéáééáóáβáð ñýéïóçð éáé ïáðááεÞðóéóçð ðñïóáññïóïÝñò ððñÞá (ΕὰοÛεάεί 8).
- Íá áβóðá áñééáéùÝñò ïá ôçï áóóÛεάéá éáé ôïí ðñïðï ðïð áóðÞ ó÷áðβæáðáé ïá ôï FreeBSD (ΕὰοÛεάεί 14).
- Íá éáðáñáβóá ðùð ïðïñáβóá íá áíáéðÞóáðá ôïð ðççáβï εÞáééá ôïð FreeBSD éáé íá ôïí ÷ñçóéïðïðéçéïýáð Þóðá íá áðáíáíáðááεùððóáðá ôï óýóççïá óáð (ΕὰοÛεάεί 24).

**Ðñïáéáïðïβççð:** Ôç áááñÝçç óðéáïÞ, ôï DTrace éáùñáβóáé ùðé áβιάέ óá ðáéñáíáðééù óðÛáéï. ÌñéóïÝíáð áðééïáÝð ïðïñáβ íá ððïéáβðïðáé óá éáéðïðñáééùðçðá, éáé éÛðïéá ðïðïáðá βóóð íá ïç éáéðïðñáïý éáéüéïð. Ìá ôçï ðÛñïá ðïð ÷ññïò, ïé ðáñáðÛïù áðïáóóçðáð éá éáùñççéïý Ýðïéïáð áéá ÷ñÞóç óá ïç÷áíÞáðá ðáñááùãÞð, éáé ç ðáññïýá ðáéïçñβóóç éá áíáíáéáβ Þóðá íá áíóéðñïóóáýáé áððÞ ôçï éáðÛóóáç.

## 25.2 ÁéáóïñÝð óóçï Õéïðïβççð

Áí éáé ôï DTrace óðï FreeBSD áβιάέ áñéáðÛ ùñéï ïá áóðù ôïð Solaris, ððÛñ÷ïí éÛðïéáð áéáóïñÝð ðïð éá ðñÝðáé íá óéð áïçãÞóïíá ðñéï óðïá÷βóïíá. Ç ïááéýðáñç áéáóïñÛ ðïð éá ðáñáðçñÞóïí íé ÷ñÞóðáð, áβιάέ ùðé óðï FreeBSD ôï DTrace ðñÝðáé íá áíáñáïðïðéçéçáβ ÷áéññéβïçðá. ÓðÛñ÷ïí áεÛóïñáð áðééïáÝð éáé áñεñÞíáðá áéá ôïð ððñÞá ðïð ðñÝðáé íá áíáñáïðïðéçéïý Þóðá ôï DTrace íá éáéðïðñáβ óóóðÛ. Éá áïçãÞóïíá áñáùðáñá áóðÝð óéð ððéïβóáéð.

Ç άδέειάP DDB\_CTF οίο δδñPía ÷ ñçóειίδιέάβδάέ άέα ίά άίάñāīδιέPόάέ όçί δδίοδPñείç òñòPíáòìò òùí äāāñÝíùí CTF áδù οίí δδñPía έάέ όά άññPíáóá οίò. Òí CTF άβίάέ οί Compact C Type format οίò Solaris, οί ίδñβί άίέδέάPíáέ ίέα άέαóòùíÝίç ίññòP δέçñíòñέPí άδίοóάέìÙòùóçò (debugging), ùñέά ίά οί DWARF έάέ όά stabs. ΆóòÙ όά äāāñÝíá CTF δñíóóβέάίόάέ όά άέóάέÝóείά ίÝóù òùí άñāάέάβùí ctfcconvert έάέ ctfmerge. Òí άίçèçòέέù δñùāñāíá ctfcconvert άñιçíáýάέ όά òìPíáóá òùí DWARF ELF δìò δāñέÝ ÷ ίòí δέçñíòñβáò debug (άçίέíòñāíýíόάέ áδù οί ίáóáāέùòóέóòP), έάέ οί ctfmerge óōā ÷ ùíáýάέ όά òìPíáóá CTF έάέ ELF áδù όά άίóέέάβίáíá όά Ùέέά άέóάέÝóείά P έίέíù ÷ ñçóóáò άέάέέíέPέáò. Δāñέóóùóāñāò δέçñíòñβáò άέα όçί άίάñāīδιέβçóç òùí δāñáòÙíù óóç ίáóáāέPòóέóç οίò δδñPía έάέ οίò óóóòPíáóòìò οίò FreeBSD, έά äýíá δāñάέÙòù.

Óòí FreeBSD έÙδìέíέ δāñí ÷ άβò άβίάέ άέάóìñāóέέíβ όά ó ÷ Ýóç ίά οί Solaris. Í δέí άίέίόçíáβùòìò άβίάέ í δāñí ÷ Ýáò dtmalloc í ίδñβìò άδέóñÝδāέ οί tracing οίò malloc() άÙέέíáá ίά οίí óýδì οίò, óòíí δδñPía οίò FreeBSD.

Ìññí í root ίδññáβ ίά ÷ ñçóειίδιέPόάέ οί DTrace óòí FreeBSD. Άóòù ó ÷ άòβάέάóάέ ίά άέάóìñÝò óóçí áóóÙέέάέ, έάέPò οί Solaris άέάέÝóάέ έÙδìέíέò άέÝā ÷ ίòò áóóÙέέάó ÷ άίçíçý άδέóÝāíò, ίέ ίδñβίέ άáí òδÙñ ÷ ίòí áέùíá óòí FreeBSD. Άέα οί έúāí áóòù, ç ÷ ñPóç όçò óóóέáòPò /dev/dtrace/dtrace áδāāñāýáóάέ áóóóçñÙ άέα ùέíòò οίòò ÷ ñPóóáò άέòùò áδù οίí root.

ÓÝέíò, οί έíάέóíέέù DTrace άñβóέáóάέ óδù όçí Ùāάέá CDDL όçò Sun. Íδññáβòá ίά άέάáÙóáòá οί έáβíáñí όçò Ùāάέáò Common Development and Distribution License óòí FreeBSD, óòí άñ ÷ άβí /usr/src/cddl/contrib/opensolaris/OPENSOLARIS.LICENSE P ίά οί άέάáÙóáòá online óóç άέáýέóíóç <http://www.opensolaris.org/os/licensing>.

Ç Ùāάέá ίóóέáóóέέÙ óçíáβíáέ ùóέ Ýíáò δδñPíáò FreeBSD ίá óέó άδέέíāÝò οίò DTrace, άίάέíέíòέáβ ίá άñβóέáóάέ óδù όçí Ùāάέá BSD. Ùóòùóí οί CDDL άìδēÝέáóάέ όç óóέáñP δìò άβíáóάέ άέáññP òùí άñññùìÙòùí óá äóááέP ίññòP, P όç óóέáñP δìò òññòPñíóáέ.

## 25.3 Άίáñāīδιέβçóç όçò ÒδίοδPñείçò DTrace

Άέα ίá άίáñāīδιέPόáòá όçí δδίοδPñείç άέα οί DTrace, δñíóέÝóóá óέó áέùέíòέáò āñāíÝò óòí άñ ÷ άβí ñòèìβóáùí οίò δδñPía:

```
options          KDTRACE_HOOKS
options          DDB_CTF
```

**Óçíáβùóç:** Íέ ÷ ñPóóáò óçò άñ ÷ έóáέòíέέPò AMD64 έά έÝέíòí ίá δñíóέÝóíòí όçí áέùέíòέç āñāíñP óòí άñ ÷ άβí ñòèìβóáùí οίò δδñPía οίòò:

```
options          KDTRACE_FRAME
```

Ç άδέέíāP áóòP δāñÝ ÷ άέ δδίοδPñείç άέα όç έáέóíòñāβá FBT. Òí DTrace ίδññáβ ίá έáέóíòñāPóáέ έάέ ÷ ùñβò áóòPí. Ùóòùóí, έá δāñÝ ÷ άέ δāñέíñέóíÝίç δδίοδPñείç άέα function boundary tracing.

¼έíò í δçāáβìò έPáέέáò έá δñÝδāέ ίá ίáóáāέùòóέóóáβ ίáíÙ ίá óέó άδέέíāÝò CTF. Άέα ίá άβíáέ áóòù, ίáóáāέùòóóóá ίáíÙ οί FreeBSD ÷ ñçóειίδιέPíóáò:

```
# cd /usr/src
# make WITH_CTF=1 kernel
```

Έά ÷ ñāέáóóáβ ίá áδāíáέέέíPóáòá οί óýóóçíá.

ÏäöÛ ôçí áðáíäëëßíçós, éäé ïä ôíí íÛí ðññÞíá öíñòùíÛí ðëÛíí óðç ïíÞíç, éä ðñÛðäé íá ðñíóèÛóäâä ððíóðÞñéíç äéá ôí èÛëðöíð Korn. Áðöü äðäéäâðäé, éäèð ðá äñäéäâá DTrace ðññééäíäÛííöí äéÛöíñá äíçççðééÛ ðñññÛííäðä ðá ïðíßá äßíäé äñäñÛíá ðá ksh. ÁäéäðäóðÞðä ôí port shells/ksh93. Ïðññâðä äðßòçð íá äèðäëÛóäâä äðöÛ ðá äñäéäâá éäé ïÛóù ðíð shells/pdksh Þ ðíð shells/mksh.

ÔÛëò, áíäèðÞðä ôçí ðñÛ ÷ ïðä óäñÛ äñäéäâßí DTrace. Ç ðäèäððäâá Ûéäíóç äéäðßèäðäé óðçí ðíðíèäðá <http://www.opensolaris.org/os/community/dtrace/dtracetoolkit/>. Äéäðßèäðäé éäé ðññäññíá ääèäðöðäóçð, ôí ïðíßí ääí äßíäé ùðöüóí äðáñâðçðí íá äèðäëÛóäâä ðññéäéÛíö íá ÷ ñçðéíðíèÞðäðä ðá äñäéäâá.

## 25.4 × ñçóéíðíèÞðäð ðí DTrace

Ðñéí ÷ ñçðéíðíèÞðäð äèð èäéðíðññâð ðíð DTrace, éä ðñÛðäé íá ððÛñ÷äé ç áíðßðíè÷ç óððèäðÞ. Äéá íá öíñðÞðäð ðç ðððèäðÞ, éä ðñÛðäé íá äÞðäðä ôçí ðáñäéÛòù áíðíèÞ:

```
# kldload dtraceall
```

Éä ðñÛðäé íá Û÷äðä ðëÛíí ððíóðÞñéíç DTrace. Äéá íá äâðä üèä ðá probes, éä ðñÛðäé íá äèðäëÛóäâä ùð äéä÷äéñéóððð ðçí ðáñäéÛòù áíðíèÞ:

```
# dtrace -l | more
```

¼èç ç Ûíñíð ðáñíÛäé ïÛóù ðíð äíçççðééÛ ðñññÛííäððð more, äéäöíñäðééÛ äñÞññá éä ððáñ÷äßèéäð ðçí ðñíóùñéíÞ ïíÞíç ðçð ïèüíçð. Óðí ðçíäßí äðöü, éä ðñÛðäé íá èäññçèâß üðé ðí DTrace èäéðíðññâß. Äßíäé ðëÛíí Þñá íá äíäðÛóíðíä äððÞ ðç óäñÛ äñäéäâßí.

Ç óäñÛ ðùí äñäéäâßí äßíäé íéä óðèèñÞ äðü Ûðíèíá scripts ðíð äèðäëÛíðäé ïä ôí DTrace Þððá íá óðèèÛíöí ðèçñíðññâð ó÷äðééÛ ïä ôí óýóçíá. ÓðÛñ÷íöí scripts ðíð äèÛä÷íöí äéä áíééðÛ äñ÷âá, ðç ïíÞíç, ðç ÷ñÞóç ðçð CPU éäé ðíèèÛ äéüñá. ÈÛíðä äíäññâÞ ðùí scripts ïä ôçí äéüèðèç áíðíèÞ:

```
# gunzip -c DTraceToolkit* | tar xvf -
```

Ïäðäéíçèâðä óðíí èäðÛëíñ ðíð ðá äðíððíðèÛóäðä ïä ôçí áíðíèÞ cd éäé äèèÛíðä ðá äèèäèÞðä äèðÛéäçðð ðá üèä ðá äñ÷âá, üðùð óðá äñ÷âá ïä óä íèñÛ äñÛííäðä, óä 755.

Éä ÷ñäèäððä íá äßñíöí äèèääÛðð ððí ðáñéä÷üññí ðá üèä ðá scripts. ¼ðá ðáñéÛ÷íöí ðí /usr/bin/ksh éä ðñÛðäé íá äèèä÷èÛí ðá /usr/local/bin/ksh, ðá Ûèèä ðíð ðáñéÛ÷íöí ðí /usr/bin/sh éä ðñÛðäé íá äèèä÷èÛí ðá /bin/sh, éäé ðÛëò äðöÛ ðíð ðáñéÛ÷íöí ðí /usr/bin/perl éä ðñÛðäé íá äèèä÷èÛí ðá /usr/local/bin/perl.

**Óçíäíðéèü:** Óðí ðçíäßí äðöü äßíäé óçíäíðéèü íá ððáíèðíðíðíðä óðíí áíäñíÞðç üðé ç ððíóðÞñéíç DTrace óðí FreeBSD äßíäé äðäèÞð éäé ðäèñáíäðéèÞ. ÐíèèÛ äðü äðöÛ ðá scripts ääí éä èäèðíðññÞðíðí, éäèð äßíäé äßðä ðíèÛ ðñíðäíäðíèèéðíÛíá ððí Solaris, Þ ÷ ñçóéíðíèÞíç probes ðá ïðíßá ääí ððíóçñßæííðäé ðç ääññÛíç óðèäíÞ.

Ôç óðèäíÞ ðíð äñÛöíðäé äððÛð ïè äñäñÛð, ïüñ äÛí scripts äðü ðç óäñÛ äñäéäâßí ðíð DTrace ððíóçñßæííðäé ðèÞñùð óðí FreeBSD: ðí hotkernel éäé ðí procsystime. ÁðöÛ ðá äÛí éä äíäññðíÞðíðíä ððä äðññáíá ðíÞíäðä äðððð ðçð áíüðçðäð.

Ôí hotkernel Û÷äé ó÷äèäððä íá áíäñññßæäé ðíèä óðíÛñçðç èäðáíäèÞíäé ðí ïääèÛðäñí ÷ññíí óðíð ðññÞíá. ÄèðäèÞðäð ðí ððü èáííèèÛð ðíèèèèèð, éä äâðä Ûíññ ðáññíèéä ïä ôçí ðáñäéÛòù:

```
# ./hotkernel
```

Sampling... Hit Ctrl-C to end.

Ï äéá ÷ äéñéóóÐð òïð óðóóÐíáóïð èá ðñÝðáé íá ÷ ñçóéííðíéÐóáé òí óðíáóóóíü ðéÐéðñíí **Ctrl+C** äéá íá óðáíáðÐóáé òç äéáñááóóá. Ìá òíí òáñíáóéóíü òíð, òí script èá áðáééííßóáé íéá óáéñÛ áðü óðíáñðÐóáéð òíð ððñÐíá éáé ðéçñííðñßáð ó÷áðééÛ Ìá òí ÷ ñííí òíðð, òáíéíñþíóáð ðéð óá áýííðóá óáéñÛ áíÛéíáá Ìá òí ÷ ñííí:

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`strcmp	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 áðòü éáéóííðñááß áðßóç Ìá áñéñþíóá òíð ððñÐíá. Äéá íá ÷ ñçóéííðíéÐóáðá áðòü òí ÷ áñáéðçñéóóééü, áéðáéÝóóá òí Ìá òçí áðééíáÐ -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 êáé óððíáé ðí ÷ ñííí ðíí êëðóáíí óðóðíáóíð ãéá íéá óðãêêñéíÝíç äéãñãáóáá ìÝóù ðíð PID Þ ðíð ñíííáóíð ðçð. Óðí ðãñáéÛðù ðãñÛãáéáíá Ý÷íðíá íãêéíðóáé íéá íÝá äéãñãáóáá ðíð /bin/csh. ÁéóãéÝóáíá ðí procsystime êáé ðí áððóáíá óççí áíáíííÞ êáëðð ãñÛóáíá íãñééÝð áíóíéÝð óðí csh ðíð áß÷áíá áíííáé. ÁððÛ áβíáé óá áðíðãéÝóíáóá ðçð äíëéíðð 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

¼ðùð óáβíáóáé, ç êëðóç ðíð óðóðíáóíð ãéá áíÛáíùóç (read() ) áβíáé áððÞ ðíð éáóáíáëðíáé ðíð ðãñéóóóóðãñí ÷ ñííí óá íáííãáððãññéãððá, áíÞ ðí êëãíðãñí ðíí éáóáíáëðíáé ç êëðóç óðóðíáóíð getpid().

## 25.5 Ç Æëðóóá D

Ç óáéñÛ ãñãáéãáβíí DTrace, ðãñééáíáÛíáé áñêãðÛ scripts ãñãñÝíá óççí áéãééÞ ãëðóóá ðíð DTrace. Ç ãëðóóá áððÞ ñííÛãáóáé “ç ãëðóóá D” óççí óáéíçñβùóç ðçð Sun, êáé áβíáé áñêãðÛ ùííéá íá ðç C++. ÁíáéðóéêÞ ðãñéãñãóÞ áððÞð ðçð ãëðóóáð áβíáé ðÝñá áðu ðíðð óéíðíýð ãóðíý ðíð êáéíÝííð. ÕðÛñ÷áé áíãñãÞ óðãðçóç ó÷áðééÛ íá áððÞ, óççí äéãýéðíóç <http://wikis.sun.com/display/DTrace/Documentation>.

## IV. ΆεεοθαέΥο Άδεείεϊύίβαò

Ôi FreeBSD áβιáé Ýíá áδü óá δέi áðñÝùð áέάάάñÝíá έάέοiññάέέÛ óóóòÞιáόá áέá ðøçèÞò áδüáιόçò áέέòóάέÝò áòáñiñÝò έάέ áiðδçñáòçòÝð. Ôá έáòÛέάέά óá áóòü òi òiÞιá δáñέáñÛοiòι:

- Óέò áδεείεϊύίβαò iá óáέñáúέÞ óýíäáóç (serial)
- Óá δñùòüéiέέá PPP έάέ PPP δÛiñ áδü Ethernet
- Óçí ÇäέêòñiέέêÞ Άέççèiñáòá
- Óçí ÁáέάóÛóóάóç ΆέέòóάέÞi ÓδçñáóέÞi
- Óç Ñýèiέóç έάέ Έάέóιòñáβá òüi Firewalls
- ¶έέá Ðñi÷ùñçìÝíá ÈÝiάόá Άέέóγùi

ΆóòÛ óá έáòÛέάέá Ý÷iòι ó÷άέάóóáß δáñέóóüòáñi ùð iäçãüð áíáóñÛò δáñÛ ùð áέóááüáέέü έáβιáñi. Άέ áóòü áβιáé δέi ÷ñÞóέiá ùð iäçãüß óòiòò iðiβiòð iðiñáβòá iá áíáóñÝíáòá üóái ÷ñáέÛæáóóá έÛðιέá δççñiòññá áέá òi FreeBSD. Άá ÷ñáέÛæáóóáé iá óá áέάáÛóáòá iá έÛðιέá óðáέáñέiÝiç óáέñÛ, iýòá ÷ñáέÛæáóóáé iá óá Ý÷áòá áέάáÛóáé üέá δñéi áñ÷βóáòá iá áó÷iέáβóóá iá òi FreeBSD.

# ΕὰοÛεάεί 26 ΟάέñέάέÛò Àðéêíéíùíβὰò

## 26.1 Óýíñσç

Ôì UNIX ðÛííòðà ððíòòðñéæà óáέñéáέÛò àðéêíéíùíβὰò. Æέá ðçí áέñβááέá, óá ðñðóá UNIX ìç÷-áíðíáóá ááóβæííóáí óá óáέñéáέÛò àñáñíÛò áέá ðçí áβóíñí éáέ Ýíññí óòí ÷ñðóç. Óá ðñÛáíáóá ùóòùóí Ý÷íòí áέεÛíáέ ðñéç áðù óéò ìÛñáò ðñò ðí óóíçééóíÛí “òáññíáóééù” áðñíáéçíóáí áðù Ýíá óáέñéáέù áéòòðòð 10 ÷áñáéòðñíùí ðí ááòòáññéáððòí éáέ Ýíá ðéççòññéùáéí. Ôí éáòÛéáéí áòòù éá éáéçóáé εÛðñéíòð áðù ðñòð ðññðñòð óáέñéáέðð àðéêíéíùíβὰò ðñò ÷ñçóéíñðñéçíóáé áðù ðí FreeBSD.

Áçñç áέááÛóáðá áòòù ðí éáòÛéáéí, éá ñÛñáðá:

- Ðùò íá óðñáÛóáðá ðáññíáóééÛ óòí FreeBSD óçóóçíá óáð.
- Ðùò íá ÷ñçóéíñðñéçíóáé Ýíá modem áέá íá óðñááéáβðá óá áðññáéñòóíÛíá óòóððíáóá.
- Ðùò íá áðéòñÛóáðá óá áðññáéñòóíÛíñòð ÷ñðóáð íá óðñááéçíóáé óòí óçóóçíá óáð ìÛòù modem.
- Ðùò íá áéééíðóáðá ðí óçóóçíá óáð ìÛòù óáέñéáέðð éííóíéáð.

Ðñéí áέááÛóáðá áòòù ðí éáòÛéáéí, éá ðñÛðáé:

- Íá ñÛñáðá ðùò éá ñòèìβóáðá éáέ éá ááéáóáóòðóáðá Ýíá ñÛí ðòñðñá (ΕὰοÛéáéí 8).
- Íá éáóáññáβðá óéò Ûáéáð éáέ áéáññááóβáð ðñò UNIX (ΕὰοÛéáéí 3).
- Íá Ý÷áðá ðññóááóç óòí ðá÷íééù áá÷áέñβáéí ðñò ðéééççíóáð (modem ð εÛñòá ðñééáððñí óáέñéáέðñí èòñññí) ðñò èÛéáðá íá ÷ñçóéíñðñéçíóáé óòí FreeBSD.

## 26.2 Áéóááñùñð

### 26.2.1 Ìññéíñáβá

bps

Bits ÁíÛ Ááòòáññéáððòí — ñ ñòèìùò ìáòÛáíóçò ðñí áááñÛíùí

DTE

Data Terminal Equipment, Óáññíáóééùò Áññðééóíùò ÁááñÛíùí — áέá ðáñÛááéáíá, ñ ððñéíñéóòðð óáð

DCE

Data Communications Equipment, Áññðééóíùò Àðéêíéíùíβὰò ÁááñÛíùí — ðí modem óáð

RS-232

Ðññòððí ðçò EIA áέá ðí ðéééù ðñò ÷ñçóéíñðñéçíóáé óóéò óáέñéáέÛò àðéêíéíùíβὰò

¼óáí áíáóáññíáóáðá óòí ñòèìùò ìáòÛáíóçò áááñÛíùí àðéêíéíùíβὰò, ááí ÷ñçóéíñðñéçíóáé ðÛííòðá ðñí ùññ “baud”. Ôí baud áíáóÛñáóáé óòíñ áñéèìù ðñí ìáòááÛóáðá ðñò çéáéòñéççíóáé óðñáòòð óçç ññÛáá ðñò ÷ñññò, áñ éáññééÛ ðñÛðáé íá



Óβιá	ÁεñτáÛέεδò #		ÁεñτáÛέεδò #	Óβιá
TD	3	óðτáÛάδάέ óðτ	2	RD
DTR	4	óðτáÛάδάέ óðτ	6	DSR
DTR	4	óðτáÛάδάέ óðτ	1	DCD
SG	5	óðτáÛάδάέ óðτ	5	SG
DSR	6	óðτáÛάδάέ óðτ	4	DTR
DCD	1	óðτáÛάδάέ óðτ	4	DTR
RTS	7	óðτáÛάδάέ óðτ	8	CTS
CTS	8	óðτáÛάδάέ óðτ	7	RTS

**Δβιáέάδ 26-3. Έάεβάετ Null-Modem DB-9 óá DB-25**

Óβιá	ÁεñτáÛέεδò #		ÁεñτáÛέεδò #	Óβιá
RD	2	óðτáÛάδάέ óðτ	2	TD
TD	3	óðτáÛάδάέ óðτ	3	RD
DTR	4	óðτáÛάδάέ óðτ	6	DSR
DTR	4	óðτáÛάδάέ óðτ	8	DCD
SG	5	óðτáÛάδάέ óðτ	7	SG
DSR	6	óðτáÛάδάέ óðτ	20	DTR
DCD	1	óðτáÛάδάέ óðτ	20	DTR
RTS	7	óðτáÛάδάέ óðτ	5	CTS
CTS	8	óðτáÛάδάέ óðτ	4	RTS

**Όçτáβúδòç:** ¼δάτ Ûιáδ άεñτáÛέεδò óá τέα Ûεñç ÷ ñάέÛεάδάέ τά óðτáάεάβ τά áÿτ άεñτáÛέεδάδ óδçτ Ûέεç, óðτβεúδ άτβττúτá δτδδ άεñτáÛέεδάδ τάδάτÿ δτδδ óδç τέα Ûεñç τά Ûιá τέεñú έάεβάετ, έάέ ÷ ñçóέττδτέτÿτá Ûιá τάεñÿδάñτ έάεβάετ άέα δçτ Ûτúδç τά δçτ Ûέεç Ûεñç.

Ç δάñάδÛτú έέÛδάτç óάβτáδάέ τά άβτáέ ç δέτ έέαάάάñÛτç. Óá τέα δάñάέέάβ (δτδ άτçάάβδάέ óðτ άέάεβτ *Ότ RS-232 τά ΆδεÛ Άβτáδά*), δτ SG óðτáÛάδάέ óðτ SG, δτ TD óðτáÛάδάέ óðτ RD, δά RTS έάέ CTS óðτáÛττάέ óðτ DCD, δτ DTR óðτáÛάδάέ óðτ DSR, έάέ άτδβδδñτúά.

**26.2.2.1.2 ΌδδτδτέçτÿÛιá Έάεβάέα RS-232C**

τá δδδτδτέçτÿÛττú óάεñέάέú έάεβάετ RS-232C, τάδάóÛñάέ úέα δά óβτáδά άδάδεάβάδ άδú δç τέα Ûεñç óδçτ Ûέεç, ÷ ùñβδ έάετÛ έέαάβ óðτδδ άεñτáÛέεδάδ. Άδδú άδεÛ óçτáβτáέ úδέ τ άεñτáÛέεδò “τáδÛάτúδòδ ΆάάñÛττú (TD)” δçδ τέαδ Ûεñçδ, óðτáÛάδάέ óðττ άεñτáÛέεδç “τáδÛάτúδòδ ΆάάñÛττú (TD)” δçδ Ûέεçδ Ûεñçδ. Άδδú άβτáέ έάέ δτ άβάτδ δτδ έάέúάβτδ δτδ έά ÷ ñçóέττδτέεβόάδά άέα τά óðτáÛόάδά Ûιá modem óðτ FreeBSD óÿóδçτá óάδ, έάέ άβτáέ άδβδçδ έάδÛέεçεττú άέα τñέóτÿÛιá δάñτáδέέÛ.

26.2.2.2 Έγνάδ

Ίε οάεήεάέΥδ έγνάδ άβίαέ Ίε οδδóαδΥδ δΊο ίαδάδΎήδΊο δά άάάήΎία ίαδάίΎ δΊο FreeBSD οδδóΠιαδΊδ εάέ δΊο δάήιáδέεΎ. Ç áηύδδδ άδδΠ δάήεάήΰάε δά άβιαç δΊι δδñπΊ δΊο δδΰñ ÷ ΊδΊ, εάέ δΊδ δά ÷ άέήβίαδδάε δΊ FreeBSD.

26.2.2.2.1 Άβιαç ΈδñπΊ

Οδΰñ ÷ ΊδΊ άέΰδΊά άβιαç οάεήεάέπΊ δδñπΊ. ΔñέΊ áήñΰοάδδ Π έαδάόεάδΰόάδδ έΰδΊεί εάέπάεί, εά δñΎδάέ ίά άάάάεϋέάβδδά ϋδε οάεήεΰάέ ίά δç έγνά δΊο δάήιáδέεΎ εάέ δΊο FreeBSD οδδóΠιαδΊδ οάδ.

Οά δάήεδδδδδάή δάήιáδέεΰ άεάέΎδΊδΊ έγνάδ DB-25. Ίε δñδδδδέεΊβ δδΊεΊεδδΎδ, δδΊδάήεεάίάήñΎΊδΊ εάέ άδδπΊ δΊο áεδδάειΎΊ FreeBSD, ίδΊήάβ ίά Ύ ÷ ΊδΊ έγνάδ δΎδΊδ DB-25 Π DB-9. Αί άεάέΎδδδδ έΰñδδά δΊεεάδδπΊ οάεήεάέπΊ δδñπΊ οδΊδ δδΊεΊεδδΠ οάδ, ίδΊήάβ ίά άεάέΎδδέ έγνάδ δΎδΊδ RJ-12 Π RJ-45.

Άάβδδά δçΊ δάέΊçñβδδδ δΊο δδΊήάΎάέ δΊ δεέεϋ οάδ, áεά δεδ δδ ÷ ίέέΎδ δñΊεάάήδΎδ δçδ έγνάδ δΊο ÷ ñçóειΊδΊεάβ. ΟδΊδϋδδ ίδΊήάβδδά ίά άΰεάδδά οδΊδΎήάσΊά αί άδδπδ εΊέδΰΊάδδά δçΊ δδΊά ÷ Π.

26.2.2.2.2 ΊΰΊδδά ΈδñπΊ

ΟδΊ FreeBSD, Ύ ÷ άδδ δñϋδδδδδσ οά έΰεά οάεήεάέΠ έγνά ίΎδδΊ ίεάδ έάδδ ÷ ñπέδδδδ δδΊΊ έάδΰεΊάΊ /dev. Οδΰñ ÷ ΊδΊ άΎΊ άεάδΊήάδέεΰ άβιαç έάδδ ÷ ññβδδΰΊ:

- Ίε έγνάδ δΊο ίδΊήΎΊ ίά ÷ ñçóειΊδΊεçειΎΊ άεά άβδΊάΊ οδΊ δΎδδδçΊά, ΊñΰΰεΊδδάέ /dev/ttydN ϋδΊδ δΊ N άβίαέ Ί άñεδΊδδ δçδ έγνάδ (ç áñβεΊδδσ ίάέεΊΰάέ άδΰ δΊ ίçΰΎΊ). ΑάΊέΰΰ, Ίε έγνάδ άδδΎδ δñññβΰεΊδδάέ άεά δΎΊάδδσ ίά δάήιáδέεΰ. Ίε έγνάδ άεδδΰΊδδ άδδδδΊΎΊ ίά άβίαέ άΊάñΰδ δΊ σΊΊά αίβ ÷ ίάδδδçδ δΎΊñΊδΊδδ (DCD) οδç οάεήεάέΠ άñάΊΠ, δñΊεάέΎΊδδ ίά εάέδδΊδñβδδΊδΊ οδδδΰΰ.
- Ίε έγνάδ έεΠδδδδ Π άñϋάΊδ, ΊñΰΰεΊδδάέ /dev/cuadN. Ίε έγνάδ άδδΎδδ άάΊ ÷ ñçóειΊδΊεΊΎΊδδάέ οδΊδϋδδ άεά δάήιáδέεΰ, άεεΰ άεά modems. ΊδΊήάβδδά ίά ÷ ñçóειΊδΊεΠδδδδά άδδΠ δç έγνά άεά έΰδΊεί δάήιáδέεϋ δΊο άάΊ δδΊδδçñβΰεάέ δΊ σΊΊά αίβ ÷ ίάδδδçδ δΎΊñΊδΊδδ.

Αί Ύ ÷ άδδ οδΊΊάΎδδΊ ΎΊά δάήιáδέεϋ οδçΊ δñπδç οάεήεάέΠ έγνά (δΊο δδΊ MS-DOS αίάδΎήάδδάέ ϋδ COM1), εά δñΎδάέ ίά ÷ ñçóειΊδΊεΠδδδδά δçΊ οδδóεάδΠ /dev/ttyd0 άεά ίά αίάδδñεάβδδά οδΊ δάήιáδέεϋ. Αί δΊ δάήιáδέεϋ άβίαέ δçç άΰΎδδñç οάεήεάέΠ έγνά (δΊο άβίαέ άδδβδçδ άñδδδΠ ϋδ COM2) ÷ ñçóειΊδΊεΠδδδά δç οδδóεάδΠ /dev/ttyd1, ε.Ί.έ.

26.2.3 ΉΎεΊδδσ δΊο ΔδñΠΊά

ΟΊ FreeBSD άδΰ δñΊάδΊεΊΊΠ δδΊδδçñβΰεάέ δΎδδδδδέδ οάεήεάέΎδ έγνάδ. ΟδΊΊ έϋδΊδ δΊο MS-DOS Ίε έγνάδ άδδΎδ άβίαέ άñδδδΎδ ϋδ: COM1, COM2, COM3, εάέ COM4. ΟΊ FreeBSD άδδΠ δç οδΊεΊΠ δδΊδδçñβΰεάέ “είδδΎδ” οάεήεάέΎδ έΰñδδδ δΊεεάδδπΊ δδñπΊ, ϋδδδ δέδ BocaBoard 1008 εάέ 2016, ϋδδδ εάέ δΊε άδδδΠδδ έΰñδδδ, ϋδδδ άδδΎδ δΊο έάδάόεάδΰΰεΊδδΊάέ άδΰ δçΊ Digiboard εάέ δçΊ Stallion Technologies. Ί δñΊάδΊεάΊΎΊδδ δδñΠΊάδ ϋδδδΰΊ, áεδάεάβ αίβ ÷ ίάδδσ ΊñΊ άεά δέδ δδδΊΎδ οάεήεάέΎδ (COM) έγνάδ.

Άεά ίά άάβδδά αί Ί δδñΠΊάδ οάδ αίάΊΊñβΰεάέ ΊδΊεάΠδΊδδά άδΰ δέδ οάεήεάέΎδ έγνάδ, δάñάδçñΠδδδά δά ίçΊΎΊάδά έάδΰ δç άεΰñεάέά άέέβΊçδçδ δΊο οδδóΠιαδΊδ, Π ÷ ñçóειΊδΊεΠδδδά δçΊ άΊδΊεΠ /sbin/dmesc άεά ίά ίάΊάάάβδδά δά ίçΊΎΊάδά δΊο δδñΠΊά έάδΰ δç άεΰñεάέά δçδ άέέβΊçδçδ. ΔΊε δδΰεάέñεΊΎΊά, αίάΰçδΠδδδά δά ίçΊΎΊάδά δΊο ίάέέΎΊΊ ίά δΊοδ ÷ άñάέδΠñδδ sio.

**ΟδϋάάεΊç:** Άεά ίά άάβδδά ΊñΊ δά ίçΊΎΊάδά δΊο δάήεΎ ÷ ΊδΊ δç ΎΊç sio, ÷ ñçóειΊδΊεΠδδδά δçΊ άΊδΊεΠ:

```
# /sbin/dmesg | grep 'sio'
```

Áέα δάνÛäëäíä, óä Ýíä óýóðçíä íä öÝóóäñëð óäëñéáëÝð èýñäð, óä íçíýíäðä öíð ððñÞíä ðíð ó÷: äðβæííðäë íä áðöÝð óäβñííðäë δάνäëÛðù:

```
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
```

Áí í ððñÞíäð óäð ääí áíáíúññβæäë ùëäð ðëð óäëñéáëÝð óäð èýñäð, ðëëáíúí íä ÷ñäéáóðäβ íä öíí ñðëíβóäðä ÷ñçóëííðíëÞíðäð öí äñ÷: äβí /boot/device.hints. Ìðññäβðä äðβçðð íä íäðáðñÝððäðä óä ó÷: ùëéí (Þ êáé íä äéáñÛðäðä óäëäβùð) äñäñÝð ðíð áíáöÝññíðäë óä óðóëäðÝð ðíð ääí ððÛñ÷: íðí óðí óýóðçíä óäð.

Δάνäéäéíýíä áíáðñÝíðä óðç óäëβäá manual öíð sio(4) äéä ðäñéóóúðäñäð ðëçñííöíñβäð ó÷: äðëéÛ íä óëð óäëñéáëÝð èýñäð êáé ðëð ñðëíβóäëð öúí êáñðÞí ðíëëäðëÞí óäëñéáëÞí ëðñÞí. Áí ÷ñçóëííðíëäβðä äñ÷: äβí ñðëíβóäðí ðíð ðñíÝñ÷: äðäé äðù éÛðíëä ðäéäéúðäñç Ýëäíóç öíð FreeBSD, êä ðñÝðäë íä áβóðä éäéäβðäñä ðñíóäëðëéíβ, êäëÞð éÛðíëäð äðù ðëð äðëéíäÝð öúí óðóëäðÞí êáé ç óýíðäíç öíðð Ý÷: íðí äëëÛíäë óðëð íäúðäñäð äëäúóäëð.

**Óçíäëβúóç:** Òí port IO\_COM1 ððíëäëéóðÛ öí port 0x3f8, IO\_COM2 äβíäé öí 0x2f8, IO\_COM3 äβíäé öí 0x3e8, êáé öí IO\_COM4 äβíäé öí 0x2e8. ÁðöÝð äβíäé êáé íë ðëí êíëíÝð ñðëíβóäëð äéä ðëð δάνäðÛíú èýñäð. Ìë äñäñÝð interrupt 4, 3, 5 êáé 9 äβíäé íë ðëÝíí óðíçëéóíÝíäð óðëð óäëñéáëÝð èýñäð. Óçíäëβóðä äðβçðð ùðë íë óðíçëéóíÝíäð óäëñéáëÝð èýñäð ääí íðñíýí íä ííëñÛæííðäë öí βäëí interrupt íä éÛðíëä Ûëëç óðóëäðÞ óä ððíëíäéóðÝð ðíð äéäéÝðíðí äβäðëí óýðíð ISA (íë éÛñðäð ðíëëäðëÞí ëðñÞí äéäéÝðíðí äéäéëÛ ëðëëÞíðäð öíð äðëðñÝðíðí óä ùëä óä 16550Á öíð ÷ñçóëííðíëäβ ç éÛñðä íä êäëðíðñäíýí ÷ñçóëííðíëÞíðäð íúíí íβä Þ äýí äñäñÝð interrupt).

### 26.2.4 ÁëäééÛ Äñ÷: äβä ÓðóëäðÞí

Ç ðñúóäáóç óðëð ðäñéóóúðäñäð óðóëäðÝð öíð ððñÞíä, äðëððä÷: Ûíáðäé íÝóù “äéäëÞí äñ÷: äβúí óðóëäðÞí”, óä íðíβä äñβóëííðäë óðíí êäðÛëíäí /dev/. Óðëð óðóëäðÝð sio ç ðñúóäáóç äðëððä÷: Ûíáðäé íÝóù öúí äñ÷: äβúí /dev/ttydN (äéä óðóëäðÝð äéóúüíð, dial-in) êáé /dev/cuadN (äéä óðóëäðÝð äñúüíð, call-out). Òí FreeBSD δάνÝ÷: äë äðβçðð óðóëäðÝð äñ÷: éëíðíβççðð (/dev/ttydN.init êáé /dev/cuadN.init) êáé óðóëäðÝð êëäëÞíäððð (/dev/ttydN.lock êáé /dev/cuadN.lock). Ìë óðóëäðÝð äñ÷: éëíðíβççðð ÷ñçóëííðíëÝíðäë äéä óçí ñýëíéóç öúí äñ÷: éëÞí ðáñäíÝðññí äðëéíéíúíβáð óðç èýñä, éÛëä öíñÛ ðíð áñíβääë. ÒÝðíëäð δάνÛíäðñíë äβíäé ð÷: öí crtscs äéä óä modems öíð ÷ñçóëííðíëÝíð óçíäðíäíóβä RTS/CTS äéä Ýëää÷: í ñíÞð. Ìë óðóëäðÝð êëäëÞíäððð ÷ñçóëííðíëÝíðäë äéä íä êëäëÞíðí éÛðíëäð ñðëíβóäëð óðëð èýñäð, Þðä íä íçí íðñíýí íä äëëä÷: èíýí äðù Ûëëíðð ÷: ñÞóðäð Þ ðñíñÛíäðä. Áέα ðëçñííöíñβäð ó÷: äðëéÝð íä óëð ñðëíβóäëð ðäñíäðëëÞí, óçí äñ÷: éëíðíβççð êáé óä êëäëÞíðäð óðóëäðÞí, êáé óç ñýëíéóç ðáñäíÝðññí óðä ðäñíäðëéÛ, ääβðä áíðβóðíë÷: á ðëð óäëβäð manual termios(4), sio(4), êáé stty(1).

### 26.2.5 Ñõèìβóáèð Óáëñéáêþí Èõñþí

Ç óðóèáðP ttydN (P cuadN) áβíáé ç èáííéèP óðóèáðP ðíð ðñíñáβóá íá ÷ñçóéíðíéPóáðá óðéð áðáñííáÝð óáð. ¼ðáí íéá áéááééáóβá áñíβááé íéá óðóèáðP, ÷ñçóéíðíéíýíóáé èÛðíéáð ðñíñáðééááíÝíáð ñõèìβóáèð I/O áéá òí ðáñíáðééú. Ìðñáβóá íá ááβóá áððÝð ðéð ñõèìβóáèð ìá òçí áíðíèP:

```
# stty -a -f /dev/ttyd1
```

Áí áéèÛíáðá ðéð ñõèìβóáèð óá áððP òç óðóèáðP, áððÝð èá ðáñáíáβííðí ìÝ ÷ñé òí èéáβóéí òçð óðóèáðPð. ¼ðáí áñí÷èáβ íáíÛ, èá Ý ÷áé áðáíÝèèéé óðéð ðñíñáðééááíÝíáð ñõèìβóáèð. Áéá íá áéèÛíáðá ðéð ðñíñáðééááíÝíáð ñõèìβóáèð, ìðñáβóá íá áñíβáðá éáé íá áéèÛíáðá ðéð ñõèìβóáèð òçð óðóèáðPð “áñ÷éèPð èáðÛóðáçð”. Áéá ðáñÛááéáíá, áéá íá áíáñáñíéPóáðá òç èáéóíññáβ CLOCAL, íá ìñβóáðá áðééíéíúíβá 8bit éáé Ýéáá÷í ñíPð ìÝóú XON/XOFF áéá òç óðóèáðP ttyd5, áñÛððá:

```
# stty -f /dev/ttyd5.init clocal cs8 ixon ixoff
```

Ç áñ÷éèíðíβçð ðúí óáëñéáêþí óðóèáðþí áéá üèí ðí óýóðçíá, áéÝá÷áðáé áðú ðí áñ÷áβí /etc/rc.d/serial. Òí áñ÷áβí áððú áðçñáÛæáé ðéð ðñíñáðééááíÝíáð ñõèìβóáèð ðúí óáëñéáêþí óðóèáðþí.

Áéá íá áðíðñÝðáðá òçí áéèááP óðáéáñéíÝíúí ñõèìβóáúí áðú èÛðíéá áðáñííáP, áéèÛíáðá ðéð ñõèìβóáèð òçð óðóèáðPð “èéáéáþíáðíð”. Áéá ðáñÛááéáíá, áéá íá èéáéáþóáðá òçí óá÷ýçðá òçð óðóèáðPð ttyd5 óðá 57600 bps, áñÛððá:

```
# stty -f /dev/ttyd5.lock 57600
```

Ïþñá, íéá áðáñííáP ðíð áñíβááé òç èýñá ttyd5 éáé áðé÷áéñáβ íá áéèÛíáðá òçí óá÷ýçðá òçð èýñáð, èá áíááéáóðáβ íá ðáñáíáβíáé óðá 57600 bps.

ÏðóééÛ, èá ðñÝðáé íá ñõèìβóáðá ðéð óðóèáðÝð áñ÷éèíðíβçð éáé èéáéáþíáðíð, þóðá íá áβíáé áááñÛðéíáð ìúíí áðú òíí èíááñéáóíú ðíð root.

## 26.3 ÓáñíáðééÛ

*ÓðíáéóöíñÛ ðíð Sean Kelly.*

Óá ðáñíáðééÛ ðáñÝ÷íð íéá áñééèP éáé ÷áíçéíý èúóðíðð ìÝèáí ðñíóááçð ððí FreeBSD óýóðçíá óáð, ìðáí ááí áñβóéáóðá ðñíóóÛ óçí èííóúéá P óá èÛðíéí óðíááíÝíí áβéððí. Ç áñúðçðá áððP ðáñéáñÛðáé ðúð íá ÷ñçóéíðíéPóáðá ðáñíáðééÛ óðí FreeBSD.

### 26.3.1 ×ñPóáèð éáé Áβäç Óáñíáðééþí

Óá áñ÷éèÛ óðóðíáðá UNIX ááí áβ÷áí èííóúéáð. Áíðβéáðá, íé ÷ñPóðáð áéóÝñ÷íðáí ððí óýóðçíá éáé áéðáéíýóáí óá ðñíáñÛíáðá ðíðð ìÝóú ðáñíáðééþí ðíð óðíáÝííðáí óðéð óáëñéáéÝð èýñáð ðíð ððíèáéóðP. Áððú ìéÛæáé áñéáðÛ ìá òç ÷ñPóç modem éáé èíáéóíééíý áñíñíβóçð ðáñíáðééíý áéá óýíááçç óá Ýíá áðñáéñðóíÝíí óýóðçíá. Ìá ðíí ðñúðí áððú ìðñáβóá áÝááéá íá áéðáéÝóáðá áñááóβáð ìúíí óá ðáñéáÛéèíí èáéíÝííð.

Óá óçíáñéíÛ PC áéáéÝðíðí èííóúéáð ééáíÝð íá áðáéèíβóíðí áñáðééÛ ðñéý ðççèPð ðñéúðçðáð, áéèÛ ç ééáíúðçðá óýíááççð ððí ìç÷Ûíçíá ìÝóú óáëñéáéPð èýñáð, ððÛñ÷áé áéúíá ó÷ááúí óá üéá óá óçíáñéíÛ óðóðíáðá óýðíð UNIX. Òí FreeBSD ááí áðíðáéáβ áíáβñáç. ÓðíáÝííðáð Ýíá ðáñíáðééú óá íéá á÷ñçóéíðíβçðç óáëñéáéP èýñá, ìðñáβóá íá áéóÝèèáðá ððí óýóðçíá éáé íá áéðáéÝóáðá ìðíéíáβðíðá ðñíáñáíá éáéíÝííð òí ìðíβí èá ìðñíýóáðá ððóéíèáééÛ íá áéðáéÝóáðá óçí èííóúéá P óá Ýíá ðáñÛéðñí xterm ðíð óðóðíáðíð X Window.

Ἄρα ÷ ñÞç óà áðé ÷ àñÞðáèð, àβίαé àðιάουί íá óðíaÝðáðá ðíεεÙ ðàñιάðέεÙ óà Ýía FreeBSD óγóðçιά éαé íá ðá ðíðíεàðÞðáðá óðéð εÝðáèð àñááðáð ðùí ððάεεÞεùí, ðáð íέέέáεùð ÷ ñÞðòç ðíðíàβ íá ÷ ñçóέííðíεÞðáé εÙðíεí ðáέέú ððíεíáέóðÞ (ð.÷. Ýía ðáέέú IBM PC Þ Macintosh) ùð ðàñιάðέεù áñúð ðíεý éó ÷ ðñúðàñíð ððíεíáέóðÞ ðíð áéðáεàβ FreeBSD. Ìá ðí ðñúðí áðóù, ðíðíàβðá íá ðáðáðñÝðáðá áðóù ðíð éáñíέεÙ εá Þðáí óγóðçιά áñúð ÷ ñÞðòç, óà Ýía ðáíβó ÷ ðñí óγóðçιά ðíεεáðέÞí ÷ ñçóðÞí.

Ὀðí FreeBSD ððÙñ ÷ íðí ðñβá àβαç ðàñιάðέέÞí:

- ἘíððÙ ὈàñιάðέέÙ
- PC ðíð εάέóíðññáíýí ùð ðàñιάðέέÙ
- ὈàñιάðέέÙ X

Ìé ðáñáέÙð ððíáñúðçðáð ðáñεáñÙíðíðí éáéÝía áðù áðóíýð ðíðð óýðíðð.

### 26.3.1.1 ἘíððÙ ὈàñιάðέέÙ

Ὀά εíððÙ ðàñιάðέέÙ àβίαé àíáέέέáðíÝíáð óðóέáðÝð ðíð áðέðñÝðíðí ðç óýíááóç óà ððíεíáέóðÝð ðíð ðáέñέáέÞí àñáñíÞí. Ἀðíεáεíýíðáé “εíððÙ” áέñεáÞð áðáέáÞ ç ðíúç ððíεíáέóðέεÞ éó ÷ ý ðíð Ý ÷ íðí àβίαé áéá áðáέέúíέóç, áðíóðíεÞ, éáé εÞçç éáéÝíñð. Ἄáí ðíðíàβðá íá áéðáεÝðáðá ðñíáñÙíáðá óà áððÙ. ¼εç ç éó ÷ ýð ðíðð ðñíÝñ ÷ áðáé áðù ðíð ððíεíáέóðÞ ðíð εá ðá óðíaÝðáðá, éáé ðíð ðáðóíý ðíðíàβðá íá áéðáεÝðáðá óðíðÙεðáð éáéÝíñð, ðáðáέúððέóðÝð, ðñíáñÙíáðá email, ðáé ÷ íβáέá ε.í.ε.

ὈðÙñ ÷ íðí áέáðíðÙááð àβαç εíððÞí ðàñιάðέέÞí áðù àñέáðíýð éáðáóέáðáðóÝð, ùðùð ðí VT-100 ðçð Digital Equipment Corporation éáé ðí WY-75 ðçð Wyse. Ὀ ÷ ááúí ððíέíðáÞðíðá óýðíð ðíðíàβ íá εάέóíðñáÞðáé íá ðí FreeBSD. ÌáñέέÙ ðàñιάðέέÙ ðççéíý éúóðíðð ðíðíýí áðβóçð íá áðáέέíβðíðí éáé àñáóέέÙ, áέεÙ áððÞ ðç áðíáðúðçðá ðíðíýí íá ðçí àéíáðáέéáðéíýí ó ÷ áðέέÙ εβáá ðáéÝðá εíáέóíέέíý.

Ὀά εíððÙ ðàñιάðέέÙ àβίαé àçííðέéÞ óà ðáñέáÙεεíðá àñááðáð ùðíð íé àñááεúíáñíé ááí ÷ ñáέÙεíðáé ðñúðááóç óà àñáóέéÝð áðáñíáÝð, ùðùð áððÝð ðíð ðáñÝ ÷ íðáé áðù ðí óγóðçιά X Window.

### 26.3.1.2 PC ðíð Ἐάέóíðññáíýí ùð ὈàñιάðέέÙ

Ἄí Ýía εíððù ðàñιάðέέÙ Ý ÷ áé áέñεáÞð ðçí éó ÷ ý ðíð ÷ ñáέÙεáðáé áéá íá àáβ ÷ íáé, íá óðÝέíáé, éáé íá εáíáÙíáé éáβíáñí, ðùðá éáé εÙεá ððíεíáέóðÞð ðíð óáð ðáñέóðáýáé ðíðíàβ íá εάέóíðñáÞðáé óáí εíððù ðàñιάðέέú. Ὀí ðíðí ðíð ÷ ñáέÙεáðáð àβίαé ðí óùðóù éáέÞáéí éáé εÙðíεí ðñúáñáíá *áñííβúçð ðàñιάðέέíý* ðí ðíðíβí éá áéðáέáβðá óðíð ððíεíáέóðÞ áððú.

Ç ðáñáðÙíù áέÙðáíç àβίαé àçííðέéÞð áéá íέέέáέÞ ÷ ñÞðç. Ἄí áéá ðáñÙááέáíá εÙðíεíð àíðέáýáé óðçí εíñóúέá ðíð óðóðÞáðíð óáð, ðíðíàβðá íá áéðáεÝðáðá ðçí àñááóβá óáð (íá ðçí ðñíúðúεáðÞ ùðé àβίαé ðíðí éáβíáñí) ðçí βáέá óðέáíÞ, ÷ ñçóέííðíεÞíðáð Ýía ééáùðáñí éó ÷ ðñú óγóðçιά ðí ðíðíβí óðíaÝðáðé óðí FreeBSD óáð ùð ðàñιάðέέú.

ὈðÙñ ÷ íðí áýí ðíðέÙ ÷ éóðíí àíçεçðέέÙ ðñíáñÙíáðá óðí ááóέέú óγóðçιά ðíð FreeBSD ðíð ðíðíýí íá ÷ ñçóέííðíεçéíýí áéá íá àíðεÝðáðá ðíð ðáέñέáέÞð óýíááóçð: ðí cu(1) éáé ðí tip(1).

Ἄέá íá óðíááέáβðá áðù Ýía Ὑεεí íç ÷ Ὑíçιά ðíð áéðáέáβ FreeBSD óðç óáέñέáέÞ óýíááóç áñúð Ὑεεíð óðóðÞáðíð, ðíðíàβðá íá ÷ ñçóέííðíεÞðáðá ðçí ðáñáέÙðù áíðíεÞ:

```
# cu -l serial-port-device
```

¼ðíð ðí “serial-port-device” àβίαé ðí ùíñá ðíð àñ ÷ àβíð óðóέáðÞð ðíð áíóέðñíðúðáýáé íéá óáέñέáέÞ εýñá ððí óγóðçιά óáð. ἌððÙ ðá àñ ÷ àβá óðóέáðÞí éáέíýíðáé /dev/cuadn.

Όι “N” όοι ύίηά όçð όóóέάðÐð, áíðέðñíóóððάγáέ όίí άñέέιù όçð όάέηέέέÐð έγñάð.

**Όçíáßóç:** Όçíáέβóðά ύóέ ç áñßέιçόç όùí όóóέάðßí όóι FreeBSD ίάέείÛ άðù όι ιçάΎί, έάέ ύ÷έ άðù όι Ύίá (ύðùò όóίάάßίáέ άέά ðáñÛάάέáíá όóά όóóðßíáóá ðίð ό÷ άóßæííóáέ ίá όι MS-DOS). Άóòù ðñάέóέέÛ όçíáßίáέ ύóέ ç έγñά ðίð όóι MS-DOS έάέάßóáέ COM1 έά άßίáέ όóíßέùò ç /dev/cuad0 όóι FreeBSD.

**Όçíáßóç:** ÈÛðíέίέ ÷ ñßóðάò ðñíóέίίγί ίá ÷ ñçóέίíðίέίγί Ûέέά ðñíáñÛίίáóá ðίð áέáðßέáίóáέ ίΎóù όçð Óðέέííáßò όùí Ports. Óá Ports ðáñέέáíáÛίíóí άñέάðÛ áίççéðóέέÛ ðñíáñÛίίáóá ίá έάέóíðñáßò ðáñύíίέáð ίá όι cu(1) έάέ όι tip(1), άέά ðáñÛάάέáíá όι comms/minicom.

**26.3.1.3 ÓáñíáóέέÛ X**

Όά óáñíáóέέÛ X άßίáέ óá ðέí áíáέέáíΎίá áßæç óáñíáóέέßí ðίð ððÛñ÷íóí. Άίóß ίá óóíáΎίíóáέ óá όάέηέέέÐ έγñά, όóíßέùò óóíáΎίíóáέ ίΎóù áέέóγíð, ð.÷. Ethernet. Άίóß ίá ðáñέíñßæííóáέ ύíñí óá áóáñíáΎð έάέίΎίíð, ίðñíγί ίá áðάέέíßóíóí ίðίέááßðίðά áóáñíáß όùí X.

ΆίáóΎñáíá óá óáñíáóέέÛ X ύíñí áέá έüáíðð ðççñúðçðάð áððÐð όçð áíúðçðάð. Óóí έáòÛέάέí áðòù ùóóúóí, ááí έάέγððάóáέ ç ááέáðÛóóáç, ñγέιέóç, έάέ ÷ ñßóç όùí óáñíáóέέßí X.

**26.3.2 Ñγέιέóç**

Ç áíúðçðά áððß ðáñέáñÛóáέ óέ ÷ ñάέÛέáðάέ ίá ñòέíßóáðά όóι FreeBSD óγóçíá óáð áέá ίá άßίáέ áðíáðß ç áßóííáð óá áðòù ίΎóù óáñíáóέέγí. ðñíúðíέΎóáέ ύóέ Ύ÷άðß ðæç ñòέíßóáέ όίí ððñßíá óáð ίá óðíóçñßæáέ όç όάέηέέέÐ έγñά óóçí ίðíßá άßίáέ óóíáíΎίç όι óáñíáóέέÛ—έάέ ύóέ όι Ύ÷άðß ðæç óóíáΎίóáέ.

Όóι ΈáòÛέάέí 12 áßáíá ύóέ ç áέáñááóáá íñít άßίáέ óðάγέóíç áέá όίí Ύέáá÷í όùí Ûέέúí áέáñááóέέßí, έάέ áέá όçí áñ÷έέíðíßçόç έáðÛ όçí áέέßίçόç ðίð όóóðßíáðíð. Ιέá áðù óέð áñááóßáð ðίð áέðáέáß ç íñít άßίáέ ίá áέááÛέáέ όí áñ÷áßí /etc/ttys έάέ ίá ίάέέίÛ ίέá áέáñááóáá getty óá έÛέá áέáέΎóέíí óáñíáóέέÛ. Ç áέáñááóáá getty áίáέáíáÛίíáέ ίá áέááÛóáέ όí ύίηά ÷ ñßóç έάέ ίá ίάέέíßóáέ όí ðñúáñáíá login.

Άέá ίá ñòέíéóóíγί óá óáñíáóέέÛ óóι FreeBSD óγóçíá óáð, έá ðñΎðáέ ίá áέðáέΎóáðά óá áέüέíðέá áßíáóá ùð root:

1. ðñíóέΎóðά ίέá áñáíß όóι /etc/ttys ίá όι ύίηά όçð όóóέάðÐð ύðùð óáßίáóáέ όóíí έáðÛέíáí /dev, áí ááí ððÛñ÷άέ ðæç.
2. Έάέíñßóðά ύóέ έá áέðáέáßóáέ ç /usr/libexec/getty óççí έγñά, έάέ áðέέΎíðά όίí έáðÛέέççéí óγðí getty áðù όí áñ÷áßí /etc/gettytab.
3. Έάέíñßóðά όίí ðñíáðέέááíΎίí óγðí óáñíáóέέγí.
4. Άíáñáíðíέßóðά όç έγñά έΎóííóáð όçí áíóßóóίέ÷ç áðέέíáß όóι “on”.
5. ΆðέέΎíðά áí ç έγñά έá άßίáέ áóóáέßò ίá όçí áðέέíáß “secure”.
6. ΆίáíááέÛóðά όçí íñít ίá áέááÛóáέ ίáíÛ όí áñ÷áßí /etc/ttys.



- ③ Õτ ðñβðτ δάαβτ áβτáέ τ ðýðτð ðτð ðáñτáðέέετý ðτð óðτáÛάðάέ óðτβεùð óá áððβ ðç áñáττβ tty. Άέά εýñáð áðέέττáέεβττ óðτáÛóáττ (dial-up), ç ðέττβ áððτý ðτð δάαβτð óð÷τÛ εά áβτáέ unknown β dialup, έάεβð τέ ÷ ñβóðáð εά τðττττττ τά ðñááτáðτðττέβóττττ óýττááóç τá τðττττββðττðά εττáέóττεέυ β ðáñτáðέέευ. Άέά Ûτáóά óðτááττÛττá ðáñτáðέέεÛ, τ ðýðτð ðáñτáðέέετý ááτ áέεÛεάέ, Ûðóέ τðττáβðά τά áÛεάðά Ûττá ðñááτáðέέευ ðýðττ ðáñτáðέέετý óá áððυ ðττ δάαβτ, ðττ τðττβτ εά áñáβðά óðç áÛóç áááñÛτττ ðτð termcap(5).

Άέά ðáñÛááέáττ, ðττ Wyse-50 ÷ ñçóέτττðττέάβ ðττ ðñááτáðέέευ ðýðττ ðáñτáðέέετý ðτð, áττ ðττ 286 PC ðτð áέðáέáβ ðττ Procomm, Ûττ áέ ñðέττεóðάβ τά áττττεβτáέ ðáñτáðέέευ ðýðττð VT-100.

- ④ Õτ ðÛóáñðττ δάαβτ έάέττβεάέ áτ ç εýñά εά áβτáέ áτáñáβ. Õτττέάðβττáð ááβ ðç εÛτç on, ç init εά τάέέττβóάέ ðττ ðñυáñáττá ðττ áτáðÛñáðάέ óðττ ááýðáñττ δάαβτ, ðçττ getty. Άττ áÛεάðά off óá áððυ ðττ δάαβτ, ááτ εά áέðáέáóðάβ ç getty, έάέ Ûðóέ ááτ εά τðττáβ τά áβτáέ áβóτττð óðττ óýóðçττá áðυ ðç óðáέáêñεττÛττ εýñά.

- ⑤ Õτ ðáέáððάβττ δάαβτ ÷ ñçóέτττðττέάβðάέ áέά τά έάέττβóάέ áτ ç εýñά áβτáέ áóðáέβð. Άττ ÷ áñáέðçñβóáðά τέά εýñά ùð áóðáέβ, óçττáβτáέ υðέ ðçττ áτðέóðáýáóðά áñέáðÛ βóðά τά áðέðñÛðáðá ðçττ áβóττττ ðττ root τÛóυ áððβð (β τðττέττáββττðά εττááñέáóττττ τά ID 0). Ááτ áðέðñÛðáðά ç áβóττττ ðττ root óá τέά εýñά ðττ Ûττ áέ ÷ áñáέðçñέóðάβ τç-áóðáέβð. Óá τç-áóðáέáβð εýñáð, τέ ÷ ñβóðáð ðñÛðáέ τά áέóÛñ÷ττáέ ÷ ñçóέτττðττέβττáð Ûττá óðττçέέóττÛττ εττááñέáóτττ ÷ ñβóðç, έάέ τά ÷ ñçóέτττðττέττττ ðçττ áτðττβ su(1) β Ûέέττ áτðβóðττε÷ττ τç÷áττεóτττ áέά τά áðττέβóττττ ðñττττττέά ððáñ ÷ ñβóðç.

Óáð óðττεóðττττá áττáðέóýέáέðά τά ÷ ñçóέτττðττέβττáðá ðç ñýέττεóç “insecure”, áέυττá έάέ áέá ðáñτáðέέεÛ ðττ áñβóέτττáέ óá έέáέáττÛττá áττÛðέά. Άβτáέ áñέáðÛ áýέττεττ τά áέóÛεάðά ùð έáñττεέυð ÷ ñβóðçð έάέ τά ÷ ñçóέτττðττέβττáðá ðçττ áτðττβ su áτ ÷ ñáέÛεάóðά ðñττττττέά ððáñ ÷ ñβóðç.

### 26.3.2.2 ÁττáτáέέÛóðά ðçττ init τά τáτáέέááÛóáέ ðττ /etc/ttys

÷ττáðá εÛττáέ ðέð áðáñáβðçðáð áέέááÛð óðττ áñ÷áβττ /etc/ttys, εά ðñÛðáέ τά óðáβέáðά óβττá SIGHUP (hangup) óðçττ áέáñááóβá init áέá τά ðçττ áττáέÛóðáðá τά áέááÛóáέ τáτÛ ðττ áñ÷áβττ ñðέττβóáτττ ðçð. Άέά ðáñÛááέáττ:

```
# kill -HUP 1
```

**Óçττáβòç:** Ç init áβτáέ ðÛτττðά ç ðñβðç áέáñááóβá ðττ áέðáέáβðάέ óá Ûττá óýóðçττá, έάέ Ûðóέ εά Ûττ áέ ðÛτττðά ðττ áñέέτττ áέáñááóβáð (PID) 1.

Άττ υέáð τέ ñðέττβóáέð áβτáέ óυóðÛð, ðá έάέβεάέ áβτáέ óðç εÛóç ðττð, έάέ ðá ðáñτáðέέεÛ áβτáέ áτáñáÛ, εά áέðáέáóðάβ ç getty óá εÛεά ðáñτáðέέευ, έάέ ððττ óçττáβττ áððυ εά ááβðά ðçττ ðñττðñττββ áέóυττττ (login) óðέð τευττáð ðυττ ðáñτáðέέεβττ óáð.

### 26.3.3 Áτðέττáðβðέóç ðñττáέçττÛóυττ Óýττááóçð

Άέυττá έάέ áτ áβóáðά τááÛέç ðñττττ÷β óðέð εáððñÛñáέáð, ðÛττá ðττáβ τά ðÛáέ εÛðέ óðñááÛ υðáττ ñðέττβεάðά Ûττá ðáñτáðέέευ. Ááβ εά áñáβðά τέά έββóá áðυ óðττðβττáðά έάέ óðττεóðβττáττáð áέτττεβóáέð.



## 26.4 Õðçñåóβá Áέóüäíð ìÝóù ÁðéëíäéêÞð Óýíääóçð (dial-in)

ÓðíäέóðíÛ ðíð Guy Helmer. ÐñíðèêÞêâð áðu ðí Sean Kelly.

Ç ñýèíέóç ðíð FreeBSD óðóðÞíáðíð óáð äéá äβóíäí ìÝóù äðéëíäéêÞð óýíääóçð, äβíäé äñéäðÛ ùííéá ìä ðç óýíääóç ðåñíäíðéêÞí, äêððð áðu ðí äääíñúð ùðé ÷ñçóëíðíëíýíðäé modems áíðβ äéá ðåñíäíðéêÞí.

### 26.4.1 ÁíùðåñéêÛ éääé ÁóùðåñéêÛ Modems

Óå áíùðåñéêÛ modems äβíäé ìÛëëí ðéí äíëéêÛ äéá äðéëíäéêÞð êêÞóáéð, éäêÞð íé ðåñéóóúðåñåð ñðëíβóáéð ðíðð ìðíñíýí íå äðíëçéåðéíýí ìíñéíå óðç ìÞ-ððçðéêÞ ìíÞíç RAM ðíð äéääéÝðíðí. Óå áíùðåñéêÛ modems äéääéÝðíðí óðíÞèùð òùðåíÝð äíåäβíäéð ðíð äåβ÷íðí ðçí éåðÛóðáóç óçíåíðéêÞí óçíÛðúí ðíð RS-232. òùðð óå òùðÛééå ðíð áíåñíðåñíðí íå áíóððùóéÛëíðí ðíðð äðéóéÝððåð, äéêÛ äβíäé äðβóçð ÷ñÞóëíå äéá íå óåβíåðåé ðúðå ðí modem éåóðíðñåäβ óúóðÛ.

Óå áóùðåñéêÛ modems óðíÞèùð äåí äéääéÝðíðí áððÞ ðç ìíÞíç RAM, éääé Ýðóé íé ñðëíβóáéð ðíðð ðåñíñβæíðåé ìíñ óðçí äéääéäÞ ðÝóçð óå êÛðíéíðð äéääéðððð ñðëíβóåñí (DIP switches). Áí ðí áóùðåñéêÛ óáð modem äéääéÝðåé òùðåíÝðð äíåäβíäéð, ìÛëëí éå äβíäé äýóéíëí íå ðéð äåβðå ùðåí ðí êÛëðíå ðíð óðóðÞíáðíð óáð äβíäé óðç ðÝóç ðíð.

#### 26.4.1.1 Modems éääé ÊääÞäéå

Áí ÷ñçóëíðíëéåäβðå áíùðåñéêÛ modem, éå ÷ñåéåóðåäβðå òðóéêÛ ðí óúóðú éääÞäéí. ÓðíÞèùð äðåñéåäβ ðí ðððíðíëçíÝíñ éääÞäéí RS-232C, äòúðíñ äéääéÝðåé óðíåÝðåéð äéá ùéå ðå óðíççéóíÝíå óÞíåðå:

#### Ðβíäéåð 26-4. Ìñåóβåð ÓçíÛðúí

Áêñúíýíéå	Íñíåðå
RD	ÊÞøç ÄååñÝñí (Received Data)
TD	ÁðíóðíêÞ ÄååñÝñí (Transmitted Data)
DTR	ÓåñíäíðéêÞ ÄååñÝñí óå Áðíëíùçðå (Data Terminal Ready)
DSR	Óýñíëí ÄååñÝñí óå Áðíëíùçðå (Data Set Ready)
DCD	Áíβ÷íåðóç ÖÝñíðíð ÓÞíåðíð (Data Carrier Detect). Áíβ÷íåðóç óýíääóçð ðçð åñåñíÞð RS-232C
SG	Äåβùóç ÓÞíåðíð (Signal Ground)
RTS	Áβðçóç ÁðíóðíêÞð (Request to Send)
CTS	Áðíëíùçðå äéå ÁðíóðíêÞ (Clear to Send)

Óí FreeBSD ÷ñåéÛæåðåé ðå óÞíåðå RTS éääé CTS äéå Ýéää÷í ñíÞð óå ðå ÷ýðçðåð ðÛíú áðu 2400 bps, ðí óÞíå CD äéå íå áíé÷íåýåé ðúðå Ý÷åé äðåíðçéåäβ íéå êêÞóç Þ ðúðå ç åñåñíÞ Ý÷åé êêåβóåé, éääé ðí óÞíå DTR äéå íå äðåíåðÝñåé ðí modem óðçí åñ÷éêÞ ðíð éåðÛóðáóç ìåðÛ ðç êÞíç íéåð óýíääóçð. ÌåñéêÛ éääÞäéå äåí äéääéÝðíðí ùéå ðå äðåñåñåðçðå óÞíåðå, Ýðóé áí Ý÷åéð ðñíåêÞíåðå ìå ðíð ðåñíäíðéóíù ðçð óðíåññβåð äéóúñåíð ìå ðí êêåβóéí ðçð åñåñíÞð, ðééåñíñ íå äðéýíåðåé ðí éääÞäéí ðíð ÷ñçóëíðíëéåäβðå.

¼ðùð éääé Ûééå éåóðíðñåéêÛ óðóðÞíåðå óýðíð UNIX, ðí FreeBSD ÷ñçóëíðíëéåäβ ðå óÞíåðå ðíð ðéééíý äéå íå áíéëççðéåäβ ðúðå Ý÷åé äðåíðçéåäβ íéå êêÞóç, éääêÞð éääé äéå ðíð ðåñíäíðéóíù ðçð éääé ðçí äðåíåðíÛ ðíð modem óðçí åñ÷éêÞ ðíð éåðÛóðáóç ìåðÛ ðí ðÝëíð ðçð. Óí FreeBSD äðíðåýååé íå óðÝëíåé áíðíëÝðð óðí modem Þ íå ðåñíåñíðéåäβ áíåñíÝðð éåðÛóðáóçð áðu áðòú. Áí äβðå äñíéääéñÝñúð ìå óðíåÝðåéð modems óå BBS (Bulletin Board Systems) ðíð äåóβæíðåé óå PC, áðòú ìðíñåäβ íå óáð óåíåäβ Ûåñí.

## 26.4.2 Έεεβρίαόά ΟάεñεάέΠδ Ἀεάόγιάάόç

Οι FreeBSD δδισόçñβæάε όά έεεβρίαόά Ἀδέειρέιφβί δισ άάόβæιίόάε όόά NS8250, NS16450, NS16550, έάέ NS16550A έάέ EIA RS-232C (CCITT V.24). Ίέ όόόεάδΥδ 8250 έάέ 16450 Υ÷ιρι άίάέΰιάόç ιίΠιç (buffer) ιάάΥέτιδ άίυδ ÷ άñάέδΠñά. Ç όόόεάδΠ 16550 άεάέΥδάέ άίάέΰιάόç ιίΠιç 16 ÷ άñάέδΠñι, ç ιδισά ἈδέονΎδάέ όçι έάέγδανç άδυσίόç όçδ. (Έυάυ δñιάεçιΰδύι όόç ό÷ άάβάόç όιδ 16550, άάι άβίάέ άδίαδΠ ç ÷ ñΠόç άδδΠδ όçδ ιίΠιçδ, άί άβίάέ άδίαδύι ÷ ñçόείιθιεΠόά όά 16550Á). Έάεβδ ιέ όόόεάδΥδ δισ άεάέΥδιρι άίάέΰιάόç ιίΠιç άίυδ ÷ άñάέδΠñά άδάέόιγί δñάέόύδανç άñάάόβά άδύ όι έάέόιñάέέυ όγόόçιά όά ό÷ Υόç ιά άδδΥδ δισ άεάέΥδιρι 16 ÷ άñάέδΠñάδ, όδισόάίόάέ έάέάβδάñά ιέ όόόεάδΥδ δισ άάόβæιίόάέ όδισ 16550Á. Άί όι όγόόçιά όάδ Υ÷άέ διεέΥδ άίάñάΥδ όάέñεάέΥδ δυνόάδ, Π δñυέάέόάέ ίά έάέόιñάΠόάέ έΰδύ άδύ άανγ ύυνδισ, ιέ έΰñόάδ δισ άάόβæιίόάέ όδισ 16550A άβίάέ έάέγδανñδ, έάεβδ δάνΥ÷ιρι Ἀδέειρέιφβά ιά ιέñυδανι ñδειυ όόάειΰδύ.

## 26.4.3 ἈñΠάιñç Ἀδέόέυδçόç

¼δύδ έάέ ιά όά δάνιαδέέΰ, ç init άέδάέάβ ιέά έάάñάάόβά getty άέά έΰέά όάέñεάέΠ έγñά δισ Υ÷άέ ñδειεόόάβ άέά άέόάν ÷ υιάρδ ἈδέειρέέΥδ όσάΥόάέδ. Ἀέά δάνΰάέάιá, άί Υ÷άδ άδίαΥόάέ Υίá modem όόç έγñά /etc/ttyd0, ç άίόιεΠ ps ax έά άάβιáέ έΰδέ όάι όι δάνάέΰδύ:

```
4850 ?? I 0:00.09 /usr/libexec/getty V19200 ttyd0
```

¼όάί έΰδιερι ÷ ñΠόόçδ έάέΥόάέ όόç άñάιΠ άδδΠ έάέ όι modem όδίαάέάβ, άίάñάιθιεάβδάέ άδύ όι modem ç άñάιΠ CD. Ί δññβιáδ δάνάόçñάβ υδέ Υ÷άέ άίέ ÷ ίάδεάβ όΎñι όβια, έάέ ιειέεçñβιáέ όç έάάέέάάόβά άίβιáιáδισ όçδ έγñάδ άδύ όι modem. Το getty όδΥέιáέ ιέά δñιδñιδΠ login: όόçι άδύ δñέι έάειñέόιΥίç άñ ÷ έέΠ όá ÷ γόçδά όçδ έγñάδ. Οι getty δñάέιεριδεάβ άέά ίá άάέ άί έάιαΰιñόáέ Υάέονιε ÷ άñάέδΠñάδ, έάέ όόçι όδδέέΠ ñγέιεόç, άί άίάέάέγφάέ υδέ έάιαΰιáέ όειδδβáέά (δέέáιφδ έυάυ έάέόιñΰδ όόçι όá ÷ γόçδά όγίαάόçδ όιδ modem όά ό ÷ Υόç ιά όçι όá ÷ γόçδά όιδ getty), δñιδάέάβ ίá ñδειβάέ όçι όá ÷ γόçδά όçδ άñάιΠδ ιΎ ÷ ñέ ίá έΰάάέ όδóειρέιáέειγύδ ÷ άñάέδΠñάδ.

Άόιγ ÷ ñΠόόçδ άέόΰάάέ όιι έυάέέυ όιδ, όι getty άέδάέάβ όι /usr/bin/login, όι ιδισβι έάέ ιειέεçñβιáέ όç έάάέέάάόβά άέόυάιδ, æçóβιáδ άδύ όιι ÷ ñΠόόç όιι έυάέέυ όιδ, έάέ ίάέέιβιáδ Υδάέόά όι έΎέοδισ όιδ.

## 26.4.4 Ἀñ ÷ άβά ñδειβόάυι

Οδΰñ ÷ ιρι δñβá άñ ÷ άβá ñδειβόάυι όδóδβιαδισ όόιι έάδΰειάι /etc, όά ιδισβá δέέáιφδ έά ÷ ñάέάόόάβ ίá άδñάñάάόδάβδά άέά ίá ἈδέονΎφάδά όçι άβóιáι ιΎού ἈδέειρέέέΠδ όγίαάόçδ όδισ FreeBSD όγόόçιά όάδ. Οι δñβδισ άñ ÷ άββι άβίáέ όι /etc/gettytab, όι ιδισβι δñάέΥ ÷ άέ δέçñιριñβáδ ñγέιεόçδ άέά όιι άάβιιá /usr/libexec/getty Οι άáyόάνι άñ ÷ άββι άβίáέ όι /etc/ttys όι ιδισβι δñάέΥ ÷ άέ δέçñιριñβáδ δισ άίυόδισδιεγί όόçι /sbin/init όά διεάδ όόόεάδΥδ tty έά δñΥδάέ ίá άέδάειγίόάέ έάάñάάόβáδ getty. ΟΎέιδ, ιδισñβóά ίá άΰέάδά άίόιεΥδ άñ ÷ έέιθιβçόçδ όçδ έγñάδ όδισ script /etc/rc.d/serial.

Οδΰñ ÷ ιρι άγί “ό ÷ ιέΥδ” υδισ άόιñΰ όç ÷ ñΠόç modems άέά άβóιáι όά Υίá όγόόçιά UNIX. Ç δñβç, δñιδείΰ ίá ñδειβæάέ όά modems έάέ όά όδóδβιαόά ιά όΎδιει δñυδθι, βóδά ΰό ÷ άδά ιá δέ όá ÷ γόçδά όσάΥάόάέ ÷ άδñάέñδóιΥñδ ÷ ñΠόόçδ, ç όιδέέΠ όγίαάόç όδιερέέόδΠ — modem ιΎού όιδ RS-232C ίá Υ ÷ άέ δΰιá όçι βáέά έέάέάυιΥίç όá ÷ γόçδά. Οι υδάέιδ ιέάδ όΎοιέάδ ñγέιεόçδ άβίáέ υδέ ÷ άδñάέñδóιΥñδ ÷ ñΠόόçδ άέΥδάέ δΰιá ΰιáόá όçι δñιδñιδΠ άέόυάιδ. Οι ιάειγέδççιά, άβίáέ υδέ όι όγόόçιά άάι άίυñβæιίόάέ όçι δñάñάάόέέΠ όá ÷ γόçδά όγίαάόçδ όιδ ÷ ñΠόόç, έάέ Υόóέ δñιáñΰιáόά δέΠñιδδ ιειγίçδ υδύδ όι **Emacs**, άάι άίυñβæιίόάέ δύδ ίá ñδειβóιρι όçι όá ÷ γόçδά άίáíΥυόçδ όçδ ιειγίçδ όιδδ βóδά ίá άίδειάδύδβóιρι έάέγδάñά δέδ άñάΥδ όσάΥόάέδ.

Ç ΰέεç ό ÷ ιέΠ ñδειβæάέ όç έάάδáδΠ RS-232 όιδ modem ίá άέέΰæάέ όá ÷ γόçδά, βóδά ίá άέιιεδάβ όçι όá ÷ γόçδά όγίαάόçδ όιδ άδñάέñδóιΥñδ ÷ ñΠόόç. Ἀέά δάνΰάέάιá, όσάΥόάέδ όγδισ V.32bis (14.4 Kbps) όδισ modem, ιδισñάβ ίá



```
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:
```

Άδου έά Ύ÷άέ ùδ άδιθΎεάοιά οοιάΎόάεδ 8bit ÷ùñβδ εοίθείβá.

Όι δάηάδΎύ ðάηΎάέαιά, ίάέειΎ οι ñθèù άδέειέιύβδ οόά 19.2 Kbps (άέά ίέά ούίάαόç V.32bis), έάέ Ύδάέόά äíέειΎεάέ έδèέέέΎ οόά 9600 bps (άέά V.32), 2400 bps, 1200 bps, 300 bps, έάέ δβóù οόά 19.2 Kbps. ΆδδP ç έδèέέέP άίάέέάP ñθèù άδέόδ÷Ύίάόάέ ίά όçί έέάíúδçδά nx= (“next table”). ÈÛεά ίέά άδù δέδ άηάùΎδ ÷ñçοέιθίέάβ ίέά έάόά÷βñέόç tc= (“table continuation”) άέά ίά άηάέ δέδ δδùέιέδδδ “δδθίθίέçίΎίάδ” ñθèιβóάέδ άέά èÛθίέί οόάέέηέίΎí ñθèù ίάδΎάιόç άάñΎίúí.

Άί Ύ÷άδå modem 28.8 Kbps P/έάέ èΎεάδå ίά άδùθάέçδάβδå άδù όçί οοιδβάόç άíúδ modem 14.4 Kbps, έά δñΎδå ίά ÷ñçοέιθίέPóåδå ñθèù άδέειέíúβδ ίάάέýόάñí άδù 19.2 Kbps. ΔάηάέÛδù θάβίάόάέ Ύίά δάηΎάέαιά ίέά έάόά÷βñέόçδδ όδθί gettytab θίθ ίάέέίΎάέ άδù όά 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÷άδå άηάù άδάíáñάάόδP P ίάάÛέí οίñδβí, έάέ οι ούόόçίά οάδ άάí άέάέΎδåέ οάέηέέέΎδ èýñåδ θίθ ίά άάóβæíθάέ όθί 16550Á, βóùδ èÛάάδå èÛεç “sio” “silo” οόά 57.6 Kbps.

**26.4.4.2 /etc/ttys**

÷íδíå Pæç έάέýθάέ όç ñýèìέόç όíθ άñ÷άβíθ /etc/ttys όδθί ΔάηΎάέαιά 26-1. Ç ñýèìέόç άέά modems άβίάέ δάñùííέά, άέèÛ δñΎδå ίά άβóíθíå έέάοíñάδέέèù ùñέόíå όδçί getty έάέ ίά έάέíñβóíθíå έέάοíñάδέέèù όýθí δάñíάδέέéý. Ç άάíέέP ïñθP θúοí άέά έέάέάùíΎίç üοí έάέ άέά ίάδάάέçδP όά÷ýδçδά άβίάέ ç δάηάέÛδù:

```
ttyd0 "/usr/libexec/getty xxx" dialup on
```

Όí δñθòí δάάβí όδçί δάηάδΎύ ñάñìP άβίάέ όí έέάέέèù άñ÷άβí οδóέåδPδ άέά άδδP όçί έάόά÷βñέόç — όí ttyd0 άíόέόóíέ÷άβ όδθί άñ÷άβí /dev/ttyd0 όí ίθíβí έάέ έά δάηάέέíέíθέάβ ç getty. Όí άáýόάñí δάάβí, "/usr/libexec/getty xxx" (όí xxx έά Ύ÷άέ όçί άñ÷έέP όέίP έέάíúδçδάδ όíθ gettytab), άβίάέ ç έέάñάάόβá θίθ έά άέδåέΎόάέ ç init όδç όδóέåδP. Όí όñβδí δάάβí, dialup, άβίάέ í δñíáδέέάñΎíδ όýθíθ δάñíάδέέéý. Ç

όΎόάηος δάνΰιáðñìð, on, ääβ÷íáé óóçí init üðé ç ãñáñìÞ áβíáé óá éáéóìðñáééÞ éáðΰóóáós. Ìðñáβ íá ððΰñ÷áé éáé íéá ðΎìðç δάνΰιáðñìð, ç secure, áéèÛ éá ðñΎðáé íá ÷ñçóéìðñéáβóáé iúñí áéá óáñíáðéèÛ óóá ðñíβá ç ððóééÞ ðñúóáós áβíáé áóóáéÞð (üðùð áβíáé ç éìíóüéá ðìð óðóðñíáðìð).

Ï ðñíáðééáñìΎíñð óγðìð ðáñíáðééíγ (dialup óðì δάñáðΰíñ δάνΰιáééáìá) ðññáβ íá áéèÛíáé áíΰεíáá íá ðéð ðñìðéìÞóáéð óáð. Õì dialup áβíáé ð ðáñáñìóéáéüð óγðìð ðáñíáðééíγ áéá áðéεíáééΎð ãñáñìΎð. Ìé ÷ñÞóðáð ðññíγí Ύóóé íá ðñìóáñìüáéìðí óá scripts óγíááósð ðìðð þóðá íá áíááñññáéìðí ðì dialup éáé íá ðñéìβáéìðí áððüíáðá ðìí óγðì ðáñíáðééíγ. ΰóðúóì, áβíáé ðΰεεíí áðéεíóðáñí íá éáéìñβóáðá ðì vt102 ùð ðìí ðñíáðééáñìΎíñ óγðì ðáñíáðééíγ, éáéÞð ðé ÷ñÞóðáð ÷ñçóéìðñéíγí óðìÞèðð áññìβúós VT102 óóá áðñíáéñðóíΎíá ðìðð óðóðñíáðá.

Áóíγ éΰíáðá ðéð áééááΎð óðì /etc/ttys, ðññáβðá íá óðáβéáðá óós áéáñááósβá init Ύíá óÞíá HUP áéá íá íáíááéááΰóáé ðì áñ÷áβì. Ìðñáβðá íá ÷ñçóéìðñéÞóáðá óçí δάñáéΰðð áíóìεÞ áéá áððü ðì óéìðü:

```
# kill -HUP 1
```

Áí áððÞ áβíáé ç ðñÞós ðìñÛ ðìð ðñéìβáéáðá ðì óγóóçíá óáð, βóùð éΎεáðá íá ðáñéíΎíáðá ðΎ÷ñé íá ðεéεçñþóáðá ðεÞñùð óç óγíááós éáé ðγέìéós ðìð modem óáð ðñéí óðáβéáðá óÞíá óóçí init.

### 26.4.4.2.1 Νýεìéós áéá ΈéáéáñìΎίç Óá÷γóçðá

Άéá éáéóìðñáβá óá ééáéáñìΎίç óá÷γóçðá, éá ðñΎðáé ç éáðá÷þñéós óáð óðì ttys íá δάñΎ÷áé óóçí getty íéá éáðá÷þñéós óðáéáñÞð óá÷γóçðáð. Άéá Ύíá modem ðá ðá÷γóçðá éγñáð ééáéáñìΎίç óóá 19.2 Kbps, ç éáðá÷þñéós ttys éá ðñéΰáé ðá ðçí δάñáéΰðð:

```
ttyd0 "/usr/libexec/getty std.19200" dialup on
```

Áí ðì modem óáð áβíáé ééáéáñìΎίç óá áéáóìñáðééü ðñéìü áááñìΎíñ, áíóééáðáóðÞóðá ðá ðçí éáðΰéεççç ðéìÞ ðì std.19200 óóçí éáðá÷þñéós std.speed. Άáááéüèáβðá üðé ÷ñçóéìðñéáβðá Ύíá Ύáéðñì óγðì, üðùð ðññáéðáé óðì /etc/gettytab.

### 26.4.4.2.2 Νýεìéós áéá ðáðááéçðÞ Óá÷γóçðá

Óá íéá ðΎíðéá ðγέìéós, ç éáðá÷þñéós óáð áéá ðì ttys éá ðñΎðáé íá áíáðΎñáðáé óóçí áñ÷ééÞ “auto-baud” (sic) éáðá÷þñéós ðìð /etc/gettytab. Άéá δάñΰιáééáìá, áí ðñìóéΎóáðá óçí δάñáðΰíñ óðìéóðñíáç éáðá÷þñéós áéá modem ðá ðáðááéçðÞ óá÷γóçðáð óáéñéáéÞð, éáé ðá áñ÷ééÞ óá÷γóçðá ðá 19.2 Kbps (óçí éáðá÷þñéós gettytab ðìð ðáñéΎ÷áé ùð óçíáβì áééβίçóçð ðì V19200), ç éáðá÷þñéós óáð óðì ttys éá ðñéΰáé ðá ðçí δάñáéΰðð:

```
ttyd0 "/usr/libexec/getty V19200" dialup on
```

### 26.4.4.3 /etc/rc.d/serial

Óá modems ðøçεÞð óá÷γóçðáð, üðùð óá V.32, V.32bis éáé V.34, áðáéóìγí Ύéáá÷ì ðñÞð ðΎóù ðéééíγ (RTS/CTS). Ìðñáβðá íá ðñìóéΎóáðá áíóìεΎð stty óðì /etc/rc.d/serial áéá íá éΎóáðá óðìí ððñÞíá ðìð FreeBSD óçí éáðΰéεççç δάñΰιáðñì Ύéáá÷ì ðñÞð ðΎóù ðéééíγ ðüí éðñÞì modem.

Άéá δάñΰιáééáìá, áéá íá éΎóáðá óçí áðééíáÞ termios óóçí ðéìÞ crtscts óðéð óðóéáðΎð áñ÷ééìðñçóçð ðçð ááγóáñçð óáéñéáéÞð éγñáð (COM2) áéá áðééíáééΎð éεÞóáéð áéóüáìð éáé áññáìð, éá ðñΎðáé íá ðñìóéΎóáðá ðéð δάñáéΰðð áñáñìΎð óðì áñ÷áβì /etc/rc.d/serial:

```
# Serial port initial configuration
```

```
stty -f /dev/ttydl.init crtscts
stty -f /dev/cuadl.init crtscts
```

### 26.4.5 Νόειβόάέδ ίίΠιçð

Άί Ύ ÷ άδά Ύία modem όοί ιδibi ιδιναβδά ίά άδιεçέάγόάδ όέδ δάηάιΎόηιόδ ιιίείά όόçί ιç-δδçόέέP RAM διό έέέέΎόάέ, έά δñΎδάέ ίά ÷ ηçόείιθιέPόάδά Ύία δñυάηάιιά όάηιάόέέιγ (ιδιόδ όι **Telix** ιΎού όιό MS-DOS P όιό tip όοί FreeBSD) άέά ίά ηόειβόάόδ όέδ δάηάιΎόηιόδ. Όόίάάέάβδά όοί modem ÷ ηçόείιθιέPιόάδ όçί βάέά άη÷έέP όά÷γόçδά άδέείέιιύβδ ίά άδδP διό Ύ ÷ άδά άçέPόάέ ιδ άη÷έέP όά÷γόçδά όόçί getty, έέέ ηόειβόά όέδ δάηάιΎόηιόδ όόç ίίΠιç όιό Pόδά ίά όάέηέΎείόί ίά όέδ δάηάέΎδιό άδάέδPόάέδ:

- Όί όPιά CD έά άβιάέ άίάηάιιό ιδάί όι modem άβιάέ όόίάηιΎίι
- Όί όPιά DTR έά άβιάέ άίάηάιιό έάδΎ όç έάέόιθόηάβ. ΆδάίάηάιθιέPόç όιό DTR έέάβιάέ όç άηάηιP έέέ άδάίάΎήάέ όι modem όόçί άη÷έέP όιό έάδΎόδάόç.
- Όί CTS έά ÷ ηçόείιθιέάβδάέ άέά Ύέάά÷ι ηιPδ ίάόάέέάιιάιιύ άάηιΎίι
- Ι Ύέάά÷ιό ηιPδ XON/XOFF έά άβιάέ άίάίάηάιιό
- Όι RTS έά ÷ ηçόείιθιέάβδάέ άέά Ύέάά÷ι ηιPδ εçöèΎίόιι άάηιΎίι
- <sup>1</sup>ό÷ç έάέόιθόηάβ (Quiet mode, ÷ υñβδ άδιόθιέP έυάέέPι άδιόάέάόιΎδιι)
- Άάί έά άβιάόάέ echo διι άίόιέPι

Έά δñΎδάέ ίά έέάΎόάδά όçί δάέιçηβιόç όιό modem όάδ άέά ίά άηάβδά όέδ άίόιέΎδ διό δñΎδάέ ίά άδιόάέβέάδ. εβδιό άδβόçð ÷ ηάέάόδάβ ίά έέέΎιάδά όç εΎόç έΎθιέιι ηόειέόέέPι έέέέιθόPι (dip switches).

Άέά δάηΎάέάιιά, άέά ίά ηόειβόάόδ όέδ δάηάδΎιι δάηάιΎόηιόδ όά Ύία άιιόδάνέέυ modem U.S. Robotics® Sportster® 14,400, έά Ύδñάδά ίά όάβέάδά όέδ δάηάέΎδιό άίόιέΎδ όοί modem:

```
ATZ
AT&C1&D2&H1&I0&R2&W
```

Ιδιναβδά ίά όçί άδέέέηβά ίά ηόειβόάόδ έέέ Ύέέιόδ δάηάιΎόηιόδ όιό modem, ιδιόδ άέά όι άί έά ÷ ηçόείιθιέάβδάέ όι δñιόιέέει V.42bis P όοιδβάόç MNP5.

Όι άιιόδάνέέυ modem U.S. Robotics Sportster 14,400 έέάέΎόάέ άδβόçð έέέ έΎθιέιόδ ηόειέόέέιγ έέέέυδδάδ διό δñΎδάέ ίά ηόειέόίγί. Άέά Ύέέά modem, βούδ ιδιναβδά ίά ÷ ηçόείιθιέPόάδά άδδΎδ όέδ ηόειβόάέδ ιδ άίάόιιΎ:

- Άέάέυδδçð 1: Pιι έΎόç — ΈάίίέέP έάέόιθόηάβ DTR
- Άέάέυδδçð 2: N/A (Έυάέέυδ ΆδιόάέΎόιάόιιό ιδ Έάβιάιι/Έυάέέυδ ΆδιόάέΎόιάόιιό ιδ Άñέέιιό)
- Άέάέυδδçð 3: Pιι εΎόç — × υñβδ Έυάέέυδ ΆδιόάέΎόιάόιιό
- Άέάέυδδçð 4: ΈΎδι έΎόç — × υñβδ echo έέέ offline άίόιέΎδ
- Άέάέυδδçð 5: Pιι εΎόç — Άδδιιάόç ΆδΎίόçç
- Άέάέυδδçð 6: Pιι εΎόç — ΌδóέιέιέέP Άίβ÷ιάόç ÖΎηιόιό ΌPιάόιιό
- Άέάέυδδçð 7: Pιι εΎόç — Öυñδιόç ΔñιάδέέιάPι άδι NVRAM (ιç-δδçόέέP ίίΠιç)
- Άέάέυδδçð 8: N/A (ιδδñδ/Έιθόδιόδ Öñδιόδ Έάέόιθόηάβ)

Έα δñΎδάε ίά άδáiñāñδίεΠόάδά Π ίά δñññΠόάδά οίδδ εΰάέέίγδ άδίοάέάοίΰδού ί οόί modem, áεά ίά άδίογáάδά δññāεΠιάδά δίδ ίδññίγί ίά άçíείδñāçείγί άί ç getty άδú εΰΎεíδ όδάβέάέ δññδññδΠ login: όδóí modem άίΠ άδδú āñβόέάδάέ όά έάδΰόδός άίδóεΠί. Όδçί δāñβδδóçç άδδΠ, δóí modem ίδññάβ ίά άίάδāñΰάάέ ίάίΰ δçί άίδóεΠ (echo) Π ίά όδάβέάέ εΰδóεί εΰάέεΰ άδίοάέΎοίάοίδ. Άδδú ίδññάβ ίά Ύ ÷ άέ ùδ άδίοΎέάοίά ίέά ίάέññ ÷ ñίτç έάέ ÷ άεΠ όδñέέβά ίάδάίγ δίδ modem έάέ όçδ getty.

**26.4.5.1 Ñδèìβóáéδ áεά ΈέάέΰìΎίç Óá÷γδçδά**

Άέά έάέδóíñάβά όά έέάέΰìΎίç όά÷γδçδά, έά ÷ ñάέάόδάβ ίά ñδèìβóáδά δóí modem ίά έάάδçñάβ όδάέāñΠ όά÷γδçδά δóείñέόδΠ — modem, ΰδ ÷ άδά ίά όçί όά÷γδçδά άδέέίεΰίΰβδ όçδ άδέέίñέέΠδ όγίάάόçδ. Óά Ύ ίά άíñδāñέéΰ modem U.S. Robotics Sportster 14,400, ίέ άίδóεΎδ άδδΎδ έά έέάέΠόóíδ όçί άδέέίεΰίΰβά δóείñέόδΠ — modem όδçί βάέά όά÷γδçδά δíδ Ύάέίά ç εΠδç δού άίδóεΠί:

ATZ  
AT&B1&W

**26.4.5.2 Ñδèìβóáéδ áεά ίάδάάεçδΠ Óá÷γδçδά**

Άέά έάέδóíñάβά όά ίάδάάεçδΠ όά÷γδçδά, έά ÷ ñάέάόδάβ ίά ñδèìβóáδά δóí modem όάδ ίά δññóáññúεάέ όçί όά÷γδçδά όçδ όάέñέάέΠδ εγñάδ δíδ Πόδά ίά όάέñέΰεάέ ίά άδδΠ όçδ άέόāñ ÷ ùίάίçδ έεΠόçδ. Óά Ύ ίά άíñδāñέéΰ modem U.S. Robotics Sportster 14,400, ίέ άίδóεΎδ άδδΎδ έά έέάέΠόóíδ όçί όά÷γδçδά ίάδάöñΰδ āāñΎίΰí ίά έέΰñέδóç έάέΠí δíδ modem όδçί όά÷γδçδά δíδ ÷ ñçóéíδíεΠεçέά άέά όçί άδίοδóεΠ δúí άίδóεΠί, áέεΰ έά άδέδñΎθóíδ όδçί όά÷γδçδά όçδ όάέñέάέΠδ εγñάδ ίά ίάδάΰΎέέάδάέ άέά όóíΎόάέδ δíδ āáí Ύ ÷ íδí έέΰñέδóç έάέΠí:

ATZ  
AT&B2&W

**26.4.5.3 ,έάā ÷ íδ δúí Ñδèìβóáúí δíδ Modem**

Όά δāñέόδúδāñά modem δθçεΠδ όά÷γδçδάδ, δāñΎ ÷ íδí άίδóεΎδ ίά όέδ íδñβδδ ίδññάβδά ίά δāñάέίεΰεΠόάδά όέδ δñΎ ÷ íδóδδ δāñāíΎδñíδδ έάέδóíñάβδδ δíδδ ίά ό ÷ άδέέΰ έάάάίçδú δññúδí. Όδóí άíñδāñέéΰ modem U.S. Robotics Sportster 14,400, ç άίδóεΠ AT15 āāβ ÷ ίάέ όέδ ñδèìβóáéδ δíδ āβίάέ άδíεçέάóíΎίάδ όδç íç-δδçδóέεΠ RAM δíδ modem. Άέά ίά āāβδά όέδ δñāāíάόέΎδ δāñāíΎδñíδδ έάέδóíñάβδδ δíδ modem (úδδδ άδδΎδ άδçñāΰείíδάέ άδú όέδ εΎόάέδ δúí ñδèìβóéέΠί έέάέíδδΠí δíδ), ÷ ñçóéíδíεΠόδά όέδ άίδóεΎδ ATZ έάέ ίάδΰ AT14.

Άί άέάέΎδάδά modem ΰεεçδ άδάέñβδδ, áεΎāíδά όέδ ñαçāβδδ ÷ ñΠδçδ δíδ áέά ίά āāβδά δδδ ίδññάβδά ίά áεΎāíδά ίά όέάíδñέΰ όέδ δāñāíΎδñíδδ ñγέίεδçδ δíδ.

**26.4.6 ΆίδóείάδΠδéόç Δññāéçíΰδúí**

Δāñάέΰδδ έά āñάβδά ίāñέέΰ āΠιάδά δíδ ίδññάβδά ίά áείεΰεΠόάδά áέά ίά áεΎāíδά όç έάέδóíñάβά δíδ modem όóí όγóδçíά όάδ.

**26.4.6.1 ΆέΎā ÷ ííδóád δí Όγóδçíά όάδ**

ΌóíΎΎóδά δóí modem όóí FreeBSD όγóδçíά όάδ, áέέέίΠόδά δóí, έάέ άί δóí modem όάδ έάέΎΎάέ òδάέίΎδ άíñάβίάέδ έάδΰόδός, δāñάέίεΰεΠόδά όέδ áέά ίά āāβδά άί άíñāñíδíεάβδάέ ç Ύίάάέίç DTR úδάί āìδάíβέάδάέ ç δññδññδΠ





pn=\@

### 26.5.4 Ðùð Ìðíñþ íá Êäéÿóù ÿá Ôçäâöüíééü Áñéèü Áðü ôçí Ññáìþ Áíðíëþí;

ÁÛëðá íéá “ääíééþ” éáðá÷þñéóç óðí áñ÷âβí /etc/remote. Áéá ðáñÛäáéáíá:

```
tip115200|Dial any phone number at 115200 bps:\
      :dv=/dev/cuad0:br#115200:at=hayes:pa=none:du:
tip57600|Dial any phone number at 57600 bps:\
      :dv=/dev/cuad0:br#57600:at=hayes:pa=none:du:
```

ðäéðá ìðíñâðá íá äβíðáð áíðíëÿð üðùð:

```
# tip -115200 5551234
```

Áí ðñíðéíÛðá ôçí cu áíðâ äéá ôçí tip, ÷ñçóéíðíéþðáð íéá äääíééþ éáðá÷þñéóç äéá ôçí cu:

```
cu115200|Use cu to dial any number at 115200bps:\
      :dv=/dev/cuad1:br#57600:at=hayes:pa=none:du:
```

éáé ðéçéðñíëíäþðá:

```
# cu 5551234 -s 115200
```

### 26.5.5 Ðñÿðáé íá Ðéçéðñíëíäþ ðí Ñðéèü bps ÊÛëà ÖíñÛ ðíð ðí ÊÛíü Áóðü;

Éá ðñÿðáé íá ðñíðéÿóðáð íéá éáðá÷þñéóç tip1200 þ cu1200, äééÛ ìðíñâðá íá äÛëðáð ôçí äééþ óáð äðééðíçðþ ðéþ óðçí ééáíüðçðá br. Ç áíðíëþ tip éáññâð üðé ðá 1200 bps äβíáé íéá éáéþ ðñíäðéëíäþ, éáé äéá ðí éüäí áððü ðÛ÷íáé íá ññâé íéá éáðá÷þñéóç tip1200. Ááí ÷ñäéÛæáðáé ùððüðí íá ÷ñçóéíðíéþðáð ðá÷ýðçðá 1200 bps.

### 26.5.6 ÷ù Ðñüðááóç óá ÿá Áñéèü Öðíëíäéóðí Ìÿóù Áíüð Áíððçñâðçðþ Õáñíáðééþí

Áíðβ íá ðáñéíÿíáðá ìÿ÷ñé íá óííäéâðá éáé íá ðéçéðñíëíäâðá CONNECT host ÊÛëà öíñÛ, ÷ñçóéíðíéþðáð ôçí ééáíüðçðá cm ðíð tip. Áéá ðáñÛäáéáíá, äâðáð ôéð ðáñáéÛðù éáðá÷÷ñðáðéð óðí /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/cuad2:br#38400:at=hayes:du:pa=none:pn=5551234:
```

Ïí ðáñáðÛíü, éá óáð äðéðñÿðáé íá äñÛðáðá tip pain þ tip muffin äéá íá óðíáÿáóðá óðíðð ððíëíäéóðÿð pain þ muffin, éáé tip deep13 äéá íá óðíáÿáóðá óðíí áíððçñâðçðþ ðáñíáðééþí.

### 26.5.7 Ìðññáß ç Tip íá ÄíëéíÛóääé Ðañéóóúòðññò Äðü íéá ÄñáííÝò äéá êÛëä Óýíääóç;

Äðöü ðí ðññääçíá óóíβëùð àìòáíβæääðáé óää Ýíá ðáíáððéóððíëí ðíò Ý ÷ äé àñéääòÝð ãñáííÝò äéá modem, äéëÛ êääé ÷ ééëÛääð öíéóçðÝð ðíò ðññóððáéíýí íá óéð ÷ ñçóéííðíéðóíóí.

Äçíëíðññáðóðää íéá éääðá ÷ ðññéóç äéá ðí ðáíáððéóððíëí óääð óðí /etc/remote êääé ÷ ñçóéííðíéðóðää ðí @ óóçí ééáíúóçðá ðñ:

```
big-university:\
    :pn=\@:tc=dialout
dialout:\
    :dv=/dev/cuad3:br#9600:at=courier:du:pa=none:
```

ðñéðá, äçíëíðññáðóðää íéá éβóðá íä ðíòð àñééííýð óçéääðβíúí ðíò ðáíáððéóçðíβíò óðí /etc/phones:

```
big-university 5551111
big-university 5551112
big-university 5551113
big-university 5551114
```

Ç tip éä äíëéíÛóääé êÛëä íβá, íä óç óáéñÛ ðíò àìòáíβæííðáé, êääé éä óðáíáððóðáé. Áí èÝéääðá íá óóíá ÷ βæääé óçí ðññóððÛëääé, äéðääéÝóðää óçí tip ìÝóá óää Ýíá àññä ÷ ì while.

### 26.5.8 Äéáóß ÐñÝðáé íá ÐéÝóù Ctrl+P Äýí ÖíñÝð äéá íá Óðáßëù ðí Óóíäðáóíù Ctrl+P íéá ÖíñÛ;

Ì óóíáððáóíùð ðéðéðññí **Ctrl+P** áðíòääéää ðíí ðññíððééääíÝíí ÷ àñáéððñá “áíáíáääéáóííý (force)”, êääé ÷ ñçóéííðíéääðóðáé äéá íá éääóääéÛääé ç tip úðé ì áðññáíñò ÷ àñáéððñáð éä ðñÝðáé íá ÷ ñçóéííðíéçéääß úðùð áβíáé. Ìðññáβðää íá èÝóðáðá ðíí ÷ àñáéððñá áíáíáääéáóííý óää ìðíëíáððíòää Ûéëí ÷ àñáéððñá, ÷ ñçóéííðíéðíóðää óçí áéíëíðéβá äéáððáðð ~s, ç ìðíβá óçíáβíáé “ñýèíéóää íéá íääóääéçðβ”.

Ðéçéðññíëíáðóðää ~sforce=single-char êääé óóíá ÷ βóðá íä Ýíá ÷ àñáéððñá íÝáð ãñáííðð. Öí single-char áβíáé ìðíëíóáððíòää ìíúð ÷ àñáéððñáð. Áí áððóðáðää éääíú ðí single-char, ì ÷ àñáéððñáð áíáíáääéáóííý éä áβíáé ì nul, ðíí ìðíβí ìðññáβðää íá ðéçéðññíëíáðóðáð ÷ ñçóéííðíéðíóðää ðí óóíáððáóíù ðéðéðññí **Ctrl+2 P Ctrl+Space**. Íéá àñéääòÛ éääéð ðéíð äéá ðí single-char áβíáé ðí **Shift+Ctrl+6**, ðíò ÷ ñçóéííðíéääðóðáé ìúíí óää èÛðíëíòð áíððçññáðóçÝð ðáññíáðééðí.

Ìðññáβðää íá ìññóðáðá ðí ÷ àñáéððñá áíáíáääéáóííý óää ìðíëíí áóáßð áðééðíáβðää, íä óçí áéíëíðéç éääðá ÷ ðññéóç óóíí àñ ÷ áβíí \$HOME/.tiprc:

```
force=single-char
```

### 26.5.9 ÍáóíééÛ ¼óé ÄñÛòù Àìòáíβæääðáé íä Êääóääéáβá ÄñÛííáðá!!

Ûéëëí Ý ÷ áðá ðéÝóääé **Ctrl+A**, ðíò áβíáé ì “ ÷ àñáéððñáð áíýðùóçð” óçð tip, êääé áβíáé ó ÷ äääéáóííÝíúð äéáééÛ äéá úóíòð Ý ÷ ìóí ðññääçíá íä ðí ðéðéðññí **CAPS LOCK**. × ñçóéííðíéðóðää óçí áíóíëð ~s ðíò ááβíáíá ðáñáðÛíú, äéá íá èÝóðáðá íéá ëíäééð ðéíð óóç ìääóääéçðβ raisechar. Óóçí ðññáííáðééúóçðá, ìðññáβðää íá èÝóðáðá óçí βæääé ðéíð ìä ðíí ÷ àñáéððñá áíáíáääéáóííý, áí ááí óéíðáýáðá ðíòÝ íá ÷ ñçóéííðíéðóðáðää èÛðíëéá áðñ áððÝð ðéð äóíáðúóçðáð.

ÐáñáéÛòù óáβíáðáé Ýíá ððññáéääíá àñ ÷ áβííò .tiprc, ðí ìðíβí áβíáé óÝéääéí äéá ÷ ññóðáðð ðíò **Emacs** ðíò ÷ ñáéÛæääðáé íá ðéçéðññíëíáíýí óð ÷ ìÛ **Ctrl+2** êääé **Ctrl+A**:



### 26.6.2 Νýειέος ΟάέñέάέΎδ Είιούεάδ (Όýιόιις έαίός)

Ç áíúδσδά άδδΨ δδìèΎδάε úεε σέιδδáγδδά ίά ÷ñçσέιιδìέΨδδδδ δέδ δñìδδέεάñΎίάδ ñδèìβδδάέδ, έάέ èΎέδδδ άδèΨδ ίέά ãñΨáñç άδδέδδδσδός δçδ άέάέέάδδδδ ñýειέοςδ δçδ δάέñέάέΎδ έίιούεάδ.

1. ΌδίαΎδδδ δì δάέñέάέú έάèΨάει δόçí COM1 έάέ δδì δάñìάδέέú.
2. Άέά ίά äáβδδά úεά δά ίçíγíάδά äèèβίçόçδ δόçí δάέñέάέΎδ έίιούεά, äΨδδδ δçí δάñάέΎδδδ άίδìèΨδ ùδ δδãñ ÷ ñΨδόςδ:  
# echo 'console="comconsole"' >> /boot/loader.conf
3. Άδδáñáñάδδδδδδ δì /etc/ttys έάέ áèèΎìδδ δì off δά on έάέ δì dialup δά vt100 άέά δçí έάδδδ ÷ ññέόςç ttyd0. ΆέάσìñάδέέΎ, äáí έά ÷ ñάέΎæάδάέ èùάέέúδ δñúδάάδçδ άέά δç όýíάάός ìΎδδδ δçδ δάέñέάέΎδ έίιούεάδ, δì ìδìβì άδìδάέäβ δέέάíú έáíú άδδάέäβδδ.
4. ΆδδáíäèèέίΨδδδ δì όýόδçíά άέά ίά äáβδδά άί βδδ ÷ δδάí íé áèéáΎΎδ.

Άί ÷ ñάέΎæάδδδ άέάσìñάδέέΎδ ñδèìβδδάέδ, έά äñáβδδά έäδδδñΎñάέδδ άέά δçí ñýειέόςç δδì ΌìΨíά 26.6.3.

### 26.6.3 Νýειέος ΟάέñέάέΎδ Είιούεάδ

1. ΔñìδδìέìΎδδδά Ύίά δάέñέάέú έάèΨάει.  
Έά ÷ ñάέδδδδδδδδ äβδδά Ύίά έάèΨάει όýδìδδ null-modem, äβδδά Ύίά δδδδìδìέçíΎíí δάέñέάέú έάèΨάει έάέ Ύίά δñìδδáñìñáΎά null-modem. Άäβδδά δì ΌìΨíά 26.2.2 άέά έäδδδñΎñάέδδ ò ÷ äδέέΎ ìä δά äβäç δδì δάέñέάέèΨí έάέúäβúí.
2. ΆδìδδìñáΎδδδ δì δèçèδñìèúάει δάδ.  
Όά δñáñέδδδδδδñá PC øΎ ÷ ñδì άέά δì δèçèδñìèúάει έάδδΎ δçí äèΎñèάέά δδì äéáñúδδέèèΨí äèèβίçόçδ (POST, Power On Self Test), έάέ έá άίάδΎñìδδì όδδΎέíá άί δì δèçèδñìèúάει äáí äβíάέ όδìñáñíΎíí. ÌáñέέΎ ìç ÷ άίΨíάδά δñáñáδìíέíγíάέ ç ÷ çñΎ άέά δçí Ύέéáέθç δèçèδñìèñíäβìδ, έάέ äáí όδìñá ÷ βæìδì δçí äèèβίçόç ìΎ ÷ ñé ίά δì όδìñáΎδδδä.  
Άί ì δδìèñáέδδδδδδ όδδ δñáñáδìíέΎδάέ άέά δì èΎέìδ, áèèΎ ìáέέíΎ Ύδδέ έάέ áèèèΨδ, äáí ÷ ñάέΎæάδάέ ίά èΎíáδδä όβδδìδά έάέäβδδäñìñ áέά áδδδ. (ÌáñέέΎ ìç ÷ άίΨíάδά ìä BIOS δçδ Phoenix, èΎίá άδèΨδ "Keyboard Failed" έάέ όδìñá ÷ βæìδì δçí äèèβίçόç έáñíέέέΎ.)  
Άί ì δδìèñáέδδδδδδ όδδ äñíáβδδάέ ίά äèèέíΨδάέ ÷ ùñβδ δèçèδñìèúάει, έá δñΎδäέ ίά ñδèìβδδάδδ δì BIOS ðδδδά ίά äáñíäβ δì èΎέìδ (άί äβíáδάέ). Όδìäìδèäδδδδδδ δì äñ ÷ äέñβäέí δçδ ìçδñέέΎδδ όδδ άέá έäδδδñΎñάέδδ ò ÷ äδέέΎ ìä άδδδΨ δç äéáéέέάδδä.

**Όδδäáέίç:** Ñδèìβδδδδ δì δèçèδñìèúάει όά "Not installed" όδì BIOS. Ç ñýειέόςç άδδδΨ άδèΨδ άδìδδñΎδäέ δì BIOS άδδδ δì ίά άίέ ÷ íáγáέ δì δèçèδñìèúάει όδçí äèèβίçόç, έάέ äáí δñúèäέδδάέ ίά όδδ äìδìñáβδδάέ ίά δì ÷ ñçσέιιδìέΨδδδδä έáñíέέέΎ. Ìδìñáβδδά ίά άδδδδδδδ δì δèçèδñìèúάει όδìñáñíΎíí áèúíá έάέ úδáí Ύ ÷ äδä äíáñáìδìέΨδδάέ δç ñýειέόςç "Not installed". Άί äáí όδδΎñ ÷ äé ç δñáñáδδΎíú ñýειέόςç όδì BIOS, øΎìδä άέά δçí äδέέìäΨ "Halt on Error". ΆèèΎìδä δç όά "All but Keyboard" Ψ áèúíá έάέ όä "No Errors", έάέ έá Ύ ÷ äδä δì βäέí äδìδΎέάδδä.

**Όçíáβδδόςç:** Άί δì όýόδçíά όδδ äéáέΎδäέ δìñδδέé όýδìδδ PS/2®, δέέáíúí ίά δñΎδäέ ίά δì äδìδδìñáΎδδδä έάέ άδδδ. Όά δìñδδέéά όýδìδδ PS/2 Ύ ÷ ñδì èΎδìέá èδèèΨíáδά έίέíΎ ìä δì δèçèδñìèúάει, äááñíúδ δìδ ìδìñáβ ìä δñìέáέΎδäέ όýá ÷ όόςç όδì δñúäñáìíá άίβ ÷ íáδδόςç δìδδ δèçèδñìèñíäβìδ. ÈΎδìέá όδδδδδδδä, úδδδ δì Gateway 2000 Pentium 90 MHz ìä AMI BIOS, όδìδñáñέΎñííδäέ ìä άδδδδδ δìδδδδì. Όá äáíέέΎδδ äñáñíΎδ, άδδδ äáí äβíáέ δñúäέçíá έάèΨδ δì δìñδδέé Ύδδέ έάέ áèèèΨδ äáí äβíáέ ÷ ñΨδέíí ÷ ùñβδ δì δèçèδñìèúάει.

- 3. ΟδίαΥόαά Υία εϊδου δάνιαδέεου όδçi COM1 (sio0).

Αί αάι Υ ÷ άδδ εϊδου δάνιαδέεου, ιδιναβδδά ίά όδίαΥόαάά Υία δάέεου PC/XT ιά Υία δνιανάλι άέα modem, P ίά ÷ ηçóεϊιδιέPóαάδ όç óάένεάέP εγνά όά Υία Üεεϊ ιç ÷ Üίçια UNIX. Αί αάι Υ ÷ άδδ όάένεάέP εγνά COM1 (sio0), άανÜόδδά ίέα. Όç άάανΥίç όδέαϊP αάι δδÜñ ÷ άέ δñüδïð ίά άδέέΥίαάά Üεεç εγνά άέδüð άδü όç COM1, ÷ ùñβδ ίά άδάíαιάόάάεüδδβδάάδ άά boot blocks. Αί ÷ ηçóεϊιδιέάβδδά Pαç όç COM1 άέα εÜδιεά Üεεç όδóεάδP, έά δñÝδάέ ίά όçί άóάένΥόαάά δνιουήεÜ, έάέ ίά άάέάόάόδPóαάά íΥi boot block έάέ δδñPía, ιüεέδ όδίαάέάβδδά όδi FreeBSD. (ÖδïèÝóïðiä üδé ç COM1 έά άβίάέ Υόδóé έάέ άέέεPδ άέάέΥóείç óά Υία άïðçñάδçδP άñ ÷ άβüí/δδïèïάέóïπí/δάνιαδέέPí. Αί δñάñιαδέέÜ ÷ ñάέÜæάóδά όç COM1 άέα εÜδé Üεεϊ (έάέ άάι ιδιναβδδά άδδü όï εÜδé Üεεϊ ίά όï ιάόάέίPóαάά όδçi COM2 (sio1)), ιÜεεϊí αάι έά Υδñάδδά ίά άó ÷ ïεçέάβδδά έάέüεïð ιά üεï άδδü όï εΥία).

- 4. Άάάάέüèáβδδά üδé όï άñ ÷ άβi ñδèìβδάüí όïð δδñPía óάó Υ ÷ άέ όéð έάóÜεéçέáð άδéεïäÝð (flags) άέα όç COM1 (sio0).

Ιέ ó ÷ άδéέΥδ άδéεïäÝð άβίάέ:

0x10

Αíññáïðιεάβ όçi δδïðPñéíç εïíóüéáð άέα άδδP όç εγνά. Αί αάι δάέάβ άδδP ç άδéεïäP, δά δδüεïéδά flags άέα όçi εïíóüéá αάι έάñÜñíðάέ δδüðéí. Όç άάανΥίç όδέαϊP, ç δδïðPñéíç εïíóüéáð ιδιναβ ίά άβίάέ άíññáïðιεçíΥίç ιüíí óά ίέα εγνά. Ç δñþç δïð έάέïñβæάδάέ óóï άñ ÷ άβi ñδèìβδάüí, άβίάέ έάέ άδδP δïð έά δñïðιεçέάβ. Άδü ιüíç όçð, ç άδéεïäP άδδP αάι έά άíññáïðιεPóάέ όçi εïíóüéá όδç óδάέάέñéíΥίç óάένéάέP εγνά. Έά δñÝδάέ ίά εΥóάάά όï δñάέÜδü flag P ίά ÷ ηçóεϊιδιέPóαάά όçi άδéεïäP -ñ δïð δñέéñÜóáδάέ δñάέÜδü, ιάæβ ιά άδδü όï flag.

0x20

ΑíáíáåÜæάέ όç óδáέάέñéíΥίç εγνά ίά άβίάέ ç εïíóüéá (άέδüð άí δδÜñ ÷ άέ Üεεç εïíóüéá δççéüδάνçð δñïðñáñéüδçóάó) Üó ÷ άάά ιά όçi άδéεïäP -ñ δïð δñέéñÜóáδάέ δñάέÜδü. Έά δñÝδάέ ίά ÷ ηçóεϊιδιέPóαάά όï flag 0x20 ιάæβ ιά όï flag 0x10.

0x40

Δñάέñάάάβ όç óδáέάέñéíΥίç εγνά (óά óðíäóáóíü ιά όçi 0x10) éÜñíðάó όçi ιç άέάέΥóéíç άέα έáñíéέP δñüóáάóç. Αάí έά δñÝδάέ ίά εΥóάάά άδδP όçi άδéεïäP óóç óάένéάέP εγνά δïð óéïðáÿάδά ίά ÷ ηçóεϊιδιέPóαάά üð óάένéάέP εïíóüéá. Ç ιüíç ÷ ñPç άδδïÿ δïð flag, άβίάέ ίά έάέïñβδδάά üδé ç εγνά έá ÷ ηçóεϊιδιέçέάβ άέα áδñάέñóóïΥίç áέóóáéíÜδüóç όïð δδñPía (kernel debugging). Άάβδδά Öï Áέάéβi όïð ΔñíññáñiάδéóδP ([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/books/developers-handbook/index.html](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/developers-handbook/index.html)) άέα δñέóóóüδññáð έáδδñÝñάέáð ó ÷ άδéέÜ ιά όçi áδñάέñóóïΥίç áέóóáéíÜδüóç.

ΔññÜäάέάíá:

```
device sio0 at isa? port IO_COM1 flags 0x10 irq 4
```

Άάβδδά όç óάέβáá manual sio(4) άέα δñέóóóüδññáð έáδδñÝñάέáð.

Αί αάι Υ ÷ ïðí έάέïñέóδάβ flags, έά δñÝδάέ ίά áéðáéÝóáάά όï UserConfig (óά áέáöïññάδééP εïíóüéá) P ίά άδάíαιάόάάéüδδβδάάά όïð δδñPía.

- 5. ΆçíéïðñáPóάά όï άñ ÷ άβi boot.config όδïí ñέæέéü έάóÜεéïäí όçð έáóÜδìççóçð a δïð áβóéïð áέέβíçóçð.

Οϊ αν÷αβι αδου εα εαδωδεγίαε οϊ εραεεα οϊ boot block ο÷αδεεΎ ια οϊ δυο εΎεαδω ια αεεεϊΠωε οϊ ογόδϋα. Άεα ια αναναιδιεΠωαδω οϋι οαεηεεεΠ ειρουεα, εα ÷νεααοωαβωα ιβα Π δαηεοουδωανωα αδυ δεδ δαναεΎδω αδεεϊαΎδ—αι εΎεαδω ια δνιραεινβωαδω δρεεαδεΎδ αδεεϊαΎδ, εα δνΎδαε ια δεδ δανεεΎααδω υεαδ οδϋι βαεα ανανιΠ.

-h

ΆιαεεΎοωαε ιαοαιγ οϋδ αουδωανεεΠδ εαε οϋδ οαεηεεεΠδ ειρουεαδ. Άεα δανΎααεαϊα, αι ιαεεϊΠωαδω αδυ οϋι αουδωανεεΠδ ειρουεα (ιεϋιϋ), ιδινωαβωα ια ÷νεοειιδιεΠωαδω οϋι αδεεϊαΠ -h αεα ια εαδωδεγίαε οϊ οινδουδΠ αεεβιϋοϋδ εαε οϊ δδνΠια ια ÷νεοειιδιεΠωαδω οϋ οαεηεεεΠδ εγνα υδ οδωεαδΠδ ειρουεαδ. ΆιαεεαεεεεΎ, αι αεεεϊΠωαδω ΙΎου οϋδ οαεηεεεΠδ εγναδ, ιδινωαβωα ια ÷νεοειιδιεΠωαδω οϋι αδεεϊαΠ -h αεα ια εαδωδεγίαε οϊ οινδουδΠ αεεβιϋοϋδ εαε οϊ δδνΠια ια ÷νεοειιδιεΠωαδω οϋι εαιηεεεΠδ ειρουεα αιωβ αεα οϋ οαεηεεεΠδ.

-D

ΆιαεεΎοωαε ιαοαιγ οϋδ αδεΠδ εαε οϋδ αεδεΠδ ειρουεαδ. Οδϋι ηγελεοϋδ αδεΠδ ειρουεαδ, εα ÷νεοειιδιεεαβ αβωα ϋ αουδωανεεΠδ ειρουεα (αδωεεϋιεοϋδ οα ιεϋιϋ) αβωα ϋ οαεηεεεΠδ εγνα, αιΎεϊαα ια οϊ δυο Ύ÷αε ωαεαβ ϋ αδεεϊαΠ -h διω ανωοΎωαϊα δαναδΎιϋ. Οα δανβδωοϋδ αεδεΠδ ειρουεαδ, εα αναναιδιεγϊαι οαδου ÷ηιια ουοι ϋ αουδωανεεΠδ υοι εαε ϋ οαεηεεεΠδ ειρουεα, Ύο÷αδω αδυ οϋ ηγελεοϋδ οϋδ αδεεϊαΠδ -h. ΟϋιαεΠωαδω υδουοι υδε ϋ ηγελεοϋδ αεδεΠδ ειρουεαδ ιδινωαβ ια αναναιδιεεαβ ιϋηι εαδΎ οϋι αεεβιϋοϋδ, υοι αεωαεαβωαε οϊ boot block. Ιυεεδ αιεαβ ι Ύεαα÷ιδ οοι οινδουδΠ αεεβιϋοϋδ, ϋ ιηιαεεεΠδ ειρουεα διω δαναιΎιαε αβιαε αδδΠ διω εαεινβωαδωε αδυ οϋι αδεεϊαΠ -h.

-P

Άιαναιδιεαβ οϋι αιβ÷ιαοοϋδ δεϋεδωηιεϊαβιω οϊδ boot block. Αι ααϊ ανωεαβ δεϋεδωηιευαεϊ, αναναιδιεγϊιαε αδουιαδωα ιε αδεεϊαΎδ -D εαε -h.

**Οϋιαβωοϋδ:** Εϋαυ δαηεηεοιπι ÷βηιω οδϋι δνΎ÷ιδωα Ύεαιωϋδ ουι boot blocks, ϋ αδεεϊαΠ -P ιδινωαβ ια αιε÷ιαγωαε ιϋηι αεδωαδαιΎια (extended) δεϋεδωηιευαεα. Δεϋεδωηιευαεα ια εεαυδωαηα αδυ 101 δεΠεδωηα (εαε ÷υηβδ ωα δεΠεδωηα F11 εαε F12) βουδ ια ιϋι αιε÷ιαδϋι. Άιαεοβωδ αδωιγ οϊδ δαηεηεοιηγ, αβιαε δεεαϊϋ ια ιϋι αιε÷ιαδϋι εαε εΎδιεα δεϋεδωηιευαεα οηνεδπι οδιεϊαεοδπι. Αι οοιααβιαε αδου οοι ογόδϋα ωαδ, εα δνΎδαε ια οοαϊαδΠωαδω ια ÷νεοειιδιεαβωαδ οϋι αδεεϊαΠ -P. Αδωδδ÷βδ, ααϊ δδΎñ÷αε εΎδιεοιδ ωηϋδω ια δαηαεΎιωαδω αδω οϊ δνϋαεϋια.

×νεοειιδιεΠωαδω αβωα οϋι αδεεϊαΠ -P αεα ια αδεεΎιαδω οϋι ειρουεα αδουιαδωα, Π οϋι αδεεϊαΠ -h αεα ια αναναιδιεΠωαδω οϋ οαεηεεεΠδ ειρουεα.

Ιδινωαβωα αδβοϋδ ια δανεεΎααδω εαε Ύεεαδ αδεεϊαΎδ διω δανεανΎοιηδωε οϋε οαεβαα manual οϊδ boot(8).

¼εαδ ιε αδεεϊαΎδ αεεβιϋοϋδ, αεδυδ οϋδ -P, εα δανΎοιρι οοι οινδουδΠ αεεβιϋοϋδ (/boot/loader). Ι οινδουδΠδ αεεβιϋοϋδ εα εαεινβωαε αι ϋ ειρουεα εα αϋιειωηαεαβ οδϋι ιεϋιϋ Π οδϋ οαεηεεεΠδ εγνα, αοιγ ανωοΎωαε ιϋηι οϋι αδεεϊαΠ -h. Αδω οϋιαβιαε υδε αι εαεινβωαδω οϋι αδεεϊαΠ -D αεεΎ υ÷ε οϋι αδεεϊαΠ -h οοι /boot.config, εα ιδινωαβωα ια ÷νεοειιδιεΠωαδω οϋ οαεηεεεΠδ εγνα υδ ειρουεα ιϋηι εαδΎ οϋι αεδΎεαοϋ οϊδ boot block. Ι οινδουδΠδ αεεβιϋοϋδ υιδω εα ÷νεοειιδιεΠωαε οϋι αουδωανεεΠδ ειρουεα (ιεϋιϋ).

6. ΆεεεϊΠωαδω οϊ ιϋ÷Ύιϋα.

¼οαι ιαεεϊΠωαδω οϊ FreeBSD ιϋ÷Ύιϋα, ωα boot blocks εα ααβηιωι ωα δανεα÷υιαια οϊδ /boot.config οδϋι ειρουεα. Άεα δανΎααεαϊα:

```
/boot.config: -P
```

Keyboard: no

Ç äáyóãñç ãñãìÞ åá àìöáíεóóðãß iùñí áí áŰεάðå ðçí åðέειãÞ -Þ óðì /boot.config, έάέ åãß÷íåέ áí ððŰñ÷åέ Þ ù÷έ óðíååìŰñí ðέçέðñíεùåέí. Óå ìçíŷíåðå áððŰ έáðåðέŷñííðåέ ððçí óåέñέάέÞ Þ ððçí áóùðåñέέÞ έííóùεά, Þ åέùíå έάέ óðέð äŷí, áíŰεíåå ìå ðçí åðέειãÞ ðíð Ű÷åέ åβíåέ óðì /boot.config.

ΆδέειãŰð	Όì ìÞíðíå àìöáíßæåðåέ óðçí
έåìβå	åóùðåñέέÞ έííóùεά
-h	óåέñέάέÞ έííóùεά
-D	åóùðåñέέÞ έάέ óåέñέάέÞ έííóùεά
-Dh	óåέñέάέÞ έάέ åóùðåñέέÞ έííóùεά
-Þ, ðέçέðñíεùåέí óðíååìŰñí	åóùðåñέέÞ έííóùεά
-Þ, ÷-ùñßð ðέçέðñíεùåέí	óåέñέάέÞ έííóùεά

ÌåðŰ óå ðåñåðŰñí ìçíŷíåðå, έå ððŰñíåέ ìεå ìέέñÞ ðåŷóç ðñέí óå boot blocks óðíå÷-ßóíðí ðñðÞñííðåð ðì ðññðùðÞ åέέßíçóçð, έάέ ðñέí àìöáíεóóðíŷí ðåñέóóùðåñå ìçíŷíåðå ððçí έííóùεά. Óðù έåñíέέŰð óðíεÞεåð, ååí ÷-ñåέŰæåðåέ ìå åέåέùðåðå ðå boot blocks, åέέŰ ßóùð εŰεåðå ìå ðì έŰíåðå áððù åέå ìå ååååέεåßðå ùðέ ùεå åβíåέ ãðεíεóìŰñíå òùóðŰ.

ÐέŰóðå ðñέíåÞðñíå ðεÞεðñí åέðùð áðù ðì **Enter** ððçí έííóùεå åέå ìå åέåέùðåðå ðç åέååέέåóßå åέέßíçóçð. Óå boot blocks έå óåð ãùðÞóíðí åέå ðåñέóóùðåñåð ðέçñíðñíßð. Έå ðñŰðåέ ìå ååßðå έŰðέ ùðùð ðì ðåñåέŰðù:

```
>> FreeBSD/i386 BOOT
Default: 0:ad(0,a)/boot/loader
boot:
```

Άðåέçεåŷóðå ùðέ ðì ðåñåðŰñí ìÞíðíå àìöáíßæåðåέ åßðå ððçí óåέñέάέÞ έííóùεά, Þ ððçí åóùðåñέέÞ έííóùεά Þ έάέ óðέð äŷí, áíŰεíåå ìå ðέð åðέειãŰð ðñð Ű÷åέå ððì åñ÷-åβí /boot.config. Áí ðì ìÞíðíå àìöáíßæåðåέ ððçí òùóðÞ έííóùεå, ðέŰóðå **Enter** åέå ìå óðíå÷-ßóåðå ìå ðç åέååέέåóßå åέέßíçóçð.

Áí åðέέðíåßðå óåέñέάέÞ έííóùεå, åέέŰ ååí åεŰðåðå ðçí ðñíðñíðÞ óå áððÞí, ððŰñ÷åέ έŰðíέí έŰεèð óðέð ãðεíßóåð. Óðì ìåðåíŷ, åñŰððå -h έάέ ðέŰóðå **Enter** Þ **Return** (áy åβíåðåέ) åέå ìå ðåßðå ððì boot block (έάέ Űðåέðå ððì ðññðùðÞ åέέßíçóçð έάέ ðñí ððñÞíå) ìå åðέέŰñåέ ðç óåέñέάέÞ εŷñå åέå ðçí έííóùεå. Ìùέð ðì óŷóçíå ìåέέíÞóåέ, έíεðŰíðå ìåíŰ ðέð ãðεíßóåð åέå ìå åñåßðå ðñð åβíåέ ðì έŰεèð.

ÌåðŰ ðç ðññðùðç ðñð ðññðùðÞ åέέßíçóçð, åñßóέåóðå ððì ðñßðì óðŰåέí ðçð åέååέέåóßåð åέέßíçóçð έάέ Ű÷åέå åέùíå ðç åðíåðùðçðå ìå åðέέŰñåðå ìåðåíŷ ðçð åóùðåñέέÞð έάέ óåέñέάέÞð έííóùεåð, εŰðñíðåð ðέð έåðŰεέçåð ìåðååέçðŰð ðåñέåŰεέñíðð ððì ðññðùðÞ åέέßíçóçð. Άåßðå ðì ΌìÞíå 26.6.6.

### 26.6.4 Ðåñßεçøç

ΆåÞ έå åñåßðå ìεå ðåñßεçøç ðùí åέŰðññí ððέειãÞñí ðñð ðåñíðóέŰóðçέáy ðå áððÞ ðçí åñùðçðå, έάέ ðçí έííóùεå ðñð åðέέŰ÷έçåð ðåέέέŰ.

#### 26.6.4.1 ìç Ðåñßððùðç: ÷-åðå ΈŰóåέ ðì Flag 0x10 åέå ðç Έŷñå sio0

```
device sio0 at isa? port IO_COM1 flags 0x10 irq 4
```

ÁðέειάÝò óοί /boot.config	Έίíóüέα έáoÛ óç άέÛñέάέά óúí boot blocks	Έίíóüέα έáoÛ óç άέÛñέάέά óíò óíñòóòß άέέßíçóçò	Έίíóüέα óοίí ðòñßíá
έáíßá	άóòòáñέέß	άóòòáñέέß	άóòòáñέέß
-h	óάέñέάέß	óάέñέάέß	óάέñέάέß
-D	óάέñέάέß έάέ άóòòáñέέß	άóòòáñέέß	άóòòáñέέß
-Dh	óάέñέάέß έάέ άóòòáñέέß	óάέñέάέß	óάέñέάέß
-P, ðεçέòñíεüάεί óóíááíÝíí	άóòòáñέέß	άóòòáñέέß	άóòòáñέέß
-P, ÷-ùñßò ðεçέòñíεüάεί	óάέñέάέß έάέ άóòòáñέέß	óάέñέάέß	óάέñέάέß

**26.6.4.2 2ç Ðáñßðòóç: ÷-άòά ΈÝóάέ óí Flag 0x30 άέά óçí Έýñά sio0**

```
device sio0 at isa? port IO_COM1 flags 0x30 irq 4
```

ÁðέειάÝò óοί /boot.config	Έίíóüέα έáoÛ óç άέÛñέάέά óúí boot blocks	Έίíóüέα έáoÛ óç άέÛñέάέά óíò óíñòóòß άέέßíçóçò	Έίíóüέα óοίí ðòñßíá
έáíßá	άóòòáñέέß	άóòòáñέέß	óάέñέάέß
-h	óάέñέάέß	óάέñέάέß	óάέñέάέß
-D	óάέñέάέß έάέ άóòòáñέέß	άóòòáñέέß	óάέñέάέß
-Dh	óάέñέάέß έάέ άóòòáñέέß	óάέñέάέß	óάέñέάέß
-P, ðεçέòñíεüάεί óóíááíÝíí	άóòòáñέέß	άóòòáñέέß	óάέñέάέß
-P, ÷-ùñßò ðεçέòñíεüάεί	óάέñέάέß έάέ άóòòáñέέß	óάέñέάέß	óάέñέάέß

**26.6.5 ÓοíáíòεÝò άέά óçí Óάέñέάέß Έίíóüέα**

**26.6.5.1 Ñýειόç íááάέýòáñçò Óά ÷-ýòçóáò άέά óç Óάέñέάέß Έýñά**

Íε ðñíáðέέάáíÝíáò ñòεíßóάέò óçò óάέñέάέßðò έýñáò áßíáέ: 9600 baud, 8 bits, ÷-ùñßò έóíòεíßá (parity), 1 stop bit. Áí έÝέáòά íá áεεÛíáòά óçí ðñíáðέέάáíÝíç óá ÷-ýòçóáò óçò έίíóüέαò, Ý ÷-άòά óέò ðáñάέÛòòú áðέειάÝò:

- Άðáíáíáòάάεüòòßòάά óá boot blocks έÝóííóáò óç íáðάάεçòßß BOOT\_COMCONSOLE\_SPEED άέά íá ññßóáòά óçí íÝá óá ÷-ýòçóá έίíóüέαò. Άáßòά óí Òíßíá 26.6.5.2 άέά εáðòíñáñáßò íαçáßáò ó ÷-άòέέÛ íá óç íáðάάεçòðóέóç έάέ ááέáòÛóóáóç íÝúí boot blocks.

Áí ç áíáñáíðíßçóç óçò óάέñέάέßðò έίíóüέαò ááí áßíáòάέ íÝóú óçò áðέειάßðò -h, P áí ç óάέñέάέß έίíóüέα ðíò ÷-ñçóέííðíέáßòάέ áðú óíí ðòñßíá áßíáέ áέáóíñáòέέß áðú áòòß ðíò ÷-ñçóέííðíέáßòάέ áðú óá boot blocks, έá ðñÝðáέ áðßóçò íá ðñíóεÝóáòά óçí ðáñάέÛòòú áðέειάß óóí áñ ÷-áßí ñòεíßóáúí óíò ðòñßíá, έάέ íá íáðάάεüòòßòάά Ýíá íÝí ðòñßíá:

```
options CONSPEED=19200
```

- Óóέò áðέειάÝò áέέßíçóçò óíò ðòñßíá, ÷-ñçóέííðíέßòά óí -s. Ìðíñáßòά áðßóçò íá ðñíóεÝóáòά óçí áðέειάß -s óοί /boot.config. Ç óάέßáá manual boot(8) ðáñέÝ ÷-άέ íέá έßóóá óúí òðíóççñέáüíáíúí áðέειάßí, έάέ ðáñέáñÛóáέ

ðùð íá ðεò ðñτòεÝóáðá óðτ áñ÷áβτ /boot.config.

- ΑτáñáτðτεΠóðá ðçτ áðέεττáΠ comconsole\_speed óðτ áñ÷áβτ /boot/loader.conf.

Άεά τά εάεóττòñáΠóáε áóðΠ ç áðέεττáΠ, εά ðñÝðáε áðβóçð τά εÝóáðá ðετÝò áεά ðεð áðέεττáÝò console, boot\_serial, εάε boot\_multicons óðτ βáετ áñ÷áβτ, ðτ /boot/loader.conf. ΔάñáεÙòù óáβτáðáε Ýτá ðáñÙááεáτá ÷ñΠóçð ðτò comconsole\_speed áεά áεεááΠ ðá÷ýðçðά ðçð óáεñέάεΠð εττúóεάð:

```
boot_multicons="YES"
boot_serial="YES"
comconsole_speed="115200"
console="comconsole,vidconsole"
```

### 26.6.5.2 ×ñçóεττðτεΠóðá ΟάεñέάεΠ Èýñá Áêòùð ðçð sio0 áεά ðçτ Èττúóεά.

Èá ðñÝðáε τά áðáτáτáðáεùððβóðá εÙðττεά ðñτáñÙττáðά áεά τά ÷ñçóεττðτεΠóðá ùð εττúóεά τεά óáεñέάεΠ èýñá áêòùð ðçð sio0. Ατ áεά τðτεττáΠðττá εüáτ εÝεάðά τά ÷ñçóεττðτεΠóðá Ùεεç óáεñέάεΠ èýñá, εά ðñÝðáε τά áðáτáτáðáεùððβóðá óá boot blocks, ðτ ðττòùðΠ áêεβτççðð εάε ðττ ðòñΠτá, τá ðττ ðñτðτ ττò óáβτáðáε ðáñáεÙòù.

1. ΑτáεðΠóðá ðττ ðçááβτ εηáεεά ðτò ðòñΠτá. (Άáβðá ðτ ÈáοÙεάετ 24)
2. Άðáτáñááóðáβðá ðτ áñ÷áβτ /etc/make.conf εάε εÝóðá ðçτ áðέεττáΠ BOOT\_COMCONSOLE\_PORT óðç áεάýεðτóç ðçð èýñáð ðτò εÝεάðά τά ÷ñçóεττðτεΠóðá (0x3F8, 0x2F8, 0x3E8 or 0x2E8). Ìðττáβðá τά ÷ñçóεττðτεΠóðá ττττ ðεð èýñáð sio0 ùð sio3 (COM1 ùð COM4). ÈÙñòðð ðττεάðεητ εðñητ, ááτ ðñτúεάεðáε τά εάεóττòñáΠóτττ. Άáτ ÷ñáεÙεáðáε τά ðòετβóðá ðçτ ðετΠ ðτò interrupt.
3. ΆçτεττòñáΠóðá Ýτá áñ÷áβτ ðñτετóçð ðñτóáñττòτÝτò ðòñΠτá, εάε ðñτòεÝóðá ðá εáðÙεεçεά flags áεά ðç óáεñέάεΠ èýñá ðτò áðέεðτáβðá τά ÷ñçóεττðτεΠóðá. Άεά ðáñÙááεáτá, áτ εÝεάðά ç sio1 (COM2) τά áβτáε ç εττúóεά:  

```
device sio1 at isa? port IO_COM2 flags 0x10 irq 3
```

Π

```
device sio1 at isa? port IO_COM2 flags 0x30 irq 3
```

Άáτ εά ðñÝðáε τά εÝóáðá flags εττúóεάð áεά ðεð Ùεεáð óáεñέάεÝò èýñáð.
4. Ìáðáεùððβóðá εάε ááεáðáóðΠóðá τáτÙ ðá boot blocks εάε ðττ ðττòùðΠ áêεβτççðð:  

```
# cd /sys/boot
# make clean
# make
# make install
```
5. Άðáτáτáðáεùððβóðá εάε ááεáðáóðΠóðá ðττ ðòñΠτá.
6. ΆñÙððá ðá boot blocks óðττ áβóετ áêεβτççðð ÷ñçóεττðτεΠóðá ðçτ bsdlable(8) εάε áêεετΠóðá τá ðτ τÝτ ðòñΠτá.

### 26.6.5.3 Άβóττáðò óðττ DDB Debugger τÝóùð ðçð ΟάεñέάεΠð Άñáττò

Ατ εÝεάðά τά áεóÝεεáðá óðττ debugger ðτò ðòñΠτá áðτ ðçτ óáεñέάεΠ εττúóεά (εÙðε ðτò áβτáε ÷ñΠóεττ áεά τά áêòáεÝóðá áεάáττòóεεÙ áðτ áðñáεñòóτÝτç ðτττεáóá, áεεÙ áðβóçð εάε áðέεβτáðττ áτ óááβεáðá εáðÙ εÙετò BREAK τÝóùð ðçð óáεñέάεΠð èýñáð!) εά ðñÝðáε τά ðáñεεÙááðá ðçτ ðáñáεÙòù áðέεττáΠ óðττ ðòñΠτá óáð:

```
options BREAK_TO_DEBUGGER
options DDB
```

### 26.6.5.4 Ἐπιθῆθη Ἀεουαῖο ὀφί Ὁ ἀνεπέε Ἐπιουέα

Αἱ εἰς ἀδου αἱ ἀβίαι ἀναβάδοι, βουδ ἰά ἐΥεῖα ἰά Ὑ÷ᾶδ Ἐπιθῆθη Ἀεουαῖο (login) ἰΥου ὀφδ Ὁ ἀνεπέεδ ἄναιδ, ὀπῆα δῖο ἰθῆναδ δῆΥῖ ἰά ἀβδᾶ ὀά ἰγῖγῖαδᾶ ἀεβίφφδ ἔε ἰά Ἀεὺἔεᾶδ ὀδῖ debugger ὀδῖ δῖδῖ ἰΥου ὀφδ Ὁ ἀνεπέεδ Ἐπιουέαδ. Ἐ ἀεῖεῖαδᾶ δᾶνεᾶ Ὑδᾶδᾶ δᾶνεᾶ Ὑδᾶδ.

Ἰὰ ἐΥδῖεῖ ὀδῖ Ὑεδᾶ ἔεῖ Ὑῖδ, ἀῖβῖδᾶ ὀῖ ἄν÷ᾶβῖ /etc/ttys ἔε ἄνᾶδᾶ ὀεδ ἄναιῖΥδ:

```
ttyd0 "/usr/libexec/getty std.9600" unknown off secure
ttyd1 "/usr/libexec/getty std.9600" unknown off secure
ttyd2 "/usr/libexec/getty std.9600" unknown off secure
ttyd3 "/usr/libexec/getty std.9600" unknown off secure
```

Ἰε ἔαδᾶ÷ᾶ ἄνᾶδᾶδ ἄδῖ ttyd0 ἄδῖ ttyd3 ἀῖδῖδῖδῖ÷ῖγῖ ὀδῖ COM1 ἄδῖ COM4. Ἀεῖ Ὑῖδᾶ ὀῖ off ὀᾶ on ἔε ὀφῖ ἔγῖα δῖο ἄδῖδῖδῖδῖ. Αἱ Ὑ÷ᾶδ Ἀεῖ Ὑῖδᾶ ὀφῖ ὀᾶ÷ῖδῖδῖ ὀφδ Ὁ ἀνεπέεδ ἔγῖαδ, ἔᾶ ÷ᾶεῖαδᾶ ἰά Ἀεῖ Ὑῖδᾶ ὀῖ std.9600 ἄδῖ ἰά Ὁ ἀνεπέε ἰᾶ ὀφῖ ὀᾶῖῖδῖ ἄῖδῖδῖ, δ.÷. std.19200.

Ἰῖεῖ ἔᾶ ἐΥεῖα ἰά Ἀεῖ Ὑῖδᾶ ἔε ὀῖ ὀγῖδῖ ὀῖδ ὀᾶῖδῖδῖ, ἄδῖ unknown ὀῖδ ὀᾶῖδῖδῖδῖ ὀγῖδῖ ὀῖδ Ὁ ἀνεπέε ὀᾶδ ὀᾶῖδῖδῖ.

Ἀῖγῖ Ἀεῖ Ὑῖδᾶ ὀεδ ἄδῖδῖδῖ, ἔᾶ δῖ Ὑῖδᾶ ἰά Ἀεῖ Ὑῖδᾶ ὀφῖ ἰῖδῖ kill -HUP 1 ἄδῖ ἰά ἰᾶῖδῖδῖδῖ.

### 26.6.6 Ἀεῖαῖ Ἐπιουέαδ ἰΥου ὀῖ Ὁ ὀῖδῖδῖ Ἀεβίφφδ

Ὁᾶ δῖδῖδῖδῖδῖ ἄῖδῖδῖδῖ, δᾶνεᾶ Ὑδᾶῖ δῖδῖ ἰά ἄδῖδῖδῖ ὀφῖ Ὁ ἀνεπέε Ἐπιουέα Ἀεῖ Ὑῖδᾶ ὀεδ ἄδῖδῖδῖδῖ ὀῖδ boot block. Ὁφῖ ἄῖδῖδῖδῖ, ἄβ÷ῖδῖδῖ δῖδῖ ἰθῆναδ ἰά ἔεῖδῖδῖδῖ ὀφῖ Ἐπιουέα ἄβῖδῖδῖδῖ ἐΥδῖδῖ ἰῖδῖδῖ ἔε ἰᾶᾶᾶδῖδῖδῖ δᾶνεᾶ Ὑεῖδῖδῖ ὀῖδ ὀῖδῖδῖ Ἀεβίφφδ. Ἐᾶδῖ ἰ ὀῖδῖδῖδῖ Ἀεβίφφδ ἔεᾶδῖδῖ ἄδῖ ὀῖ δῖδῖ ὀᾶῖδῖ ὀφδ ἔεᾶᾶᾶδῖδῖδῖ Ἀεβίφφδ, ἔε ἰᾶδῖ ὀῖ boot block, ἰε ἄδῖδῖδῖδῖ ὀῖδ ὀῖδῖδῖ Ἀεβίφφδ ὀδᾶνεᾶ÷ῖδῖ ὀᾶ ὀ÷ῖδῖ ἰᾶ ἄδῖδῖ ὀῖδ boot block.

#### 26.6.6.1 ἄῖδῖδῖ ὀφδ Ὁ ἀνεπέεδ Ἐπιουέαδ

Ἰθῆναδ ἄῖδῖδῖ ἰά ἔεῖδῖδῖδῖ ἰῖδῖ ἔᾶ ÷ᾶδῖδῖδῖδῖδῖ ὀφδ Ὁ ἀνεπέε Ἐπιουέα ὀῖδ ὀῖδῖδῖ Ἀεβίφφδ ἔε ὀῖδ δῖδῖδῖ δῖο ἔᾶ ὀῖδῖδῖδῖ, ἄᾶὙῖδῖδῖ ἄδῖδῖ ἰᾶ ἄᾶῖδῖ ὀῖδ /boot/loader.conf:

```
set console="comconsole"
```

Ἐ ἄῖδῖδῖ ἄδῖδῖ ἔᾶ ἰᾶᾶᾶδῖδῖδῖ, Ὑδ÷ᾶδ ἰᾶ ὀῖ boot block δῖο ὀδᾶδῖδῖδῖ ὀφῖ δῖδῖδῖδῖ ἄῖδῖδῖ.

Ἀβίαι ἔεῖδῖδῖ ἄᾶῖδῖ ἄδῖδῖ ἰά Ἀβίαι ὀφῖ ἄν÷ᾶβῖ /boot/loader.conf, ἄδῖ ἰά Ἀεῖ Ὑῖδᾶ ὀᾶ ἄν÷ᾶἔῖ ἰγῖγῖαδᾶ Ἀεβίφφδ ὀφδ Ὁ ἀνεπέε Ἐπιουέα.

Ἰὰ ὀῖ βᾶῖδῖ ὀᾶῖδῖ, ἰθῆναδ ἰά ἔεῖδῖδῖ ὀφῖ ἄδῖδῖδῖδῖ Ἐπιουέα ἄδῖ:

```
set console="vidconsole"
```

Αἱ ἄῖ ἔεῖδῖδῖδῖ ὀφδ ἰᾶᾶᾶδῖδῖδῖ δᾶνεᾶ Ὑεῖδῖδῖ console, ἰ ὀῖδῖδῖδῖ Ἀεβίφφδ (ἔε Ὑῖδῖδῖ ἰ δῖδῖδῖ) ἔᾶ ÷ᾶδῖδῖδῖδῖδῖδῖ ἰθῆναδῖδῖδῖ Ἐπιουέα Ὑ÷ᾶδ ἔεῖδῖδῖ ὀῖδ boot block ἰᾶ ὀφῖ ἄδῖδῖδῖ -h.

Ἰθῆναδ ἰά ἔεῖδῖδῖδῖ ὀφῖ Ἐπιουέα ὀῖδ /boot/loader.conf.local ὀῖδ /boot/loader.conf.

Ἀᾶδῖ ὀῖ loader.conf(5) ἔε δᾶνεᾶδῖδῖδῖδῖ δῖδῖδῖδῖ.

Όαίβύος: Όα άάίίίγί οόέαιπ, ι οίηουδπ άέέβίγος άάί Υ÷άέ άδέέιαπ άίδβόιέ÷α ιά όαί -π οίδ boot block, έάέ άάί οδύη÷άέ έύδείο δñüδίο ίά ββίάέ άδουίαόα άδέέιαπ ιάόάίγ άούόαήέέπδ έάέ οάέηέέπδ έίίούέά άίύέιαά ιά όαί δάηιόόβά δέαδñέιαβίδ.

**26.6.6.2 ×ñβός Οάέηέέπδ Έγñάδ Άέδύδ όαδ sio0 άέά όαί Έίίούέά**

Έά δñÝδάέ ίά άάίάίάάάέυδδβόάά όι οίηουδπ άέέβίγος βόδά ίά ÷ñαέίίδρεπράέ ίέά οάέηέέπδ έγñά άέάοίηάδέέπ άδύ όαί sio0 άέά όαί οάέηέέπ έίίούέά. Άέίέρεπβόά όαί άέάάέέάόβά δίδ δάηέñύδάάέ όδρ Όιπία 26.6.5.2.

**26.6.7 ΔέέάίΥδ Δάάβää**

Αάίέέπ έάΥά άβίάέ ίά άδέδñÝδάδάέ οά ύοίδδ όι άδέέδρίγί, ίά άαίέιόηάπρίοι άίάέάέάοιΥήδδ άίδδγñάδόςΥδ δίδ άάί άδάέδρίγί έύηδάδ άñάόέέπί έάέ δέαδñέιαέά. Άδδδδ÷βδ, άί έάέ δά δάηέόούδάñά όδδδπίαδά έά οάδ άδέδñÝδρίοί ίά άέέέίπράδδ ÷ñβδ δέαδñέιαέί, οά δρεγ έβää έά ιδñÝδάδά ίά άέέέίπράδδ ÷ñβδ έύηδά άñάόέέπί. Όά ια÷άίπίαδά ιά BIOS όαδ AMI ιδñίγί ίά ñδέιέδδρίγί ιά άδδδ όίι δñüδρ, άδέβδ άέέύάειδάδ όαί άδέέιαπ “graphics adapter” όδέδ ñδέιβόάέδ δίδ CMOS οά “Not installed.”

Όά δάηέόούδάñά ια÷άίπίαδά ύδδδδρί άάί δδρίόδγñβέιδρ άδδπ όαί άδέέιαπ, έάέ έά άñίαέίγί ίά άέέέίπρίοι άί άάί άύέάδά ίέά έύηδά άñάόέέπί. Όδά ια÷άίπίαδά άδδύ έά δñÝδάέ ίά άδπράδδά ίέά όδρε÷άέπαα (άέύια έάέ ιίü÷ñüα) έύηδά άñάόέέπί, άί έάέ άάί άβίάέ άδάñάβδόςοι ίά όοίάΥόάδά έάέ ιέυια. Ιδññβδά άδβόςδ ίά άρεέιύδδά ίά άάέάδδδπράδδά BIOS όαδ AMI.

# ΈαöÛεάεί 27 PPP έάέ SLIP

*Αίαüñßεçêá, αίαüειñáiñβεçêá, έάέ αίαίáñβεçêá άðü õü Jim Mock.*

## 27.1 Óýññç

Ôï FreeBSD äέάέÝóάέ ðεßεìð òñüðüí äέά ðç óýñññç áñüð ððñεñέóðß ìá Ýñá Ûεεñ. Άέά ìá äðέóý ÷ áðá óýñññç ìÝóü modem óðï Internet ß óá Ýñá Ûεεñ áβέòðï, ß äέά ìá äðέòñÝòáòá óá Ûεεñòò ìá óññáäεñýñ ìÝóü ðïð óòóðßñáðïð óáò, áðáέðáßðάέ ç ÷ ñßóç PPP ß SLIP. Ôï έáöÛεάεί áòðü ðñéññÛóáέ έäððñññðò õñ ðñüðñ ñýεìέóçò ðñ ðññáðÛñ ððçññáóéñ ìáé ÷ ñßóç ìÝóü modem.

Άõñý äέάáÛóáðá áòðü ðï έáöÛεάεί, έá ìÝññáð:

- Dùò ìá ñðèìβóáðá ðï PPP ÷ ñßóç (User PPP).
- Dùò ìá ñðèìβóáðá ðï PPP ðññßñ (Kernel PPP).
- Dùò ìá ñðèìβóáðá ðï PPPoE (PPP ìÝóü Ethernet).
- Dùò ìá ñðèìβóáðá ðï PPPoA (PPP ìÝóü ATM).
- Dùò ìá ñðèìβóáðá Ýñá ðñέÛóç έάέ äñðççñáðçðß SLIP.

Ðñέñ äέάáÛóáðá áòðü ðï έáöÛεάεί, έá ðñÝðάέ:

- ìá áβóðá äñέέáέüñÝñò ìá ðç äáóέéß ñññεññáá ðñ äέέòýññ.
- ìá έáóáññáßðá ðέò äáóέéÝð Ýññέáð έάέ ðï óéñðü ðñ äðέεñäέéñ ðññáÝóáññ έάέ ðïð PPP έάέ/ß SLIP.

Ûðññá ìá áññññðέÝóðá ðñέá áβñáέ ç äáóέéß äέáòññÛ ìáðáñý ðïð PPP ÷ ñßóç έάέ ðïð PPP ðññßñ. Ç áðÛñççç áβñáέ áðéß: ðï PPP ÷ ñßóç áðñññññáÛáðáέ óá äáññÝñá áέóüññò έάέ äññññò ìÝóü ðñññññññÛðñ ÷ ñßóç (userland) áñóß äέáñÝóñ ðïð ðññßñ ðïð έάέòñññέéñý. Άòðü ðññέáέáß έÛðñέáð äðέáññýñóáέð έüñ ðçð áñðέáññáðß äáññÝññ ìáðáñý ðïð ðññßñ έάέ ðçð áòáñññáðß ÷ ñßóç, äέéÛ äðέòñÝðάέ έáòÛ ðñέý ðéñ ðεñýóέá (áðü Ûðñçç äññáòñððò) ðεñðñßçç ðïð PPP ðññòñεñέεñò. Ôï PPP ÷ ñßóç ÷ ñçóéññðñέáß ðç óòóέáðß tun äέá ðçñ äðέéñéñññá ìá ðñÝññ έüòñ, ññ ðï PPP ðññßñ ÷ ñçóéññðñέáß ðçñ óòóέáðß ppp.

**Óçññáßòç:** Óá üéñ ðï έáöÛεάεί, ðï PPP ÷ ñßóç έá áñáéÝññáðáέ áðéÛ ðò **ppp** áέòüð έάέ áñ ÷ ññέÛäέáðáέ ìá áβñáέ äέÛéñέóç óá ó÷Ýç ìá Ûεεñ έñέáέíέéü PPP üðü ðï **pppd**. Άέòüð áñ áñáéÝññáðáέ äέáòññáðééÛ, üέáð ìέ áñðñέÝò ðïð áñçáñýñóáέ óðï έáöÛεάεί áòðü έá ðñÝðάέ ìá äέðáéñýñóáέ ðò root.

## 27.2 ×ñçóέéñðñέñíóáò ðï PPP ×ñßóç

*Άññññβεçêá έάέ ääέðéβεçêá áðü ðñ Tom Rhodes. Άñ÷έéß óññáέóññÛ ðïð Brian Somers. ìá ðç äñðéáέá ðñ Nik*

Clayton, Dirk Frömberg, έάέ Peter Childs.

## 27.2.1 PPP ×ñΠόδς

### 27.2.1.1 ΔññιὺδιεΎοάέ

Όι έάβιαñ άόδὺ ΔññιὺδιεΎοάέ ὡδέ Ύ÷άόά όά ΔάñάέŪδὺ:

- Έτραñέάοιὺ όά εŪδιεί Δάññ÷Ύά Ūδςñάόέπí Internet (ISP) όοñ ιδιβí όοñάΎάόά ÷ñςόέñιδιέπíόάδ PPP.
- íά modem Π Ūέες όόόέάδΠ όοñάñΎίς όοñ όύόδςíά όάδ, έάέ ñδελείοíΎίς όὺόδŪ πρόά íά όάδ άδέδñΎδάέ íά όοñάέάβόά όοñ ISP όάδ.
- Όιόδ άñέέñγδ έέΠόδς άέά όñ ISP όάδ.
- Όι ὡññά ÷ñΠόδς (login) έάέ όñ έὺάέέὺ όάδ (password). Άβόά έάñíέέὺ ὡññά έάέ έὺάέέὺ (όýδιō UNIX) Π Ύíά άάýαìδ ñññάόìδ / έὺάέέíý όýδιō PAP Π CHAP.
- Όέδ IP άέάόέýíόάέό άñὺδ Π Δάñέόόὺδάñññί άέάέñέόδπí ññŪδὺñ (DNS). ŪδóέñεñάέŪ, ñ ISP όάδ έά όάδ άπóάέ άýñ όΎοíέάδ άέάόέýíόάέό. Άí άάí Ύ÷άόά διόέŪ÷έόδññ íβά, ñδιñάβόά íά άíñάñιδιέΠόάόά όςí άíόñέΠ enable dns όοñ ppp.conf έάέ όñ **ppp** έά ñδελίβόάέ όιόδ άέάέñέόδŪ ññŪδὺñ άέά όάδ. Όñ ÷άñάέδςñέόδέέὺ άόδὺ άíñάδŪόάέ άδñ όςí όδñόδΠñέίς όςδ άέάδñάñŪδάόόδς DNS άδñ όñ ISP όάδ.

Ū ISP όάδ άíñά÷ñΎíὺδ íά όάδ άπóάέ έάέ όέδ ΔάñάέŪδὺ Δέςñññññβάδ, άέέŪ άάí άβíάέ άíόάέπδ άδάñάβόδςόάδ:

- Ός άέάýέδíoς IP άέά όςí Δýές (gateway) όñ ISP όάδ. Ū Δýές άβíάέ όñ ñς÷Ūίςíά ñΎóὺ διō ñδιβíδ όοñάΎάόά, έάέ έά άδñόάέΎόάέ όςí ΔññάδέέάñΎίς άέάάñññΠ (default route) άέά όñ ñς÷Ūίςíά όάδ. Άí άάí Ύ÷άόά άόδΠ όςí Δέςññññβά, έά ÷ñςόέñιδιέςέάβ íέά άέέñíέέΠ, έάέ ὡόάí όοñάέάβόά έά εŪάάόά όςí έάñíέέΠ άέάýέδíoς άδñ όñ άέάέñέόδΠ PPP όñ ISP όάδ.

ΆόδΠ ς άέάýέδíoς IP άíάόŪñάόάέ ὡδ HISADDR άδñ όñ **ppp**.

- Ός ñŪóέά άέέόýñ (netmask) Δñō ΔñΎδάέ íά ÷ñςόέñιδιέΠόάόά. Άí ñ ISP όάδ άά όάδ όςí ΔάñΎ÷άέ, ñδιñάβόά ñά άόóŪέάέά íά ÷ñςόέñιδιέΠόάόά όςí όέñΠ 255.255.255.255.
- Άí ñ ISP όάδ ΔάñΎ÷άέ όόάόέέΠ άέάýέδíoς έάέ ὡññά όδñέñάέόδΠ (hostname) ñδιñάβόά íά ÷ñςόέñιδιέΠόάόά άόδŪ. ΆέάόññάόέέŪ, έά άόΠóññά όñ άδñάέñδóíŪññ όδñέñάέόδΠ íά άπóάέ ὡδñέά άέάýέδíoς IP έάññάβ έάóŪέέςς.

Άí όάδ έάβδññí εŪδιέέάδ άδñ όέδ άδάέόññññάñάδ Δέςñññññβάδ, άδέέñέñññΠόάά ñά όñ ISP όάδ.

**Όςíάβὺδς:** Όά ñέὺέέςñς όςí Δάññýόά άñὺδςόά, ΔñέέŪ άδñ όά Δάñάάάβάñάόά Δñō άάβ÷ññí όά Δάñέά÷ñññάά όññ άñ÷άβñññ ñδελίβόάññ, άβíάέ άñέέñςñΎíά άíŪ άñάññΠ. Íέ άñέέñññ άόδññ άñōδςñάόññýí όδςí Δάñññóβάός έάέ ός όόάΠόδς όñ εŪέά Δάñάάάβάñάόδñ, έάέ άάí ΔñΎδάέ íά άñάόñññ ñΎóά όοñ ΔñάññάόέέέŪ άñ÷άβñ. Άβíάέ άδβóς όςíάíδέέέŪ íά όςñάβόά ς όὺόδΠ όδññ÷έός όά εŪέά άñ÷άβñ, ñά ός ÷ñΠόδς όδςέñέάδπí (tabs) έάέ έάñπí άέάόδςñŪδὺñ.

### 27.2.1.2 Άόδὺñάδς ñýέìέός PPP

Όὺοí όñ ppp ὡοí έάέ όñ pppd (ς όέñδñβςός όñ PPP όά άδβδάññ δδñΠíά) ÷ñςόέñιδιέññýí όά άñ÷άβά ñδελίβόάññ όοñ έάóŪέñññ /etc/ppp. ñδιñάβόά íά άñάβόά Δάñάάάβάñάόά άέά όñ ppp ÷ñΠόδς όοñ έάóŪέñññ /usr/share/examples/ppp/.

H ηύειός οἷο ppp áðάέοάβ όçí ðñíðìðìβçόç áíñò áñέειύ áðu áñ÷άβá, áíἘειάά íà όέò áðάέòðóάέò óáò. Ὀί όέ έá áἘέάòά óá áòòἘ, áíáñòἘόάέ óá Ἐίá ðìóίóòù áðu òí áí í ISP óáð áðíáβάάέ óòάóέέἘò äέáòέýíóáέò IP (äçè. óáò ðáñἘ÷áέ íέá äέáýèòίóç IP ç ðìíβá ááí äέἘἘáέ) ð áðíáíέἘò (äçè. ç IP äέáýèòίóç óáò äέἘἘáέ éἘέá óìñἘ ðìò óíáἘáóóá óòí ISP óáò).

27.2.1.2.1 PPP έάέ ÓóáóέέἘò Äέáòέýíóáέò IP

Έá ÷ñáέáóóάβ íá ðñíðìðìέðóáòά òí áñ÷άβì ñòèìβóáùí /etc/ppp/ppp.conf. Έá ðñἘðáέ íá ìέἘáέé íá áòòù ðìò óáβíáóáέ ðáñáέἘòù:

**Όçíáβùòç:** Ἐέ áñáìἘò ðìò óáéáέðííòí íá : íáέéíýí όóçí ðñòç όððèç (áñ÷ð όçò áñáìðò) — üέáò íέ Ἐέέáò áñáìἘò έá ðñἘðáέ íá óòíέ÷έóéíýí íá òíí ðñùðì ðìò óáβíáóáέ, íá όç ÷ñòç έáíðí ð óóçèìéáòðí.

```
1 default:
2 set log Phase Chat LCP IPCP CCP tun command
3 ident user-ppp VERSION (built COMPILATIONDATE)
4 set device /dev/cuad0
5 set speed 115200
6 set dial "ABORT BUSY ABORT NO\\sCARRIER TIMEOUT 5 \
7      \"\" AT OK-AT-OK ATE1Q0 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
```

Άñáìð 1:

Άíááíññβáέ όçí ðñíáðέéááìἘίç έáóá÷ðñέóç. Ἐέ áíóìέἘò óá áòòð όçí έáóá÷ðñέóç áéòáέíýíóáέ áòòùíáóá, üòáí áéòáέáβòáέ òí ppp.

Άñáìð 2:

Άíáñáìðìέáβ όçí έáóááñáòð (logging) òùí ðáñáíἘòñùí. ¼óáí íέ ñòèìβóáέò ðìò Ἐ÷ìíí áβíáέ έáέóìññáýí έέáíðìέçðέéἘ, ç áñáìð áòòð έá ðñἘðáέ íá íέέñýíáέ όóçí ðáñáέἘòù:

```
set log phase tun
áέá íá áðìòáò÷έíýí íááἘέá íááἘέç óóá áñ÷άβá έáóááñáòðò.
```

Άñáìð 3:

ΈἘáέ óòí PPP ðùò íá áíáóἘñáέ ðέçñìòìñβáò áέá òíí ááòòù ðìò óóçí Ἐέèç íáñéἘ όçò óýíááóçò. Ç áέáέέέáóβá áòòð áβíáóáέ áí òí PPP Ἐ÷áέ ðñùáέçíá όóçí áέáðñááìἘòáòóç έáέ íέíèèðñùóç όçò óýíááóçò, ðáñἘ÷áέ ìíóáò íá áòòù òíí ðñùðì ðέçñìòìñβáò óòíí áðíáέñòòíἘíí áέá÷áέñέóòð. Ἐέ ðέçñìòìñβáò áòòἘò ðìñάβ íá áβíáέ ÷ñòçíáò όóçí áðβèòóç òìò ðñíáèðíáòìò.

Άñάιπ 4:

Άíάάíññβέάέ όç όδóέάδP όόçí ìðìβά άβίάέ όóíάάíÝíí όì modem. Ç όδóέάδP COM1 άβίάέ ç /dev/cuad0 έάέ ç COM2 άβίάέ ç /dev/cuad1.

Άñάιπ 5:

Έάέìññβέάέ όçí όά÷ýόçόά ìά όçí ìðìβά άδέέðìάβόά ìά όóíάάέάβόά. Άí άάí έάέόìòñάάβ ç όέìP 115200 (ç ìðìβά ðñÝðάέ ìά έάέόìòñάάβ ìά έÙέά ό÷άόέέÙ όýά÷ñííí modem), άíέέìÙόόά ìά 38400.

Άñάιπ 6 & 7:

Όì έάέόάñέέìçόέέè ðìò έά ÷ñçόέìðìέέçέάβ άέά όçí έέPόç. Όì PPP ÷ñPόόç ÷ñçόέìðìέέάβ όýíόάíç expect-send ðáññííέά ìά άδóP ðìò ÷ñçόέìðìέέάβ όì ðññáññάíá chat(8). Άάβόά όç όάέβάά manual άέά ðέçñìòññáð ό÷άόέέÙ ìά όέð άóíάόèùόçðάð άδóPð όçð άέPóόάð.

ΌçìάέPóόά ùέέ άδóP ç άíóìέP όóíά÷βέάέ όόçí άðññάíç άñάιπ άέά έüáìòð άíάάíùóέìùόçόάð. Άόòù ìðìñάβ ìά άβίάέ όά έÙέά άíóìέP όìò ppp.conf, άòùóíí όì \ άβίάέ ì όάέάðóάβìð ÷άñάέðPñάó όçð άñάιπð.

Άñάιπ 8:

Έάέìññβέάέ όì ÷ññíí óáññíάόέόìýý έüáñ άáñÙíάέάð όçð όýíάάόçð. Όά 180 άάóðáññüέάððά άβίάέ ç ðññíáðέέάάíÝíç όέìP, Ýóóέ ç άñάιπ άδóP άβίάέ άäP έάέάñÙ έάέέìóìçόέέP.

Άñάιπ 9:

ΈÝάέ όóì PPP ìά ñùðPóάέ όçí Ùέέç ðέáðñÙ άέά ìά άðέάάάέPóάέ όέð όìðέέÝð ñòέìβóάέð όìò resolver. Άí άέóáέάβóά όìðέέè ìέάέñέóóP ìññÙóùí (DNS), έά ðñÝðάέ ìά ìάóáðñÝðάóά άδóP όç άñάιπ όά ό÷üέέì P ìά όçí άóάέñÝóάðá.

Άñάιπ 10:

ΈάìP άñάιπ P óóá ç άíÙάíùόç όìò άñ÷άβìò ìά άβίάέ ðέì άýέìέç. ìέ έάρÝð άñάιπÝð άάñíýíóάέ άðù όì PPP.

Άñάιπ 11:

Άíάάíññβέάέ όçí έάόά÷Pñέόç άíùð ðáññ÷Ýά ìά όì ùíñá “provider”. ìðìñάβóά άäP ìά ÷ñçόέìðìέέPóάóá όì ùíñá όìò ISP óáð, Póðá άñáññóáñá ìά ìάέέìÙóá όç όýíάάόç óáð ìά όçí άðέέìP load ISP.

Άñάιπ 12:

ΈÝόάέ όìí άñέέèù έέPόçð άέά άóòù όìí ðáññ÷Ýά. ìðìñάβóά ìά έάέìñβóάóá ðìέέáðέìýð άñέέèýð έέPόçð ÷ñçόέìðìέέPíóáð Ùíù-έÙòù óáέάβá (: ) P όìí ÷άñάέðPñá (|) ùð άέá÷ùñέóóέέè. Ç άέάóìñÙ ìάóáíý ðùí áýí άέá÷ùñέóóέέPì ðáñέáñÙóáóάέ όóì ppp(8). ðáñέέçððέέέÙ, άí έÝέáðá ìά άìέέìÙάìíóάέ έðέέέέÙ ùέìέ ìέ άñέέèññ, ÷ñçόέìðìέέPóóá όçí Ùíù-έÙòù óáέάβá. Άí έÝέáðá ìά άβίáóάέ ðÙíóìòá áðùðáέñá έέPόçð όìò ðñPóìò άñέέèýý έάέ ìέ óðùέìέðìέ ìά άìέέìÙάìíóάέ ìññí άí ì ðñPóìò áðìóý÷άέ, ÷ñçόέìðìέέPóóá όì ÷άñάέðPñá ðáññ÷Ýóáóóçð. ìά άñÙóáóá ðÙíóìòá ùέì όì όýíñέì ðùí óçέáðùìέέPì άñέέèìPì ìά όìí óññðì ðìò óáβíáóáέ.

Άí ì άñέέèùð óçέáðPñìò ðáñέÝ÷άέ έάρìÙ, έá ðñÝðάέ ìά όìí ðáñέέέάβóáóá óá άέóááññάέέÙ ("). Ç ðáñÙέάέóç όìòð, άí έάέ άβίάέ áðèù óóÙέìá, ìðìñάβ ìά ðññέάέÝóάέ ðññάέPíáóá ðìò άáí ìðìñíýí ìά άíóìðέέóóìýí áýέìέá.

Άñάιπ 13 & 14:

Άíάάíññβέάέ όì ùíñá ÷ñPóόç έάέ όìí έüáέέè ðìò. ¼ðáí óóíáÝáóóá ÷ñçόέìðìέέPíóáð ðññòññìP óýðìò UNIX, ìέ óέìÝð άðóÝð άíάóÝññíóάέ άðù όçí άíóìέP set login ÷ñçόέìðìέέPíóáð ðέð ìάóáάέçðÝð \U έάέ \P. ¼ðáí

ὀίάΎάοά ιά ÷ ñΠόç PAP Π CHAP, ιέ οειΎὸ άὀδΎὸ ÷ ñçοείιθιέιγίόάε ὀçι þñά ὀçð ðέὀὀιθιβçόçð ὀάὀὀιὀçὀάὀ ὀιὀ ÷ ñΠόç.

ΆñάιιΠ 15:

Άί ÷ ñçοείιθιέάβὀά PPP Π CHAP, άάί έά ὀδἘñ ÷ άέ ὀὀί ὀçιάβι άὀὀι ḁñιὀñιḁΠ άέὀιιιὀ (login), έάέ έά ḁñΎḁάέ ίά ίάὀάὀñΎθάὀά ὀç ñάιιΠ άὀδΠ ὀά ὀ ÷ üέέι Π ίά ὀçι άὀάέñΎὀάὀά. Άάβὀά ὀçι ḁέὀὀιθιβçόç PAP έάέ CHAP άέά ḁñέὀὀὀιὀñάὀ έάḁḁὀñΎñάέά.

Ὀι άέὀάñέέιçðέέυι άέὀιιιὀ ÷ ñçοείιθιέάβ ὀγίόάίç ḁάñιιιέά ίά ὀι chat(8), υḁḁὀ ὀὀιάάβίάέ έάέ ίά ὀι άέὀάñέέιçðέέυι έέΠὀçð. Ὀὀι ḁάñἘάέάιά ίάὀ, ὀι άέὀάñέέιçðέέυι ÷ ñçοείιθιέάβὀάέ άέά ίέά ὀççñάὀβά ὀçι ιθιβά ç ὀὀιάάñβά άέὀιιιὀ ιιέἘάέέ ίά ὀçι ḁάñάέἘὀ:

```
J. Random Provider
login: foo
password: bar
protocol: ppp
```

Έά ÷ ñάέάὀάβ ίά άέἘἘίάὀά άὀὀι ὀι script άίἘἘάά ίά ὀέὀ άίἘἘέάὀ ὀάὀ. Ἔὀάί ññἘὀάὀά άὀὀι ὀι script ὀçι ḁñþç ὀñἘ, άάάέέέέάβὀά υḁέ Ύ ÷ άὀά άίάñάιθιέΠὀάέ ὀι άñ ÷ άβι έάὀάñάὀβὀ άέά ὀι “chat” þὀὀά ίά ιθιñάβὀά ίά ḁñιὀάέñβὀάὀά άί ç άέάέέέάὀβά άίάίþñέὀçð ḁñι ÷ υñἘάέ ὀιὀὀἘ.

ΆñάιιΠ 16:

ΈΎὀάέ ὀι ÷ ñιιιι άάñἘίάέάὀ (ὀά άάὀὀάñιιέάḁḁά) άέά ὀç ὀγίάάὀç. Άάþ, ç ὀγίάάὀç έά έέάβὀάέ άὀὀιιάὀά άί άάί ὀδἘñ ÷ άέ έβιçόç άέά 300 άάὀὀάñιιέάḁḁά. Άί άάί έΎέάὀά ίά άβίάὀάέ ḁιὀΎ ὀάñιάὀέὀιιὀð ὀçð ὀγίάάὀçð έυιιυ άάñἘίάέάὀ, έΎὀά άὀδΠ ὀç ὀειΠ ὀά ιçάΎί, Π ÷ ñçοείιθιέΠὀά ὀçι άḁέειΠ -dial ὀçç ñάιιΠ άίὀιέΠ.

ΆñάιιΠ 17:

ΈΎὀάέ ὀç άέάγέὀίὀç ὀçð άέάḁάὀβὀ. Ὀι άέὀάñέέιçðέέυι x.x.x. x έά ḁñΎḁάέ ίά άίὀέέάὀάὀὀάέάβ ίά ὀç άέάγέὀίὀç IP ḁιὀ ὀάὀ Ύ ÷ άέ άḁιιέάβ άḁυ ὀι ḁάñι ÷ Ύά ὀάὀ. Ὀι άέὀάñέέιçðέέυι y.y.y. y έά ḁñΎḁάέ ίά άίὀέέάὀάὀὀάέάβ ίά ὀçι άέάγέὀίὀç IP ḁιὀ Ύ ÷ άέ έάειñβὀάέ ι ISP ὀάὀ υḁ ḁγέç (gateway, ὀι ιç ÷ Ἐίçιά ὀὀι ιθιβι ὀὀιáΎάὀά). Άί ι ISP ὀάὀ άάί ὀάὀ Ύ ÷ άέ þρὀάέ άέάγέὀίὀç ḁγέçð, ÷ ñçοείιθιέΠὀά ὀçι 10.0.0.2/0. Άί ḁñΎḁάέ ίά ÷ ñçοείιθιέΠὀάὀά ίέά IP άέάγέὀίὀç ḁιὀ Ύ ÷ άὀά “ιάίὀΎθάέ”, άάάάέέέάβὀά υḁέ Ύ ÷ άὀά άçιέιθñάβὀάέ ίέά έάὀά ÷ þñέὀç ὀὀι /etc/ppp/ppp.linkup ὀγίὀιιά ίά ὀέὀ ιάçάβάὀ άέά ὀι PPP έάέ ἘὀιίέέΎὀ IP Ἐέὀέγίὀάέ. Άί ḁάñάέάβὀάὀά άὀδΠ ὀç ñάιιΠ, ὀι ppp άάί έά ιθιñάβ ίά άέὀάέέάὀάβ ὀά έάὀἘὀάὀç -auto.

ΆñάιιΠ 18:

ḁñιὀέΎὀά ίέά ḁñιάḁέέάñΎίç άέάññιΠ (default route) ḁñιὀ ὀι ιç ÷ Ἐίçιά ḁγέçð (gateway) ὀιὀ ISP ὀάὀ. Ç άέάέΠ έΎίç HISADDR άίὀέέάέβὀὀάὀάέ ίά ὀçι άέάγέὀίὀç ḁγέçð ḁιὀ έάειñβæάὀάέ ὀçç ñάιιΠ 17. Άβίάέ ὀçιάίὀέέυι ç ñάιιΠ άὀδΠ ίά άιὀάίβæάὀάέ ίάὀἘ ὀçι ñάιιΠ 17, άέάὀιιñάὀέἘ ὀι HISADDR άάί έά Ύ ÷ άέ άέυιιά έἘάάέ άñ ÷ έέΠ ὀειΠ.

Άί άάί άḁέέὀιιάβὀά ίά άέὀάέΎὀάὀά ὀι ppp ὀά έάὀἘὀάὀç -auto, έά ḁñΎḁάέ ίά ίάὀάέέίΠὀάὀά άὀδΠ ὀç ñάιιΠ ὀὀι άñ ÷ άβι ppp.linkup.

Άάί άβίάέ άḁάñάβçὀι ίά ḁñιὀέΎὀάὀά έάὀά ÷ þñέὀç ὀὀι άñ ÷ άβι ppp.linkup υḁάί Ύ ÷ άὀά ὀάάέέΠ άέάγέὀίὀç IP έάέ άέὀάέάβὀά ὀι ppp ὀά έάὀἘὀάὀç -auto. Ὀççι ḁάñβḁḁὀç άὀδΠ, ιέ έάὀά ÷ υñβὀάέὀ ὀάὀ ὀὀι ḁβίάέά άññιιέυιάççὀç άβίάέ ὀιὀὀΎὀ ḁñέί έάί ὀὀιάάέάβὀά. υḁὀὀ υḁὀὀι ίά έΎέάὀά ίά άçιέιθñάβὀάὀά ίέά έάὀά ÷ þñέὀç άέά ίά άέὀάέΎὀάὀά έἘἘιέά ḁñιñἘιιάὀά ίάὀἘ ὀçι άḁιέάὀἘὀάὀç ὀçð ὀγίάάὀçð. Έά ὀι άίçάβὀιὀιά άὀὀι άñάυὀάñά ὀά Ύίά ḁάñἘάέάιά ίά ὀι sendmail.

Ιθιñάβὀά ίά άñάβὀά ḁάñάάάβάιάὀά άñ ÷ άβιι ñὀέιβὀάυι ὀὀι έάὀἘἘιιά usr/share/examples/ppp/.



proxy óòí áñ÷áβí /etc/ppp/ppp.conf. Έá ðñÝðáέ áðβόçð íá áðέáááέðρσáðá ùðέ òí áñ÷áβí /etc/rc.conf ðáñέÝ÷áέ óá ðáñáέÛòù:

```
gateway_enable="YES"
```

**27.2.1.2.4 ðíέí getty;**

Ç áíùçðά Õðçñáóβά Άέóüäíò ìÝòù Άðέέíäέέðð Óýíááóçð (dial in) ðáñÝ÷áέ íέá έάέð ðáñέñáóð ó÷áðέέÛ ìá ççí áíáñáíðíβçðç òðçñáóέπí áðέέíäέέέπí έέðρσáùí ÷ñçóέííðíέπíóáð ççí getty(8).

Íέá áíáέέäéðέέð óççí getty áβíáέ ç mgetty (<http://www.leo.org/~doering/mgetty/index.html>), íέá ðέí Ýíððíç Ýέäíóç óçð getty, ç ìðíβá Ý÷áέ ó÷ááέáóðáβ áέá íá έáìáÛíáέ òðùέí ðέð áðέέíäέέÝð ãñáìÝð.

Óá ðέáííäéððíáðá óçð mgetty áβíáέ ùðέ áðέέíäέέíáβ áíáñáÛ ìá óá modem, òí ìðíβí óççíáβíáέ ùðέ áí ç έýñá áβíáέ áðáíáñáíðíέçíÝíç óòí /etc/ttys, òí modem óáð äáí έá áðáíðρσáέ óççí έέβçð.

ÌáðáááíÝóðáñáð áέäüóáέð óçð mgetty (áðü ççí 0.99beta έάέ ìáóÛ) òðíóçññβæíòí áðβόçð áððüìáç áíβ÷íáðçç PPP streams, áðέòñÝðííóáð óòíòð ðáέÛðáð óáð ðñüóááçç óòíí áíððçñáðçðð ÷ññò ÷ñðçç scripts.

ΆέááÛóðá ççí áíùçðά Mgetty έάέ AutoPPP áέá ðáñέóóüðáñáð ðççñííòñβáð ó÷áðέέÛ ìá ççí mgetty.

**27.2.1.2.5 ¶ááέáð áέá òí PPP**

ÕðóέíäέέέÛ, ç áέðÝέáçç óçð áíðíέðð ppp ðñÝðáέ íá áβíáðáέ ùð ÷ñðóçð root. Áí ùðóüóí έÝέáðá íá áðέòñÝðáðá ççí áέðÝέáçç óíò ppp óá έáðÛóðáçç áíððçñáðçðð ùð έáñíέέüð ÷ñðóçð (ìá òíí ðñüðí ðíò ðáñέñáñÛóáðáέ ðáñáέÛòù) έá ðñÝðáέ íá áðρáðá óá áððü òí ÷ñðóçç óá έáðÛέέçέá áέέέέπíáðá áέá íá áέðáέáβ òí ppp, ðñíóέÝòííóáð òíí óççí ñÛáá network óòí áñ÷áβí /etc/group.

Έá ðñÝðáέ áðβόçð íá òíòð áðρáðá ðñüóááçç óá Ýíá ð ðáñέóóüðáñá ðíðíáðá òíò áñ÷áβíò ñðèìβóáùí, ÷ñçóέííðíέπíóáð ççí áíðíέðð allow:

```
allow users fred mary
```

Áí ÷ñçóέííðíέπíóáðá ççí áðέέíäέέð áððð óòí ðíðíá default, έá áðρáðá óá áððíýð òíòð ÷ñðóçð ðñüóááçç óá ùέáð ðέð ñðèìβóáέð.

**27.2.1.2.6 Έáέýçç PPP áέá × ñðóðáð ìá ΆðíáíέέÛ IP**

Άçìέíðñáðρσá Ýíá áñ÷áβí ìá òí ùíñá /etc/ppp/ppp-shell òí ìðíβí íá ðáñέÝ÷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 ἀδου έά δñÝðάέ ίά άβίάέ άέδάέÝόει. ἈçίείονάΠρόά όρñά Ýίά όδιάρέέέυ άάόιυ διό ίά πñÛæάδάέ ppp-dialup ÷ñçόείιδιέβίόάδ όέδ δάñάέÛόυ άίόιεÝð:

```
# ln -s ppp-shell /etc/ppp/ppp-dialup
```

Έά δñÝðάέ ίά ÷ñçόείιδιέβίόάδ άδου όι script ùδ όι έÝέδóòð άέά üειòδ όιòδ dialup ÷ñΠόάδ. Ἀπ όάβίάδάέ Ýίά δάñÛάάέάιά όιò /etc/passwd άέά Ýίά ÷ñΠόόç dialup ίά üññά pchilds (έδιçέάβδά üδέ άάί δñÝðάέ ίά όπιδιδιέάβδά Ûιάόά όι άñ÷άβι όυί έùάέέβί, άέέÛ ίÝόυ όçδ άίόιεΠδ vipw(8)).

```
pchilds:*:1011:300:Peter Childs PPP:/home/ppp:/etc/ppp/ppp-dialup
```

ἈçίείονάΠρόά Ýίά έάδÛέίαι /home/ppp δññίόáÛόει άέά άíÛάίυόç άδύ üειòδ, ί ιδιβιò έά δάñέÝ÷άέ όά δάñάέÛόυ έάρÛ άñ÷άβι:

```
-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 ιδιβά άιδιραβιόί όçί άιòÛίέόç όιò ίçίγιάόιò άδύ όι άñ÷άβι /etc/motd.

### 27.2.1.2.7 Έάέýόç PPP άέά ×ñΠόόάδ ίά Óόάόέέυ IP

ἈçίείονάΠρόά όι άñ÷άβι ppp-shell üδùδ όάβίάδάέ δάñάδÛí, έάέ άέά έÛέά έιáάñέάόιυ ίά όόάόέέυ IP, άçίείονάΠρόά Ýίά όδιάρέέέυ άάόιυ δññò όι ppp-shell.

Ἀέά δάñÛάάέάιά, άί Ý÷άδά όñάέδ δάέÛόάδ dialup, όιòδ fred, sam, έάέ mary, όόιòδ ιδιβιòδ άέόάέάβδά άññüέüάçόç /24 CIDR, έά δñÝðάέ ίά άñÛόάδ όά δάñάέÛόυ:

```
# 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
```

Ἀέά έÛέά έιáάñέάόιυ ÷ñΠόόç dialup, έά δñÝðάέ ίά ñδειέόδάβ όι έÝέδóòð όόι όδιάρέέέυ άάόιυ διό άçίείονάΠέçέά δάñάδÛí (άέά δάñÛάάέάιά ί όδιάρέέέυδ άάόιυδ άέά όι έÝέδóòð όιò ÷ñΠόόç mary έά δñÝðάέ ίά άβίάέ ί /etc/ppp/ppp-mary).

### 27.2.1.2.8 Νýèιέόç όιò ppp.conf άέά ×ñΠόόάδ ίά Ἀόίáíέέυ IP

Οἱ άñ÷άβι /etc/ppp/ppp.conf έά δñÝðάέ ίά δάñέÝ÷άέ έÛόέ άίόβόδιέ÷ί ίά όι δάñάέÛόυ:

```
default:
    set debug phase lcp chat
    set timeout 0

ttyd0:
    set ifaddr 203.14.100.1 203.14.100.20 255.255.255.255
    enable proxy

ttyd1:
    set ifaddr 203.14.100.1 203.14.100.21 255.255.255.255
    enable proxy
```

**Όχιάβύος:** Ç óðïß÷έός άβιάέ όçιάίόέêß.

Άέά εÛεά όóíääñßá, öññöþíáóáέ ç áñúóçóá default : . Άέά εÛεά äñáñß dialup ðïö áñáñáñðíεάβóóáέ όðï /etc/ttys, έά ðñÝðáέ íá äçìεíññáßóóá íέά έάóá÷ßñέός ùñέά íá áóòß ðïö óáβíáóáέ ðáñáðÛúú áέά όï ttyd0 : . ÊÛεά äñáñß έά ðñÝðáέ íá ðáβññíáέ íέά ïñááέêß äέáyέðïç IP áðu όï áðuεáíá óúí IP áέáðέýíóáúí ðïö ðñññßæñíóáέ áέά όïòð äðíáíέέéýð ÷ñßóóáð.

**27.2.1.2.9 Ñýèìέός όïö ppp.conf áέά ×ñßóóáð íá Óóáóέéü IP**

Άέóóð áðu óá ðáñέá÷ùíáíá ðïö ððñááβáíáóïð /usr/share/examples/ppp/ppp.conf έά ðñÝðáέ íá ðñíóεÝóáóá íέά áñúóçóá áέά έάεÝíá áðu όïòð ÷ñßóóáð dialup óðïòð ïðñíòð Ý÷áέ áðñáñέáß óóáóέéü IP. Έά όóíá÷βóíçíá íá όï ðáñÛááέáíá íáð íá όïòð ÷ñßóóáð 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 äñ÷áβí /etc/ppp/ppp.linkup έά ðñÝðáέ áðβóçð íá ðáñέÝ÷áέ ðεçññïññßáð äñññεüäçóçð áέά εÛεά ÷ñßóç íá óóáóέéü IP (áí áðáέóáβóáέ). Ç ðáñáέÛóò äñáñß έά ðñíóεÝóáέ íέά áέáäññß ðñíð όç áέáyέðïç áέέóýñö 203.14.101.0/24 ïÝóú όçð óýíááóçð ppp όïö ðáεÛóç.

```
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
```

**27.2.1.2.10 mgetty έάέ AutoPPP**

Ç ñýèìέός έάέ íáóááεþóóέός ðïö mgetty íá áñáñáß όçí áðέεíäß AUTO\_PPP, έá áðέóñÝóáέ óóçí mgetty íá áíέ÷íáýáέ όçí ðÛóç LCP óúí óóíáÝóáúí PPP έάέ íá áέóáέáß áóóúíáóá Ýíá εÝέóóïð ppp. Ûóóúóí, έáεþð íá áóóú όñ ðñúðñ äáñ áñáñáñðíεάβóóáέ ç ðññáðέéääñÝç áέñεíðεβá ïññáóïð ÷ñßóç έάέ εüáέééý, áβíáέ áðáñáβóçðí íá äβíáέ ðέóóïðñíβçç όúí ÷ñçóðþí íá όç ÷ñßóç PAP Þ CHAP.

Ç áñúóçóá áóòß ðññúðñεÝóáέ ùóε ï ÷ñßóçð Ý÷áέ ððεíβóáέ, íáóááεüðóβóáέ έάέ äáέáóáóòß íá áðέóð÷βá íέá Ýέäñç όçð mgetty íá όçí áðέéíäß AUTO\_PPP (Ýέäñç v0.99beta Þ íáóááñÝóóáñç).

Äáááέéüεáβóá üóε όï äñ÷áβí óáð /usr/local/etc/mgetty+sendfax/login.config ðáñέÝ÷áέ óá ðáñáέÛóò:

```
/AutoPPP/ - - /etc/ppp/ppp-pap-dialup
```

Άóóú έá ðáε óóçí mgetty íá áέóáέÝóáέ όï script ppp-pap-dialup áέá óέó PPP óóíáÝóáέð ðïö áíέ÷íáýέçέáí.

ΆçìέìòñāΠρόά Υία άñ÷άβì ìά òì ùññά /etc/ppp/ppp-pap-dialup òì ìðìβì έά ðñέΥ÷άέ ðά áέüέìòέά (òì άñ÷άβì έά ðñÝðáέ ìά άβìάέ áέòάέΥóέì):

```
#!/bin/sh
exec /usr/sbin/ppp -direct pap$IDENT
```

Άέά έÜέά ãñáñΠ dialup ðìò άβìάέ áññáñìðìέçìÝíç óòì /etc/ttys, άçìέìòñāΠρόά ìέά áíòβóòìέ÷ç έάóά÷βñέóç óòì άñ÷άβì /etc/ppp/ppp.conf. Ç έάóά÷βñέóç áðòΠ ìðìñáβ ìά óðìðÜñ÷άέ ÷ùñβò ðñüáέçìά ìά áóðÝð ðìò ìñβóáìά ðáñáðÜñ.

```
pap:
  enable pap
  set ifaddr 203.14.100.1 203.14.100.20-203.14.100.40
  enable proxy
```

ΈÜέά ÷ñΠρόóç ðìò áέóÝñ÷άóάέ ìά áóòü òì ðñüðì, έά ðñÝðáέ ìά áέάέΥóáέ ùññά ÷ñΠρόóç/έüáέέü óòì άñ÷άβì /etc/ppp/ppp.secret. ΆìáέέáέòέέÜ, ìðìñáβóá ìά ðñìóέÝóáòá òçì ðáñáέÜòü áðέέìñΠ βρόά ìά άβìάóáέ ðέóóìðìβçóç óùì ÷ñçóðìíÝóù PAP ìά áÜóç ðά óòìέ÷άβά ðìò άñ÷άβìò /etc/passwd.

```
enable passwdauth
```

Άì έÝέáðά ìά áðìñáβóáòá óáóóέέü IP óά έÜðìέìòð ÷ñΠρόóðò, ìðìñáβóá ìά έáέìñβóáòá òçì áέáýέòìóç ùò ðñβòì ùñέóìά óòì άñ÷άβì /etc/ppp/ppp.secret. Άέά ðáñáääáβáìάóά, äáβóá òì άñ÷άβì /usr/share/examples/ppp/ppp.secret.sample.

### 27.2.1.2.11 ΆðáέòÜóáέò MS

Άβìάέ áòìάóùì ìά ñòèìβóáòá òì PPP βρόά ìά ðáñÝ÷άέ áέáðέýìóáέò DNS έάέ NetBIOS έáðÜ áðάβóçóç.

Άέά ìά áññáñìðìέçìΠρόáòá áóðÝð ðέò áðáέòÜóáέò ìά òçì Ýέäìóç 1.x ðìò PPP, έά ðñÝðáέ ìά ðñìóέÝóáòá ðέò ðáñáέÜòü ãñáñÝð óòì ó÷áðέέü òìΠìά ðìò /etc/ppp/ppp.conf.

```
enable msex
set ns 203.14.100.1 203.14.100.2
set nbns 203.14.100.5
```

Άέά òì PPP áðü òçì Ýέäìóç 2 έάέ ðÜñ:

```
accept dns
set dns 203.14.100.1 203.14.100.2
set nbns 203.14.100.5
```

Όì ðáñáðÜñü έά áçìññáβóáέ ðìòð ðáέÜóáòá áέά òì έýñέì έάέ äáðòáñáýìíóá áìòðçñáòçòΠ DNS, έάέ áέá òì áìòðçñáòçòΠ ìññÜòü NetBIOS.

Άðü òçì Ýέäìóç 2 έάέ ðÜñ, áì ðáñáέáέòέáβç ãñáñìΠ set dns, òì PPP έά ÷ñçóέììðìέçìΠρόáέ ðέò ãñáñÝð ðìò έά áñáέ óòì /etc/resolv.conf.

27.2.1.2.12 Δέοὀιῖβζόζ PΑΡ έάέ CHΑΡ

ΈῚῖέιέ ISP ἢέιβέιῖί ὀά ὀόόβιάόά ὀιῖὀ ἰά ὀΨῖέι ὀἢῖῖ, ἢόόά ὀι έἢἢῚὀέ ὀζ ὀύίάάόζ ὀῖὀ ὀό ÷ ἰέάβόάέ ἰά ὀζ ὀέόὀιῖβζόζ ὀῖὀ ÷ ἢἢόζ ἰά ἰβίάόάέ ἰΨῖὀ ὀῖ ἰζ ÷ ἰίέὀἢἢἢ PΑΡ ἢ CHΑΡ. Ἀί ὀὀἰάβίάέ ὀόὀῖ ὀόζ ἰέῖῖ ὀά ὀ ὀἢἢβὀὀὀ, ἰ ISP ὀά ὀ ἰά ὀά ὀόάβέάέ ὀἢὀἢὀἢ login ὑὀάί ὀὀἰάάέἰὀ, ἰέῖῚ ἰά ἰἢ ÷ βόάέ ὀὀὀἰἰὀ ὀζ ἰά ὀῚὀῖ PPP.

Ὀἢ PΑΡ ἰβίάέ έέἰὀὀἢἢ ὀόὀἰΨὀ ὀῖ CHΑΡ, ἰέῖῚ ζ ὀόὀῚέά ἰἢ ἰἢ ἰβίάέ ὀῖ ὀὀὀἰἰἢ ἰΨῖὀ, έάῖῖ ἰέ ἰῖἰἰἰἢ (ἰί έάέ ὀΨῖἢὀἰἰ ὑὀ έἰἢῖῖῖ έἰἰἢἢ) ἰὀὀἰἢὀἰἰἰ ἰῖἢ ἰΨῖὀ ὀἰἢῖἰὀ. ὀὀ ἰἢ ὀὀῚ ÷ ἰέ ὀἢἰἰὀὀῖῖ ὀὀἰὀὀὀὀ ὀῖ crackers ἰά “ἰἢὀὀἰὀὀὀὀ”.

× ἢζὀῖἢὀῖῖὀὀ ὑὀ ἰἰὀἢῚ ὀὀ ἰῖὀὀὀ PPP έάέ ὈὀὀῖΨὀ Ἀέὀὀῖὀὀὀ IP ἢ PPP έάέ ἈὀἰἰῖῖΨὀ Ἀέὀὀῖὀὀὀ IP, έά ὀἢΨὀἰ ἰά ἰἢὀὀὀ ἰέ ὀἢἰἰῚὀὀ ἰῖῖἰἰὀ:

```
13      set authname MyUserName
14      set authkey MyPassword
15      set login
```

Ἀἢἰἢ 13:

ζ ἰἢἰἢ ὀὀἢ έἰἢἢἰἰἰἰ ὀἢ ὑἢἢἰ ÷ ἢἢόζ ἰῖ ὀἰ PΑΡ/CHΑΡ. Έἰ ÷ ἢἰἰὀὀἰ ἰἰ ἰῖὀὀὀὀ ὀζ ὀὀὀἢ ὀῖἢ ἰῖ ὀἢ MyUserName.

Ἀἢἰἢ 14:

ζ ἰἢἰἢ ὀὀἢ έἰἢἢἰἰἰἰ ὀἢ ἰῖἰἰἰ ἰῖ ὀἰ PΑΡ/CHΑΡ. Έἰ ÷ ἢἰἰὀὀἰ ἰἰ ἰῖὀὀὀὀ ὀζ ὀὀὀἢ ὀῖἢ ἰῖ ὀἢ MyPassword. ὀὀὀ ἰΨῖὀ ἰἰ ὀἢὀὀΨὀὀὀ ἰῖ ἰῖἢἰ ἰἢἰἢ, ὑὀὀ ὀζ ὀἢἰἰῚὀὀ:

```
16      accept PAP
P
16      accept CHAP
```

ἰῖ ἰἰ ἰβίάέ ὀἰἢἢ ζ ὀἢὀὀὀ ὀὀ, ὑὀὀὀὀ ὀὀὀὀ ὀἢ PΑΡ ὑὀὀ ἰῖ ὀἢ CHΑΡ ἰἢὀὀὀὀ ἰῖὀῚ ὀῖ ὀἢἰἰὀὀἰἢ.

Ἀἢἰἢ 15:

ἰ ISP ὀὀ ἰἢ ἰἰ ὀὀὀὀὀ ὀὀὀὀὀὀὀ ἰἰ ἰῖὀὀὀὀ ὀὀἢ ἰὀὀὀἢὀὀὀ ἰἰ ÷ ἢζὀῖἢὀῖἰἰὀὀ PΑΡ ἢ CHΑΡ. Ἀῖ ὀἢ ἰῖἢ ὀὀὀ, έἰ ὀἢΨὀἰ ἰἰ ὀὀἰἢἢἢὀῖῖὀὀ ὀἢ ἰῖὀἢἢὀὀὀὀὀὀ “set login”.

27.2.1.2.13 ἈέῖῚῖῖὀὀ ἢἰὀὀ ὀὀ ἢὀῖἢὀὀὀ ὀῖὀ ppp

Ἀβίάέ ὀὀὀὀὀ ἰἰ ἰὀὀὀὀὀὀὀ ἰἰ ὀἢ ὀἢἢἢἢἢ ppp έἰῖὀ ἰὀὀὀὀὀὀ ὀὀἢ ὀἢἰὀὀὀὀὀ, ἰῖῚ ἰῖἢ ἰἰ ἰ ÷ ἰὀὀ ἢὀῖὀὀὀ ἰῖ ἰῖὀὀὀὀὀ ἰῖἢἢὀὀὀὀ ἰῖἢἢ ἰῖ ὀὀὀ ὀἢ ὀῖὀὀ. Ἀῖ ἰἰ ὀἢ ἰὀὀὀ ὀὀὀ, ὀἢὀὀΨὀὀ ὀζ ὀἢἰἰῚὀὀ ἰἢἢἢ ὀὀὀ ἢὀῖὀὀὀ ὀὀ:

```
set server /var/run/ppp-tun%d DiagnosticPassword 0177
```

Ἀὀὀ ἰῖὀὀ ὀἢ PPP ἰἰ “ἰῖὀὀ” ὀὀἢ έἰἢἢὀὀὀὀ UNIX socket ὀῖὀ ὀἢΨὀ, έἰῖ ἰἰ ἢὀὀὀὀ ὀῖὀ ὀἰὀὀ ἰῖ ἰῖἢὀὀὀ ὀῖὀ ἰῖἢὀὀὀὀ ὀἢἢἢ ἰὀὀὀὀὀὀ ὀζ ὀἢὀὀὀὀὀ. Ὀἢ %d ὀὀἢ ὑἢἢἰ, ἰὀὀὀὀὀὀὀὀὀ ἰἰ ὀἢ ἰἢὀὀὀ ὀζ ὀὀὀὀὀὀ tun ὀῖὀ ÷ ἢζὀῖἢὀῖἰἢὀὀὀ.

Ἀὀὀ ὀζ ὀὀὀὀ ὀῖὀ ἢὀῖὀὀὀ ὀἢ socket, ὀἢ ὀἢἢἢἢἢ pppctl(8) ἰὀἢἢ ἰἰ ÷ ἢζὀῖἢὀῖὀὀὀ ὀἢ scripts ἰἰ ὀἰ ἰὀἢἢ ἰὀὀὀὀὀὀ ἰἰ ἰῖỰ ÷ ἰῖὀὀὀὀὀὀ ὀἢ ὀἢἢἢἢἢ ppp ὀἢ ἰὀἢἢ ἰὀὀὀὀὀὀὀ Pἰζ.

### 27.2.1.3 ×ñçόείιθιέπιόαό όç Āóíáóüóçóá láóÜöñáóçò Āéáóέγíóáúí (NAT) óιö PPP

Όι PPP Ý÷áέ όçí έέάííóçóá íá ÷ñçόείιθιέΠόάέ áέέü óιö áóüóñέέü NAT, ÷üñβò íá áðάέóíγíóáέ íé έέάííóçóáò áíáέáóáγέóíóçò óιö ðññΠíá. Ìðñáβòá íá áíáñáíθιέΠόáóá áóðΠ όç έáέóíöñáβá lá όçí áέüέíöèç ãñáíìΠ óóí /etc/ppp/ppp.conf:

```
nat enable yes
```

ΆíáέéáέóέέÜ, óí NAT óιö PPP ìðñáβ íá áíáñáíθιέçέáβ íá όçí áðέέíáΠ -nat óóçí ãñáíìΠ áíóíεπí. Ìðñáβòá áέüíá íá áÜέáóá όçí áðέέíáΠ ppp\_nat óóí áñ÷áβí /etc/rc.conf. Ç áðέέíáΠ áóðΠ áβíáέ áíáñáíθιέçíÝíç áðü ðñíáðέέíáΠ.

Άí ÷ñçόείιθιέΠόáóá áóðü óí ÷áñáέóçñέóóέέü, ìÜέέíí έá ãñáβòá ÷ñΠόέíáð έáέ óέð ðáñáέÜóü áðέέíáÝò áέá óí /etc/ppp/ppp.conf, lá óέð ìðñáβò áíáñáíθιέέáβóáέ ç ðññεçόç áέóáñ÷üíáííí óóíáÝóáúí:

```
nat port tcp 10.0.0.2:ftp ftp
nat port tcp 10.0.0.2:http http
```

Π áí ááí áìðέóóáγáóóá έáέüέíö óí áíüóñέέü áβέðóí:

```
nat deny_incoming yes
```

### 27.2.1.4 ÓáέέéÝò Ñöèìβóáέò ÓóóðΠíáóìò

÷áóá ðéÝíí ñöèìβóáέ óí ppp, áέéÜ óðÜñ÷íóí ìáñέéÜ áέüíá ðñÜáíáóá óιö ðñÝðáέ íá εÜíáóá ðñéí íá áβíáέ Ýóíέíí áέá έáέóíöñáβá. ¼έá ðáñέéáíáÜííóí όçí áðáíáñááóβá óιö áñ÷áβíö /etc/rc.conf.

Ìáέέíπíóáð áðü όçí áñ÷Π óιö áñ÷áβíö áóóíγ, ááááέüèáβòá üóé áβíáέ ññέóíÝíç ç ãñáíìΠ hostname=, ð.÷.:

```
hostname="foo.example.com"
```

Άí í ISP óáð ðáñÝ÷áέ óóáóέéΠ IP áέáγέóíóç έáέ üñá, áβíáέ ìÜέέíí έáέýðáñí íá ÷ñçόείιθιέΠόáóá áóðü óí üñá üò üñá áέá óí íç÷Üíçíá óáð.

ØÜíðá áέá όç ìáóááέçðΠ network\_interfaces. Άí εÝέáðá íá ñöèìβóááð óí óýóóçíá óáð íá έáέáβ óíí ISP óáð έáðÜ áðáβóçόç, ááááέüèáβòá üóé óðÜñ÷áέ óóç εβóóá ç óóóéáðΠ tun0, áέáóíñáðέéÜ áóáέñÝóóá όçí.

```
network_interfaces="lo0 tun0"
ifconfig_tun0=
```

**Όçíáβúóç:** Ç ìáóááέçðΠ ifconfig\_tun0 έá ðñÝðáέ íá áβíáέ Üááέá, έáέ έá ðñÝðáέ íá áçíέíöñáçέáβ Ýíá áñ÷áβí ìá üííá /etc/start\_if.tun0. Όí áñ÷áβí áóðü έá ðñÝðáέ íá ðáñέÝ÷áέ όçí ðáñáέÜóü ãñáíìΠ:

```
ppp -auto mysystem
```

Όí script áóðü áέóáέáβòáέ έáðÜ όç áéÜñέáέá ñγέíέóçò óιö áέéðýíö, ìáέέíπíóáð Ýóóé óí ááβííá ppp óá έáðÜóóáóç áóðüíáóçò έáέóíöñáβáð. Άí áέáέÝóáðá εÜðíéí óíðέéü áβέðóí (LAN) áέá óí ìðñí óí íç÷Üíçíá áóðü Ý÷áέ óí ñüέí όçò ðýèçò, βóüò íá εÝέáðá áðβóçò íá ÷ñçόείιθιέΠόáóá όçí áðέέíáΠ -alias. Άáβòá όç óáέβáá manual áέá ðáñέóóüðáñáð έáððííÝñáέáð.

Άáááέüèáβòá üóé ç ìáóááέçðΠ áέá óí ðñüáñáíá router Ý÷áέ óáέáβ óóí ñö íÝóü όçò áðüíáíçò ãñáíìΠò óóí /etc/rc.conf:

```
router_enable="NO"
```

Άβιάέ όçíáíóέέü íá íçí íáέέíΠόάέ í ááβίííáò routed, í ìðíβíò óóíΠέüò áέááñÛóáέ óέò ðñíáðέέááíÝíáò óέíÝò ðíò ðβíáέá áññíëüäçóçò ðíò äçíέíòñáíýíóáέ áðu ðí ppp.

Άβιάέ ìÛέëí έάέΠ έáÝá íá áíáóóáέβóáòá üóέ ç áñáííΠ sendmail\_flags ááí ðáñέέáíáÛíáέ óçí áðέέíáΠ -ç, áέáóññáðέέÛ ðí sendmail έá ðñíóðáέáβ έÛέá ðüóí íá έÛíáέ áíááΠóçóç ðíò áέέòýíò, íá ðέέáíü áðíòÝέáóíá ðí íç÷Ûíçíá óáò íá áέòáέáβ óçέáòüíéέΠ óýíááóç (dial out). Ìðñíáβòá íá äíέéíÛóáòá:

```
sendmail_flags="-bd"
```

Ïí íáέíÝέóçíá ðíò ðáñáðÛíü, áβιάέ üóέ ðñÝðáέ íá áíáíááέÛóáòá ðí sendmail íá áðáíáíáòÛóáέ óçí íòñÛ ðüí íçíòíÛòüí, έÛέá óññÛ ðíò áðíέáέβóóáóáέ ç óýíááóç ppp, áñÛóííóáò:

```
# /usr/sbin/sendmail -q
```

εòüò èÝέáòá íá ÷ñçóέííðέΠóáòá óçí áíóíéΠ !bg óòí ppp.linkup áέá íá áβíáòáέ ðí ðáñáðÛíü áðòüíáóá:

```
1 provider:
2 delete ALL
3 add 0 0 HISADDR
4 !bg sendmail -bd -q30m
```

Áí áðòü ááí óáò áñÝóáέ, áβιάέ áóíáòüí íá ðñèíβóáòá Ýíá “dfilter” ðí ìðíβí íá áðíéüðòáέ óçí έβίçóç SMTP. Άáβòá óá ððíááβáíáóá áέá ðáñέóóüòáñáò έáððñÝñáέáð.

Ïí ìüí ðíò ìÝíáέ áβιάέ íá áðáíáέέέΠóáòá ðí íç÷Ûíçíá. ÌáòÛ óçí áðáíáέέβίçóç, ìðñíáβòá áβòá íá áñÛóáòá:

```
# ppp
```

έάέ Ýðáέóá dial provider áέá íá íáέέíΠóáòá óç óóíááñβá PPP, Π áí èÝέáòá ðí ppp íá áðíέáέέóóÛ óέò óóíááñβáò áðòüíáóá έÛέá óññÛ ðíò ððÛñ÷áέ έβίçóç ðñíò ðí áñüðáñέéü äβέòòí (έάέ ááí Ý÷áòá äçíέíòñáΠóáέ ðí script start\_if.tun0) ìðñíáβòá íá áñÛóáòá:

```
# ppp -auto provider
```

### 27.2.1.5 Ðáñβέçøç

Άέá íá áíáέáòáέáέβóóíá, óá ðáñáέÛòü áΠíáóá áβιάέ áðáñáβóçóá üóáí ááέáέέóóÛòá ðí ppp áέá ðñòç óññÛ:

Áðu óç íáñέÛ ðíò íç÷áíΠáòíò-ðáέÛòç:

1. Άáááέüéáβòá üóέ ðáñέέáíáÛíáóáέ óóí ððñΠíá óáò ç óðóéáòΠ tun.
2. Άáááέüéáβòá üóέ ððÛñ÷áέ ðí áñ÷áβí ðçò óóóéáòΠò tunw óóíí έáòÛέíáí /dev.
3. ÄçíέíòñáΠóáòá íέá έáóá÷ñéóç óóí áñ÷áβí /etc/ppp/ppp.conf. Ïí ðáñÛááέáíá áέá ðí pmdemand έá ðñÝðáέ íá áβιάέ áðáñéÝð áέá ðíòð ðáñέóóüòáñíòð ISPs.
4. Áí Ý÷áòá áóíáíέέΠ áέáýèóíóç IP, äçíέíòñáΠóáòá íέá έáóá÷ñéóç óóí /etc/ppp/ppp.linkup.
5. Áíçíáñβòá ðí áñ÷áβí /etc/rc.conf.
6. ÄçíέíòñáΠóáòá ðí script start\_if.tun0 áí ÷ñáέÛáóóá έέΠóç έáòÛ áðáβóçóç.

Άδύ όç ιάñέÛ όϊό άϊόδçñάόçόP:

1. Άάάέέεάβόά ύδέ δάñέέάιáÛίάόάέ όόϊí δόñPία όάδ ç όόόέάόP tun.
2. Άάάέέεάβόά ύδέ όδÛñ÷άέ όϊ άñ÷άβι όçδ όόόέάόPδ tunW όόϊí έάόÛέϊάι /dev.
3. ΆçìέϊόñáPόάά ίέα έάόά÷ñέόç όόϊ /etc/passwd (÷ñçόέϊíðϊέPίόάδ όϊ δñüáñáìιά vipw(8)).
4. ΆçìέϊόñáPόάά Ýία άñ÷άβι profile όόϊí δñϊούδέέü έάόÛέϊάι όϊό ÷ñPόόç, όϊ ίðïβι ίά άέόάέάβ όçί άίόϊέP ppp -direct direct-server P έÛðϊέά άίόβόόϊέ÷ç.
5. ΆçìέϊόñáPόάά ίέα έάόά÷ñέόç όόϊ /etc/ppp/ppp.conf. Όϊ δάñÛάέέάιá άέά όϊ direct-server έά δñÝðáέ ίά άβίάέ άðάñέÝð.
6. ΆçìέϊόñáPόάά ίέα έάόά÷ñέόç όόϊ /etc/ppp/ppp.linkup.
7. ΆίçìáñPόάά όϊ άñ÷άβι /etc/rc.conf.

## 27.3 ×ñçόέϊíðϊέPίόάδ όϊ PPP όϊό ΔόñPία

ΈÛðϊέά όϊPιáόά δñïÝñ÷ϊόάέ άδύ άñ÷έέP όόϊάέόόϊñÛ όύí Gennady B. Sorokopud έάέ Robert Huff.

### 27.3.1 Ñöèìβæïíόάδ όϊ PPP όϊό ΔόñPία

Δñεί ίάέέϊPόάάά ίά ñöèìβæïíόά όϊ PPP όόϊ ίç÷Ûίçìά όάδ, άάάέέεάβόά ύδέ όϊ pppd άñβόέάόάέ όόϊí έάόÛέϊάι /usr/sbin έάέ ύδέ όδÛñ÷άέ í έάόÛέϊάιð /etc/ppp.

Όϊ pppd Ý÷άέ άÿί έάόάόόÛόάέδ έάέόϊóñáβáδ:

1. Ûð δάέÛόçδ (“client”) — ύόάί έÝέάόά ίά όóïáÝόάόά όϊ ίç÷Ûίçìά όάδ ίά όïí Ýíü έüóïï ίÝóü όάέñέάέPδ όÿίááόçδ όÿίááόçδ P áñáïìPδ modem.
2. Ûð άïðδçñáόçδPδ (“server”) — όï ίç÷Ûίçìά όάδ άβίάέ όóïááïÝíí όóïí άβέðóï έάέ ÷ñçόέϊíðϊέPίόάέ άέά ίά όóïáÝόάέ Ûέεϊóð όðïέϊάέóðÝð, ÷ñçόέϊíðϊέPίόάδ όϊ PPP.

Έάέ όόέð άÿί δάñέððPόάέδ έά ÷ñáέάόάβ ίά άçìέϊόñáPόάάά Ýία άñ÷άβι άðέέϊáPí (/etc/ppp/options P ~/.ppprc άί όόï ίç÷Ûίçìά όάδ όδÛñ÷ϊóï δάñέόóüóáñïέ άδύ Ýίáð ÷ñPόάάδ ðïó ÷ñçόέϊíðϊέPίόάέ όϊ PPP).

Έά ÷ñáέάόάβόά άðβόçδ έάέ έÛðϊέϊ έϊάέóïέέü άέά ÷ñPόç ίά modem έάέ όάέñέάέÝð όóïáÝόάέδ (έάόÛ δñïòβιçόç όï comms/kermit), Pόάά ίά ίðïñáβόά ίά έάέÝόάάά έάέ ίά άðïέάόάόðPόάάά όç όÿίááόç ίά όïí άðïïáέñóóïÝíí άïðδçñáόçδP.

### 27.3.2 ×ñçόέϊíðϊέPίόάδ όϊ pppd ύð ΔάέÛόçδ

ΆάόέóïÝíí όά δέçñïïóïñβáð ðïó δάñáβ÷á í Trev Roydhouse.

Ìðïñáβόά ίά ÷ñçόέϊíðϊέPόάάά όï /etc/ppp/options ðïó óáβίáόάέ δάñάέÛóü, άέά ίά όóïááέάβόά όά ίέα áñáïìP PPP άίüð άïðδçñáόçδP óáñïáíóέέPí (terminal server) όçδ Cisco.

```
crtscts      # enable hardware flow control
modem        # modem control line
noipdefault  # remote PPP server must supply your IP address
```

```

        # if the remote host does not send your IP during IPCP
        # negotiation, remove this option
passive      # wait for LCP packets
domain ppp.foo.com      # put your domain name here

:remote_ip   # 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

```

Άέά ίά όόίάέάβόά:

1. ΈάέΥόόά όίί άδñáέñόóίÝíí áíððçñáόçð ÷ñçόέíðíεπίόάό όí **Kermit** (ð èÛðíεí Ûεεí ðñüáñáñá áέά modem) έάέ άέóÛááόά όí ùññá ÷ñðόç έάέ όíí èùáέéü óáò (ð üóέ Ûεεí ÷ñáέÛæáόάέ áέά ίά áñáñáíðíεðóááόά όí PPP όόίί άδñáέñόóίÝíí ððíεíáέόóð).

2. Άááβόά áðü όí **Kermit** (÷ùñβò ίά èéáβόáόά όç áñáñíð).

3. ðεçêòñíεíáðóáά όά ðáñáέÛòù:

```
# /usr/sbin/pppd /dev/tty01 19200
```

Άáááέúèáβόά üóέ ÷ñçόέíðíεáβόά όí óùòóü ùññá óðóέáððò έάέ όçί έáðÛεεçεç όá÷ýόçά.

Ï ððíεíáέóððò óáò áβίáέ ðρñá óóíáñíÝíò ìÝòù PPP. Áί ç óýíááόç áðíòý÷áέ, ìðñáβόά ίά ÷ñçόέíðíεðóááόά όçί áðέέíáð debug óóíí áñ÷áβí /etc/ppp/options έάέ ίά áéÝáíáόά όά ίçíýíáόά óóçί έííóüéá áέά ίά áίέ÷íáýóááόά όí ðñüáεçíá.

Ïí ðáñáέÛòù script /etc/ppp/pppup áððñááðíðíεáβ έάέ όά 3 óðÛáέá:

```

#!/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.dial
pppd /dev/tty01 19200

```

Ïí áñ÷áβí /etc/ppp/kermit.dial áβίáέ Ýíá script áέά όí **Kermit** όí íðíβí èÛíáέ όçί èéðόç έάέ όçί ðéóóíðíβεçόç όíò ÷ñðόç όóíí άδñáέñόóίÝíí ððíεíáέόóð (óóí óÝεíð áðóíý όíò áááñÛóíò, éá áñáβόά Ýíá ðáñÛááέáíá áέά Ýíá óÝóíεí script).

×ñçóéííðíéßóáâ òí ðáñáéÛòù script /etc/ppp/pppdown ãέα ίά άðíóðíáÝóáââ ôçí ãñáíìß 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
```

ΆέÝáíòá άί άέðáέáßóáέ áéúíá òí pppd, áéðáέßíóáð òí /usr/etc/ppp/ppptest, òí íðíßí έá ïíέÛæáé ίá òí ðáñáéÛòù:

```
#!/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
```

Άέα ίά έέáßóáðâ ôçí ãñáíìß, áéðáέÝóáâ òí /etc/ppp/kermit.hup, òí íðíßí έá ðñÝðáέ ίά ðáñéÝ÷άέ:

```
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

Ëέά άίάέέάέδóέέP ìÝέìäò ðìð ÷ ñçóέìðìέάß ðì chat άίóß áέά ðì kermit:  
 Óά ðáñáέÛòù äýì äñ ÷ áßá áðñέìýì áέά ðç äçìέìðñáßá ìέάð óýìááóçð 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 serve 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:

**Óçìáßòóç:** Òì ðáñáέÛòù έά ðñÝðáέ ìá ãñáóáß óá ìέά ìüì ãñáììP.

```

ABORT BUSY ABORT 'NO CARRIER' "" AT OK ATDTphone.number
CONNECT "" TIMEOUT 10 ogin:-\r-ogin: login-id
TIMEOUT 5 sword: password
    
```

Ëüέέð ðñìðìðìέPóáðá έάέ ááέáðáóðPóáðá óùóðÛ óά ðáñáðÛíü äñ ÷ áßá, ðì ìüì ðìð ÷ ñáέÛæáðáέ ìá έÛìáðá áßìáέ ìá áέðáέÝóáðá óçì άίóìέP pppd, ìá ðì ðñüðì ðìð óάßìáðáέ ðáñáέÛòù:

# pppd

### 27.3.3 × ñçóέìðìέPìðáð ðì pppd ùò ÁìððçñáðçðP

Òì /etc/ppp/options έά ðñÝðáέ ìá ðáñέÝ ÷ áέ έÛóέ άίðBóóìέ÷ì ìá ðì ðáñáέÛòù:

```

crtscts # 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

```

Ôĩ script /etc/ppp/pppserv ðĩð óáβĩáðáέ ðáñáέÛòù, έá ðáέ óôĩ **pppd** íá έάέôĩõñāβóάέ ùð áĩððçñāðçðβò:

```

#!/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

```

×ñçóέĩðĩεβóάά ôĩ ðáñáέÛòù script /etc/ppp/pppservdown áέά íá óóáĩáðβóάάôá ôĩĩ áĩððçñāðçðβò:

```

#!/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

```

Ôĩ ðáñáέÛòù script áέά ôĩ **Kermit** (/etc/ppp/kermit.ans) ðĩññāβ íá áĩáñāĩðĩέάβ έάέ íá áðáĩáñāĩðĩέάβ ôçĩ έάέôĩõñāβá áððüĩáðçð áðÛĩôçóçð óôĩ modem óáð.

```

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

```

Όιί ἀδιάνηοίΎί οδιειάροδP, ÷ñçóειιθιεάβθαέ οι script /etc/ppp/kermit.dial αέα έεPόç έάέ θεόοιθιβçόç οιθ ÷ñPόç. Έά θñΎθαέ ίά οι θηιθιθιεPθαδα όγιουία ία θεθ άίUαεαδ όαδ. Αῆεδα οι υίηά ÷ñPόç έάέ οι έυάέευ όαδ όά άοδου οι script. Έά ÷ñάέάοδάβ άδβόçò ίά άεεUίαδα όçi άñάιP αέα όçi άβόιαι (input) άίUειάά ία θεθ άδαίόPθαέο θιθ άβίάέ οι modem όαδ έάέ ί άδιάνηοίΎίθ οδιειάροδP.

```

;
; 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:

```

## 27.4 Αίόείãòρδέός ΔñîäëçìÛòùí óå ÓõíäÝóáέò PPP

*ÓõíäέóõîñÛ òîð Tom Rhodes.*

Ç áñúòçðá áðòρ έάέýððáέ ìáñέέÛ áðu óá ðñîäèðìáðá ðîð ìðñáß íá ðáñîðóέáóðîýí úðáí áßíáðáέ ÷ ñρç òîð PPP ìÝòù óýíááóçðò modem. Άέá ðáñÛäáέäìá, έá ðñÝðáέ íá ìÝñáðá ìá áèñßááέá óá ìçíýíáðá áέóúäîð ðîð έá äìóáíßóáέ òî óýóðçìá òî ìðìßì έάέáßðá. Ìáñέέìß ISP áßñîí òçí ðñîðñîðρ ssword, áñ Ûέέìέ áßñîí òçí password. Αí äáí Ý ÷ äðá äñÛøáέ óùóðÛ òî script áέá òî ppp, ç áðuðáέñá áέóúäîð έá áðîðý ÷ áέ. Ì ðέí óðíçέέóìÝñò ðñúðò ìá áέóóáέìáðρðáðá ìέá óýíááóç ppp, áßíáέ íá óðíäáέßðá ÷ áέñîèßìçðá. Ìέ ðεçñîðñßðò ðîð äìóáíßæñíðáέ ðáñáέÛòù, έá óáð ìäçáρóíðí áðìá ðñîð áðìá óðç ÷ áέñîèßìçðç áðìέáðÛóðáóç òçð óýíááóçð.

### 27.4.1 ΆέΥάιὐά όά Άñ ÷ άβά Όόόέάορί

Άί ÷ ñçóείιθιέάβόά θñιόάνιιόίΥίι θδñΠρία, άάάέέέέάβόά υέέ Υ ÷ άόά θάñέέŪάάέ όçί θάñάέŪόὐ άñάιιΠ όόι άñ ÷ άβι ñέειβόάυι όιθ δδñΠρία όάό:

```
device sio
```

Άί ÷ ñçóείιθιέάβόά όιθ δδñΠρία GENERIC, άάί ÷ ñάέŪάάόάέ ίά έŪίάόά έŪθιέά άέέάάΠ, έάέθδ ç όόόέάγç sio θάñέέάίάŪίάόάέ Παç όά άόόυι. Άθέθδ άέΥάιὐά όά ίçγίγιάόά όçδ dmesg άέά όçί όόόέάόΠ modem, ÷ ñçóείιθιέβίόάό όçί θάñάέŪόὐ άίόιέΠ:

```
# dmesg | grep sio
```

Έά θñΥθάέ ίά άάβόά έŪθιέά Υίñαι ό ÷ άόέέΠ ίά όέό όόόέάόŪό sio. θñüέάέόάέ άέά όέό έγñάδ COM θιθ ÷ ñάέάέυιάόόά. Άί όι modem όάό έάέόιθñάάβ υò όόθιθιέçίΥίç όάέñέάέΠ έγñά, έά θñΥθάέ ίά όι άάβόά ίά άίάόŪñάόάέ υò sio1, Π COM2. Άί όόιάάβίάέ άόόυι, άάί ÷ ñάέŪάάόάέ ίά άθάίάίάόάάέυòόβόάόά όιθ δδñΠρία όάό. Άί ç όάέñέάέΠ έγñά θιθ άίόέόθιέ ÷ άβ όόι modem όάό άβίάέ ç sio1 Π COM2 όόι DOS, ç άίόβόθιέ ÷ ç όόόέάόΠ modem έά άβίάέ ç /dev/cuad1.

### 27.4.2 × άέñιέβίçόç Όύίάάόç

Ç ÷ άέñιέβίçόç όύίάάόç όόι Internet ίά ÷ ñΠόç όçδ ppp, άβίάέ Υίάό άñΠάιñιθ έάέ άγέέιέιθ όñüθιθ ίά άίόιθβόάόά όó ÷ υίθ θñιάέΠιαόά όύίάάόçδ, Π άθέθδ ίά θŪñάόά θέçñιθιñβάδ ό ÷ άόέέŪ ίά όι θυò ι ISP όάό άίόέίάόυθθβάέ όέό όόίάŪόάέθ θάέάόρί ppp. Έά ίάέέίΠόιθίά όçί άόάνιñΠ PPP άδυ όçί άñάιιΠ άίόιέΠι. Όçίάέθόά υέέ όά υέά ίάό όά θάñάάάβάιáόά, έά ÷ ñçóείιθιέγίγίά όι *example* υò όι υίñά όιθ όθιέάέόδΠ θιθ άέόάέάβ όι PPP. Ιθιñάβόά ίά ίάέέίΠόάόά όι ppp, άñŪόιθίόά άθέθδ ppp:

```
# ppp
```

÷ ιθίά όρñά ίάέέίΠόάέ όι ppp.

```
ppp ON example> set device /dev/cuad1
```

ΈŪόιθίά όç όόόέάόΠ modem. Όόι θάñŪάέέάίά ίάό, άβίάέ ç cuad1.

```
ppp ON example> set speed 115200
```

ΈŪόιθίά όçί όά ÷ γόçόά όύίάάόçδ, όά άόόΠ όçί θάñβθόυόç ÷ ñçóείιθιέγίγίά 115,200 kbps.

```
ppp ON example> enable dns
```

ΈŪίά όόι ppp ίά ñέειβόάέ όιθ resolver έάέ θñιόέŪόιθίά όέό έάόŪέέçέάδ άñάιιŪό άέά όι άέάέñέόόΠ ιññŪόυι όόι /etc/resolv.conf. Άί όι ppp άάί ιθιñάβ ίά έάέιñβόάέ όι υίñά όιθ άέάέñέόόΠ, ιθιñγίγίά ίά όι έάέιñβόίθίά ίά ÷ άέñιέβίçόι θñüθι άñάυόάñά.

```
ppp ON example> term
```

ΆέέŪάέίθίά όά έάόŪόόάόç “terminal” θόά ίά ιθιñγίγίά ίά άέŪάñιθίά όι modem ÷ άέñιέβίçόά.

```
deflink: Entering terminal mode on /dev/cuad1
type '~h' for help
```

at
OK
atdt123456789

× η̄ςοείη̄διείγιά ο̄ι at έάά ίά αν̄÷έεῑδιε̄Πο̄ῑο̄ῑά ο̄ι modem, έάέ Ῡδ̄άέοά ÷η̄ςοείη̄διείγιά ο̄ι atdt έάέ ο̄ῑ αν̄έεῑ ο̄ῑο̄ ISP
έάά ίά ίάέεῑΠο̄ῑο̄ῑά ο̄ς έάάέέάοβ̄ά ο̄ς έε̄Πο̄ςο̄.

CONNECT

Άᾱη̄ Ῡ÷ῑο̄ῑά άδ̄έάάάάβ̄ῡο̄ς ο̄ς ο̄ γ̄ίάάο̄ςο̄. Άί Ῡ÷ῑο̄ῑά δ̄η̄ίάε̄Πῑᾱοά γ̄ίάάο̄ςο̄ ο̄ά ῑδῑβ̄ά άάί ο̄÷άδ̄β̄αῑῑοάέ ίά ο̄ῑ ο̄έέεῑ ίάο̄,
άᾱη̄ άβ̄ίάέ ο̄ῑ ο̄ςίάβ̄ῑ ο̄ῑο̄ δ̄η̄Ῡδ̄άέ ίά δ̄η̄ῑο̄δ̄άε̄Πο̄ῑο̄ῑά ίά ο̄ά άδ̄έέγ̄ο̄ῑο̄ῑά.

ISP Login:myusername

Ç δ̄η̄ῑο̄η̄ῑδ̄Π άο̄δ̄Π άβ̄ίάέ έάά ίά άΠο̄ῑο̄ῑά ο̄ῑ ῡίη̄ίά ÷η̄Πο̄ςο̄. × η̄ςοείη̄διε̄Πο̄ο̄ά ο̄ῑ ῡίη̄ίά ÷η̄Πο̄ςο̄ δ̄ῑο̄ ο̄άο̄ Ῡ÷άέ ά̄ῑε̄άβ̄ άδ̄ῡ ο̄ῑ
ISP ο̄άο̄.

ISP Pass:mypassword

Ç δ̄η̄ῑο̄η̄ῑδ̄Π άο̄δ̄Π άβ̄ίάέ έάά ο̄ῑ έῡάέεῑ δ̄η̄ῡο̄άο̄ςο̄. Άδ̄άίο̄Πο̄ο̄ά ίά ο̄ῑ έῡάέεῑ δ̄ῑο̄ ο̄άο̄ Ῡ÷άέ ά̄ῑε̄άβ̄ άδ̄ῡ ο̄ῑ ISP ο̄άο̄. Ī
έῡάέεῑδ̄ άο̄δ̄ῡ άάί έά ά̄ῑο̄άέο̄δ̄άβ̄ ο̄ο̄ςί̄ ῑε̄ῡίς ο̄άο̄, ῡδ̄ῡδ̄ άε̄η̄έά̄η̄ ο̄ο̄ῑάάβ̄ίάέ έάέ ίά ο̄ῑ έῡάέεῑ ο̄άο̄ ῡο̄άί ο̄ῑ αν̄Ūο̄άο̄ά ο̄ο̄ςί̄
δ̄η̄ῑο̄η̄ῑδ̄Π άέο̄ῑά̄ῑο̄ ο̄ῑο̄ FreeBSD ο̄ο̄ο̄δ̄Πῑᾱο̄ῑο̄ ο̄άο̄.

Shell or PPP:ppp

ΆίŪε̄ῑάά ίά ο̄ῑ ISP ο̄άο̄, ῑδ̄ῑη̄άβ̄ ίά ῑςί̄ άᾱβ̄ο̄ά έάέ έάέῡεῑο̄ ο̄ςί̄ δ̄αν̄άδ̄Ūῑῡ δ̄η̄ῑο̄η̄ῑδ̄Π. Óο̄ςί̄ δ̄αν̄άδ̄Ūῑῡ δ̄αν̄β̄δ̄ο̄ῡο̄ς ίάο̄
η̄ῡδ̄Ūάέ άί άδ̄έέδ̄ο̄ῑγ̄ῑά ίά άε̄ο̄άέῩο̄ῑο̄ῑά ε̄Ūδ̄ῑε̄ί̄ ε̄Ῡε̄ο̄ῑο̄ (shell) ο̄ο̄ῑ ῑς÷Ūίςί̄ά ο̄ῑο̄ δ̄αν̄ῑ÷Ῡά, Π άί ε̄Ῡε̄ῑο̄ῑά ίά άέέέεῑΠο̄ῑο̄ῑά
ο̄ῑ ppp. Óο̄ῑ δ̄αν̄Ūάέάῑά ίάο̄ άδ̄έέῩί̄άί̄ά ίά ÷η̄ςοείη̄διε̄Πο̄ῑο̄ῑά ppp έάέ̄η̄δ̄ ε̄Ῡε̄ῑο̄ῑά ίά ο̄ο̄ῑάάεῑγ̄ῑά ο̄ο̄ῑ Internet.

Ppp ON example>

Δ̄αν̄άο̄ςη̄Πο̄ο̄ά ῡο̄έ ο̄ο̄ῑ δ̄αν̄Ūάέάεῑά ο̄ῑ δ̄η̄η̄ο̄ῑ p άβ̄ίάέ έάο̄άέάβ̄ῑ. Άο̄δ̄ῡ άᾱβ̄÷ίάέ ῡο̄έ Ῡ÷ῑο̄ῑά ο̄ο̄ῑάάέάβ̄ άδ̄έο̄δ̄÷η̄δ̄ ίά ο̄ῑ
ISP.

Ppp ON example>

÷ῑο̄ῑά δ̄έο̄ο̄ῑδῑε̄ςέάβ̄ ίά άδ̄έο̄δ̄÷β̄ά άδ̄ῡ ο̄ῑ ISP ίάο̄, έάέ δ̄αν̄εί̄Ῡῑο̄ῑά ίά ίάο̄ άδ̄ῑαῑε̄άβ̄ έάέγ̄ε̄ο̄ῑο̄ς IP.

PPP ON example>

÷άέ δ̄ε̄Ῡί̄ έάεῑη̄έο̄δ̄άβ̄ έάέγ̄ε̄ο̄ῑο̄ς IP, έάέ Ῡ÷ῑο̄ῑά ῑε̄ῑε̄ςη̄η̄ο̄άέ ο̄ς ο̄γ̄ίάάο̄ς ίά άδ̄έο̄δ̄÷β̄ά.

PPP ON example>add default HISADDR

Άᾱη̄ δ̄η̄ῑο̄ε̄Ῡο̄ῑο̄ῑά ο̄ςί̄ δ̄η̄ῑάδ̄έέάᾱῑῩίς έάέάη̄η̄Π (default route). Óο̄ῑ άβ̄ίά άο̄δ̄ῡ άβ̄ίάέ άδ̄αν̄άβ̄ο̄ςο̄ῑ δ̄η̄εί̄ ῑδ̄ῑη̄Ῡο̄ῑο̄ῑά ίά
άδ̄έέεῑε̄ῑῡΠο̄ῑο̄ῑά ίά ο̄ῑ Ῡῑῡ έῡο̄ῑ, έάέ̄η̄δ̄ ο̄ς άάᾱη̄Ῡίς ο̄ο̄έά̄ῑΠ ç ῑῡίς ο̄γ̄ίάάο̄ς δ̄ῑο̄ Ῡ÷ῑο̄ῑά άβ̄ίάέ ίά Ῡίά ο̄δ̄ῑε̄ῑάέο̄δ̄Π άδ̄ῡ ο̄ςί̄
Ūε̄ε̄ς ίάη̄ε̄Ū ο̄ςο̄ αν̄ά̄ῑη̄δ̄. Άί ο̄ῑ δ̄αν̄άδ̄Ūῑῡ άδ̄ῑο̄γ̄÷άέ άδ̄άέά̄Π ο̄δ̄Ūη̄÷ῑο̄ῑ Πᾱς έάεῑη̄έο̄ῑῩίάο̄ έάέάη̄η̄Ῡδ̄, ῑδ̄ῑη̄άβ̄ο̄ά ίά
άŪε̄άο̄ά Ῡίά έάο̄ῑάο̄δ̄έέ̄ῡ ! ῑδ̄η̄ῑο̄δ̄Ū άδ̄ῡ ο̄ῑ add. Άίάέέάέο̄δ̄έέŪ, ῑδ̄ῑη̄άβ̄ο̄ά ίά ε̄Ūί̄άο̄ά άο̄δ̄Π ο̄ς η̄γ̄ε̄ῑέο̄ς δ̄η̄εί̄
άδ̄ε̄÷άε̄η̄Πο̄άο̄ά ο̄ς ο̄γ̄ίάάο̄ς, έάέ έά άβ̄ίάέ άο̄δ̄ῡῑάο̄ά έάέδ̄η̄ά̄ῑŪδ̄άο̄ς ο̄ςο̄ ίῩάο̄ έάέάη̄η̄Πδ̄.

Άί ῡε̄ά δ̄β̄ᾱάί έάέŪ, έά δ̄η̄Ῡδ̄άέ ο̄η̄ά ίά Ῡ÷άο̄ά άί̄άη̄άΠ ο̄γ̄ίάάο̄ς ίά ο̄ῑ Internet, ο̄ςί̄ ῑδῑβ̄ά ῑδ̄ῑη̄άβ̄ο̄ά ίά ίάο̄άέεῑΠο̄άο̄ά ο̄ο̄ῑ
δ̄αν̄άο̄ε̄Πίε̄ί̄ ÷η̄ςοείη̄διε̄Πῑᾱο̄ ο̄ῑ ο̄ο̄ῑάο̄άο̄ῑῡ δ̄ε̄Πε̄δ̄η̄ῡί̄ CTRL+z. Άί δ̄αν̄άο̄ςη̄Πο̄άο̄ά ο̄ῑ PPP ίά άβ̄ίάο̄άέ ίάŪ ppp, ç
ο̄γ̄ίάάο̄ς Ῡ÷άέ έάέάεῑδ̄άβ̄. Īά ο̄ῑ δ̄η̄ῡδ̄ῑ άο̄δ̄ῡ ῑδ̄ῑη̄άβ̄ο̄ά ίά δ̄αν̄άεῑε̄ῑο̄ε̄άβ̄ο̄ά ο̄ςί̄ έάο̄Ūο̄άο̄ς ο̄ςο̄ ο̄γ̄ίάάο̄ς ο̄άο̄. Óά έάο̄άέάβ̄ά

P αάβ÷ííí ùέé ððÙñ÷έέ óýíääóç ìά ðíí ISP άίρ ðά ìέέñÙ p αάβ÷ííí ùέé áέá έÙðíέí έüüί ç óýíääóç Ý÷έé ÷έέάβ. Õί ppp Ý÷έé ìüíí áððÝð ðέéð äýí έάðάóðÙóάέð.

27.4.2.1 Άίóέίάòððέóç ðñíäέçìÙòúí

Άí Ý÷έéά ððáðέέάβáð äñäíìð έέέ äáí öáβíáðάέ íá ìðíñáβðά íá äðíέáóáóððóáðά ðç óýíääóç, äðáíäñäíðíέðóáð ðíí Ýέää÷í ñíðð ìÝóù ðέέέíý (CTS/RTS) ÷ñçóέííðíέðíóáð ðçí äðέέíäð set ctsrts off. Õí ðñáððÙíù óðíääáβíáέ óðíðέùð áí áβóóά óðíääíÝíð ðά έÙðíέíí äíððçñáðçðð ðäñíáðέέèð íá äðíáðóçðά PPP, ùðíò ðí PPP óóáíáóÙάέ íá äðíέññáβíáðάέ ùðáí ðñíððáέáβ íá äñÙðάέ äääñÝíá ðçç óýíääóç óáð. Óðçí ðñññððòùç áððð, óðíðέùð ðññέíÝíáέ áέá έÙðíέíí óðíá CTS (Clear To Send) ðí ìðíβíí äáí Ýñ÷áðάέ ðíðÝ. Άí ùóóóóí ÷ñçóέííðíέðóáðά áððð ðçí äðέέíäð, έá ðñÝðáέ äðβóçð íá ÷ñçóέííðíέðóáðά έέέ ðçí äðέέíäð set accmap ç ìðíβá äíää÷ñÝíùð äðáέóáβðάέ áέá íá äðíííùέáβ ðí ðέέέü ðíð äíäñðÙóάέ áðù ðç ìáðÙäíòç óðáέäèññέíÝíùí ÷äñáéððñùí áðù ðç ìέá Õèñç óðçí Õέέç, óðíðέùð ìÝóù ðíð XON/XOFF. Άάβðά ðç óáèβáá manual ðíð ppp(8) áέá ðññέóóóðñäñð ðççñííòíññáð ó÷áðέέÙ ìá áððð ðçí äðέέíäð έέέ ðùð ìðíñáβðά íá ðçí ÷ñçóέííðíέðóáðά.

Άí áέáέÝðáðά Ýíá ðáέáέüðäñíí modem, βòùð ÷ñçóέííðíέðóáðά ðçí äðέέíäð set parity even. Ç ðñíäðέέääíÝíç ñýèìέóç äβíáέ íá ìçí ððÙñ÷έέ óíðíέíβá (parity none), áέέÙ ðá ðáέέÙ modems (έέέ ðά έÙðíέííòð ISP) ÷ñçóέííðíέáβðáέ áέá Ýέää÷í έáèðí (ç ÷ñðóç ðçðð ðñíέáέáβ ùóóóóí ìääÙέç áýíçóç óðç ìáðάέβίççç äääñÝíùí). ðóùð ÷ñçóέííðíέáβðáέ áððð ðçí äðέέíäð, áí í ISP óáð äβíáέ ç CompuServe.

Õí PPP βòùð íá ìçí äðáíÝέέéáέ óðçí έáóÙðóáóç äíòíèðí, ðí ìðíβíí áβíáέ óðíðέùð óóÙέíá áέáðñäñíÙðáðçðð, έáèð ì ISP ðññέíÝíáέ áðù ðç áέέð óáð ìäñέÙ íá ìáέéíðóáέ ðç áέáðñäñíÙðáðçðç. Õíí óçíäβíí áððù, ç ÷ñðóç ðçðð äíòíèðð ÷p έá äíáíäéÙóáέ ðí ppp íá äñ÷βóáέ íá óðÝέíáέ ðέéð ðççñííòíññáð ó÷áðέέÙ ìá ðç ñýèìέóç.

Άí äáí ððñáðá ðíðÝ ðñíðñíðð áέóóüäíð, ðí ðέéáíùðäñíí áβíáέ íá ðñÝðáέ íá ÷ñçóέííðíέðóáðά ðéóòíðíβççç PAP ð CHAP áíðβ áέá ðçí ðýðíò UNIX ðéóòíðíβççç ðíð ðññέäñÙðáíä óðí ðñáñððÙí ðñáñÙääéäíá. Άέá íá ÷ñçóέííðíέðóáðά PAP ð CHAP áðèðð ðñíòéÝóðά ðέéð ðññáéÙòù äðέέíäðÝð ðççí äóäñíäð PPP ðñέí äñáέáβðá ðá έáðÙðóáóç ðäñíáðέέíý:

```
ppp ON example> set authname myusername
```

Έá ðñÝðáέ íá áíðéέáðáóððóáðά ðí myusername ìá ðí ùíñá ÷ñðóç ðíð óáð Ý÷έé äíèáβ áðù ðíí ISP óáð.

```
ppp ON example> set authkey mypassword
```

Έá ðñÝðáέ íá áíðéέáðáóððóáðά ðí mypassword ìá ðíí έüäέέü ÷ñðóç ðíð óáð Ý÷έé äíèáβ áðù ðíí ISP óáð.

Άí óðíáÝáóðά έäñíέέÙ, áέέÙ äáí öáβíáðάέ íá ìðíñáβðά íá äðέέíέííðíέðóáðά ìá έáíέÙ áέáýèðíòç, ðñíððáέβðóáð íá ÷ñçóέííðíέðóáðά ðçí äíòíèðð ping(8) ìá ìέá áέáýèðíòç IP áέá íá äáβðá áí έá έÙääáðá äðÙíòççç. Άí äéÝðáðá äðèáέá ðáέÝòùí 100%, ðí ðéí ðέéáíù áβíáέ ùέé äáí Ý÷έéäéäèññóáέ έÙðíέá ðñíäðέéääíÝíç áέääññð. ΆέÝáíðά ìáíÙ ùέé Ý÷έéäéäèññóáέ ðçí äðέέíäð add default HISADDR έáðÙ ðç äéÙñέáέá ðçð óýíääóçð. Άí ìðíñáβðά íá äðέέíέííðíέðóáðά ìá ìέá äðñáèñðóíÝíç áέáýèðíòç IP, ðí ðέéáíùðäñíí áβíáέ ùέé äáí Ý÷έéäéäèññóáέ ðç äéáýèðíòç έÙðíέíò äέáèíέóðð ìññÙòùí óðí äñ÷áβíí /etc/resolv.conf. Õí äñ÷áβíí áððù έá ðñÝðáέ íá ìέÙæáέ ìá ðí ðññáéÙòù:

```
domain example.com
nameserver x.x.x.x
nameserver y.y.y.y
```

¼ðíò ðá x.x.x.x έέé y.y.y.y έá ðñÝðáέ íá áíðéέáðáóðáέíýí ìá ðέéð áέáðéýíóáέð IP ðùí äέáèíέóððí DNS ðíð ISP óáð. Άíää÷ñÝíùð ìέ ðççñííòíññáð áððÝð íá óáð Ý÷έéíí äíèáβ έáðÙ ðçí äääñáòð óáð óðçí ððçñáðóá. Άí ù÷έé, έá ìðíñÝóáðά íá ðέéð äñáβðά äýèíέá ìá Ýíá ðçέäòðíçíá óðíí ISP óáð.

Ìðíñáβðά äðβóçð íá äíäñäíðíέðóáðά ðçí έáðáääñáðð óðíáÙíòùí áέá ðçí PPP óýíääóç óáð, ìÝóù ðíð syslog(3). Άðèðð ðñíòéÝóðά:

```
!ppp
*. *      /var/log/ppp.log
```

όοι /etc/syslog.conf. Óέδ δάνέόούδάνάδ οϊñÝò, áδδP ç έάέόϊδñāβά οδÛñ÷άέ Pāç.

## 27.5 ×ñçόέϊδϊέπίôάò PPP ìÝóù Ethernet (PPPoE)

ÓδϊάέόοϊñÛ (άδÛ <http://node.to/freebsd/how-tos/how-to-freebsd-pppoe.html>) όϊö Jim Mock.

Ç áíúôçά άδδP δάνέññÛôάέ ðùò íá ññèìβóάôά íέα όýíáάόç PPP ìÝóù Ethernet (PPPoE).

### 27.5.1 Ñýèìέόç όϊö ÐðñPía

Äáí άδάέôâβόάέ δέÝíí áέάέêP ñýèìέόç όϊö δðñPía áέα ôç έάέόϊδñāβά PPPoE. Áí ï δðñPíáð óάð äáí δάνέέáíäÛíáέ ôçí άδάνάβôçôç δðñóðPñéîç netgraph, όï ppp έά ôçí οϊñðβóάέ άδδóùíάόά ùð Ûññèñùíá.

### 27.5.2 Ñýèìέόç όϊö ppp.conf

ÐάνάέÛòù óάβίáôάέ Ýíá δðñüäéáíä áñ÷άβïð 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
```

### 27.5.3 ΆέôÝέάόç όϊö ppp

Ûð ÷ñPóôçð root, ìðññāβóά íá άέôάέÝóάôά:

```
# ppp -ddial name_of_service_provider
```

### 27.5.4 Άέêβίçόç όϊö ppp έάôÛ ôçí Άέêβίçόç

ÐññïέÝóôά óέð δάνάέÛòù ãñáñÝò óóí áñ÷άβï /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"
```

## 27.5.5 ×ñΠόç ιέαὸ ἈόέέΥόάὸ Ὀδçñάόβὰὸ PPPoE

ÌáííéέΥὸ οἱñΥὸ εά ÷ñáέάόὸáß íá ÷ñçόέηἰðíéΠόáὸá ιέα áðéέΥόά Ὀδçñάόβὰὸ (service tag) áέá ὄçí áðíέáὸὺόὸáόç ὄçð óýíááόçð óáð. Ìé áðéέΥὸáð Ὀδçñάόβèí ÷ñçόέηἰðíéíýíόáé áέá ὀíí áέá÷ñíéόíἰ ἰáὸáíý áέáὀíñáὸέέèí ἰñὈδçñάόçðí ΠPPoE ðíὸ áñβόέηἰόáé ὄðí βáéí áβέὸðí.

Ç ðáέìçñβùç ðíὸ óáð Ý÷áé áπóáé ἰ ISP óáð, εά ðñÝðáé íá Ý÷áé ὀέð áðáέόíýíáíáð ðεçñíἰἰñβáð áέá ὄçí áðéέΥόά Ὀδçñάόβὰὸ ðíὸ ÷ñáέὺáέόὸá. Ἀí ááí ἰðíñáβὸá íá ὄçí áñáβὸá, ñùðΠόáὸá ὄçí áñὈδçñÝόççόç ðáέáὸí ὀíὸ ISP óáð.

ὺὸ ὀáέáὸὸáβá éýόç, εά ἰðíñíýόáὸá íá áñέéὺὸáὸá ὄçí ἰÝéíáí ðíὸ ὀóíβόáὸáé ὄðí ðññáñáñá Roaring Penguin PPPoE (<http://www.roaringpenguin.com/pppoe/>) ὀí ἰðíβí ἰðíñáβὸá íá áñáβὸá ὄçí ὈðééíáΠ ὀἰí Ports. Íá Ý÷áὸá Ὀðἠçç óáð, ἠὸé áðὸἰ ἰðíñáβ íá áðíðñíáñáñáíáὸβὸáé éáé íá á÷ñçόáýόáé ὀí modem óáð, Ýὸóé ὀέáὸὸáβὸá ὀí éáέὺ ðñéí ὀí éὺíáὸá. Ἀðèð ðáέáὸáὸΠόáὸá ὀí ðññáñáñá ðíὸ áβíáé ἰ ðáñí÷Ýáð óáð ἰáæβ ἰá ὀí modem. ðáέὸá, áέόÝéèáὸá ὄðí ἰáñíý System ὀíὸ ðññáñáñá. Ἀέáβ εά ðñÝðáé íá áβíáé ὀí ἠñá ὀíὸ ðñíὸβé óáð. ὈðíΠèùð áñὺὸáé ISP.

Ὀí ἠñá ὀíὸ ðñíὸβé (áðéέΥόά Ὀδçñάόβὰὸ) εά ÷ñçόέηἰðíéçèáß ὄçí éáὸá÷ñéόç áέá ὄçí ñýèíéόç ὀíὸ PPPoE ὄðí áñ÷áβí ppp.conf, ἠὸ ὀí ὀíΠíá ðíὸ áçèííáé ὀí ðáñí÷Ýá ὄçí áíὸíèΠ set device (ááβὸá ὄç ὀáέβáá manual ὀíὸ ppp(8) áέá ðèΠñáὸé εáðὸñÝñáέáð). εά ááβ÷íáé ἠðἠὸ ὀí ðáñáéὺὸἰ:

```
set device PPPoE:x11:ISP
```

Ìçí ἰá÷ὺὸáὸá íá áέéὺíáὸá ὀí x11 ἰá ὄç ὀἠὸðΠ ὀὸóéáðΠ ðíὸ áíὸéόðíé÷áß ὄçí éὺñὸá Ethernet ðíὸ ÷ñçόέηἰðíéáβὸá.

Ìçí ἰá÷ὺὸáὸá íá áέéὺíáὸá ὀí ISP ἰá ὀí ðñíὸβé ðíὸ áñΠéáὸá ðáñáðὺí.

Ἀέá ðáñéόóἠáñáð ðεçñíἰἰñβáð, ááβὸá:

- Ὀεçíἠὸáñáð ἈðñὸæἠéέέΥὸ ὈðíáÝόáέð ἰÝὸἰ FreeBSD ὀá ἈñáñΠ DSL (<http://renaud.waldura.com/doc/freebsd/pppoe/>) áðἠ ὀíí Renaud Waldura.
- Nutzung von T-DSL und T-Online mit FreeBSD (<http://www.ruhr.de/home/nathan/FreeBSD/tdsl-freebsd.html>) áðἠ ὀíí Udo Erdelhoff (ὄðá ἈáñáíáéέέἺ).

## 27.5.6 Ὀí PPPoE ὀá Modem 3Com® HomeConnect® ADSL Dual Link

Ἀὸὸἰ ὀí modem ááí áéíéíðéáß ὀí RFC 2516 (<http://www.faqs.org/rfcs/rfc2516.html>) (Íέα ἰÝéíáñὸ áέá ἰáðὺáἰόç PPP ἰÝὸἰ Ethernet (PPPoE), áñáñÝíí áðἠ ὀíὸð L. Mamakos, K. Lidl, J. Evarts, D. Carrel, D. Simone, éáé R. Wheeler). Ἀíὸβέáὸá, ÷ñçόέηἰðíéáß áέáὀíñáὸééíýð ὄýðíðð èἠáéèí ðáéÝὸἰí áέá ὀá ðéáβὸéá Ethernet. ðáñáéáéíýíá íá áéὸñὺὸáὸá ὀá ðáñὺðíá óáð ὄçí 3Com (<http://www.3com.com/>) áí ἰñβæáὸá ἠὸé εá ðñÝðáé íá ὀðíἰñἠὸéáß ἰá ὀέð ðñíáéáñáόÝὸ ὀíὸ PPPoE.

Ἀέá íá ἰðíñáβ ὀí FreeBSD íá áðééíéíáíáß ἰá áððΠ ὄç ὀὸóéáðΠ, εά ðñÝðáé íá ὀáéáβ Ýíá éáðὺéççéí sysctl. Ἀὸὸἰ ἰðíñáβ íá áβíáὸáé áðὸἠíáὸá éáðὺ ὄçí áééβíççόç, ἰá ὄçí áíçíÝñἠὸç ὀíὸ áñ÷áβíὸ /etc/sysctl.conf:

```
net.graph.nonstandard_pppoe=1
```

Π ἰðíñáβ íá áβíáé Ἲíáὸá ἰá ὄçí áíὸíèΠ:

```
# sysctl net.graph.nonstandard_pppoe=1
```

Ἀðὸὸð÷ðò, áðáéáΠ ðññáéáὸáé áέá íέα ñýèíéόç ðíὸ áðçñáὺáé ðéἠéçñí ὀí ὀýόðçíá, ááí áβíáé áñíáὸἠí íá áðééíéíáíáβὸá ὀáðὸἰ÷ñíá ἰá Ýíá éáñíééἠ ðáéὺðç Π áñὈδçñάόçðΠ PPPoE éáé ἰá Ýíá ADSL modem 3Com HomeConnect®.

## 27.6 × η̄ςόεῑῑδῑε̄πί̄ο̄ᾱο̄ PPP ἰ̄Ύού̄ ATM (PPPoA)

<sup>1</sup> ᾱί̄ῡό̄ς̄ο̄ά̄ δ̄ῑο̄ ᾱε̄ῑε̄ῑο̄ε̄ᾱβ̄, δ̄āñēāñ̄Ḳ̄ōāē δ̄ūō ἰ̄ā n̄ōēīβ̄ōāōā ο̄ī PPP ᾱε̄ā ε̄āēōīōñ̄āβ̄ā ἰ̄Ύού̄ ATM (PPPoA). Ὀ̄ī PPPoA ᾱβ̄īāē ἰ̄ε̄ā āç̄īīōēēP̄ō āδ̄ēēīāP̄ ōōīō δ̄āñ̄ī ÷ āβ̄ō ōδ̄ç̄ñ̄āōēp̄ī DSL ōōç̄ī Ἀ̄ōñ̄p̄δ̄ç̄.

### 27.6.1 × η̄ςόεῑῑδῑε̄πί̄ο̄ᾱο̄ PPPoA ἰ̄ā ο̄ī Alcatel SpeedTouch™ USB

Ç̄ ōδ̄īōōP̄ñ̄ēīç̄ PPPoA ᾱε̄ā āōōP̄ ōç̄ ōōōēāōP̄, δ̄āñ̄Ȳ ÷ āōāē Ḳ̄ō port ο̄ōī FreeBSD, ε̄āēp̄ō ο̄ī firmware ο̄ç̄ō ōōōēāōP̄ō āēāīȲīāōē ōδ̄ī ο̄ç̄ī Ḳ̄ōāēā Alcatel's license agreement ([http://www.speedtouchdsl.com/disclaimer\\_lx.htm](http://www.speedtouchdsl.com/disclaimer_lx.htm)) ε̄āē āāī ἰ̄δ̄īñ̄āβ̄ ἰ̄ā āēāīāīç̄ēāβ̄ āēāȳēāñ̄ā ἰ̄ā ο̄ī āāōēēū ōȳōōç̄īā ο̄īō FreeBSD.

Ἀ̄ε̄ā ἰ̄ā āāēāōāōP̄ōāōā ο̄ī ēīāēōīēēū, āδ̄ēḲ̄ ÷ η̄ςόεῑīδῑε̄πί̄ο̄āō ο̄ç̄ī Ὀ̄δ̄ēēīāP̄ ο̄ūī Ports. Ἀ̄āēāōāōP̄ōāōā ο̄ī port net/pppoa ε̄āē āēīēīōēP̄ōā ōēō ἰ̄āç̄āβ̄āō δ̄īō δ̄āñ̄ēēāīāḲ̄ōīōāē ōā āōōū.

¼δ̄ūō δ̄īēēȲō ōōōēāōȲō USB, ο̄ī Alcatel SpeedTouch™ ÷ η̄āēḲ̄ōāōāē ἰ̄ā ēāōāāḲ̄ōāē ο̄ī firmware ο̄īō āδ̄ū ο̄īī ōδ̄īēīāēōP̄ ο̄ōī ἰ̄δ̄īβ̄ī āβ̄īāē ōōīāāīȲī, δ̄ñ̄īēāēīȲīō ἰ̄ā ēāēōīōñ̄āP̄ōāē ōūōōḲ̄. Ç̄ āēāēēāōβ̄ā āōōP̄ ἰ̄δ̄īñ̄āβ̄ ἰ̄ā āōōñ̄āōīδ̄īēç̄ēāβ̄ ο̄ōī FreeBSD, p̄ōōā ç̄ ἰ̄āōāōīñ̄Ḳ̄ō ἰ̄ā āβ̄īāōāē ēḲ̄ōā ōīñ̄Ḳ̄ō δ̄īō ōōīāȲāōāē ç̄ ōōōēāōP̄ ōōç̄ ēȳñ̄ā USB. ἰ̄δ̄īñ̄āβ̄ōā ἰ̄ā δ̄ñ̄īōēȲōāōā ōēō δ̄āñ̄āēḲ̄ōū δ̄ēç̄ñ̄īōīñ̄β̄āō ōōī āñ̄ ÷ āβ̄ī /etc/usb.d.conf ᾱε̄ā ἰ̄ā ἰ̄āīñ̄āīδ̄īēP̄ōāōā ο̄ç̄ī āōōūīāōç̄ ἰ̄āōāōīñ̄Ḳ̄ō ο̄īō firmware. Ἐ̄ā δ̄ñ̄Ȳōāē ἰ̄ā āδ̄āīñ̄āāōāōāβ̄ōā āōōū ο̄ī āñ̄ ÷ āβ̄ī Ḳ̄ō ÷ η̄P̄ōōç̄ō 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"
```

Ἀ̄ε̄ā ἰ̄ā ἰ̄āīñ̄āīδ̄īēP̄ōāōā ο̄ī **usb**d, ο̄ī āāβ̄īīā USB, δ̄ñ̄īōēȲōōā ο̄ç̄ī δ̄āñ̄āēḲ̄ōū āñ̄āīñ̄P̄ ο̄ōī āñ̄ ÷ āβ̄ī /etc/rc.conf:

```
usb.enable="YES"
```

ἰ̄δ̄īñ̄āβ̄ōā āδ̄β̄ōç̄ō ἰ̄ā n̄ōēīβ̄ōāōā ο̄ī **ppp** p̄ōōā ἰ̄ā āēōāēāβ̄ āōōūīāōā ēēP̄ōç̄ ēāōḲ̄ ο̄ç̄ī āēēβ̄īç̄ōç̄ ο̄īō ōōōōP̄īāīō. Ἀ̄ε̄ā ἰ̄ā āβ̄īāē āōōū, δ̄ñ̄īōēȲōōā ōēō δ̄āñ̄āēḲ̄ōū āñ̄āīñ̄Ȳō ōōī /etc/rc.conf. Ἐ̄ā δ̄ñ̄Ȳōāē ε̄āē δ̄Ḳ̄ōē ἰ̄ā āēōāēȲōāōā ο̄ç̄ī āēāēēāōβ̄ā āōōP̄ Ḳ̄ō root.

```
ppp.enable="YES"
ppp.mode="ddial"
ppp.profile="adsl"
```

Ἀ̄ε̄ā ἰ̄ā ēāēōīōñ̄āP̄ōāē ōūōōḲ̄ō ο̄ī δ̄āñ̄āδ̄Ḳ̄ōū, ēā δ̄ñ̄Ȳōāē ἰ̄ā Ȳ ÷ āōā ÷ η̄ςόεῑīδῑε̄πί̄ο̄āē ο̄ī ōδ̄ūīāēāīā ο̄īō āñ̄ ÷ āβ̄īō ppp.conf ο̄ī ἰ̄δ̄īβ̄ī δ̄āñ̄Ȳ ÷ āōāē ἰ̄ā ο̄ī port net/pppoa.

### 27.6.2 × η̄ςόεῑīδῑε̄πί̄ο̄āο̄ ο̄ī mpd

ἰ̄δ̄īñ̄āβ̄ōā ἰ̄ā ÷ η̄ςόεῑīδῑε̄πί̄ο̄āōā ο̄ī **mpd** ᾱε̄ā ἰ̄ā ōōīāāēāβ̄ōā ōā Ȳīā δ̄ēP̄ēīō ōδ̄ç̄ñ̄āōēp̄ī, ε̄āē āēāēēūōāñ̄ā ōδ̄ç̄ñ̄āōβ̄āō PPTP. ἰ̄δ̄īñ̄āβ̄ōā ἰ̄ā āñ̄āβ̄ōā ο̄ī **mpd** ōōç̄ī Ὀ̄δ̄ēēīāP̄ ο̄ūī Ports, ο̄ōī net/mpd. Δ̄īēēḲ̄ō ADSL modem āδ̄āēōīȳī ο̄ç̄ āç̄īēīōñ̄āβ̄ā āīūō PPTP ο̄īȳīāē ἰ̄āōāīȳ ο̄īō modem ε̄āē ο̄īō ōδ̄īēīāēōP̄. ἰ̄ā ōȲōīēī modem āβ̄īāē ο̄ī Alcatel SpeedTouch Home.

Δ̄ñ̄p̄ōā δ̄ñ̄Ȳōāē ἰ̄ā āāēāōāōP̄ōāōā ο̄ī port, ε̄āē ἰ̄āōḲ̄ō ἰ̄δ̄īñ̄āβ̄ōā ἰ̄ā n̄ōēīβ̄ōāōā ο̄ī **mpd** p̄ōōā ἰ̄ā ēāēȳδ̄ōāē ōēō āδ̄āēōP̄ōāēō ōāō ε̄āē ōēō n̄ōēīβ̄ōāēō ο̄īō δ̄āñ̄ī ÷ Ȳā ōāō. Ὀ̄ī port āāēāēōōḲ̄ō ēḲ̄ōīēā δ̄āñ̄āāāβ̄āīāōā āñ̄ ÷ āβ̄ūī n̄ōēīβ̄ōāūī ο̄ōī ēāōḲ̄ōēīāī PREFIX/etc/mpd/. Ὀ̄ā āñ̄ ÷ āβ̄ā āōōḲ̄ō δ̄āñ̄ēȲ ÷ īōī āñ̄ēāōḲ̄ō ēāēP̄ ōāēīç̄ñ̄β̄ūōç̄ ο̄ūī n̄ōēīβ̄ōāūī. Ὀ̄ç̄īāēp̄ōā āāp, Ḳ̄ōē ο̄ī PREFIX āβ̄īāē ἰ̄ ēāōḲ̄ōēīāīō ο̄ōī ἰ̄δ̄īβ̄ī āāēāēβ̄ōōāīōāē ōā ports, ε̄āē āδ̄ū δ̄ñ̄īāδ̄ēēīāP̄ āβ̄īāē ἰ̄ /usr/local/. ἰ̄āōḲ̄ō ο̄ç̄ī

άάέάδΰόόάόç õĩõ port, έά άñáβδά Ύία δέPñç ιάçãũ áέά όç ñýèìέόç õĩõ **mpd** όά ιĩñõP HTML. Ç όάèìçñβùόç άάέέεβόόάόάέ όóĩĩ έάόΰέĩĩĩ *PREFIX/share/doc/mpd/*. Δάñάέΰδù όάβίάόάέ Ύία όδũääέάĩά ñèìβόάũĩ áέά όýĩääόç όά ιέά όδçñáόβά ADSL ιΎóũ õĩõ **mpd**. Ίέ ñõèìβόάέδ ÷ ùñβæĩĩόάέ όά äýĩ άñ÷άβá, δñpδά άάβ÷ĩĩõĩά õĩ 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 Όĩ üĩñá ÷ñPόόç ιά õĩ ιδĩβĩ άβίάόάέ ç δέόóĩδĩβçόç όóĩĩ ISP όάδ.
- ❷ Ί èùάέέüδ ιά õĩĩ ιδĩβĩ άβίάόάέ ç δέόóĩδĩβçόç όóĩĩ ISP όάδ.

Όĩ άñ÷άβĩ mpd.links δάñέΎ÷άέ δέçñĩõĩñβáδ ó÷άόέέΰ ιά όç όýĩääόç P δέδ όóĩáΎόάέδ δĩõ έά δñááĩáóĩδĩέçèĩýĩ. Άέά δάñΰääέáĩá, õĩ mpd.links δĩõ όóñĩääýáέ õĩ δάñάδΰĩù δάñΰääέáĩá, όάβίάόάέ δάñάέΰδù:

```
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 áέáýèδĩόç IP õĩõ FreeBSD όδĩέĩääέόδP όάδ, όóĩĩ ιδĩβĩ έά ÷ñçόέĩĩδĩέPόάόά όĩ **mpd**.
- ❷ Ç áέáýèδĩόç IP õĩõ ADSL modem όάδ. Άέά õĩ Alcatel SpeedTouch Home, ç áέáýèδĩόç áδδP άβίάέ áδũ δñĩáδέέĩāP ç 10.0.0.138.

Άβίάέ άóĩáóũĩ ιά άñ÷έέĩδĩέPόάόά όç όýĩääόç áýèĩέá, άβĩĩĩόάδ όçĩ δάñάέΰδù áĩóĩέP ùδ root:

```
# mpd -b adsl
```

Ίδĩñάβδά ιά άάβδά όçĩ έάόΰόόάόç όçδ όýĩääόçδò ιά όçĩ δάñάέΰδù áĩóĩέP:

```
% ifconfig ng0
ng0: flags=88d1<UP,POINTOPOINT,RUNNING,NOARP,SIMPLEX,MULTICAST> mtu 1500
    inet 216.136.204.117 --> 204.152.186.171 netmask 0xffffffff
```

Οι mpd άδιόάέάβ οι οοίέοόπιάνι όνυδι όγίαάόçò οι FreeBSD ίά ίέά οδçñάόβά ADSL.

### 27.6.3 ×ñçóέιιδιέπιόάò οι pptpclient

Ìðñάβòά άδβόçò ίά ÷ñçóέιιδιέπιόάò οι FreeBSD άέά ίά οοίάάέάβòά οά Ûέέάò οδçñάόβάò PPPoA ÷ñçóέιιδιέπιόάò οι net/pptpclient.

Άέά ίά ÷ñçóέιιδιέπιόάò οι net/pptpclient άέά ίά οοίάάέάβòά οά ίέά οδçñάόβά DSL, άάέάόόòòòòά οι port P οι ðάέÝδι, έάέ άðáññάάόòάβòά οι άñ÷άβι /etc/ppp/ppp.conf. Έά ÷ñάέάόòάβ ίά άβòά root άέά ίά έÛίάòά έάέ όέò άγί ðáñáðÛíù áέάάέάóβáò. ÐáñáέÛòù óáβίáóáέ Ýίá ðáñÛááέάíá ίέάò áíúòçóáò οιò ppp.conf. Άέά ðáñέóóúòáñáò ðççñíòññáò ó÷áðέέÛ ίá όέò áðέέíáÝò οιò ppp.conf, ááβòά ðç óáέβáá manual οιò 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 Οι úññá ÷ñβóç άέά οι έíááñέάóíù óáò óοίí ðáñí÷Ýá DSL.
- ❷ Ì έùáέέúò άέά οι έíááñέάóíù óáò.

**Ðñíáέάιιδιέβçç:** Έάέòò έά ðñÝðáέ ίá áñÛòáòά οι έùáέέú óáò ïñòò áðέíγ έáέίÝííò óοί άñ÷άβι ppp.conf, έά ðñÝðáέ ίá ááááέúέάáòά úòέ έάίÝίáò Ûέέíò áái έά ïðñáñ ίá áέάáÛóáέ óá ðáñέá÷úíáía áóòíγ οιò άñ÷άβιò. Ìá όέò ðáñáέÛòù áíóíēÝò, ïðñáñáòά ίá áíáóóáέáòáòά úòέ οι άñ÷άβι έά ïðñáñ ίá áέάááóóáñ ïúí ïÝóá áðù οι έíááñέάóíù οιò root. Άáβòά όέò óáέááò manual óúí chmod(1) έάέ chown(8) άέά ðáñέóóúòáñáò ðççñíòññáò.

```
# chown root:wheel /etc/ppp/ppp.conf
# chmod 600 /etc/ppp/ppp.conf
```

Áóòù έá áñβίáέ Ýίá όíγίáέ άέά ίέά οοίááñβá PPP ïá οι DSL áññíέíäçòò óáò. Óá DSL modem óýðíò ethernet Ý÷íοί ίέά ðñíέáέíñέóíÝíç áέáýέóίóç IP óοί ðíðέέú óáò áβέòòí, óòçí ïðñáñ ïðñáñáòά ίá οοίááέáβòά. Óòçí ðáñβðòúòç οιò Alcatel SpeedTouch Home, ç áέáýέóίóç áóòò áβίáέ 10.0.0.138. Ç óáέíçñβúòç ðíò áέάέÝóáέ ï áññíέíäçòò óáò, έá áíáóÝñáέ ðíέá áέáýέóίóç ÷ñçóέιιδιέάβ ç óóóéáòò óáò. Άέά ίá áñβίáòά οι όíγίáέ έάέ ίá ïáέíòòáòά ίέá οοίááñβá PPP, áέòáέÝóáò óçí áέúέíòèç áíóíēò:

```
# pptp address adsl
```

**Óúúááέíç:** Άβίáέ έáέò έáÝá ίá ðñíóέÝóáòά Ýίá "&" óοί óÝέíò óçò ðñíçáíγíáíçò áíóíēòò, áέáóíñáòέέÛ οι pptp áái έá óáò áðέóòñÝòáέ οι Ýέáá÷í (ðñíòñíðò) οιò óáñíáòέέíγ óáò.

Έά άçiείτñãçèåß íéá óóóéåðP tun (άέείίέέú ðíýíåé) áéá ôçí áέέçéåðßãñáóç ìåóáíý ðùí áéåñåáóéßí pptp έάέ ppp. Ìüέέð áðéóðñÝðåé ç ðñíðñíðP óðí ðåñíåðέέú óåð, P ðí pptp áðéåååéßðåé ôç óýíååóç, ìðñåßðå íá åñåðΰóåðå ðí ðíýíåé ìå ðíí ðñúðí ðíð óåßíåðåé ðåñåéΰðù:

```
% ifconfig tun0
tun0: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 1500
    inet 216.136.204.21 --> 204.152.186.171 netmask 0xffffffff0
    Opened by PID 918
```

Άí ååí ìðñÝóåðå íá óðíåååßðå, åéÝåíðå ðέð ñðèìßóåðð ðíð åññíéíåçðP óåð, íé ìðßðð óðíPèùð åßíåé ðñíóåΰóéíåð ìÝóù telnet P ìÝóù éΰðñέíð óðééñåðñçðP. Άí áέúñå ååí ìðñåßðå íá óðíåååßðå, έå ðñÝðåé íá åñåðΰóåðå ôçí Ýñåí ôçð ðíóíèPð pptp έάέ óå ðåñέå÷-ùíåíå ðíð åñ÷-åßíð έåóååñåððð ðíð ppp, /var/log/ppp.log áéå ðέέåíΰ óðíé÷-åßå.

### 27.7 × ñçóέííðñέßíðåð ðí SLIP

Άñ÷-έèP óðíåέóðñíΰ ðíð Satoshi Asami. Ìå ôç åñPèðåéå ðùí Guy Helmer έάέ Piero Serini.

#### 27.7.1 Ñðèìßæííðåð Ýíå ðåéΰðç SLIP

ðåñåéΰðù ðåñíðóέΰæííðå Ýíå ðñúðí íá ñðèìßóåðå Ýíå ìç÷-ΰίçíå FreeBSD ùð ðåéΰðç SLIP óå Ýíå åßέððí ìå óðåóέέÝð áéåðéýíóåéð. Άέå ìç÷-åíPñåóå óå ìðßå éåñåΰñíðí ùññå åðíåíέΰ (ç áéåýèðíóç ðíðð áέéΰæåé éΰèå ðñíΰ ðíð óðíåÝñíðåé), ðέέåíñí íá ÷ ñåååóåðßß íá éΰíåðå ðéí ðñéýðñééåð ñðèìßóåðð.

Άñ÷-έéΰ, έå ðñÝðåé íá éåéñßóåðå óå ðñåå óåέñέåèP éýñå åßíåé óðíååñÝñí ðí modem óåð. Άñέåðíß ÷ ñPóðåð åçίέíðñåýíí Ýíå óðíåñέέú ååóíù ð.÷. /dev/modem, ðí ìðßí ååß÷-íåé óóçí ðñåñíåðέέèP óðóέåðP /dev/cuadn. Άððù óåð áðéóðñÝðåé íá óðíå÷-ßóåðå íá ÷ ñçóέííðñέåßðå ðí ßæíí ùññå óðóέåððð, áέúñå έάέ åí ìåóåέíPóåðå ðí modem óå áέåóññåðέèP éýñå. Άßíåé ìΰέéñí ΰåññí íá ðñÝðåé íá áέéΰíåðå ðèPèðð åñ÷-åßñí óðí /etc έåèðð έάέ óå åñ÷-åßå .kermrc óå üéí ðí óýóóçíå!

Óçíåßùóç: Õí /dev/cuad0 åßíåé ç COM1, ðí /dev/cuad1 åßíåé ç COM2, é.í.έ.

Άåååéèèåßðå ùðé ðí åñ÷-åßí ñðèìßóåðùí ðíð ððñPñå óåð ðåñέÝ÷-åé óå ðåñåéΰðù:

```
device sl
```

Õí ðåñåðΰñù ðåñέéåñåΰíåðåé óðíí ððñPñå GENERIC, έάέ åí ååí ðí Ý÷-åðå áέååñΰðåé, ååí έå Ý÷-åðå ðññåéçíå.

#### 27.7.1.1 Ñðèìßóåðð ðíð έå × ñåååóåðßß íá éΰíåðå ìññ íέå Õññ

1. ðñíðéÝóåð ðí ìç÷-ΰίçíå óåð, ôçí ðýèç (gateway) έάέ ðíðð áέåññέóóÝð ìññΰðùí (nameservers) óðí åñ÷-åßí /etc/hosts. Óðí ðåñΰååéñå ìåð, ðí åñ÷-åßí åððù ìéΰæåé ìå ðí ðåñåéΰðù:

```
127.0.0.1          localhost loghost
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. Άάάέέέάβδά υέέ ς άύέόά files άñβόέάόάέ δñεί οι dns όόεί άύέόόά hosts: όιό άñ÷άβιό /etc/nsswitch.conf. Άί άάί δδὐñ÷ιόί άόόὐò ιέ δάνὐιάόñιέ, ιδñάβ ίά άιόάίέόόιγί δάνὐιάά όδιδδβιάόά.
3. Ὄñιδñιέβόά όι άñ÷άβι /etc/rc.conf.
  1. Ἰñβόά όι υñά όιό δδñιέέόόβ όάδ, όñιδñιέβιόάδ όε άñάñβ διό άñὐόάέ:
 

```
hostname="myname.my.domain"
```

 Έά δñὐάέ άάβ ίά όιδñιέέόόβόά όι δέβñάδ υñά όιό δδñιέέόόβ όάδ.
  2. Ἰñβόά όι δñιάδέέάñὐί άññιέιάόβ, άέέὐάειόάδ όε άñάñβ:
 

```
defaultrouter="NO"
```

 όά:
 

```
defaultrouter="slip-gateway"
```
4. Ἀέιέιόñάβόά ὐίά άñ÷άβι /etc/resolv.conf όι ιδñιβι έά δñέὐ÷άέ:
 

```
domain CS.Example.EDU
nameserver 128.32.136.9
nameserver 128.32.136.12
```

¼δὐδ ιδñιάβόά ίά άάβόά, όι δñάδὐὐι υñβέέ όιόδ άέάέñιέόόὐδ DNS. Ὄόέέὐ, όά δñάñιάόέέὐ ιύιιáόά έάέ ιέ άέάόέγίόάέδ όυι όñὐί άιáñδβιόάέ άδὐ όι δñέάὐέει όάδ.
5. Ἰδñιβόά έùάέέυ δñυόάάόδ άέά όιόδ ÷ñβόάδ root έάέ toor (έάέβδ έάέ άέά υίόδ ὐέειόδ έιáñέάόιγύ άάί ὐ÷ιόί έùάέέυ).
6. Ἀδάíάέέέβόά όι ις÷ὐίγίά όάδ, έάέ άάάέέέάβδά υέέ ὐ÷άέ όάέάβ όύόδὐ όι υñά δδñιέέόόβ.

### 27.7.1.2 Ἀέιέιόñάβιόά ιέά Ὄγίάόδ SLIP

1. Ἰάδὐ όεί έέβόε, άñὐόά όεί άίόιέβ slip όόεί δñιόñιδβ, άñὐόά όι υñά όιό ις÷άβιáόδ όά έάέ όι έùάέέυ. Ὄι όέ άέñέάβδ ÷ñέὐάόάέ ίά άñὐόά, άιáñδὐόάέ άδὐ όι δñέάὐέει όάδ. Άί ÷ñόέιιδñιέάβδ όι **Kermit**, ιδñιάβόά ίά ÷ñόέιιδñιέβόά ὐίά script υδὐδ όι άέυειόδ:

```
# 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
```

Ὄόέέὐ, έά δñὐάέ ίά άέέὐιáόά όι υñά ÷ñβόε έάέ όι έùάέέυ βόά ίά όάέñέὐάει ίά όά άέέὐ όάδ. Ἰάδὐ άδὐ άδδὐ, ιδñιάβόά άδέβδ ίά δέεέδñιέιáβόά slip όόεί δñιόñιδβ όγίάόδ όιό **Kermit**.

**Όαίάβυόα:** Ϙ ὁάηιϘ όιό έυάέέιγ όάό όά ιιήόβ άδέιγ έάέιγίιό όά ιδιέιαβδιόά όαίάβι άιυό όόόόβιαόιό άñ÷άβυί, άβίαέ άάίέέϐ έάέβ έάγá. Δñí÷υñβόά ίά έέέβ όάό άόέγίϘ.

2. Άόβόά όι **Kermit** έέάβ (ιδιήάβόά ίά όι όόάβέάόά όόι δάηάόέβίέι ÷ ηϘόέιιδιέβιόάό όά δέβέόηά **Ctrl-z**) έάέ υό root, άñϐόά:

```
# slattach -h -c -s 115200 /dev/modem
```

Άί ιδιήάβόά ίά έϐίαόά ping όά όδιέιαέόόγδ όόαί ϐέέϘ ίάηέϐ όιό άηηέιαϘόβ, άβόά όόιαήγίέ! Άί άόόυ άάί άιόέάγάέ, άιέέιϐόά όαί άδέέιαβ -a άίόβ έάά όαί -c υό υñέόία όόαί slattach.

### 27.7.1.3 Δυό ίά Όάηίαόβόάόά όαί ΌγίαάόϘ

Έϐιόά όά άέυέιόέά:

```
# kill -INT `cat /var/run/slattach.modem.pid`
```

έάά ίά όάηίαόβόάόά όι slattach. ΈόιϘέάβόά υόέ δñγδάέ ίά άβόά root έάά ίά έέόάέγόάόά όι δάηάόϐϐ. Δάέόά άδάίγέέάόά όόι kermit (άέόάέβιόάό όαί fg άί όι άβ÷άόά όόάβέάέ όόι δάηάόέβίέι) έάέ όάηίαόβόάόά όι (δέγ έιιόάό **q**).

Ϙ όάέβάά manual όιό slattach(8) άίαόγñάέ υόέ ιδιήάβόά ίά ÷ ηϘόέιιδιέβιόάόά όαί άίόιέβ ifconfig s10 down έάά ίά έέάέυέόάόά όϘ όγίαάόϘ, έέέϐ άόόυ άάί όάβίαόάέ ίά γ÷άέ έάίγίά άδιόγέάόία. (To ifconfig s10 άίαόγñάέ όι βάέι δñϐάια.)

Ίάηέέγδ όιηγδ, όι modem όάό ιδιήάβ ίά άηίϘέάβ ίά έέάβόάέ όϘ άηάιιβ. Όόέό δάηέδόβόάέό άόόγδ, ίάέέβόά ίάίϐ όι kermit έάέ όάηίαόβόάόά όι ίάίϐ. ΌϘ άάγόάηϘ όιηϐ όόιβέυό δάόό÷άβίαέ.

### 27.7.1.4 ΆίόέιαόβόέόϘ ΔñíάέϘιϐόυί

Άί όι δάηάόϐϐ άάί έάέόιόñάβόάέ, ηυόβόάόά όόϘ έβόάά freebsd-net (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-net>). Ίάηέέϐ άδυ όά όόίϘέέόιγία δñíάέβιαόά όά ιδιέβá γ÷ιόια ίγ÷ηέ όόέάιβδ άίόέιαόυδβόάέ:

- Ίά ίϘί γ÷άέ ÷ ηϘόέιιδιέϘέάβ Ϙ άδέέιαβ -c β -a όόαί slattach (Άόόυ έάίίέέϐ άάί άβίαέ έñβόέιι όόϐέια, έέέϐ ίάηέέιβ ÷ ηβόάόάό άίγύάηάί υόέ άόόυ γέόόά όά δñíάέβιαόά όιόό.)
- ×ñβόϘ όιό s10 άίόβ έάά s10 (Ϙ έέάόιηϐ ιδιήάβ ίά άβίαέ διέγ ίέέñβ όά ίάηέέγδ άηάιιαόιόάέñγδ).
- Άιέέιϐόά όαί άίόιέβ ifconfig s10 έάά ίά άάβόά όαί έάόϐόάόϘ όϘδ έέάδάόβδ. Άέά δάñϐάάέάια, ιδιήάβ ίά άάβόά όι δάηάέϐόυ:

```
# ifconfig s10
s10: flags=10<POINTOPOINT>
    inet 136.152.64.181 --> 136.152.64.1 netmask ffffffff0
```

- Άί Ϙ άίόιέβ ping(8) άβίαέ ίϘίγίαόά “no route to host”, βόυό όδϐñ÷άέ δñυάέϘία ίά όιί δβίαέά άηηέυέαϘόϘ όάό. Ίδιήάβόά ίά ÷ ηϘόέιιδιέβιόάόά όαί άίόιέβ netstat -r έάά ίά άάβόά όαί όñγ ÷ιόά άηηέυέαϘόϘ:

```
# 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	l00	-	0.438
inr-3.Example.ED	water.CS.Example.E	UH	1	0	s10	-	-
water.CS.Example	localhost.Example.	UGH	34	47641234	l00	-	0.438

(root node)

Όά δάναδὺή δάναάαβαίαόά άβίαέ άδὺ Ύία ό÷άοέέὺ άδαό÷ιέçΎίί όύόόçιά. Ίέ άνέειñβ έά άέάὺñίίί όδὶ όύόόçιά όάό, άίὺέίάά ίά όç άνάόόçñέιύόçά όίō άέέόçίō.

### 27.7.2 Ññèìβæίίόάό ίά Άίōδçñάόçð SLIP

Όί έάβίαιñ άόδὺ δάñΎ÷άέ έὺέέάό ððñάάβίάέό άέά όç ñýèìέόç άίιύ FreeBSD όóóðβιάόίð ùð άίōδçñάόçð SLIP. Όððέέὺ άόδὺ όçιάβίάέ υέέ όί όύόόçιά όάό έά ññèìέόóάβ ίά ίάέέίὺ άόδὺιιάόά όέó όóñάΎόάέó ίάόὺ όçί άβίίαιñ άðñάέñóίΎίί ðάέάóβί SLIP.

#### 27.7.2.1 ðññüðìèΎόάέó

Ç άίιύόçά άόðβ άβίάέ έάέάβóάñά όά÷ίέέðð όύόάυò, έάέ άέά όί έüñ άόδὺ άðάέóάβóάέ ίά Ύ÷άόά όέó άίóβóóίέ÷άó άίβóάέó άέά ίά όçί έάóάñίβóάόά. ΌðñèΎίίόίά υέέ Ύ÷άόά ίέά άñέέάβύóç ίά όί ðññüðìèέέί TCP/IP έάέ άέάέέüðάñά ίά όç έάάðéðίóέίñüóçόç έüñάι, όέó ίὺóέάð άέέóçύι, óά ððñáβéóóά, όç άñññέüñάçόç έάέ óά ðññüðìèέέά άñññέüñάçόçð υðùð όί RIP. Ç ñýèìέόç όüñ όðçñάóέβί SLIP óά Ύία άίōδçñάόçðβ άðέέίñέέβί όóñάΎόάι άðάέóάβ άίβóç άόðβί όüñ άίίίέβί, έάέ άί άάί άβóóά άñέέάέüñΎίίð ίά άóðΎð, óάó δάñάέάέίçñά ίά έάάὺὺóάóά άβóá όί TCP/IP Network Administration όίð Craig Hunt (άέüñóάέó O'Reilly & Associates, Inc, Άñέέüð ISBN 0-937175-82-X) β έὺέέίέί άδὺ óά έάέέβá όίð Douglas Comer ó÷άóέέὺ ίά όί ðññüðìèέέί TCP/IP.

ΆðέðéΎίί, ððñèΎίίόίά υέέ βáç Ύ÷άόά ññèìβóάέ όί modem óάó έάέ Ύ÷άόά ðññüðìèέέίβóάέ óά έάóὺέέççέά άñ÷άβá ññèìβóάι όί όóóðβιάόίð βóóά ίά άðέóñΎðάóάέ ç άβίίίð όóί όύόόçιά ίΎóù όüñ modem. Άί άάί Ύ÷άόά áέüñά ðññáóίέίὺóάέ όί όύόόçιά άέά άóδὺ, δάñάέάέίçñά άάβóá όί Όίβίá 26.4 άέά έáððñΎñάέáð ó÷άóέέὺ ίά όç ñýèìέόç όüñ άðέέίñέέβί όóñάΎόάι. Άίάά÷ñΎíùð ίά èΎέáóá άðβóçð ίά άάβóá όέó óάέβááð manual όçð sio(4) άέά ðέçññíóññβáð ó÷άóέέὺ ίά όί ðññüñáññά ίñβáçόçð όçð óáέñέάέβð έçñáð, óά ttys(5), gettytab(5), getty(8), έάέ init(8) άέά ðέçññíóññβáð ðññó÷άóβæίíðάέ ίά όç ñýèìέόç όίð όóóðβιάόίð βóóά ίά áΎ÷άóάέ άβίίαιñ ÷ñçóðβί ίΎóù modem, έάέ βóùð έάέ όç stty(1) άέά ðέçññíóññβáð ó÷άóέέὺ ίά όέó δάñáñΎóññóð óáέñέάέβί έðñβί (υðùð όçί cllocal άέά óáέñέάέΎð έέáðáóΎð όίð άβίάέ áðáðéάβáð όóñáñίΎíáð).

#### 27.7.2.2 Άñβáññç Άðέóέüðçόç

Όððέέὺ, Ύíáð άίōδçñάόçðβ SLIP ðññóçéíðñέάβ FreeBSD έάέóíññááβ ίά όίί άίβð ðññüðì: Ύíáð ÷ñβóóçð SLIP έάέάβ όίί άίōδçñάόçðβ SLIP, έάέ άέóΎñ÷άóάέ όóί όύόόçιά ίΎóù άίιύ άέάέέίçñ άίáññέñéóóέέίçñ áέóüñáñó άέά όί SLIP. Όί έΎέðóíð όίð ÷ñβóóç άβίάέ όί /usr/sbin/sliplogin. Όί ðññüñáññά sliplogin έέάάὺæáέ όί άñ÷άβñ /etc/sliphome/slip.hosts άέά ίά άñάέ ίέά άñáññβ ðññó ίά óáέñέέὺæáέ ίά όί ÷ñβóóç, έάέ άί ððὺñ÷άέ, óóñάΎάέ όçί óáέñέάέβ άñáññβ óά ίέά έάέέΎóέίç έέáðáóβ SLIP έάέ Ύðάέóά áéðáέάβ όί script όίð έáέçóíðð /etc/sliphome/slip.login άέά ίά ññèìβóάέ όç έέáðáóβ SLIP.

### 27.7.2.2.1 Já ΔάνÛάεαία Áέοüäĩõ óá ÁĩõδçñáõçõP SLIP

Áέα δάνÛάεαία, áέα Ýía ÷ñPóç SLIP ìá ID Shelmerg, ç áíõβóõĩε÷ç éáõá÷ñéõç óõĩ /etc/master.passwd éá Ýĩεάεá ìá õçĩ δάνáêÛòù:

```
Shelmerg:password:1964:89::0:0:Guy Helmer - SLIP:/usr/users/Shelmerg:/usr/sbin/sliplogin
```

¼õáĩ áέõÝεέáε ì Shelmerg, õĩ sliplogin éá øÛĩáε õĩ /etc/sliphome/slip.hosts áέα ìέα ãñáñP ìá ID ÷ñPóç õĩõ ìá óáεñεÛεάε. Áέα δάνÛάεαία, ìðĩñáβ ìá õðÛñ÷áε ìέα ãñáñP óõĩ /etc/sliphome/slip.hosts õĩõ ìá ãñÛóáε:

```
Shelmerg          dc-slip sl-helmer          0xfffffc00          autocomp
```

Õĩ sliplogin éá ãñáε õç ãñáñP áõõP, éá óõĩáÝóáε õç óáεñεáεP ãñáñP óõçĩ áðũĩáĩç áέαéÝóεĩç áέαðáõP SLIP, éáé Ýðáεóá éá áεõáεÝóáε õĩ /etc/sliphome/slip.login üðùò óáβĩáóáε δάνáêÛòù:

```
/etc/sliphome/slip.login 0 19200 Shelmerg dc-slip sl-helmer 0xfffffc00 autocomp
```

Áĩ üέα δÛĩá éáεÛ, õĩ /etc/sliphome/slip.login éá áεõáεÝóáε ìέα áĩõĩεP ifconfig áέα õç áέαðáõP SLIP óõçĩ ìðĩβá Ý÷áε óõĩááεáβ ç sliplogin (ç áέαðáõP 0 óõĩ δάνáδÛĩù δάνÛάεαία, ç ðñPóç δάνÛĩáõñĩõ õçð εβóóáð õĩõ áβĩáóáε óõĩ slip.login) þóðá ìá ñõèìέóõĩγĩ ç õĩðέεP áέαýεõĩóç IP (dc-slip), ç áðñáεñõõĩÝĩç áέαýεõĩóç IP (sl-helmer), ç ìÛóεá áεéõýĩõ áέα õç áέαðáõP SLIP (0xfffffc00), éáé ìðĩεáóáPðĩõá ðñüóεáóáð áðέεĩãÝò (autocomp). Áĩ εÛóε δÛĩáε óõñááÛ, éá ìðĩñÝóáðá ìá õĩ áĩõĩεβóáðá áðũ óá ãñ÷áβá éáóáãñáõPð õçð sliplogin. Ç sliplogin éáóáãñÛóáε óá ìçĩγĩáóá ÷ñçóεĩüðĩεþĩóáð õĩ ááβĩĩá **syslogd** ì ìðĩβĩð óõĩPεùð ÷ñçóεĩüðĩεáβ õĩ ãñ÷áβĩ /var/log/messages (ááβõá óέð óáεβááð ãĩPεáεáð áέα óá syslogd(8) éáé syslog.conf(5) éáé áĩãá÷ñÝĩùð áεÝáĩõá õĩ /etc/syslog.conf áέα ìá ááβõá õçĩ õĩðĩεáóáβ éáé õĩ ãñ÷áβĩ ðĩõ ÷ñçóεĩüðĩεáβ õĩ **syslogd** áέα õçĩ éáóáãñáõP).

### 27.7.2.3 Ñýεìέóç õĩõ ðõñPĩá

Ï ðñĩáðέεáãĩÝĩùð ðõñPĩáð õĩõ FreeBSD (ì GENERIC) áέαéÝóáε áĩóùĩáóùĩÝĩç ððĩóðñéĩç SLIP (sl(4)). Óõçĩ δáñβðòùóç õĩõ εÝεáðá ìá äçĩεĩõñáPóáðá ðñĩóáñĩĩõĩÝĩù ðõñPĩá, ðñĩóεÝóóá õçĩ δάνáêÛòù ãñáñP óõĩ ãñ÷áβĩ ñõèìβóáũĩ õĩõ ðõñPĩá óáð:

```
device    sl
```

Õĩ FreeBSD, áðũ ðñĩáðέεĩãP, ááĩ ðñĩùεáβ ðáεÝóá. Áĩ εÝεáðá ì áĩõδçñáõçõPð óáð ìá áĩáñááβ ùð ãñĩĩεĩãçõPð, éá ðñÝðáε ìá áðáĩáñááóóáβõá õĩ ãñ÷áβĩ /etc/rc.conf éáé ìá áεεÛĩáðá õç ñýεìέóç õçð ìáóááεçõPð gateway\_enable óá YES. ìá õĩ ðñũðĩ áðòù, éá áβĩáε óβáĩõñĩ üóε ç áðέεĩãP õçð ãñĩĩεüãçóçð éá áέαóçñçεáβ ìáõÛ áðũ ìέα áðáĩáεéβĩçóç.

Éá ðñÝðáε Ýðáεóá ìá áðáĩáεééĩPóáðá áέα ìá áĩáñáĩðĩεçεĩγĩ ìé ìÝáð ñõèìβóáεð.

Áέα ìá áóáñüóáðá áðõÝò óέð ñõèìβóáεð Ûĩáóá, ìðĩñáβõá ìá áεõáεÝóáðá õçĩ δάνáêÛòù áĩõĩεP ùð root:

```
# /etc/rc.d/routing start
```

Δάνáεáεĩγĩá ááβõá õĩ ΕὰοÛεάει 8 áέα ðáñεóóüóáñáð ðççñĩõĩñβáð ó÷áðééÛ ìá õçĩ ñýεìέóç õĩõ ðõñPĩá õĩõ FreeBSD.

### 27.7.2.4 Ñýεìέóç õĩõ Sliplogin

¼ðùð áĩáõÝñεçéá éáé ðñéĩ, õðÛñ÷ĩõ ðñβá ãñ÷áβá óõĩĩ éáõÛεĩãĩ /etc/sliphome óá ìðĩβá ÷ñçóεĩüðĩεĩγĩóáε óõç ñýεìέóç õĩõ /usr/sbin/sliplogin (ááβõá éáé õç óáεβáá manual õĩõ sliplogin(8)): õĩ slip.hosts, õĩ ìðĩβĩ

ίñβæáé õĩòð ÷ ñþóόáò SLIP έάέ όέð áίóβóóίέ÷ áò IP έέάóέγίόάέð õĩòð, õĩ slip.login õĩ ίðίβι όóίþèùò ñòèìβæάé áðèÛ όçí έάάðάóþ SLIP, έάέ ðñĩάέñάóέέÛ õĩ slip.logout, õĩ ίðίβι áíάέñάß όέð áέέάάÛð õĩòð slip.login ùóáί όáñĩάóβóάé ç όάέñέάèþ όýíááόç.

### 27.7.2.4.1 Ñýèìέόç õĩòð slip.hosts

Ôĩ /etc/sliphome/slip.hosts ðáñéÛ÷ áέ äñáìÛð ìá óÛόόáñá ðáäáβά õĩòð ÷ ùñβæίíóáé ìáóáý όĩòð ìá έάρÛ έέάóðþíáóá:

- Ôĩ áíááññέόóέέèù áέóúáíò õĩòð ÷ ñþóόç SLIP
- Ôçí õĩðέέþ έέάγέðίόç (õĩðέέþ ùò ðñĩò õĩí áíòðçñáóçðþ SLIP) όçð έέάóýíááóçð SLIP
- Ôçí áðñáέñòóĩÛίç έέάγέðίόç όçð έέάóýíááóçð SLIP
- Ôç ìÛόέá õĩòð áέέόγίò

Ç õĩðέέþ έάέ ç áðñáέñòóĩÛίç έέάγέðίόç, ìðíñáß íá áβίάέ ñĩúĩáóá ððĩεĩæέóðþĩ (όá ìðíβá íá ìáóáóñÛýðĩóáé όá έέάóέγίόáέð IP ìÛóú õĩòð /etc/hosts þ ìÛóú õĩòð DNS, áíÛέĩíá ìá όέð έάóá÷ ùñβóáέð õĩòð ððÛñ÷ ìóĩ óóĩ áñ÷ áβĩ /etc/nsswitch.conf), έάέ ç ìÛόέá έέέόγίò ìðíñáß íá áβίάέ Ûíá ùñá õĩ ìðíβι íá ìðíñáß íá έέάóèñέέέóόáß ìÛóú áíáæþόçóçð óóĩ /etc/networks. Óá Ûíá äĩέέĩáóóέέèù όýόóçĩá, õĩ /etc/sliphome/slip.hosts ìέÛæάέ ìá õĩ ðáñáέÛòù:

```
#
# login local-addr      remote-addr      mask              opt1      opt2
#                               (normal,compress,noicmp)
#
Shelmerg   dc-slip          sl-helmerg        0xfffffc00      autocomp
```

Ôóĩ óÛέĩò όçð äñáìþò, äñβóέĩíóáé ìέá þ ðáñέóóúóáñáò áðù όέð ðáñáέÛòù áðέεĩäÛð:

- normal — ÷ ùñβó óóĩðβáóç ðúĩ áðέέáóáέβäùĩ
- compress — ìá óóĩðβáóç ðúĩ áðέέáóáέβäùĩ
- autocomp — ìá óóĩðβáóç ðúĩ áðέέáóáέβäùĩ, áí áðέóñÛðáóáέ áðù õĩí áðñáέñòóĩÛίí ððĩεĩæέóðþ
- noicmp — áðáíáñáĩðĩβçóç ðúĩ ðáέÛòúĩ ICMP (ìá õĩí ðñùðĩ áóóù όá ðáέÛóá “ping” έá áðññβððĩíóáé áίóß íá έáóáíáέþĩóĩ õĩ áýñìð æþíçð όçð óýíááóçð óáð)

Ïέ áðέεĩäÛð õĩòð Û÷ ðáá έάά όέð õĩðέέÛð έάέ áðñáέñòóĩÛíáð έέáóέγίόáέð ðúĩ SLIP óóĩäÛóáùĩ óáð, áíáñòþíóáέ áðù õĩ áí ðñúέάέóáέ íá áóέäñþóáðá Ûíá ððĩäβέðóĩ TCP/IP þ áí ðñúέάέóáέ íá ÷ ñçóέĩðĩεþóáðá “proxy ARP” óóĩ SLIP áíòðçñáóçðþ óáð (ääí áβίάέ “ðñááĩáóέέèù” proxy ARP, áέèÛ óόçí áíúóçðá áóðþ ðáñέäñÛóáóáé ìá áóóù õĩí ùñĩ). Áí äáí áβóóá óβáĩòñòì ðĩέá ìÛέĩäí íá áðέéÛíáðá þ ðùò ìá áðñáέñòóĩ έέáóέγίόáέð IP, ðáñάέáéĩγĩá áíáóñÛíòá óóá έέάέβá õĩòð TCP/IP õĩòð áíáóÛñĩíóáέé óóέð ðñúððĩεÛóáέð SLIP (Ôìþíá 27.7.2.1) þ/έάέ óóĩáĩòέäðèáßòá õĩ έέá÷ áέñέóðþ έέέόγίò óáð.

Áí ðñúέάέóáέ íá ÷ ñçóέĩðĩεþóáðá ìá ÷ ùñέóóú ððĩäβέðóĩ έέá óĩòð SLIP ðæèÛóáð óáð, έá ÷ ñáέáóóáß íá έέάéÛóáðá õĩí áñέéìù ððĩäέéðóγíò áðù όçí έέáγέðίόç IP õĩòð óáð Û÷ áέ áðĩäæáß έάέ íá áðñáþóáðá óóĩòð ðæèÛóáð SLIP έέáóέγίόáέð õĩòð áíþéĩòĩ óá áóóù õĩ ððĩäβέðóĩ. ðæέóá, έá ÷ ñáέáóóáß ìÛέéĩí íá έáéĩñβóáðá ìέá óóáóέéèþ έέáäññþ óóĩ ððĩäβέðóĩ SLIP ìÛóú õĩòð áíòðçñáóçðþ SLIP óóĩí έĩíóέĩíúðáñĩ óáð äññĩεĩäçðþ IP.

ÁέáóĩñáóέέÛ, áí ÷ ñçóέĩðĩεþóáðá όç ìÛέĩäí “proxy ARP”, έá ÷ ñáέáóóáß íá áðñáέñòóĩ óóĩòð SLIP ðæèÛóáð óáð έέáóέγίόáέð IP õĩòð áíþéĩòĩ óóĩ ððĩäβέðóĩ Ethernet óóĩ ìðíβι áíþέáé í áíòðçñáóçðþ SLIP, έάέ έá ÷ ñáέáóóáß áðβόçð ìá

ñòèìβóáðá óá scripts /etc/sliphome/slip.login εάε /etc/sliphome/slip.logout íá ÷ñçóεíïðíεíγí ðí arp(8) εάε íá ÷áεñβæííóáε óεð εάóá÷ññβóáεð “proxy ARP” óðíí ðβίáεά ARP ðíð áíððçñáðçðP SLIP.

27.7.2.4.2 Ñýèíεóç ðíð slip.login

íá ðððéεü /etc/sliphome/slip.login ïéÛεάé ìá ðí ðánaéÛòù:

```
#!/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
```

Ïí áñ÷áβí slip.login áêðáεáβ áðεðð ðí ifconfig εάε ðçí εáðÛεεççç εéáðáðP SLIP, ìá ðεð ðíðééÛò εάε áðñáεñóíÛíáð εéáðεγíóáεð εάε ðç ìÛóεά εέεðγíð ðçð εéáðáðPð áððPð.

Áí Û÷áðá áðñóáóβóáε íá ÷ñçóεíïðíεPóáðá ðçí ìÛεíáí “proxy ARP” (áíðβ íá ÷ñçóεíïðíεPóáðá εéáðíñáðéεü ððíáβéððí εάε ðíðð ðáεÛðáð SLIP), ðí áñ÷áβí /etc/sliphome/slip.login εά ïéÛεάé ìá ðí ðánaéÛòù:

```
#!/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 ðñüóεáðç ãñáñP óá áððü ðí slip.login, ç arp -s \$5 00:11:22:33:44:55 pub, äçíεíðñááβ ìεά εάóá÷ññέóç ARP óðíí ðβίáεά ARP ðíð áíððçñáðçðP SLIP. ÁððP ç εάóá÷ññέóç ARP εÛíáε ðíí áíððçñáðçðP SLIP íá áðáíðÛ ìá ðçí εéáγέðíóç Ethernet MAC ùðáí εÛðíεíð Ûεεíð εüíáíð IP óðí Ethernet áðéεðíáβ íá áðéεíεííPóáε ìá ðçí εéáγέðíóç IP ðíð ðáεÛðç SLIP.

¼ðáí ÷ñçóεíïðíεáβðá ðí ðánaðÛíù ðánaÛáεéáíá, ááááεüεáβðá ùðé Û÷áðá áíðéεáðáóðPóáε ðçí εéáγέðíóç MAC ðíð Ethernet (00:11:22:33:44:55) ìá ðçí áíðβóðíε÷ç ðçð εέεPð óáð εÛñðáð Ethernet, εéáðíñáðéεÛ ðí “proxy ARP” óβáíðñá ááí εá εάεóíðñáPóáε! Ìðñáβðá íá áíáεáεγóáðá ðç εéáγέðíóç MAC ðíð εέεíγ óáð áíððçñáðçðP SLIP εíεðÛεííóáð óá áðíðáεÛíáðá ðçð áíðíεPð netstat -i. Ç äáγðáñç ãñáñP ðçð áíüáíð εá ïéÛεάé ìá ðçí ðánaéÛòù:

```
ed0 1500 <Link>0.2.c1.28.5f.4a 191923 0 129457 0 116
```

Áððü ááβ÷íáε ùðé óðí óðáεáεñεíÛíí óγóðçíá ç εéáγέðíóç MAC ðíð Ethernet áβίáε 00:02:c1:28:5f:4a. Ìé ðáεáβáð ðççí εéáγέðíóç ðíð ááβ÷íáε ç netstat -i ðñÛðáε íá áíðéεáðáóðáεíγí ìá Ûíù-εÛðù ðáεáβáð, εάε εÛεá ïíü

ääéáíááééü øçöβì ðñÝðáé íá íáoáoñáðáβ óá äéðëü ðñíóéÝóííóáo áðü ðñíóóÛ Ýíá íçäáíééü. Ç äéáyèðíóç íáoáoñÝðááoé íá áðóü ðíí ðñüðí óá íέα ðñöð ðíð ðñíñáβ íá ÷ñçóέíðíέðóáé ç arp(8). Άάβðá ðç óáέβáá manual ðçð arp(8) áέα ðáñέóóüðáñáð ðççñíñíñáð ó÷áðέέÛ íá ðç ÷ñðç ðçð áíóíèðð áðóðð.

**Óçíáβúóç:** ¼ðáí äçíέíðñááβðá ðí /etc/sliphome/slip.login έάέ ðí /etc/sliphome/slip.logout, έά ðñÝðáé íá èÝóáoðá ðí bit “áèðÝέáoçò” (ð.÷. chmod 755 /etc/sliphome/slip.login /etc/sliphome/slip.logout), äέáðíñáðέέÛ ç sliplogin äáí έά ðñíñáβ íá ðá äéðáèÝóáoé.

### 27.7.2.4.3 Ñýèíέóç ðíð slip.logout

Óí ÷ñçóέíðíέáβðá “proxy ARP”, äéÛ áí óέíðáýáðá íá ðí äçíέíðñáβðáðá, ðñíñáβðá íá ÷ñçóέíðíέðóáðá ðð ðñüääéáíá ðí ðáñáέÛðü áðëü ðáñÛääéáíá:

```
#!/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
```

Áí ÷ñçóέíðíέáβðá “proxy ARP”, έά èÝέáoðá ðí /etc/sliphome/slip.logout íá äέáñÛðáé ðçí έáoá÷ñέóç ARP ðíð ðáèÛðç 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 äέáñÛðáé ðçí έáoá÷ñέóç ARP ðíð ðñíóóÝέçέá íá ðçí äèðÝέáoç ðíð slip.login ðíð “proxy ARP”, έáoÛ ðçí áβóíáí ðíð ðáèÛðç SLIP.

ÐñÝðáé íá ðí äðáíáέÛáíñíá Ûέçç íέα ðñÛ: Áääáέüèáβðá üðé ðí /etc/sliphome/slip.logout Ý÷áέ ðñέóðáβ ðð äéðáèÝóέíí íáoÛ ðçí äçíέíðñáβá ðíð (ð.÷., chmod 755 /etc/sliphome/slip.logout).

**27.7.2.5 ΔάηΪάηίοάὸ δίο ΔηΪθάέ ίά ΈΪάάὸά Ὀδύθς όάὸ όδς Ἀηήηέυάςός**

Αί άάί ÷ ηςόείηδρείάβὸά όςί ίΪέηί “proxy ARP” άέά ίά ηηήηείάβὸά δάέΪόά ίάόάίΪ όὐί δάέάὸηί SLIP έάέ όηὸ όδύήέδίο άέέόΪή όάὸ (έάέ άίάά ÷ ηΪήὸ έάέ όηὸ Internet), έά δηΪθάέ ίΪέηί ίά δηήόέΪόάά όάάόέέΪὸ άέάάηηΪὸ δηήὸ όηί δέςόέΪόάηη όάὸ δηήάδέάηίΪή ηηήηείαςὸη άέά ίά ηηήηείάβὸά όη όδηάβέόηί όὐί SLIP δάέάὸηί όάὸ άέάΪόήὸ όηὸ άηὸδςήάόςὸη SLIP.

**27.7.2.5.1 ὌάάόέέΪὸ ἈέάάηηΪὸ**

ς δηήόέδς όάάόέήηί άέάάηηή δηήὸ όηὸ δέςόέΪόάηηὸ όάὸ δηήάδέάηίΪήὸ ηηήηείαςὸΪὸ, ίδηήά ίά άβήάέ δηήάέήάόέήη (η έάέ άάΪήάός άί άάί Ϊ ÷ άὸά δά έάὸΪέέέά άέέάέηάόά δηήόάάόςὸ). Αί ς άόάέηά όάὸ άέέέΪόάέ άβέόηί ίά δηέάδέηΪὸ ηηήηείαςὸΪὸ, έΪδηέά ηήόΪέά (δ. ÷. άδύ όςί Cisco έάέ όςί Proteon), άέόὐὸ ὐδέ δηΪθάέ ίά ηὸέηέόόηΪή ίά όςί όάάόέήη άέάάηηη δηήὸ όη όδηάβέόηί SLIP, δηΪθάέ άδβόςὸ ίά ηὸέηέόόηΪή ίά όέὸ όάάόέέΪὸ άέάάηηΪὸ δηὸ έά άίάΪήηήή όόηὸδ Ϊέέηὸδ ηηήηείαςὸΪὸ. Έά ÷ ηάέάόάβ ίά δάέηήάήάόέόάβὸά έάέ ίά άηέήΪόάά άέΪόηήάὸ ηὸέηέόάέὸ άέά ίά άηὸέΪόάέ ς ηηήηέυάςός ίΪόὸ όάάόέήηί άέάάηηή.

# ÊäöÛëáéí 28 Çëäêöñííéêü Öá÷ õänñĩáßí

Äñ÷êÞ ðáíáéóóñÛ äðu ôí Bill Lloyd. ÄñÛðçêä íáíÛ äðu ôí Jim Mock.

## 28.1 Óýíñç

Ôí “çëäêöñííéêü öá÷ õänñĩáßí”, äñýðäná äíuóðu ùð email, äßíáé óóéð íÝñàð íáð íéá äðu óéð ðeÝíí äeáááñÝíáð ïñöÝð äðéíííúíáð. Ôí êäöÛëáéí äóðu ðänÝ÷ äé íéá äáóéêÞ äeáááñÛ ðçç èäeðíñáßá äíuð äeáéñíeóðP email óðí FreeBSD, èäêð èáé íéá äeáááñÛ ðçç äeááeéäóßá äðíóðíêÞ èáé êÞçð email óðí FreeBSD. Ûóðuóíç áíáóñÛ äóðÞ äáí ðñÝðáé íá èäñççäß ðeÞñçð, èäêð ððÛñ÷ íóí áéuñá äñeáðíß ðänÛäñóðò ðíð ðñÝðáé íá èçòèíýí ððuðeí éáé Ý÷ íóí äáÞ ðänáeäeòeäß. Äéá ðeí ðeÞñç áíÛeðóç ôíò eÝíáóíò, í áíáñíÞðóçð ðänáðÝíðáðáé óðá ðíeÛÛ äñáeñáðeéÛ äeáéßá ðíò áíáéÝñííóáé óðí ðänÛñòçíá B.

Äóíý äeááÛóáðä äóðu ôí êäöÛëáéí, èá íÝñáðä:

- Ôí eíáeóíeéü ðíð ÷ñçóeíñíeäéßáðáé óðçí äðíóðíêÞ èáé êÞçç çëäêöñííeéíý öá÷ õänñĩáßíò.
- ðíð äñßóeíñíeéü öá äáóeéÛ äñ÷ äßá ñðeíßóáñí ðíò **sendmail** óðí FreeBSD.
- Öç äeáóñÛ ïðááíý äðñáeñðóíÝíúí èáé ðíðeêÞ èðñßáñí öá÷ õänñĩáßíò (mailboxes).
- ððuð íá äíðíáßáðä äíáðeéýíçðíòð spammers äðu ôí íá ÷ñçóeíñíeééðóíòí ðíí äeéü óáð äíððçñáðçðP email ùð áíáíáðáäüðç.
- ððuð íá äeááóáððóðáðä èáé íá ñðeíßóáðä Ýíá äñáeéäeóeéü Áíóeðñüóðuðí ïðáóñÛÛð Öá÷ õänñĩáßíò (Mail Transfer Agent) óðí óýóðçíá óáð, áíðeéäeéóðÞíáð Ýðóé ôí **sendmail**.
- ððuð íá áíóeíáðùðßóáðä óðíçeóéíÝíá ðñíáeÞíáðá óðíí äeáéñíeóðP öá÷ õänñĩáßíò.
- ððuð íá ÷ñçóeíñíeééðáðä ôí SMTP ïá ðí UUCP.
- ððuð íá ñðeíßóáðä ôí óýóðçíá óáð ïñíí äéá äðíóðíêÞ email.
- ððuð íá ÷ñçóeíñíeééðáðä ôí email íÝóù äðeéñáeéðò (dialup) óýíááóçð.
- ððuð íá ñðeíßóáðä ðeóðíðíßçóç äðeáíóeéüòçðáð óðí SMTP äéá ðñüòeáðç áóöÛëeá.
- ððuð íá äeááóáððóðáðä èáé íá ÷ñçóeíñíeééðáðä íéá äóáññíáÞ äðíóðíêÞ èáé êÞççð email äéá ÷ñÞóáðä, ùðuð ôí **mutt**.
- ððuð íá èáðááÛóáðä ôí email óáð äðu Ýíá äðñáeñðóíÝíúí äeáéñíeóðP POP Þ IMAP.
- ððuð íá äöänñüóáðä ðßeðñá èáé èáíúíáð óðçí äeóáñ÷ ùíáçç äeèçeíñáðáðá óáð, ïá äóðuñáðí ðñüðí.

ðñeí äeááÛóáðä äóðu ôí êäöÛëáéí, èá ðñÝðáé:

- Íá ñðeíßóáðä óuóðÛ ðçç óýíááóç ðíò äeéðýíò óáð (ÊäöÛëáéí 31).
- Íá ñðeíßóáðä óuóðÛ ðeð ðeçññíóññáð DNS äéá ðíí äeáéñíeóðP äeèçeíñáðáðáð óáð (ÊäöÛëáéí 29).
- Íá äññíáðä ððuð íá äeááóáððóðáðä ðñüòeäðí eíáeóíeéü ðñßðíð èáðáðeäðáððP (ÊäöÛëáéí 4).

## 28.2 ×ñçóéììðìéðíôáð òì Çæâðñíééù Õá÷ðãññáβì

Õá èÙèá áíðáεεάáP çæâðñíééý ðá÷ðãññáβìò, óñíñãÙæìíðáé ðÝíðá ááóéèÙ ðìðíáðá: Õì ðñüãññáìá ÷ñPóðç, ì ááβìííáð ðìò áìððçñáðçðP, ðì DNS, ìεá áðñáéñðóìÝíç P ðìðéèP èðñβáá ðá÷ðãññáβìò (mailbox) εáé ððóéèÙ ì ððìεíáéóððð ðìò áεá÷áéñβæáðáé ðì email (mailhost).

### 28.2.1 Õì ðñüãññáìá ×ñPóðç

Ç εáðçãññáá áððP ðãñéεáìáÙíáé ðñíñãÙííáðá ùððð ðá **mutt**, **pine**, **elm**, εáé mail, εáεðð εáé ðñíñãÙííáðá ðìò áεáéÝðìòì GUI ùððð áβíáé ðá **balsa**, **xfmail** (áεá ìá ððóìòìá ìáñéèÙ ðãñáááβáìáðá) εáé èÙðìεá ðéì “áìáεéáìÝíá” ùððð áβíáé ìε ððéèñáðñçðÝð áεá ðì WWW. Õá ðñíñãÙííáðá áððÙ, áðεðð ìáðááεáÙæìíðì ðéð óñíáεéááÝð ðá÷ðãññáβìò óðì ðìðéèÙ “mailhost”, áβðá εáεðíðáð èÙðìεíí áðü ðìðð ááβìííáð ðìò áìððçñáðçðP ðìò áβíáé áεáéÝðéìε, P ðãñááβáìíðáð ðéð áððáðεáβáð ìÝòù TCP.

### 28.2.2 Ááβìííáð ÁìððçñáðçðP Mailhost

Õì FreeBSD Ýñ÷áðáé ìá ðì **sendmail** ááεáðáðóçìÝíí áðü ðñíáðéεíáP, áεèÙ ððìóðçñβæáé áðβóçð εáé ìááÙεì áñéèìì áðü Ùεεìðð ááβìííáð ðá÷ðãññáβìò, ðãñéεáìááñìÝíñí εáé ðùì:

- **exim**
- **postfix**
- **qmail**

Ì ááβìííáð Ý÷áé óðìðèùð áýì εáéðìòñãñáð—áβíáé ððáýεðñìð áεá ðç èPðç áéóáñ÷ùìáñìò mail, ùððð áðβóçð εáé ðçì ðãñÙáìóç ðìò áìáñ÷ùìáñìò mail. ¼áìðð, *ááì áβíáé* ððáýεðñìð áεá ðç óðéεíáP ðìò mail ìá ðç ÷ñPóç ðñüòìεùεèì ùððð ðá POP P IMAP áεá ðçì áìÙáñùóç ðìò ðá÷ðãññáβìò óáð, ìýðá áðéðñÝðáé ðç óýíááðç ððéð ðìðéèÝð èðñβááð ðýðìò mbox P Maildir. ðéεáñí ìá ÷ñáεáðáðβðá èÙðìεíí áðéðñüóεáðì ááβìííá áεá áððü ðì óéìðü.

**ðñíáéáìðìβçðç:** ðáééùðáñáð áéäüóáéð ðìò **sendmail** Ý÷ìòì èÙðìεá ðìááñÙ ðñíáεðìáðá áóðáéáβáð, ìÝòù ðùì ìðìβùì ìðìñáβ èÙðìεìò áéóáìéÝáð ìá áðìéðPðáé ðìðéèP P áðìñáéñðóìÝíç ðñüóááðç ððì ìç÷Ùíçìá óáð. Áεá ìá áðìóýááðá ðñíáεðìáðá ðÝðìéìò áβáìòð, ááááεùεáβðá ùðé ÷ñçóéììðìéáβðá èÙðìεá ðñüóááðç Ýéáìóç. ÁíáεéáéðéèèÙ, ìðìñáβðá ìá ááεáðáðððáðá èÙðìεíí Ùεεì MTA áðü ðçì ÕðéèìáP ðùì Ports ðìò FreeBSD.

### 28.2.3 Email éáé DNS

Õì Óýðóçìá Ìñáóβáð ðãñé÷βì (DNS) εáé ì ááβìííáð ðìò, ì named, Ý÷ìòì óçìáíðéèù ñùεì ðççì ðãñÙáìóç ðìò email. Áεá ðçì ðãñÙáìóç ðìò email áðü ðì Ýíá site óá Ýíá Ùεεì, ì ááβìííáð ðìò áìððçñáðçðP εá ðÙíáε áεá ðì áðñáéñðóìÝíñ site óðì DNS, áεá ìá εáéìñβóáé ðìéìð ððìεíáéóððð εáìáÙíáé ðì email áεá ðì óðáéáεñéìÝñ ðñíñéóìü. Ç áεááéεáóβá áððP óðìááβíáé áðβóçð ùðáì ì áééùð óáð áìððçñáðçðPð εáìáÙíáé email áðü èÙðìεíí áðñáéñðóìÝíñ ððìεíáéóðP.

Õì DNS áβíáé ððáýεðñì áεá ðçì áíðéóðìβ÷çðç ìññÙðùì ððìεíáéóððì óá áεáðéýíðáéð IP, ùððð εáé áεá ðçì áðìεPéáððç ðççñìòñéβì ðìò ó÷áðβæìíðáé ìá ðçì ðãñÙáìóç çæâðñíééý ðá÷ðãññáβìò, ùððð ìε ááãñáðÝð MX. Ç ááãñáðP MX (Mail Exchanger) áíááìññβæáé ðìéìð ððìεíáéóððð (P ððìεíáéóðÝð) εá áβíáé ððáýεðñìð áεá ðç èPðç ðá÷ðãññáβìò áñüð óðáéáεñéìÝñò ðñÝá (domain). Áí ááì Ý÷áðá ááãñáðP MX áεá ðìò ððìεíáéóðP P ðìò ðñÝá óáð, ðì email εá

ðáñááβááóáé áðáðεάβáð όóñ ððñíέέόð óáð, íá όçñ ðññúðñέáðP ùέé Ý÷áðá ááñáóP όýðñò A ðñò íá ááβ÷íáé όóñ ððñíέέόð óáð P όóçñ IP áέáýέðñόç ðñò.

Ìðññáβðá íá ááβðá όέð ááñáóÝð MX áέá ððñíέáβðñðá όñÝá, ÷ñçόέññðñέðñóáð όçñ áñðñέP host(1), ùðñð όáβñíáóé όóñ ðáñáéÙòñ ðáñÙáέέñá:

```
% host -t mx FreeBSD.org
FreeBSD.org mail is handled (pri=10) by mx1.FreeBSD.org
```

### 28.2.4 ΈáñáÙññíόáò Mail

Ì mailhost áβñáé ððáýέðñò áέá όçñ έPθç mail ðñò ðññññβæáóáé áέá όñ ðñÝá óáð. Έá όέéÝñáé ùέñ ðñ mail ðñò Ýñ÷áðáé ðñò ðñÝá, éáé éá ðñ áðñέçéáýόáé áβðá όóñ mbox (όçñ ðññáðééáñÝñç ðñέññ áέá áðñέPéáðóç mail) P óá ðñòP Maildir, áñέññá íá όέð ððέñβóáéð ðñò Ý÷áðá éÙñáé. Áðñ όç óðέáñP ðñò ðñ mail Ý÷áé áðñέçéáðéáβ, ððññáβðá áβðá íá ðñ áέááÙóáðá ðñðέéÙ, ÷ñçόέññðñέðñóáð áóáññáÝð ùðñð ðñ mail(1) P ðñ **mutt**, P íá ðñ ááβðá ðñÝóñ áðñáέñðóñÝñçð óýñááóçð, ÷ñçόέññðñέðñóáð éÙðñέñ ðññòðñέñέñ ùðñð ðñ POP P ðñ IMAP. Áðñóñ óçñáβñáé ùέé áñ áðééññáβðá íá áέááÙæáðá ðñ mail óáð ðñññ ðñðέéÙ, ááñ ÷ñáéÙæáðáé íá ááéáóáóðPóáðá áñðçññáðçðP POP P IMAP.

#### 28.2.4.1 ðññóááóç óá ÁðñáέñðóñÝñçð Έðñβááð ðñÝóñ POP éáé IMAP

Áέá íá Ý÷áðá áðñáέñðóñÝñç ðññóááóç óóέð éðñβááð óá÷ðáññáβñò, áβñáé áðáñáβóçññ íá Ý÷áðá ðññóááóç óá Ýñá áñðçññáðçðP POP P IMAP. Óá ðññóúéñέéá áóðÙ, áðéðñÝðññóñ óóñò ÷ñPóðáð íá óðñáÝññóáé óóέð éðñβááð ðñòð áðñ áðñóóáóç, íá ðñáÙέç áðéñέβá. Έáé óá áýñ ðññóúéñέéá (POP éáé IMAP) áðéðñÝðññóñ óóñò ÷ñPóðáð áðñáέñðóñÝñç ðññóááóç óóέð éðñβááð ðñòð, áέéÙ ðñ IMAP ðññóóÝñáé áñéáðÙ ðéáññáéðPñáðá, ðñέóñÝñá áðñ óá ðññá óáβññíóáé ðáñáéÙòñ:

- Óñ IMAP ððññáβ íá áðñέçéáýόáé ðçññáðá óá Ýñá áðñáέñðóñÝññ áñðçññáðçðP, ùðñð áðβóçð éáé íá óá áñáέðPóáé.
- Óñ IMAP ððññóçñβæáé ðáððñ÷ññáð áñçñáñPóáéð.
- Óñ IMAP ððññáβ íá óáñáβ áñáέñáðééÙ ÷ñPóέññ óá óðñáÝóáéð ÷ñçέPð óá÷ýðçðáð, éáéPð áðéðñÝðñáé óóñòð ÷ñPóðáð íá éáðááÙóñòñ όç áñP ðññ ðññ ðññóñÝðññ, ÷ññβð íá éáðááÙóñòñ ðñ ðáñéá÷ñññ ðñòð. ððññáβ áðβóçð íá áéðáéÝóáé áñááóβáð ùðñð áýñáóç ðçññóñÝðññ áðáðéáβáð όóññ áñðçññáðçðP, áέá÷έóóñðñέðñóáð ðñ áððñ ðññ ðññðñ ðç ðáðáóññÙ ááññÝñññ ðññáý ðññ ðáέáðPñ éáé ðññ áñðçññáðçðPñ.

Áέá íá ááéáóáóðPóáðá Ýñá áñðçññáðçðP POP P IMAP éá ðñÝðáé íá áέñññέðPóáðá óá áðññáñá áPñáðá:

1. ÁðééÝñðá Ýñá áñðçññáðçðP IMAP P POP ðñò íá áñðçññáðáβ όέð áñÙáέáð óáð. Ìé ðáñáéÙòñ áñðçññáðçðÝð POP éáé IMAP áβñáé áñéáðÙ áέáááññÝññ éáé áðñóáέýñ éáéÙ ðáñáááβñáðá:
  - **qpopper**
  - **teapop**
  - **imap-uw**
  - **courier-imap**
2. ÁáéáóáóðPóáðá ðñ ááβññá POP P IMAP óçð áðééñáPð óáð, áðñ όçñ ÓðéññáP ðññ Ports.
3. Áñ ÷ñáéÙæáðáé, ðññðññέðPóáðá ðñ áñ÷áβñ /etc/inetd.conf áέá íá ðññðPóáðá ðññ áñðçññáðçðP POP P IMAP.

**Ðññáéáñññçç:** Έá ðñÝðáέ ίá òçñáέρòññá ùðé ðñóñ ðñ POP ùññ έáέ ðñ IMAP ñáðááβáñññ ðέçñññññáð ùðñ ðñ ùññá ÷ñρòðç έáέ ðññ έùáέέù òá ñññòρ áðèñý έáέñÝññ. Áðñ òçñáβñáέ ùðé áñ èÝέáðá ίá áóðáέβóáðá ðç ñáðÙáññç ðέçñññññέρñ ñÝù ñðòρ ðñ ðññòññέùέùñ, έá ðñÝðáέ ίá ðáñÙóáðá áððÝð ðéð òññáÝóáέð ñÝù ðñ ssh(1) (tunneling). Ç áέááέέáóβá áððρ ðáñέáñÙðáðáέ ñá έáððññÝñáέá òññ Õñρñá 14.11.8.

### 28.2.4.2 Ðññóááóç òá ÕñðéέÝð Έðñβááð Õá÷ðáñññáβñ

Ïðññáβðá ίá Ý÷áðá ðñðέέρ ðññóááóç òðéð èðñβááð òá÷ðáñññáβñ ÷ñçóέñññέρññáð áðáðéáβáð èÙðñέñ ðññáññáññá áðñòññέρð/έρðçð (MUA) òñññ áñðççññáðçðρ ðññ áβñáέ áðñέçέáðñÝñáð. ΈáðÙέέçέáð áóáñññáÝð áέá áððñ ðñ òέñðñ áβñáέ ð.÷. ðñ **mutt** ρ ðñ mail(1).

### 28.2.5 Ï Áñðççññáðçðρ Mail

Áñðççññáðçðρ mail èáññáβðáέ ñ ððñέñέóðρ ñ ñðñβñð áβñáέ ððáýέñññð áέá ðçñ ðáñÙáññç έáέ έρðç mail áέá ðññ ððñέñέóðρ òáð, έáέ áñáá÷ñññ ñέá ðñ áβέðññ òáð.

## 28.3 Ñýèìέóç òññ sendmail

*Õññáέóñññ ðññ Christopher Shumway.*

Õññ sendmail(8) áβñáέ ñ ðññáðέέáñÝññð Áñðέðññóùðñð ñáðáóñññ Õá÷ðáñññáβñ (Mail Transfer Agent, MTA) òññ FreeBSD. ÁññέáέÙ ðññ áβñáέ ίá áÝ÷áðáέ ðñ email áðñ ðññð Áñðέðñññòρññð Email ×ñρòðç (Mail User Agents, MUA) έáέ ίá ðñ ðáñááβááέ òññ έáðÙέέçέññ mailer ðññ ññβέáðáέ òññ áñ÷áβñ ñðèñβóáùñ ðññ. Õññ **sendmail** ñðññáβ áðβðçð ίá áá÷έáβ òñññáÝóáέð áέέðýññ έáέ ίá ðáñááρðáέ ðññ mail òá ðñðéέÝð èðñβááð ρ έáέ òá èÙðñέñ Õέέñ ðññáññáññá.

Õññ **sendmail** ÷ñçóέñññέáβ ðá áέùέññéá áñ÷áβñ ñðèñβóáùñ:

¼ññá Áñ÷áβñ	Έáέðñññáβá
/etc/mail/access	Ç áÙóç ááññÝññ ðññóááóçð ðññ <b>sendmail</b> .
/etc/mail/aliases	Ðáñññññέá (aliases) áέá ðéð èðñβááð (Mailboxes)
/etc/mail/local-host-names	Έβóðá ðññ ððñέñέóðρññ áέá ðññð ñðñβñð ðññ <b>sendmail</b> áÝ÷áðáέ mail
/etc/mail/mailer.conf	Ñðèñβóáέð ðññ ðññáñÙññáðññ mailer
/etc/mail/mailertable	Ðβñáέáð ðáñááùóáùñ ðññ mailer
/etc/mail/sendmail.cf	Õññ έáñðñέέù áñ÷áβñ ñðèñβóáùñ ðññ <b>sendmail</b>
/etc/mail/virtusertable	Ðβñáέáð áέέññέέρñ ÷ñçóðρññ έáέ ðáñέñ÷ρññ (domains)

### 28.3.1 /etc/mail/access

Ç áÙóç ááññÝññ ðññóááóçð έáέññβέáέ ðññέέ ððñέñέóðÝð ρ áέáðέýññáέð IP Ý÷ññ ðññóááóç òñññ ðñðéέù áñðçççññáðçðρ mail έáέ ðé áβáññð ðññóááóç Ý÷ñññ. Ç έáðá÷ρñçççç áññð ððñέñέóðρ ñðññáβ ίá Ý÷áέ ðéð áðέέñáÝð OK, REJECT, RELAY ρ áðέÙ ñá ñáðáέáÙáέέ ðññ Ýέáá÷ñ ðçç ññððβñá áέá÷ áβñέóçð έáέρñ ðññ **sendmail** ñá èÙðñέñ



ιά εάειήεοόαβι ιέα ἀήνιέηοοίΥίϑ εοήβιὰ ÷ήϑοείηδιέβιόαδ οϑ ήήοβ <user@example.com>. Ὀί ἀδύηήνι δάνἘάεαία, ααβ÷ιάε δὐδ ήδιήνιὰβι ιά ββιάε ααήνιὰοβ οίρ mail οά Υία αν÷αβι, οοϑ οοάεαήεήΥίϑ δάνβδδὐοϑ οί /dev/null. Ὀί οάεαδδὐοαβι δάνἘάεαία, ααβ÷ιάε δὐδ ββιάοάε ϑ ἀδιόοιέβ mail δήρὐ Υία δήνιήνιὰβι. Ὀοί δάνἘάεαία ἀοδὐ, οί ήβιόια ανἘάοάε οοϑί οοδιδιέϑιΥίϑ αβίοίη (standard input) οίρ δήνιήνιὰβι /usr/local/bin/procmail ÷ήϑοείηδιέβιόαδ Υία UNIX pipe.

ἘἘεὰ οήνἘ διρ ββιάοάε ήίϑιΥήνιόϑ ἀοοίϑ οίρ αν÷αβι, εά δήΥδάε ιά ἀεοάεαβδὐ οϑί ήιόιέβ make οοήι εάοἘεήη /etc/mail/, βρὐα ιά ήίϑιήνιέαβ ϑ αἘοϑ ααήνιήνι.

### 28.3.3 /etc/mail/local-host-names

Δήνιέεοάε αέα ιέα εβδὐά ἀδὐ ήνιήοά οδιέιέεοοβι, οϑί ήδιβι οί sendmail(8) εά αΥ÷αδὐά ἐδ ήνιήοά αέα οί οιδέεἠ ιϑ÷Ἐίϑι. Ὀιδιέεαδβδὐα οά ἀοδβι οά ήνιήοά οὐι οδιέιέεοοβι β οὐι οήνιήνι αέα οίρδ ήδιβιόδ εΥεάδὐ οί **sendmail** ιά εαίαἘιάε mail. Αέα δάνἘάεαία, ή ι οοάεαήεήΥήδ ήδδϑήνιόϑδ mail δήνιέεοάε ιά εαίαἘιάε mail αέα οίρ οήνιή example.com εάε αέα οίρ οδιέιέεοοβ mail.example.com, οί αν÷αβι local-host-names εά ήεἘεάε ιά οί δάνιέἘδὐ:

```
example.com
mail.example.com
```

ἘἘεὰ οήνἘ διρ ήίϑιήνιήοάε ἀοδὐ οί αν÷αβι, εά δήΥδάε ιά ββιάοάε ἀδίαίεεβιϑοϑ οίρ sendmail(8) αέα ιά αέαἘοάε οεδ ἀεεάἘδ.

### 28.3.4 /etc/mail/sendmail.cf

Ὀί sendmail.cf ββιάε οί εάρὐεἠ αν÷αβι ηδὐιβὐαἠ οίρ **sendmail**. Ὀί αν÷αβι ἀοδὐ ηδὐιβιέε οϑ οοήεεβ οοιδήνιέοήνἘ οίρ **sendmail**, διρ δάνεεαίαἘιάε ιαδίαΥ Ἐεἠ οϑί ἀδίαίααήνιόβ αεαδὐέϑιόαἠ εάε οϑί ἀδιόοιέβ ιϑιόιἘδὐι ἀδὐήεοϑδ δήρδ ἀδὐιέηοοίΥήδδ ήδδϑήνιόϑδ mail. Ἐάεβδ οί αν÷αβι ἀοδὐ δάνεΥ÷αε οὐοί αεαοήνιόεεἘδ ηδὐιβὐαεδ, ββιάε οοοεἠ ιά ββιάε ανεαδἘ διέϑδερἠ εάε ιε εαδδὐήνιέεαδ οίρ ββιάε Υήνι ἀδὐ οί οεἠδὐι ἀοδβδ οϑδ ήνιόϑοαδ. Ἀδδδ÷βδ, ἀοδὐ οί αν÷αβι οδἘιέά ÷ήεἘἘαδὐάε ιά αεεα÷εαβ οά οδδεεἠδὐ ήδδϑήνιόϑδ mail.

Ὀί ἀαοεἠ αν÷αβι ηδὐιβὐαἠ οίρ **sendmail** ήδιήνιὰβι ιά δάνη÷εαβ ια οϑ ήβεαέα ιαήνιήνιέβι οϑδὐο m4(1) διρ εάειήβιέδ οϑ οοιδήνιέοήνἘ εάε οά ÷ανιέδϑήεοδεεἘ οίρ **sendmail**. Αέα δάνεοοὐοαήδδ δϑϑήνιόβδ, δάνιέεἠιὰ αεαἘοάε οί /usr/src/contrib/sendmail/cf/README.

Ἐέα ιά εο÷ϑοίρ ιε αεεάἘδ διρ εἘιήοά οά ἀοδὐ οί αν÷αβι, εά δήΥδάε ιά ἀδίαίεεβιόαδ οί **sendmail**.

### 28.3.5 /etc/mail/virtusertable

Ὀί αν÷αβι virtusertable ήίεοοίε÷αβ αεαδὐέϑιόαεδ mail αεεἠέβι οήνιήνι οά δήνιήοεεἘδ εοήβιὰδ οά÷οαήνιὰβι. Ιε εοήβιὰδ ἀοδἘδ ήδιήνιὰβι ιά ββιάε οιδεεἘδ, ἀδὐιέηοοίΥιὰδ, δάνιήνιέά διρ Υ÷ιόι ήεοόαβ οοί /etc/mail/aliases, β αν÷αβι.

### ΔάνἘάεαία 28-3. ΔάνἘάεαία Ἐίεοοίβ÷ϑοϑδ Mail Ἀεἠιέεἠ Ὀήνιή

```
root@example.com          root
postmaster@example.com    postmaster@noc.example.net
@example.com               joe
```



Ἄρα ἡ ἀδελφότητα τοῦ **sendmail**, ὁποῦ ἀπενεργοποιεῖται ἡ ὀψὲς ἡ ἀδελφότητα τοῦ **sendmail**, ὁποῦ ἀπενεργοποιεῖται ἡ ὀψὲς ἡ ἀδελφότητα τοῦ **sendmail**.

```
sendmail_enable="NO"
sendmail_submit_enable="NO"
sendmail_outbound_enable="NO"
sendmail_msp_queue_enable="NO"
```

ὁποῦ `/etc/rc.conf`.

Ἄρα ἐν ἑαυτῇ ἡ ἀδελφότητα τοῦ **sendmail** ἔχει ἡ ἀδελφότητα τοῦ **sendmail** ἐὰν ἡ ἀδελφότητα τοῦ **sendmail** ἐὰν ἡ ἀδελφότητα τοῦ **sendmail**.

```
sendmail_enable="NO"
```

ὁποῦ `/etc/rc.conf`. Ἐπισημασμένο ὅτι ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**.

### 28.4.3 Ἐπεξεργασία τοῦ MTA ἐν ἑαυτῇ ὁποῦ ἡ ἀδελφότητα

Ὁποῦ ἡ ἀδελφότητα τοῦ MTA ἐὰν ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**.

```
# echo 'postfix_enable="YES"' >> /etc/rc.conf
```

Ὁποῦ MTA ἐὰν ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**.

### 28.4.4 Ἐπεξεργασία τοῦ sendmail ὁποῦ ἡ ἀδελφότητα τοῦ Mailer ὁποῦ ἡ ἀδελφότητα

Ὁποῦ **sendmail** ἀπενεργοποιεῖται ὁποῦ ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**.

Ἄρα ὁποῦ ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**.

Ἐπισημασμένο ὅτι ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**.

```
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
```

Ἐπισημασμένο ὅτι ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**, ἡ ἀδελφότητα τοῦ **sendmail**.

άέάοέιγíάέ έάέάβόαñά όçí άέέάαP όύí άέόάέYόέúí δíο άέόάέγíόάέ όόçí δñάáíάόέέúόçόά úόáí áβíάόάέ έέPόç όύí δñíáδέέáñYíúí έάέόíδñάέβí όíο sendmail.

όόέ, áí èYέάόá íá άέόάέάβόάέ όí /usr/local/supermailer/bin/sendmail-compat áíόβ áέά όí **sendmail**, έá íδñíγíόάόá íá άέέUíáόá όí /etc/mail/mailer.conf þόόá íá áñUόáέ:

```
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
```

### 28.4.5 Íέíέέçñþííόáò

Íúέέò Y÷άόá ñέòíβόάέ όá δUíόá úδúò áδέέóíáβόá, íδñáβόá áβόá íá έUíáόá kill όέò áέáñááόβáò όíο **sendmail** δíο ááí ÷ñáέUάάόá δέYíí έάέ íá άέέέíPόáόá όέò áíόβόóíέ÷άò όíο íYíο óáò έíάέóíέέíγ, P áδέþò íá έUíáόá áδáíάέέβíçόç. Ḃ áδáíάέέβíçόç έá óáò áþόáέ áδβόçò όçí áδέάέñβá íá áááάέúέάβόá úέέ όí óýóόçíá óáò Y÷άέ ñέòíέέóáβ όóóòU, þόόá όí íYí óáò MTA íá íáέέíUάέ áδóúíáόá óá έUέá áέέβíçόç.

## 28.5 Áíόέíáòþðέόç ḂñíáέçíUóúí

1. Άέάόβ δñYðáέ íá ÷ñçόέííδíέþ όí δέþñáò úñíá (FQDN) áέá δδíέíάέóόYð δíο áñβόέííόáέ όóíí όñYά ííò;

Ὀí δέí δέέáíú áβíáέ íá άέάδέόóþόáόá úέέ í δδíέíάέóόPð áñβόέáόáέ όόçí δñάáíáόέέúόçόá óá άέάóíñáόέέú όñYά. Άέά δáñUáάέáíá, áí áñβόέáόá όóíí foo.bar.edu έάέ èYέáόá íá áδέέέíúíPόáόá íá Yíá δδíέíάέóόP íá όí úñíá mumble όóíí όñYά bar.edu, έá δñYðáέ íá áíáόáñέáβόá óá áδóúí íá όí δέþñáò όíο úñíá, mumble.bar.edu, áíόβ áέά áδέþò mumble.

ḂáñááíόέάέU, áδóúí áδέóñáδúόáí áδú όíοð DNS resolvers όíο BIND. Uόóúóí, ç δñY÷íόá Yέáíόç όíο **BIND** δíο δáñέέáíáUíáόáέ όóíí FreeBSD, ááí δáñY÷άέ δέYíí óóíóíñáýόáέò áέá íç-δέþñç ííúíáόá όñYúí, áέóúò áέá όíí όñYά όóíí íδíβí áñβόέáόá. όόέ, Yíáò δδíέíάέóόPð íá íç-δέþñáò úñíá mumble έá δñYðáέ íá áñáέáβ ùð mumble.foo.bar.edu, P έá áβíáέ áíáæPðçόç áέá áδóúí óóíí ñέáέέú όñYά.

Ḃ óóíδáñέóíñU áδóP áβíáέ άέάóíñáόέέP áδú όçí δñíçáíγíáíç, úδíο ç áíáæPðçόç óóíá÷έæúόáí έάέ όóíí mumble.bar.edu, έάέ όí mumble.edu. Ñβíόá íέá íáόέU όóíí RFC 1535 áέá όí έúáí δíο όí δáñáδUíú έáúñáβόá έάέþ δñάέóέέP, P áέúíá έάέ έáíú áόóáέáβáð.

íáò óñúδíò áέá íá δáñáέUíθáόá όí δñúáέçíá áβíáέ íá δñíόέYóáόá όç áñáñíP:

```
search foo.bar.edu bar.edu
```

áíόβ áέá όçí δñíçáíγíáíç:

```
domain foo.bar.edu
```

όóíí áñ÷áβí /etc/resolv.conf. Άááάέúέάβόá ùόóúóí úέέ ç óáέñU áíáæPðçόçò ááí δçááβíáέ δYñá áδú όí “úñέí íáόáíγ όíδέέPð έάέ çúíóέáò áέá÷áβñέόçò”, úδúò όí áδíέάέáβ όí RFC 1535.





```
# echo "your.isp.example.com" > /etc/mail/relay-domains
```

Áοτγ äçéτíτñáΠόάοά Π äðáñáñááóóáβóá áóòυ οτ áñ÷áβη, εά ðñÝðáε íá äðáñáñáçééτΠόάοά οτ **sendmail**. Áóòυ äτöεáγáε íεά ÷áñÙ áτ áβóóá äεά÷áεñεóóð ãτðçñáòçðΠ εáε äáτ äðεεòτáβóá íá óóÝετáóá mail οτðεεÙ, Π áτ εÝεáóá íá ÷ñçóεττðετΠόάοά Ýτá óγóóçτá óγðτö point εáε click óá Ýτá Ùεεττ ìç÷Ùτçτá Π áεττá εáε óá Ùεεττ ISP. Άβτáε áðβóçð ðτεγ ÷ñΠóεττ áτ Ý÷áóá ñóεττβóáε τττττ Ýτá Π áγτ ετáñáεáοττγð mail. Áτ εÝεáóá íá ðñτöεÝóáóá τáááεγóáñτ áñεετττ áεáóεγτáóáττ, τðñáβóá áðεðð íá áñβτáóá áóòυ οτ áñ÷áβη τá οττ äðεεòτçóòυ óóτðÙεðç εáεττÝττö, εáε íá ðñτöεÝóáóá υεττöð οτöð óñáβð, Ýτá óá εÙεá áñáñΠ:

```
your.isp.example.com
other.isp.example.net
users-isp.example.org
www.example.org
```

Όπñá, τðεεááβðττöá áðτóðτεΠ mail áðυ οτ óγóóçτá óáó áðυ τðετáβðττöá ððτετáεóóΠ áóðΠð ðçð εβóóáð (τá ðçτ ðñττðυεáóΠ τ ÷ñΠóçð íá Ý÷áε ετáñáεáοτττ óòτ óγóóçτá óáó), εά άβτáε áðεóð÷Πð. Ðñττεáεóáε áεá Ýτá ðτεγ εáεττ óñττöττ íá áðεóñÝðáóá óðττöð ÷ñΠóðáð íá óóÝεττöττ mail áðυ οτ óγóóçτá óáó τÝóò äðñáεñóòττÝτçð óγτááóçð, ÷ññβð íá áðεóñÝðáóá óá Ùεεττöð íá óóÝεττöττ SPAM τÝóò ðτö óóóðΠτáòττ óáó.

### 28.6 Ðñττ ÷ñçττÝτá ΕÝτáóá

Ç áευετöç áττöçóá εáεγððáε ðετ ðñττ÷ñçττÝτá εÝτáóá, τððöð çç ñγέτεóç ðτö mail εáε ñóεττβóáεð áεá Ýτá τευεεçñτ óñÝá.

#### 28.6.1 ΆáóεεÝò Ñóεττβóáεò

×ññβð íá ÷ñáεáóóáβ εÙτáóá εáεÙ ñγέτεóç, εά τðñáβóá íá óóáβεáóá mail ðñτö áττöáñεεττγð ððτετáεóóÝò, áñεáβ íá Ý÷áóá ñóεττβóáε οττ /etc/resolv.conf Π íá áεóáεáβóá οττ áεεττ óáó áτöðçñáòçðΠ DNS. Áτ εÝεáóá íá ðáñáεáτáÙτáóá mail áεá οττ ððτετáεóóΠ óáó óòττ áεεττ óáó **sendmail** MTA, ððÙñ÷τöττ áγτ τÝετáε:

- Ìðñáβóá íá Ý÷áóá áεεττ óáó óñÝá εáε áεεττ óáó áτöðçñáòçðΠ DNS áεá οττ óñÝá óáó. Άεá ðáñÙááεáτá, FreeBSD.org
- Íá ðáñáεáτáÙτáóá mail áðáðεáβáð óòττ ìç÷Ùτçτá óáó. Άóòυ áβτáóáε áτ οττ mail ðáñááβááóáε áðáðεáβáð óòττ ððτετáεóóΠ óáó, ÷ñçóεττðετττáð óττ ττñá οτö (ðñÝðáε íá áñβóεáðáε óòττ DNS). Άεá ðáñÙááεáτá, example.FreeBSD.org.

¼ðετá áðεεττáΠ áðυ óεð ðáñáðÙττ εáε íá εÙτáóá, áεá íá άβτáε áóτáðΠ ç ðáñáεááΠ mail áðáðεáβáð óòττ ððτετáεóóΠ óáó, εá ðñÝðáε íá Ý÷áóá ττττç óóáóεεΠ áεáγεòτçç IP (τ÷ε äòτáεεΠ, τððöð áβτáε τε ðáñεóóòðáñáð áðεετáεεÝò óóτáÝóáεð PPP). Áτ áñβóεáóá ðβóò áðυ εÙðεττ firewall, εά ðñÝðáε íá áðεóñÝðáε çç áεáεβτççç SMTP ðñτö áóÙð. Áτ εÝεáóá íá εáτáÙτáóá mail áðáðεáβáð óòττ ððτετáεóóΠ óáó, εά ðñÝðáε íá áτáóóáεβóáóá Ýτá áðυ óá ðáñáεÙð:

- Íá ááááεεεáβóá υðε ç áááñáóΠ MX (τá οττ ÷áτçεττöáñτ áñεετττ) óòττ DNS óáó, ááβ÷τáε ðñτö çç áεáγεòτçç IP οτö ìç÷áττáòττ óáó.
- Íá ááááεεεáβóá υðε äáτ ððÙñ÷áε εáεÙ áááñáóΠ MX óòττ DNS áεá οττ ððτετáεóóΠ óáó.

¼ðεττ áðυ óá ðáñáðÙττ εáε áτ εÙτáóá, εά τðñáβóá íá εáτáÙτáóá mail áðáðεáβáð óòττ ððτετáεóóΠ óáó.

ΆίεεíŮóóå áóóυ:

```
# hostname
example.FreeBSD.org
# host example.FreeBSD.org
example.FreeBSD.org has address 204.216.27.XX
```

Άί áεΎðåå òí ðåñåðŮíò, òí mail ðíò εάðåðεýíåðåé áðåðååβåð óòí <yourlogin@example.FreeBSD.org> εå ðñŮðåé íå εåíåŮíåðåé ÷ ùñβò ðñíåεΠíåðå (εåññπíåðå ùε òí **sendmail** åéðååβòå òυóðŮ óòí ððíεíåéóðΠ example.FreeBSD.org).

Άί άíòβ åéå áóóυ ååβòå εŮúóé óåí òí ðåñåéŮòυ:

```
# 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
```

¼εί òí mail ðíò εάðåðεýíåðåé ðñíò òí ððíεíåéóðΠ óåð (example.FreeBSD.org) εå εάðåéΠíåé íå óðéŮŮååðåé óòí hub ìå òí βåέí Źñíå ÷ ñΠóç, άíòβ íå óóåååβ áðåðååβåð óòí íç÷-Ůíçíå óåð.

Ůέð ðåñåðŮíò ðεçñíòíñβåð, ðέð ÷ åéñβæåðåé í åέεùð óåð åíòðçññåðçòð DNS. Ç ååññåðΠ DNS ðíò ðåñέŮ÷åé ðέð ðεçñíòíñβåð åñññεüåççðç åéå òí mail, åβíåé ç Mail eXchange. Άί ååí ððŮñ ÷ åé ååññåðΠ MX, òí mail εå ðåñååβåðåé áðåðååβåð óòí ððíεíåéóðΠ íŮúóυ ðçð IP åéåýέðíóçð òíò.

Ç εάðå÷-πñçóç MX åéå òí freefall.FreeBSD.org Ůñíέååå εŮðíέå óéέåñΠ ìå ðçí ðåñåéŮòυ:

```
freefall      MX    30    mail.crl.net
freefall      MX    40    agora.rdrop.com
freefall      MX    10    freefall.FreeBSD.org
freefall      MX    20    who.cdrom.com
```

¼ðυð ìðññåβòå íå ååβòå, í freefall åβ÷å ðñεŮŮ εάðå÷-ùñΠóåéð MX. Ç εάðå÷-πñçóç ìå òí íέέñυðåñí åñέéñυ, åβíåé í ððíεíåéóðΠ ðíò εåíåŮíåé òí mail áðåðååβåð, άí åβíåé åέåéŮóεíò. Άí åéå εŮðíεí εñåñ ååí åβíåé ðñíóåŮóεíò, íε Ůεείε (ðíò ìνέóíŮíåð òñŮŮð εåέýííåé “backup MXes”) åŮ÷ñóåé ðå íçíýíåðå ðñíóñέñíŮ εåé ðå ìåðååéåŮæñóí óå εŮðíεí ððíεíåéóðΠ ìå ÷åíçεüðåñç åñβεíçóç, ìüεéð åβíåé åέåéŮóεíò. ŮåééέŮ ðå íçíýíåðå εάðåεΠåñíóí óòí ððíεíåéóðΠ ìå òí íέέñυðåñí åñέéñυ.

Íé åíåéåéóéέŮð òíðíεåðóβåð MX, εå ðñŮðåé íå ÷ñçóεñíðíέíýíí åéåðññåðéέŮð åñññíŮð åéå ðç óýíååçç òíòð ìå òí Internet. ΆððΠ åβíåé ç εåέýðåñç εýóç. Í ðåññí÷Ůåð óåð Π εŮðíεí Ůεέñ óéééεü site, ååí εå Ů÷ñóí εåíŮýíå ðññυåççíå íå ðåð ðåñŮŮ÷ñóç ðçñ ððçññåðå.

### 28.6.2 Mail åéå òí ŮñŮŮå Óåð

Άέå íå æçíέíòññåΠóåðå ŮñŮŮå “mailhost” (æç. ŮñŮŮå åíòðçññåðçòð mail) εå ðñŮðåé ððíεíåεΠðíòå mail óðŮñéíåðåé ðñíò εŮðíεí óóåéñυ åñññåβåð, íå εåíåŮíåðåé óå áóóñ. ΆåóéέŮ εå εŮéåðå íå “åέåéåéååβòå” ððíεíåεΠðíòå mail ðíò εάðåðεýíåðåé ðñíò ððíεíåεΠðíòå Źñíå íç÷-åñΠåòíò ðíò ðñŮŮå óåð (óðçñ ðåññβððúóç ìåð òí \*.FreeBSD.org) εåé íå òí åíåέåðåðεýíåðåé ðñíò òí åíòðçññåðçòð mail, πððå íé ÷ñΠóåð óåð íå ðñññíýí íå εŮåñíóí òí mail òíòð áðυ òí εåñññέéñυ åíòðçññåðçòð.

Άέå åðéñεβå, εå ðñŮðåé íå Ů÷ðå ŮñŮŮå εñåññέåðñυ ÷ ñΠóç ìå òí βåέí Źñíå ÷ ñΠóç εåé óðå åýí íç÷-åñΠåðå. ×ñçóεñíðíεΠóðå åéå òí óéíðñυ áóóυ ðçñ åñññέΠ adduser(8).

Ï mailhost ðíò εά ÷ñçóέíðíεΠρσάðá, ðñÝðáε íá áβíáε ðí εáεíñέóíÝíí íç÷-Ùíçíá áεά ðçí áíóáεéáαΠ íçíòíÙòúí áεά εÙεá óðáέíú áñááóβáð ðíò áεéðýíð. Áðòú áβíáðáε óðέð ñðèíβóáέð DNS íá ðíí áέúεíðèí ðñúðí:

```
example.FreeBSD.org      A      204.216.27.XX ; Workstation
                          MX  10 hub.FreeBSD.org ; Mailhost
```

Ìá ðíí ðñúðí áðòú, ðí mail ðíò εάóáðèγíáðáε ðñíð εÙðíεí óðáέíú áñááóβáð εá áíáεáðáðèðεíáβ ðñíð ðí mailhost, Ùò÷-áðá íá ðí ðíò ááβ÷-íáε ç áááñáòΠ ðýðíò Á. Òí mail óðÝεíáðáε ðñíð ðíí ððíεíáεóðΠ MX.

Ááí ìðíñáβðá íá εÙíáðá ðí ðáñáðÙíú, áí ááí áεðáεáβðá ðí áέέú óáð áíòðçñáðçðΠ DNS. Áí áðòú ááí óðíááβíáε, εáε ááí ìðíñáβðá íá ðí áεεÙíáðá, óðíáíñçεáβðá íá ðíí ðáñí÷-Ýá óáð (ISP) Π íá ùðíεíí óáð ðáñÝ÷-áε ððçñáóβáð DNS.

Áí ðáñÝ÷-áðá ððçñáóβáð áεεíεέεγύ óá÷ðáññáβíò, íε ðáñáεÙòú ðεçñíòíñβáð εá óáð óáíγíí ÷ñΠρóεíáð. Áεά ðí ðáñÙááεεíá íáð, εá ððíεÝóíòíá ùðé Ý÷-áðá Ýíá ðáεÙðç íá ðí áέέú ðíò ðñÝá, óðçí ðáñβððòúç íáð ðí customer1.org, εáε εÝέáðá ùεí ðí mail áεά ðí customer1.org íá óðÝεíáðáε óðí áέέú óáð mailhost, mail.myhost.com. Ç εáðá÷-ññέóç óáð óðí DNS εá ñíεÙæáε íá ðçí ðáñáεÙòú:

```
customer1.org  MX  10 mail.myhost.com
```

Óçíáερððá ùðé ááí ÷ñáεÙæáððá áááñáòΠ ðýðíò Á áεά ðí customer1.org áí εÝέáðá áðερð íá ÷áεñβæáððá email áεά áðòú ðíí ðñÝá.

**Óçíáβòúç:** Íá Ý÷-áðá ððúøç óáð ùðé ááí εá ìðíñáβðá íá εÙíáðá ping ðí customer1.org áí ááí ððÙñ÷-áε áεά áðòú áááñáòΠ ðýðíò Á.

Òí ðáεáððáβí ðñÙáíá ðíò ðñÝðáε íá εÙíáðá, áβíáε íá ññβóáðá óðí **sendmail** ðíò áεðáεáβðáε óðí áέέú óáð mailhost, áεά ðíεíðð ðññáβð Π / εáε íç÷-áíðíáðá εá äÝ÷-áðáε mail. ÒðÙñ÷-íòí ñáéééíβ áεáðíñáðééíβ ðñúðíε áεά íá áβíáε áðòú. Ìðíñáβðá íá ÷ñçóέíðíεΠρσάðá Ýíáí áðú ðíòð ðáñáεÙòú:

- ðñíðéÝððá óá íç÷-áíðíáðá óðí áñ÷-áβí /etc/mail/local-host-names áí ÷ñçóέíðíεáβðá ðç áðíáðúðçðá FEATURE(use\_cw\_file). Áí ÷ñçóέíðíεáβðá εÙðíεá Ýέáíòç ðíò **sendmail** ðñéí ðçí 8.10, ðí áñ÷-áβí áβíáε ðí /etc/sendmail.cw.
- ðñíðéÝððá íεá ññáíΠ Cwyour.host.com óðí áñ÷-áβí óáð /etc/sendmail.cf Π óðí áñ÷-áβí /etc/mail/sendmail.cf áí ÷ñçóέíðíεáβðá ðçí Ýέáíòç 8.10 ðíò **sendmail** Π εÙðíεá ñáðááíÝððáñç.

## 28.7 SMTP ñá UUCP

Ç ðñíáðééááíÝíç ñγέíεóç ðíò **sendmail** ðíò Ýñ÷-áðáε ñá ðí FreeBSD, ðñíñβæáðáε áεá áεéððáéÝð ðíðíεáóβáð ðíò áβíáε áðáðèáβáð óðíáááíÝíáð óðí Internet. Òá ðáñέððρáέð ðíò áβíáε áðéèðíçðΠ ç áíóáεéáαΠ email ñÝóú UUCP, εá ðñÝðáε íá ÷ñçóέíðíεçεáβ áεáðíñáðééú áñ÷-áβí ñðèíβóáúí áεά ðí **sendmail**.

Ç ÷áεñíεβίçðç ñγέíεóç ðíò áñ÷-áβíò /etc/mail/sendmail.cf áíðεáε óðá ðñí÷-ùñçíÝíá εÝíáðá. Ç Ýέáíòç 8 ðíò **sendmail** ðáñÙááε áñ÷-áβá ñðèíβóáúí ñÝóú ðíò ðñíáðáíñááóðΠ m4(1), ùðíò íε ñðèíβóáέð áβíííðáε óá Ýíá áñρðáñí áðβðááí áðáβñáóçð. Ìðíñáβðá íá áñáβðá óá áñ÷-áβá ñγέíεóçð ðíòm4(1) óðíí εáðÙεíáí /usr/share/sendmail/cf. ÁεάáÙóðá ðí README óðíí εáðÙεíáí cf áεά íεá ááóéεΠ áεóááñáΠ óðέð ñðèíβóáέð ðíò m4(1).

Ίεάέγáññò ðñüðìò äéá ôçí ðáñÛäüç mail ìÝóù ðìò UUCP, áβíáé ìá ôçí ÷ñÞóç ôçð äðíáðüçðáð mailertable. ÐáñÛäüçáé ìá áððü ðñ ðñüðìò ìéá áÛóç ääññÝíüí ðìò ìðññáβ ìá ÷ñçóéíðìéÞóáé ðì **sendmail** äéá ìá ðÛñáé áðñöÛóáéð ó÷áðééÛ ìá ôçí äñññüüäçóç.

Έá ðñÝðáé äñ÷ééÛ ìá äçìéññáÞóáðá ðì äñ÷áβτ .mc. Έá äññáðá ìáñééÛ ðáñáááβáíáðá ðññ éáðÛεññ  
/usr/share/sendmail/cf/cf. ÒðñèÝòññóáð ùéé Ý÷áðá ìñÛóáé ðì äñ÷áβτ óáð foo.mc, ðì ìññ ðìò ÷ñáéÛæáðáé ìá éÛíáðá äéá ìá ðì ìáðáðñÝðáðá óá Ýíá Ýäéðññ äñ÷áβτ sendmail.cf áβíáé:

```
# cd /etc/mail
# make foo.cf
# cp foo.cf /etc/mail/sendmail.cf
```

Ίá ðððééÛ äñ÷áβτ .mc éá äáβ÷íáé ùððò ðì ðáñáéÛðù:

```
VERSIONID('Your version number') OSTYPE(bsd4.4)

FEATURE(accept_unresolvable_domains)
FEATURE(nocanonify)
FEATURE(mailertable, 'hash -o /etc/mail/mailertable')

define('UUCP_RELAY', your.uucp.relay)
define('UUCP_MAX_SIZE', 200000)
define('confDONT_PROBE_INTERFACES')

MAILER(local)
MAILER(smtp)
MAILER(uucp)

Cw your.alias.host.name
Cw youruucpnodename.UUCP
```

Ίé äñññÝð ðìò ðáñéÝ÷ìí ðéð äðíáðüçðáð accept\_unresolvable\_domains, nocanonify, and confDONT\_PROBE\_INTERFACES éá áðññÝðññí ôç ÷ñÞóç ðìò DNS éáðÛ ôçí ðáñÛäüç ðìò mail. Ç ìáçáβá UUCP\_RELAY áðáéðáβðáé äéá ôçí ððìóðÞñéíç ðáñÛäüçðð ìÝóù ðìò UUCP. Áððð ðìðñéáðÞóáð äéáβ Ýíá ìññá ìç÷áíÞáðìò ððì Internet ðìò ìá ìðññáβ ìá ÷äéñéóðáβ äéáðéγíóáéð ðáðäñ-ðñÝíüí .UUCP. Òì ðéí ðééáíü áβíáé ìá áÛéáðá äéáβ ðññ áíáíáðáäüç (relay) äéá mail ðìò ðáñÝ÷áé ì ISP óáð.

÷ñóáð éÛíáé ðì ðáñáðÛñ, éá ÷ñáéáóðáβðá Ýíá äñ÷áβτ /etc/mail/mailertable. Áí Ý÷áðá ìññ ìéá óγíááóç ìá ðññ Ýñü éùóñ ðìò ÷ñçóéíðìéáβðáé äéá ùéá óáð óá mail, ðì ðáñáéÛðù äñ÷áβτ áβíáé áðáñéÝð:

```
#
# makemap hash /etc/mail/mailertable.db < /etc/mail/mailertable
. uucp-dom:your.uucp.relay
```

Ίá ðéí ðñéγðéññé ðáñÛäüçéññá éá ìééÛæáé ìá ðì ðáñáéÛðù:

```
#
# makemap hash /etc/mail/mailertable.db < /etc/mail/mailertable
#
horus.interface-business.de uucp-dom:horus
.interface-business.de uucp-dom:if-bus
interface-business.de uucp-dom:if-bus
.heep.sax.de smtp8:%l
horus.UUCP uucp-dom:horus
```

if-bus.UUCP uucp-dom:if-bus
. uucp-dom:

Íε οñáέο ðñρòáο ãñáñÝò ÷ áέñβæííóáέ áέáέέÝò ðáñέðòρòáέο, ùðíò οí mail ðíò áðáòέγíáòáέ οá εὐðíέí οñÝá ááí εá ðñÝðáέ íá οóáέεáβ οóçí ðñíáðέέááíÝíç áέááññÞ, áέεὐ áíòβεáòá οá εὐðíέí ááέοííέέυ UUCP ðñíέáíÝíò íá “οóíοíñáòεáβ” οí ïíñðὐέ ðáñὐáííóçð. Ḷ áðñíáíç ãñáñÞ ÷ áέñβæáòáέ οí mail ðñíò οíí οíðέέέυ οñÝá Ethernet, ùðíò áβíáέ áòíáòÞ ç ðáñὐáííóç íÝòù SMTP. ὈÝέíò, íé ááέοííέέέíβ UUCP áíáòÝñííóáέ íá ãñáòÞ ϕáòáí-òñÝúí UUCP þóòá íá áðέοñÝðáòáέ οá εὐðíέíí uucp-neighbor !recipient íá ðáñáέὐíϕáέ οíòð ðñíáðέέááíÝííòð εáíúíáò. Ḷ οáέáòòáβá ãñáñÞ áβíáέ ðὐííóá íéá ïíááέεÞ óáέéáβá, ç íðíβá óáέñέὐááέ íá íòέáÞðííóá ὐέέí, íá ðáñὐáííóç UUCP οá Ýíá ááέοííέέέυ UUCP í íðíβíð áíáñááβ ùò ááíέέÞ ðýέç mail ðñíò οíí οðñέíέðí έέυοí. ¼éá óá ïíñíáóá οðíέíáέοóρí ðíò ãñβóέííóáέ íáòὐ οí uucp-dom: εá ðñÝðáέ íá áβíáέ Ýáέοñíέ UUCP ááβοííáò, ùðòð íðíñáβòá íá ááááέρòáòá ÷ ñçóέííðíέρíóáò οí uuname.

Ὀáò οðáíέοíβæííóá ùέέ áòòú οí áñ ÷ áβí ðñÝðáέ íá íáòáòñáðáβ οá íéá áὐόç áááñÝúí DBM ðñέí ÷ ñçóέííðíέçεáβ. Ìðíñáβòá íá áὐέáòá οç ãñáñÞ áíóíέρí ðíò áðáέóáβòáέ áέá íá áðέóáò÷εáβ áòòú ùò ó÷úέέí οóçí áñ ÷ Þ οíò áñ ÷ áβíò mailertable. ðñÝðáέ ðὐííóá íá áέòáέáβòá áòòÞ οçí áíóíέρÞ εὐέá οíñὐ ðíò áέέὐááòá οí áñ ÷ áβí mailertable.

Íéá óáέáòòáβá οðñááέíç: áí ááí áβòòá áÝááέíé áέá οí áí εá εáέοííòñáÞóáέ εὐðíέá óðáέáñέñíÝíç ãñíñέυáçóç mail, έòíçεáβòá οçí áðέέíáÞ -bt οíò sendmail. ÁðòÞ íáέέíὐáέ οí sendmail οá έáòὐóóáóç áíέέíÞò áέáðέγííóáí. ÁðέÞò ãñὐòðá 3, 0, áέíέíòέíγíáñí áðñ οç áέáγέòíóç ðíò εÝέáòá íá áέÝáíáòá áέá ãññíέυáçóç mail. Ḷ οáέáòòáβá ãñáñÞ εá οáò ðáέ οíí áòòúáñέέέυ áíóέðñúòòðí mail ðíò ÷ ñçóέííðíέρçεá, οç áέáγέòíóç ðñíñέοííý íá οçí íðíβá έέÞεçέá, έέêðò έέέ οçí (ðέέáíÞò íáòáòñáóíÝíç) áέáγέòíóç. Ìðíñáβòá íá áááβòá áðñ áòòÞ οçí έáòὐóóáóç, ðέçέòñíέíáρíóáò 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
```

### 28.8 Ñýέíέóç ÁíòðçñáòçòÞ ìúíí áέá ÁðíóòíέÞ

Ὀóíáέóοíñὐ áðñ οíí Bill Moran.

Ὀðὐñ ÷ íοí ðíέéÝò ðáñέðòρòáέò, ðíò ìðíñáβ íá εÝέáòá ìúíí íá óóÝέíáòá mail íÝòù εὐðíέíò áíáíáòááúòç. Ìáñέέὐ ðáñáááβáíáóá:

- Ì ððíέíáέóòÞò óáò ÷ ñçóέííðíέáβòáέ ùò desktop, áέέὐ εÝέáòá íá ÷ ñçóέííðíέρòáòá ðñíáñὐííáóá ùðòð οí send-pr(1). Áέá íá áβíáέ áòòú εá ðñÝðáέ íá ÷ ñçóέííðíέρòáòá οíí áíáíáòááúòç mail ðíò ðáñÝ ÷ áέ í ISP óáò.
- Ì ððíέíáέóòÞò óáò áβíáέ Ýíáò áíòðçñáòçòÞò ðíò ááí ÷ áέñβæáòáέ οí mail οíðέέὐ, áέέὐ ÷ ñáέὐááòáέ íá οí áρòáέ áí' íέíέéÞñíò óá εὐðíέí áíáíáòááúòç áέá áðáíáñáóóá.

ÌðíέíáÞðííóá ó÷ááñí MTA áβíáέ έέáíú íá έáέýϕáέ οíí ðáñáðὐíñ ññέí. Áòóòò÷Þò, ìðíñáβ íá áβíáέ ðíέý áýóέíέí íá ñòέíβòáòá οúòòὐ Ýíá ðéÞñáò MTA þóòá áðέÞò íá óóÝέíáέ οí mail ðñíò áíáíáòὐáííóç. ðñíáñὐííáóá ùðòð οí sendmail έέέ οí postfix áβíáέ ððáñáíέέέὐ ìááὐέá áέá áòòÞ οç áíòέáέὐ.

Áðέðñúòέáòá, áí ÷ ñçóέííðíέáβòá εὐðíέá óóíçέέóíÝíç ððçñáòóá ðññúóááóçòð óòí Internet, ç óðíòñíβá ìá οçí áòáέñβá ðáñí÷Þò ìðíñáβ íá óáò áðáíñáγáέ íá áέòáέáβòá οí áέέέυ óáò “áíòðçñáòçòÞ mail”.

Ï áðεíεùðáññò ðñùðò ñεά íá áððεçñþóáðá áððÝð ðεð áíÛáεáð áβίáε íá ááεáðáóðþóáðá ðì port mail/ssmtp  
ÅðáεÝðάá ðεð áεùεíðεάð áíðíεÝð ùð root:

```
# cd /usr/ports/mail/ssmtp
# make install replace clean
```

ÏáðÛ ðçí ááεáðÛððáóç, ðì mail/ssmtp ïðññáβ íá ñðεíεðáβ ìá Ýíá áñ÷áβì ðáóóÛññì ìεεð áñáññì, ðì ððìβì  
áñβðéáðáé ððì /usr/local/etc/ssmtp/ssmtp.conf:

```
root=yourrealemail@example.com
mailhub=mail.example.com
rewriteDomain=example.com
hostname=_HOSTNAME_
```

Åáááεùεáβðά ùðé ÷ñçóεíðéεáβðά ðçí ðñáññáðéεþ áεáyεðíóç email ñεά ðì root. ÅÛεðά ðì áíáíáðáüðç mail ðì ISP  
óáð ðçç èÝðç mail.example.com (ìáñεéτβ ISP ðì ìñÛæτòτì “áíððçñáðçðþ áññ÷áññò ðá÷ðáññáβηò” þ  
“áíððçñáðçðþ SMTP”).

Åáááεùεáβðά ùðé Ý÷áðá áðáíáññáðéεþðáé ðεþñùð ðì **sendmail**, áεùìá éáé ðçí ððçñáðáβá áññ÷áññò ìáññì ìçðτòÛðùí.  
Åáβðά ðì Õìðìá 28.4.2 áεά εáððñÝñáεáð.

ÕðÛñ÷áññò éÛðéáðð áεùìá áεáéÝðεíáð áðεεíáÝð ððì mail/ssmtp. Åáβðά ðì ðáñÛááεáìá ðτò áñ÷áβì ñðεìβðáùí ððì  
/usr/local/etc/ssmtp þ ðç óáεβáá manual ðτò **ssmtp** áεά ðáñέóóúðáñá ðáñáááβáñáðá éáé ðççñτòññáð.

Ñðεìβáετðáð ðì **ssmtp** ìá áððù ðì ðñùðì, εá áβίáε áðíáðþ ç ðóððþ εáεðτòñáβá ððéτòáþððá éáεóéεεύ ððì ððéτáεóðþ  
óáð ðτò ÷ñáεÛæáðáé íá ððáβεáé mail. Åðβçð ñáí ðáñááεÛæáðáé ìá áððù ðì ðñùðì ç Ûááéá ÷ñþçð ðτò ISP óáð éáé  
ááí ððñáβ ððéτáεóððð óáð íá ðáñááεáððáβ éáé íá ÷ñçóεíðéçεáβ áεά ðçí áðτòεþþ áíáðεéýìçðùí ìçðτòÛðùí (spam).

### 28.9 ×ñçóεíðééðíðáð ðì Mail ÌÝòù Åðéετáéþð (Dialup) Óýíááóçð

Áí Ý÷áðá ðáðáéεþ áεáyεðíóç IP, ááí εá ÷ñáεáðáβ íá áεεÛíáðά εáίεÛ áðù ðεð ðñáðéετáÝð. Ñðεìβðά ðì ùñá ðτò  
ððéτáεóðþ óáð þðáá íá ðáεñεÛæáé ìá áððù ðτò óáð Ý÷áé ññεóðáβ áεά ðì Internet, éáé ðì **sendmail** εά εÛíáε ðá  
ððúεéðá.

Áí εáìáÛíáðá áðíáéεþ IP éáé ÷ñçóεíðéεáβðά áðεεíáéεþ PPP óýíááóç ìá ðì Internet, ðéεáíñí áεáéÝðáðá ìεá ððñáá  
ðá÷ðáññáβηò (mailbox) ððì áíððçñáðçðþ mail ðτò ðáññ÷áÝá óáð. Åð ððéÝóτòìá ùðé ðññÝáð ðτò ISP óáð áβίáε  
example.net, éáé ùðé ðì ùññá ÷ñþðç óáð áβίáε user, ðì ìç÷Ûίçá óáð εÝááðáé bsd.home, éáé ðì ISP óáð, óáð  
Ý÷áé ðáε ùðé ððñáβðá íá ÷ñçóεíðéεþðάð ðì relay.example.net ùð áíáíáðáüðç áεά ðì mail.

Åéá íá ððñÝóáðά íá εÛááðá mail áðù ðç ððñáá óáð, εá ÷ñáεáððáβðά εÛðééí áíðéðñúððì áíÛεççð (retrieval agent).  
Õì áτçççóεéù ðñúáñáìá **fetchmail** áβίáε ìεá éáεþ áðεεíáþ, éáεþð ððτòðçñáεáé ðτεεÛ áεáðñáðéεÛ ðñúðúεéεá. Õì  
ðñúáñáìá áððù áβίáε áεáéÝðετò ùð ðáεÝðì þ áðù ðçí Óðεετáþ ðùí Ports (mail/fetchmail). Óðìðεùð, ðì ISP óáð éá  
ðáñÝ÷áé ðçí ððçñáðáβá POP. Áí ÷ñçóεíðéεáβðά þñþðç, ððñáβðά íá εáðááÛóáðá áððùíáðá ðì mail óáð ìáðÛ  
ðçí áðéáðÛððáóç ðçð óýíááóçð óáð, ÷ñçóεíðééððáð ðçí áεùετððç εáðá÷þñéóç ððì /etc/ppp/ppp.linkup:

```
MYADDR:
!bg su user -c fetchmail
```

Áí ÷ñçóεíðéεáβðά ðì **sendmail** (ùðùð óáβíáðáé ðáñáεÛðù) áεά íá ðáñááþðáðá mail óá ìç-ðτéεéýð ετáñéáóττò,  
ðéεáíñí íá εÝεáðά ðì **sendmail** íá áðáíáññáÛæáðáé ðçí τðñÛ ðτò mail áíÝòùð ìáðÛ ðçí áðéáðÛððáóç ðçð óýíááóçð.  
Åéá íá ðì εÛíáðá áððù, áÛεðά ðçí ðáñáεÛðù áíðτεþ áíÝòùð ìáðÛ ðçí áíðτεþ fetchmail ððì áñ÷áβì  
/etc/ppp/ppp.linkup:

```
!bg su user -c "sendmail -q"
```

Àð ððìèÝóíοíà ùèè ððÙñ÷àé Ýíáð εíàáñέάóíυð àéá ðìí user óοίí bsd.home. Óðìí ðñìóυððέέυ έάóÙεíαι ðìò user óοί bsd.home, àçìείòñàβóðά Ýíá áñ÷àβì .fetchmailrc:

```
poll example.net protocol pop3 fetchall pass MySecret
```

Òì áñ÷àβì áðòυ àáí έá ðñÝðáé íá àβíάé áíááíβóεíí áðu έárÝíá, àèòυð áðu ðìí user, έάεβð ðàñéÝ÷àé ðìí έυàέέυ MySecret.

Άέά íá ìðìñàβòά íá óάβεάòά mail ìá ðç óυóòβ àðέέάòáέβáá from:, έá ðñÝðáé íá ñòεìβóάòά ðì **sendmail** íá ÷ñçóέìðìέάβ ðì <user@example.net> áíòβ àέά ðì <user@bsd.home>. Ϝóυð àðβçðò íá èÝέάòά íá ñòεìβóάòά ðì **sendmail** íá óóÝέíáé ùεí ðì mail ìÝóυ ðìò relay.example.net, βóðά ç ìáóÙáíóç ðìò mail íá àβíάé ðá÷ýóáñç.

Òì áέυεíòεíí áñ÷àβì .mc έá ðñÝðáé íá àβíάé àðáñέÝð:

```
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
```

ΆέάáÙóðά ðçì ðñìçáíýíáíç áíυòçðά àέá έáððñÝñáέάð ó÷àéέέÙ ìá ðçì ìáóάòñìðβ áðòìý ðìò áñ÷àβì .mc óά Ýíá áñ÷àβì sendmail.cf. Άðβçðò, ìç ìá÷Ùóáòά íá àðáíáέέέíβóáòά ðì **sendmail** ìáóÙ ðçì áíçìÝñòç ðìò sendmail.cf.

## 28.10 Δέόóìðìβçç Άðèáíòέέέυòçòάò óοί SMTP

ΆñÙððçέά áðu ðìí James Gorham.

Ç÷ñβçç SMTP ìá ðέóóìðìβçç áðèáíòέέέυòçòάò óοίí áíòðçñáòçðβ ðá÷ðàññàβìò óάð, ìðìñàβ íá óάð ðñìóóÝñáé ìέá óáέñÙ áðu ìòÝεç. ìðìñàβ íá ðñìóèÝóáé Ýíá áέυíá àðβðááí áóòÙέάέάð óοί **sendmail**, áβ Ý÷àé έáé ðì ðεáííÝέòçíá ùèè àβíάé ðç áðíáðυòçðά óοίòð ÷ñβóðάð ðìñçòβì ððìεíáέóòβì (ðìò óò÷íÙ óòíáÝííóáé ìÝóυ àέáòìñáðέέβì áέέòýìí) íá ÷ñçóέìðìέίýí ðìí βáέí áíòðçñáòçðβ ðá÷ðàññàβìò ÷ññβð ðçì áíÙáέç àðáíáñýèìέóçð έÙεà ðññÙ ðìò ðñìáñÙíááíòð áðìóóìεβð / εβççð ðá÷ðàññàβìò.

1. Άáέάóáóðβóðά ðì security/cyrus-sasl2 áðu ðç Óðέέíāβ ðυí Ports. Òì port áðòυ ððìóðçñβæáé ìέá óáέñÙ áðu àðέέεíāÝð ðìò ìðìñàβòά íá èÝέóáòά έáóÙ ðçì ìáóάáεβððέέóç. Άέά íá ìðìñÝóáòά íá ÷ñçóέìðìέέβóáòά ðçì ìÝέεíαι áðèáíòέέέíðìβççðò óοί SMTP ðìò óóæçðÙíá áαβ, ááááέέυèáβòά ùèè àβíάé áíáñáðìέçìÝíç ç àðέέέíāβ LOGIN.

2. ÌàòÛ òçí ààέάòÛóóáóç òìò security/cyrus-sasl2, òññìðìέέΠóóà òì àñ÷àßì /usr/local/lib/sasl2/Sendmail.conf (Π àçìέìòññàΠóóà òì àí àáí òðÛñ÷àέ) έάέ ðñìòέÝóóà òçí ðàñáέÛòù àñàìΠ:

```
pwcheck_method: saslauthd
```

3. ÀàέάóóóóΠóóà Ýðáέóá òì security/cyrus-sasl2-saslauthd, έάέ ðñìòέÝóóà óòì /etc/rc.conf òçí àέùέìòèç àñàìΠ:

```
saslauthd_enable="YES"
```

ÔÝέìò, ìáέέìΠóóà òì àáßìñá saslauthd:

```
# /usr/local/etc/rc.d/saslauthd start
```

Ï àáßìñáð áðòùð àñá ùð áíáέÛìáóìò áέá òì **sendmail** πóóà ìá àßìáðáέ ðέóóìðìßçóç áðέáíóέέùòçóáð ìÝóù òçò àÛóçð àáññÝíí òùάέέπì passwd òìò FreeBSD óðóóΠìáóìò óáð. Ìá áðòù òì òññìðì áðáέέÛóóáóá áðù òçí áíÛάέç àçìέìòññàΠóóà ìÝìò óáð áðù ìíñìáóá ÷ñçóóπì έάέ òùάέέìýð áέá έÛέà ÷ñΠóóç ðìò ÷ñáέÛááóáέ ìá ÷ñçóέìðìέΠóáέ ðέóóìðìßçóç óðì SMTP. ×ñçóέìðìέáßóáέ òì Βάέì ùññá έάέ òùάέέùð, òùòì áέá àßòìäì óòì óýóðçìá, ùòì έάέ áέá òì mail.

4. Àðáìññááóóáßòá òπñá òì /etc/make.conf έάέ ðñìòέÝóóà òέð àέùέìòèðò àñàìÝð:

```
SENDMAIL_CFLAGS=-I/usr/local/include/sasl -DSASL
SENDMAIL_LDFLAGS=-L/usr/local/lib
SENDMAIL_LDADD=-lsasl2
```

Ïέ àñàìÝð áðòÝð, ðàñÝ÷ìòì óòì **sendmail** òέð έáðÛέέçέáð òðèìΒóáέð πóóà ìá óòìáάέß òùóóÛ ìá òì cyrus-sasl2 έáðÛ òç àέÛñέάέ òçò ìáðáάέπòðέóçð. Àááάέùέáßòá ùέέ àßìáέ àáέáðáóóçìÝí òì ðáέÝòì cyrus-sasl2 ðñέì ìáέέìΠóóà òçí áðáíáìáðáάέπòðέóç òìò **sendmail**.

5. Àðáíáìáðáάέùòðóóá òì **sendmail** àέðáέπìðáð òέð ðàñáέÛòù áíóìέÝð:

```
# 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 install
```

Ç ìáðáάέπòðέóç òìò **sendmail** àáí ðñÝðáέ ìá ðàñìòóέÛóáέ ðñìáέΠìáðá, áí òì /usr/src àáí Ý÷àέ àέέÛìáέ óá ìááÛέì àáέìì έάέ áòùòì òðÛñ÷àέ ìέ έìέíù ÷ñçóóáð àέάέìέΠέáð ðìò áðáέòìÝìóáέ.

6. ÌàòÛ òçí ìáðáάέπòðέóç έάέ àðáíáάέáðÛóóáóç òìò **sendmail**, àðáìññááóóáßòá òì àñ÷àßì /etc/mail/freebsd.mc (Π ùðìέì àñ÷àßì ÷ñçóέìðìέáßòá ùð .mc. Ðìέέìß áέá÷áέñέóóÝð áðέέÝáìòì ìá ÷ñçóέìðìέΠóóìòì òçí Ýññäì òçò áíóìέΠð hostname(1) ùð ùññá áέá òì àñ÷àßì .mc áέá ìá áíáóóáέßòìòì ùέέ àßìáέ ìñáάέέù). ÐñìòέÝóóà óá áðòù òέð àέùέìòèðò àñàìÝð:

```
dn1 set SASL options
TRUST_AUTH_MECH('GSSAPI DIGEST-MD5 CRAM-MD5 LOGIN')dn1
define('confAUTH_MECHANISMS', 'GSSAPI DIGEST-MD5 CRAM-MD5 LOGIN')dn1
```

Ïέ áðέέìáÝð áðòÝð òðèìΒáέìòì òέð àέáóìñáðέέÝð ìáέùáìòð ðìò Ý÷àέ óðç àέÛέáóç òìò òì **sendmail**, ðñìέáέìÝíò ìá ðέóóìðìέΠóáέ òìò ÷ñΠóóáð. Áí èÝέáðá ìá ÷ñçóέìðìέΠóóáð έÛðìέá ìÝέìäì àέáóìñáðέέΠ áðù òì **pwcheck**, àáßòá òçí òáέìçñßùóç ðìò ðàñέέáìáÛìáðáέ.

7. ÔÝέìò, àέðáέÝóóà make(1) àπ àñßóέáóóá óòì έáðÛέìäì /etc/mail. Ìá òì òññìðì áðòù, έá ÷ñçóέìðìέçέáß òì ìÝì óáð .mc àñ÷àßì έάέ έá àçìέìòññáçέáß Ýìá àñ÷àßì .cf ìá ùññá freebsd.cf (Π ìóέáΠðìòá ùññá àß÷áðá àπóáέ óòì àñ÷àßì .mc). ×ñçóέìðìέΠóóà Ýðáέóá òçí áíóìέΠ make install restart, ç òìΒá έá áíóέáñÛóáέ òì

àñ÷àβì òèì sendmail.cf, έάέ έà àðáíáέέείρòάέ òòòòὐ òì **sendmail**. Ἄέά ðàñέóóòòàññàð έàðòñÝñáέàð ò÷÷àðέέὐ ìà áðòρ òç έέάάέέάóóβá, έà ðñÝðáέ ìá έέάáὐóòàð òì àñ÷àβì /etc/mail/Makefile.

Άί υέά ðρááí έάέὐ, έà ðñÝðáέ ìá ìðññáβòá ìá àρòáòá òá òòίέ÷-áβá áέóυáìò òáò òòì ðñυάñáìá ðìò ÷ñçóέìðìέáβòá áέá áðìòòίερ έάέ έρçç mail, έάέ ìá òðáβέáòá Ýíá àìέέìáóóέέυì ìρìòìá. Ἄέá ìá έέáñáòìρòáòá ðàñέóóòòàññì òç έέέòìòñáβá, έÝóðá òçì áðέέìáρ LogLevel òìò **sendmail** òòì 13 έάέ ðàñáέίέìòèðòá òì /var/log/maillog έέá òð÷ìí έὐέç.

Ἄέá ðàñέóóòòàññàð ðέçñìòìñáð, ðàñáέάέìγìá ìá àáβòá òç òάέβáá òìò **sendmail** ðìò áòìñὐ òçì ðέóòìðìβççç áðέáìóέέέυòçðáð òòì SMTP (<http://www.sendmail.org/~ca/email/auth.html>).

## 28.11 ðñìáñὐìáòá Ὀá÷òàññáβìò áέá òìí ×ñρóçç

*Ὀðìáέóòìñὐ òìò Marc Silver.*

ìá ðñυάñáìá Ἀìóέðñìòρðìò Ὀá÷òàññáβìò ×ñρóçç (Mail User Agent, MUA), áβìáέ ìέá áòáññáρ ðìò ÷ñçóέìðìέáβòáέ áέá òçì áðìòòίερ έάέ έρçç email. ἌðέðέÝíí, έάέρð òì email “áìáέβòóáðáέ” έάέ áβìáðáέ ðéì ðìέýðέìèì, òá MUA áβìíðáέ υέì έάέ έó÷òñυòáñá υòì áòìñὐ òìò ðñυðì ðìò áέέçέáðέáñìγì ìá òì email. Ἀòòυì áβìáέ òòìò ÷ñρóðáð ðàñέóóòòàññàð έáέóòìòñáβáð έάέ áðáέέìβá. To FreeBSD ðàñέÝ÷έ òðìòðρñέìç áέá ìááὐέì áñέέìυ áðυ ðñìáñὐìáòá òá÷òàññáβìò, έάέ υέá ìðñìγì ìá ááέáðáóóáέìγì ðìέý áýέìέá ìÝòυ òçð Ὀðέέìáρð òυì Ports òìò FreeBSD. Ἰέ ÷ñρóðáð ìðñìγì ìá áðέέÝíìòì ìáðáíý áñáóέέρì ðñìáñáìὐòυì, υðυð òì **evolution** ρ òì **balsa**, έάέ ðñìáñὐìáòá έìíóυέáð υðυð òá **mutt**, **pine** ρ mail, ρ áέυìá έάέ òέð áέáðáóÝð web ðìò ðñìóóÝñìðáέ áðυ ìáñέέìγð ìááὐέìòð ìñááίέóìγð.

### 28.11.1 mail

Ὀì mail(1) áβìáέ òì ðñìáðέέááìÝíì ðñυάñáìá òá÷òàññáβìò (MUA) in FreeBSD. ðñυέáέðáέ áέá Ýíá MUA έìíóυέáð, òì ìðìβì ðñìóóÝñáέ υέáð òέð ááóέέÝð έáέóòìòñáβáð ðìò áðáέóìγìóáέ áέá òçì áðìòòίερ έάέ έρçç email òá ìñòρ έάέìÝíìò, áí έάέ Ý÷έ ðàñέñéòéÝíáð áòìáòυòçðáð υòì áòìñὐ òòìçìíÝíá àñ÷àβá έάέ òðìòççñβáέ ìυíì òìðέέÝð òèñβááð.

Άí έάέ òì mail ááì òðìòççñβáέέ ááááìρð òç έρçç email ìÝóυ έέáέñέóòρì POP ρ IMAP, áβìáέ υòóòυòì áòìáòυì ìá έáðááὐóáð òá email òá ìέá òìðέέρ òèñβáá (mbox) ÷ñçóέìðìέρìðáð έὐðìέá áòáññáρ υðυð òì **fetchmail**, òì ìðìβì έá òðæçðρòìòìá áñáυòáñá òá áòòυ òì έáòὐέáεί (Ὀìρìá 28.12).

Ἄέá òçì áðìòòίερ έάέ έρçç email, áðέρð áέðáέÝóðá òçì áìòìερ mail υðυð òáβìáðáέ òòì ðàñáέὐòυ ðáñὐááέáìá:

% mail

Ὀá ðàñέá÷υáìá òçð òèñβááð òìò ÷ñρóçç òòìí έáðὐέìáì /var/mail έá έέáááóòìγì áðòυìáòá áðυ òì ðñυάñáìá mail. Ἄí ç òèñβáá òá÷òàññáβìò áβìáέ ὐááέá, òì ðñυάñáìá òáñìáðβáέðáέ ìá òì ìρìòìá υòέ ááì áñÝέçέá áέέçέìáñáòá. Ἰáðὐ òçì áíὐáñυòç òçð òèñβááð, ìáέέìὐ ç έέáðáòρ òçð áòáññáρð έάέ áìòáìβáέðáέ ìέá έβòðá ìá ìçìγìáðá. Ὀá ìçìγìáðá áñέέìγìóáέ áðòυìáðá, υðυð òáβìáðáέ òòì ðàñáέὐòυ ðáñὐááέáìá:

```
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"
```

Ὀá ìçìγìáðá ìðñìγì ðέÝíí ìá έέáááóòìγì ìá òçì áìòìερ t òçð áìòìερð mail, áέέìòðέìγìáìç ìá òìí áñέέìυ òìò mail ðìò έÝέáðá ìá áìòáìέóòáβ. Ὀòì ðáñὐááέáìá áòòυ έá έέááὐóìòìá òì ðñρòì ìρìòìá:

& 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.

¼δὺν ὁ ἀποστολέας οὐκ ἐπιθυμᾷ νὰ ἀποκριθῆτε, ἀλλὰ νὰ ἀποκριθῆτε εἰς τὸν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν. Ἄρα εἰς τὸν ἀποστολέαν ἵνα ἀποκριθῆτε εἰς τὸν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν.

Ἄρα οἱ mail ἀποστολὴν ἀποστολέαν, ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν εἰς τὸν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν. Ἄρα οἱ mail ἀποστολὴν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν. Ἄρα οἱ mail ἀποστολὴν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν. Ἄρα οἱ mail ἀποστολὴν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν.

& R 1  
To: root@localhost  
Subject: Re: test

Thank you, I did get your email.

.  
EOT

Ἄρα εἰς τὸν ἀποστολέαν ἵνα ἀποκριθῆτε εἰς τὸν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν. Ἄρα οἱ mail ἀποστολὴν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν. Ἄρα οἱ mail ἀποστολὴν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν.

& mail root@localhost  
Subject: I mastered mail

Now I can send and receive email using mail ... :)

.  
EOT

¼δὺν ἂν ἐπιθυμᾷτε νὰ ἀποκριθῆτε εἰς τὸν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν. Ἄρα οἱ mail ἀποστολὴν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν. Ἄρα οἱ mail ἀποστολὴν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν.

**Ὁδηγός:** ¼δὺν ἀποστολὴν ἀποστολέαν εἰς τὸν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν. Ἄρα οἱ mail ἀποστολὴν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν. Ἄρα οἱ mail ἀποστολὴν ἀποστολέαν ἵνα ἴσῃ ὅτι ἔλαβετε τὸν ἀποστολὴν.

## 28.11.2 mutt

Όì **mutt** àβίáέ Ýíá íέέñù, àέέŪ ðřę ýó÷ðñù ðñùàñàííá áðíóðřèðð éáέ èβθçð mail, íà áíáέñàðέέŪ ÷áñáέðçñέóðέέŪ óá ðñìβá ðáñέέáíáŪñíóí:

- Όçí ééáíúðçóá íá ààβ÷íáέ ìçíýíáóá ìà ðçí ðñòP óðæçðPóáùí
- ŐðíóðPñέίç PGP áéá θçöéáèP ððřáñáòP éáέ éñòððřáñŪöçóç email
- ŐðíóðPñέίç MIME
- ŐðíóðPñέίç Maildir
- ÁíáέñàðέέŪð áðíáóúðçóáð ðáñáíáðñíðñìβçóçð

¼éáð áððŪð ðé áðíáóúðçóáð, èŪñíóí òì **mutt** Ýíá áðù óá ðéí áíáέéáíŪíá áéáèŪóéíá ðñřáñŪííáóá óá÷ðàññàβìð. Áàβðá ðçí ðñðřèáóβá <http://www.mutt.org> áéá ðáñέóóúðáñáð ðèçñíòññáð ó÷áðέέŪ ìà òì **mutt**.

Ìðñáβðá íá àáéáóáóðPóáðá ðç óóáéáñP Ýéäíóç òìð **mutt** ìŪóù òìð port mail/mutt, áñP éáέ ç òñŪ÷íóóá ððù áíŪééíç Ýéäíóç àβίáέ áéáèŪóéíç ìŪóù òìð port mail/mutt-devel. ÌàðŪ ðçí ááéáðŪóóáóç òìð port, ìðñáβðá íá áéðáèŪóáðá òì **mutt**, ìà ðçí áéüéíðèç áíðñèP:

```
% mutt
```

Όì **mutt** èá áéááŪóáé áððùíáóá óá ðáñéá÷ùíáíá ðçð èðñβááð óá÷ðàññàβìð ÷ñPóçç óðñí éáðŪéíáñ /var/mail, éáέ èá ààβíáέ óá ðáñéá÷ùíáíá òìð áí áððù àβίáέ áðέέðù. Áí ááí ððŪñ÷íóí mails óçç èðñβáá òìð ÷ñPóçç, òì **mutt** èá áέóŪéèáé óá éáðŪóóáóç áíáññðð áíðñèP. Όì ðáñáéŪòù ðáñŪááéáíá, ààβ÷íáέ òì **mutt** íá áðáééíñβæáέ íéá èβóóá ìçíðìŪðùí:

```
q:Quit d:Del u:Undel s:Save m:Mail r:Reply g:Group ?:Help
1 N Mar 09 Super-User ( 1) test
2 N Mar 09 Super-User ( 1) user account
3 N Mar 09 Super-User ( 1) sample
-----*Mutt: /var/mail/narcs [Msgs:3 New:3 1.6K]---(date/date)----- (all)-----
```

Áéá íá áéááŪóáðá email, áðèðð áðέéŪíðá òì ÷ñçóéñðñèPñíóáð óá ááèŪééá, éáέ ðéŪóðá **Enter**. Ìðñáβðá íá ààβðá Ýíá ðáñŪááéáíá áðáééíñέóçð mail áðù òì **mutt** ðáñáéŪòù:





```

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

Copyright 1989-2003.  PINE is a trademark of the University of Washington.
? Help                P PreuCmd                R ReINotes
0 OTHER CMDS > [Index] N NextCmd                K KLock
    
```

Ότ άðñáðñéη ίçίòηΰòηί ááβ÷íáé ίçίγίáðá áðη òη òñÝ÷ííðá éáðΰεηíη, éáé ìðñáβðá ίá ίáðáééίçéáβðá òá áðòη ίá ðá ááεΰééá. Ìðñáβðá ίá áéááΰóáðá òη áðééáηÝí ηβίðηά, ðéÝæííðáð òη 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 áééηίá ðηð òáβηáðáé ðáñáéΰòη, òη **pine** áðáééηηβæáé Ýíá ððηááéáηá ίçίγίáðηð. Όòη éΰòη ίÝñηð ðçð ηεηίçð òáβñηðáé ò÷ áðééÝð òòηðñáγóáéð ðεçéðñηεηηáβηð. ίá ðáñΰááéáηá ðÝðηéáð ðòηðηηáðóçð, áβηάé òη ðεβέðñη **r** òη ηðηβη éÝáé ðòη MUA ίá äçηεηðñáβðáé áðΰηðççç ðñηð òη òñÝ÷íη ηβίðηά ðηð áðáééηηβæáðáé.

```

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
O OTHER CMDS > ViewAttach N NextMsg Spc NextPage U Undelete F Forward
    
```

Ç áδΰίδςόç óά Ύία mail ιΎού διδ pine áβιáδάέ ιá δç ÷ñδóç διδ óδιδΰέδç έáειΎιδ pico, ι ιδιδιδ άάέάεβδδάδάέ áδδ δñιáδέειάβ ιάαβ ιά οί pine. Οί pico áέáδδειέγιάέ δç ιάδάέβιçόç ιΎόά óδιδιδιá, έάέ áβιáέ έΰδδδ δει άγέει έάέ οιδδ άñ÷ΰñειδδ ÷ñδδάδ óά ó÷Ύόç ιά οί vi(1) δ οί mail(1). Ιύέδ ιειέçñδδάδ δçι áδΰίδςόç, ιδιδιáβδά ιά óδάβέáδδ οί ιδιδιá δέΎαιιδάδ óά δδδδñά Ctrl+X. Οί pine έά óάδ αçδδδάέ ιά οί áδέάάάέδδδάδ.

```

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
    
```

Ιδιδιáβδά ιά δñιόáñιυδδάδ οί pine ιά δç ÷ñδóç δçδ άδέειάβδδ SETUP áδδ οί έγñει ιάñγ. Οδιδιδέάδδέάβδδά δçι οιδιδέáδδά <http://www.washington.edu/pine/> áέά δáñέóδδδáñáδ δέçñιδιδιáδ.

## 28.12 ×ñçóειδιδιδιδιáδδ οί fetchmail

Όδιδέóδδδ άδδ οί Marc Silver.

Οί fetchmail áβιáέ Ύιáδ δδδñçδ δάέΰδçδ áέá IMAP έάέ POP, ι ιδιδιδ άδδδñΎδάέ óδιδδ ÷ñδδάδ ιά έάδάάΰαειδιδι áδδδιδιáδά mail áδδ άδιδάέñδδδιδιΎιδδ άιδδçñάδçδΎδ IMAP έάέ POP έάέ ιά οί áδιδέçέáγιδιδι óά οιδέέΎδ έδñβάδδ, áδδ υδδδ ιδιδιáβ Ύδάέδά ιά δδΰñ÷άέ δει άγέειç δñυδάάόç. Οί fetchmail ιδιδιáβ ιά áάέάδδδδάέάβ ÷ñçóειδιδιδιδιδιáδδ οί port mail/fetchmail έάέ δáñΎ÷άέ áέΰδδιδιá ÷άñάέδçñέóδέέΰ, ιάñέέΰ áδδ óά ιδιδιá δáñέείáιáΰιδιδι:

- Òðéòòðñέτç òñ ðñùðéτèùèùτ POP3, APOP, KPOP, IMAP, ETRN έάέ ODMR.
- Άοτáòùòçòά ðññèççòçð email τÝòù SMTP, òτ τðτβτ άðέòñÝðάέ òç òòóέττáέέð έάέòτòñάβά òτò òέέòñάñβóτáòτò, òçð ðññèççòçð, έάέ òñ ðάññττòτβτ (aliases).
- Ìðτñάβ τά έάέòτòñάβóάέ òά έάòÙóðάóç áάβτττá, ðóðά τά áéÝá÷άέ ðάñέττáέέÙ áέá τÝá τçτýτáòá.
- Ìðτñάβ τά áτáέòÙ ðττέάðέÝð èòñβáàð έάέ τά òέò ðñτùέάβ, áτÙέττá τά òέò ðòèτβóάέð òτò, òά áέáòττñάðέέτýð òτðέέτýð ÷ñβóðáð.

Άτ έάέ άβτáέ Ýτù áðù òτòð òέττýð áðòτý òτò έάέτÝττò τά άτçάβóάέ ττέáð òέð áòτáòùòçòάð òτò **fetchmail**, έá áτáòáñέτýτá òά éÙðττáð ááóέέÝð έάέòτòñάβáð. Òτ **fetchmail** ÷ñçóέττðττέάβ Ýτá áñ÷άβτ ðòèτβóáτ áτúòòù τð .fetchmailrc, áέá τά έάέòτòñάβóάέ òúòòÙ. Òτ áñ÷άβτ áðòù ðάñέÝ÷άέ òέð ðççñττòττñáð òτò áτðççñάòçðð áέέÙ έάέ òά òðτé÷άβá áέóúáτò òτò ÷ñβóðç. Éùáù òñ áðάβóççòñ ðççñττòττέβτ òτò áñ÷άβτò áðòτý, òάð òòτáτòέáτýτòτá τά ÷ñçóέττðττέβóáðá òçτ ðάñάέÙòù áτòτèβ ðóðά ç áτÙáτúòç òτò τά áðέòñÝðάóάέ ττττ áðù òττ έάέττèððç òτò:

```
% chmod 600 .fetchmailrc
```

Òτ .fetchmailrc ðτò òάβτáðάέ ðάñάέÙòù άβτáέ Ýτá ðάñÙáάέáτá τά òτ τðτβτ τðτñάβòά τά έáðάáÙóáðá òç èòñβáá áτúð ÷ñβóðç τÝòù òτò ðññòττèùèùτ POP. Éáðάðέτýτáέ òτ **fetchmail** τά òðτáάέάβ òòτ example.com ÷ñçóέττðττέβτðáð úττá ÷ñβóðç joesoap έάέ éùáέέù xxx. Òτ ðάñÙáάέáτá òðτéÝðάέ úðé τ ÷ñβóðçð joesoap άβτáέ áðβóçð έάέ ÷ñβóðçð òτò òτðέέτý òðòòτáðò.

```
poll example.com protocol pop3 username "joesoap" password "XXX"
```

Òτ áðùτáτ ðάñÙáάέáτá, áάβ÷τáέ óττááóç òά ðττέáðέτýð POP έάέ IMAP áτðççñάòçðÝð, έάέ áτáέáðáðέτýτáέ òά áέáòττñάðέέτýð òτðέέτýð ÷ñβóðáð úðτò άβτáέ áðάñάβóçòτ:

```
poll example.com proto pop3:
user "joesoap", with password "XXX", is "jsoap" here;
user "andrea", with password "XXXX";
poll example2.net proto imap:
user "john", with password "XXXXX", is "myth" here;
```

Òτ áτççòçóέέù ðñùáñáτá **fetchmail** τðτñάβ τά έάέòτòñάβóάέ òά έáòÙóðάóç áάβτττá, áτ òτ áέðáéÝóáðá τά òçτ áðέέττáβ -d, áέττèτòéτýτáέç áðù Ýτá áéÙòççτá (òά ááðòáñττèáððá) òτ τðτβτ έá ÷ñçóέττðττέçèάβ áέá τά áñòðτðáέέ τé áτðççñάòçðÝð òτò άβτáέ έáðá÷úñçτÝττé òðτ áñ÷άβτ .fetchmailrc. Òτ ðάñάέÙòù ðάñÙáάέáτá τáçáάβ òτ **fetchmail** τά áτé÷άτáέ áέá τÝτ mail éÙèá 600 ááðòáñττèáððá:

```
% fetchmail -d 600
```

Ìðτñάβòά τά áñάβòά ðάñέóóùðάñάð ðççñττòττñáð áέá òτ **fetchmail** òðçτ òτðττèáóβá <http://fetchmail.berlios.de/>.

## 28.13 × ñçóέττðττέβτðáð òτ procmail

*ÓðτáέóòττÙ áðù òττ Marc Silver.*

Òτ áτççòçóέέù ðñùáñáτá **procmail** άβτáέ τéá áðβóðáððá έó÷òñβ ðóáñττáβ ðτò τðτñάβ τά ÷ñçóέττðττέçèάβ áέá òτ òέέòñÙñέóτá òτò áέóáñ÷úτáτò mail. ΆðέòñÝðάέ òòτòð ÷ñβóðáð τά ττñáεττ "έáτúτáð" τé τðτβτé τðτñάβ τά òάέñέÙáεττò òά áέóáñ÷úτáτá mail έάέ τά áέðáéτýτá áéÙòττñáð έάέòτòñάβáð, β τά áτáέáðáðέτýτòτ òτ mail òά áτáέáéðέέÝð èòñβáàð β/έάέ áέáðέτýτáέð òά÷ðáññάβτò. Òτ **procmail** τðτñάβ τά ááέáðáðóðάέάβ ÷ñçóέττðττέβτðáð òτ port mail/procmail. ÌáòÙ òçτ ááέáðÙóðáóç òτò, τðτñάβ τά áτòτáòúèάβ ó÷ááúτ òά τðττéτáβðττòá MTA. Òòτáτòέáðéáβòά òçτ òάέττñβúòç òτò MTA

Το postfix μπορεί να εγκαταστήσει το **procmail** για να χρησιμοποιήσει το postfix. Εάν θέλετε να χρησιμοποιήσετε το postfix, τότε πρέπει να εγκαταστήσετε το postfix. Το postfix μπορεί να εγκαταστήσει το postfix. Το postfix μπορεί να εγκαταστήσει το postfix.

```
"|exec /usr/local/bin/procmail || exit 75"
```

Όταν εγκαταστήσετε το postfix, τότε πρέπει να εγκαταστήσετε το postfix. Το postfix μπορεί να εγκαταστήσει το postfix. Το postfix μπορεί να εγκαταστήσει το postfix.

Εάν θέλετε να εγκαταστήσετε το postfix, τότε πρέπει να εγκαταστήσετε το postfix. Το postfix μπορεί να εγκαταστήσει το postfix. Το postfix μπορεί να εγκαταστήσει το postfix.

```
Δηλώνουμε το email όμοιο με <user@example.com> μέσω του postfix
<goodmail@example2.com>:
```

```
:0
* ^From.*user@example.com
! goodmail@example2.com
```

```
Δηλώνουμε το email όμοιο με <goodmail@example2.com> μέσω του postfix
<goodmail@example2.com>:
```

```
:0
* < 1000
! goodmail@example2.com
```

```
Αν θέλουμε να εγκαταστήσουμε το postfix, τότε πρέπει να εγκαταστήσουμε το postfix.
alternate:
```

```
:0
* ^TOalternate@example.com
alternate
```

```
Αν θέλουμε να εγκαταστήσουμε το postfix, τότε πρέπει να εγκαταστήσουμε το postfix.
/dev/null:
```

```
:0
^Subject:.*Spam
/dev/null
```

Εάν θέλετε να εγκαταστήσετε το postfix, τότε πρέπει να εγκαταστήσετε το postfix. Το postfix μπορεί να εγκαταστήσει το postfix. Το postfix μπορεί να εγκαταστήσει το postfix.

```
:0
* ^Sender:.owner-freebsd-\[^\@]+\@FreeBSD.ORG
{
LISTNAME=${MATCH}
:0
* LISTNAME??^\[^\@]+
FreeBSD-${MATCH}
}
```

# ΈαöÜεάεί 29 ΆιõðçñâôçôÝò Äέéôÿíï

Αίαääēĩāáιêçêâ áðü ðĩ Murray Stokely.

## 29.1 Óÿíñç

Ôĩ έαöÜεάεί áðü έáéÿððáέ ιñέοιÝíáð áðü ðέð ðεί οó ÷ íÜ ÷ ñçόείιðíείγíιáíáð áέέððάέÝò ððçñâóβãð ðüí óðóçìÜðüí UNIX. Έá ðáñĩóέÜóιóιá ðçí ááέáðÜóðáç, ñÿέιέç, Ýέãã ÷ ι έáέ óóíðñççç ðíέεβĩ áέáóĩñáðέέβĩ ðÿðüí áέέððáέβĩ ððçñâóέβĩ. Óã üéí ðĩ έαöÜεάεί, áέá ðç áέέβ óáð áέáðέüέçίç, ððÜñ ÷ ιóí ðáñááãβãιáóá áέáðüñüí áñ ÷ áβüí ñðèìβóáüí. Άöĩÿ áέááÜóáðã áðüü ðĩ έαöÜεάεί, έá ίÝñáðã:

- Dùð íá áέá ÷ áέñβæáððã ðçí ððçñâóβã **inetd**.
- Dùð íá ñðèìβóáðã Ýíá áέέððáέü óÿóçìã áñ ÷ áβüí.
- Dùð íá ñðèìβóáðã Ýíá áíòðçñâóçðβ áέέððáέβĩ ðççñíüñέβĩ áέá ðĩ áέáíιέñáóüü έιãáñέáóιβĩ ÷ ñçόóβĩ.
- Dùð íá ÷ ñçόείιðíέβóáðã ðĩ DHCP áέá ðçí áðüüιáç ñÿέιέç ðüí ðáñáιÝðñüí ðüó áέέðÿíü.
- Dùð íá ñðèìβóáðã Ýíá áíòðçñâóçðβ ιññáóβãð ðáñέĩ ÷ βĩ (DNS).
- Dùð íá ñðèìβóáðã ðüí áíòðçñâóçðβ έóðιόáέβãüí **Apache**.
- Dùð íá ñðèìβóáðã Ýíá áíòðçñâóçðβ ιáóáüñÜð áñ ÷ áβüí (FTP).
- Dùð íá ñðèìβóáðã Ýíá áíòðçñâóçðβ áñ ÷ áβüí έáέ áέðððüðβĩ áέá ðáéÜðãð Windows ιã ÷ ñβóç ðçð áóáñιãβð **Samba**.
- Dùð íá óðã ÷ ñιĩβóáðã ðçí çιãñιçβã έáέ ðçí βñá, έáέ íá ñðèìβóáðã Ýíá áíòðçñâóçðβ βñáð ιã ðç áιβέáέ ðüó NTP ðñüðíéüέüü.

Ðñεί áέááÜóáðã áðüü έαöÜεάεί, έá ðñÝðáέ:

- Íá έáðáñιãβðã ðέð ááóέéÝð Ýíñέãð ðüí áñ ÷ áβüí script /etc/rc.
- Íá áβóðã áñέέáéüíÝíιέ ιã ðç ááóέέβ ιññέιãβã ðüí áέέðÿüí.
- Íá áññβæãðã ðüð íá ááέáðáçðβóáðã ðñüóέáðü έιáέóιέέü ðñβðüü έáðáóέáðáçðβ (ΈαöÜεάεί 4).

## 29.2 The inetd “Super-Server”

Contributed by Chern Lee. Updated for FreeBSD 6.1-RELEASE by The FreeBSD Documentation Project.

### 29.2.1 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`.

### 29.2.2 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.

### 29.2.3 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.

## 29.2.4 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 29-1. 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

Protocol	Explanation
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.

### 29.2.5 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.

### 29.2.6 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.

## 29.3 Network File System (NFS)

*Reorganized and enhanced by Tom Rhodes. Written by Bill Swingle.*

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.

### 29.3.1 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
<b>nfsd</b>	The NFS daemon which services requests from the NFS clients.
<b>mountd</b>	The NFS mount daemon which carries out the requests that nfsd(8) passes on to it.
<b>rpcbind</b>	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.

### 29.3.2 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 [Chapter 11.7](#) 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.

### 29.3.3 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.

### 29.3.4 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.

### 29.3.5 Automatic Mounts with amd

*Contributed by Wylie Stilwell. Rewritten by Chern Lee.*

`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`.

#### Ἐπιπέδον 29-2. Μοῦντῆν ἑξῆς μὲν **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.

### 29.3.6 Problems Integrating with Other Systems

*Contributed by John Lind.*

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.

## 29.4 Network Information System (NIS/YP)

*Written by Bill Swingle. Enhanced by Eric Ogren and Udo Erdelhoff.*

### 29.4.1 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.

### 29.4.2 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.
<b>rpcbind</b>	Must be running in order to enable RPC (Remote Procedure Call, a network protocol used by NIS). If <b>rpcbind</b> is not running, it will be impossible to run an NIS server, or to act as an NIS client.
<b>ypbind</b>	“Binds” an NIS client to its NIS server. It will take the NIS domainname from the system, and using RPC, connect to the server. <b>ypbind</b> is the core of client-server communication in an NIS environment; if <b>ypbind</b> dies on a client machine, it will not be able to access the NIS server.

Term	Description
<b>ypserv</b>	Should only be running on NIS servers; this is the NIS server process itself. If <code>ypserv(8)</code> 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 <b>ypbind</b> process on the client.
<b>rpc.yppasswdd</b>	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.

### 29.4.3 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.

#### 29.4.3.1 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.

### 29.4.4 Using NIS/YP

This section will deal with setting up a sample NIS environment.

### 29.4.4.1 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.

#### 29.4.4.1.1 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.

#### 29.4.4.1.2 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.

### 29.4.4.2 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.

#### 29.4.4.2.1 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.

**Σημείωση:** 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`.

#### 29.4.4.2.2 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).

### 29.4.4.2.3 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.

### 29.4.4.3 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.

#### 29.4.4.3.1 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:

```
+:::~::~:
```

**Όχιἄβύος:** 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`.

**Όχιἄβύος:** 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.

### 29.4.5 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`.

**Όχιἄβύος:** 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`.

**Όχιἄβύος:** 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.

## 29.4.6 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#

## 29.4.7 Using Netgroups

*Contributed by Udo Erdelhoff.*

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! Βούζ:** 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.

## 29.4.8 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!

## 29.4.9 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.

### 29.4.10 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.

### 29.4.11 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.

## 29.5 Automatic Network Configuration (DHCP)

*Written by Greg Sutter.*

### 29.5.1 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.

### 29.5.2 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.

### 29.5.3 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)`.

### 29.5.4 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 Εἰσαγωγή 8.

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.

**Προσοχή:** 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"
```

**Προσοχή:** Be sure to replace `fxp0` with the designation for the interface that you wish to dynamically configure, as described in Ὁδηγία 11.8.

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.

## 29.5.5 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.

## 29.5.6 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/>.

## 29.5.7 Installing and Configuring a DHCP Server

### 29.5.7.1 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 4 for more information on using the Ports Collection.

### 29.5.7.2 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 8.

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.

**Ὁρῶντες:** 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.

### 29.5.7.3 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;❷
max-lease-time 86400;❸
ddns-update-style none;❹

subnet 192.168.4.0 netmask 255.255.255.0 {
    range 192.168.4.129 192.168.4.254;❺
    option routers 192.168.4.1;❻
}

host mailhost {
    hardware ethernet 02:03:04:05:06:07;❼
    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.
- ❹ 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.

### 29.5.7.4 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.

## 29.6 Domain Name System (DNS)

*Contributed by Chern Lee, Tom Rhodes, ἐᾶέ Daniel Gerzo.*

### 29.6.1 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/>.

### 29.6.2 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.
<b>named</b> , BIND, name server	Common names for the BIND name server package within FreeBSD.
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.

### 29.6.3 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.

## 29.6.4 How It Works

In FreeBSD, the BIND daemon is called **named** for obvious reasons.

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.

## 29.6.5 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 `Οἰκία 11.7` section is also a good read.

## 29.6.6 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.

### 29.6.6.1 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.

### 29.6.6.2 /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.

**Δññääïðñçóç:** 127.0.0.1 will *not* work here. Change this IP address to a name server at your uplink.



```

};
*/

/* An example dynamic zone
key "exampleorgkey" {
  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.

### 29.6.6.3 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 `yyyymmddrr` 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.

## 29.6.7 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.

## 29.6.8 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 mailing list (http://lists.FreeBSD.org/mailman/listinfo/freebsd-security-notifications) to stay up to date with the current Internet and FreeBSD security issues.

**Πομπή:** If a problem arises, keeping sources up to date and having a fresh build of **named** would not hurt.

## 29.6.9 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>)

## 29.7 Ἡ ἀποδοχὴ τοῦ HTTP Apache

Ὁ κείμενο τῆς ἀποδοχῆς τοῦ Apache HTTP ἀποδοχῆς Murray Stokely εἶναι ἡ ἀποδοχὴ τοῦ Apache.

### 29.7.1 Ὁρίων

Ὁ FreeBSD ÷ ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache. Ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache. Ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache. Ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache. Ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache.

Ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache, ἐὰν ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache.

**Ὁρίων:** Ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache HTTP 1.3.X, ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache HTTP 2.X. Ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache HTTP 2.X. Ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache HTTP 2.X. Ἡ ἀποδοχὴ τοῦ Apache εἶναι ἡ ἀποδοχὴ τοῦ Apache HTTP 2.X.

### 29.7.2 Νϱειβόάέδ

Όδρ FreeBSD δρ ϱιάίδέέδάνρ άη÷άβρ νϱειβόάέδ δρ Άίωδϱηάδϱόΰ **HTTP Apache** άβράέ δρ /usr/local/etc/apache/httpd.conf. Άβράέ ΢ρά δδδέέδ UNIX νϱειέδδέέδ άη÷άβρ έάει΢ήρ, ιά άηάιΰδ ϱ÷ρεβύρ δρ ιάέει΢ή ιά δρ ÷άηάδΠηά #. Όέιδδ ιάδ άπ άά άβράέ ιέα ϱειέεϱηύϱ δάηέάνάδΠ έέδρ δρ δέέάπρ άδέειάπρ, άδρ ΢ήδ δά δάηέάνΰδρ ιύρ δέδ δέρ ϱιήρεέάβδ άδέει΢ήδ νϱειβόάέδ (configuration directives).

```
ServerRoot "/usr/local"
```

Άπ δάηέάνΰδδάέ ϱ δηάδδέάη΢ήρ έάηάν÷έέΰ έάδΰειάρ άάέάδΰδδάδ ϱέα δρ **Apache**. Όά έέδάέ΢έιά άη÷άβρ άβράέ άδρεϱέάδρ΢ή ϱήδδ δδρεάδάέΰιδδ bin έάέ sbin δρ έάδάέΰιδδ "ServerRoot" έάέ δά άη÷άβρ νϱειβόάέδ άδρεϱέάηήδάέ δρ έάδΰειάρ etc/apache.

```
ServerAdmin you@your.address
```

ϱ ϱέάέδηήέδ έέάγέδρϱ ϱϱί ϱδρβά έά δρ΢ήδ έά άδρδΰέέιδάέ άρδρ΢ήδ δηάεϱΰδδρ ϱ÷άδέΰ ιά δρ άίωδϱηάδϱόΰ. Άδδϱ ϱ έέάγέδρϱ άρδρβέάδάέ δά έΰδρ έάδ ϱέβάδ δρ ϱϱειδρ΢ήδάέ άδδρ δρ άίωδϱηάδϱόΰ, υδδδ ϱέ ϱέβάδδ ϱάέιΰδδρ.

```
ServerName www.example.com
```

Όρ ServerName ϱάδ άδέδρ΢ήδ έά έ΢άδά ΢ρά υήηά έυιάρ (hostname) έάέ δρ άίωδϱηάδϱόΰ ϱάδ, δρ ϱδρβί άδρδΰέέάδάέ δβδδ ϱήδδ clients άρ άβράέ έέάδρ΢ήδ άδδρ έέάβρ δρ ΢÷άδ Πϱϱ νϱειβόάέ δρ έυιάρ ϱάδ (άπ ϱδρβάδ, έά δάηΰάέιά, ιά ÷ηϱέιδρδρδάδ www άρδδ δρ δηάιάδέέϱ υήηάδδ δρ έυιάρ).

```
DocumentRoot "/usr/local/www/data"
```

DocumentRoot: Άβράέ ϱ έάδΰειάρ άδδρ δρ ϱδρβί έά δηρδΰήδρδάέ δά ΢άάάδ ϱάδ. Δηάδδέάη΢ή, υέά δά άέδΠιάδά έά άίωδϱηάδρ΢ήδ άδδρ άδδδρ δρ έάδΰειάρ, έέΰ ϱδρ΢ή άδβϱδ ιά ÷ηϱέιδρδρδρδ ϱδρρεέέβ άδρβ (symbolic link) Π δάηύρϱέα (aliases) δρ έά ϱδρ÷άϱδρ δά ΰέάδ δρδρεάδδ.

Δηεί έ΢ήδά ϱδρβάδρδά έέάπ, άβράέ έάέδρ ιά ϱϱειδρβάδ άρδβάηάδά ϱδρβέάβδ (backup) δρ άη÷άβρ νϱειβόάέδ δρ **Apache**. ΢έέδ έηβιάδδ δδδ άβδδά έέάδρδρ΢ήρ ιά δέδ άη÷έΰδ νϱειβόάέδ ϱδρβάδ ιά ιάέρΠάδδ ιά ϱϱί έέδ΢έάδ δρ **Apache**.

### 29.7.3 Άέδ΢έάδ ϱήδ Apache

Ο Apache άάρ δρ΢÷άέ έέά΢ήδρ δρ δδάν-έέάέηέδδρ **inetd** υδδδ έ΢ρδρ δρειβ ΰέει έέέδδάέιβ άίωδϱηάδϱόΰ. Άβράέ νϱειέδρ΢ήρ ιά δρ΢÷άέ άδδρ΢ή έά ιά άίωδϱηάδρβ έέγδάηά δέδ έέδΠάέδ HTTP δρ δάέάδρ δρ, ϱϱέάΠ δρ δηάηάηΰδδρ δέρΠϱϱϱδ (browsers). ϱ άάέάδΰδδάδ δρ **Apache** άδδρ δά FreeBSD Ports δάηέ΢÷άέ ΢ρά άϱϱέδέέδ shell script έάέ ϱϱί έέέβϱϱ, δρ ϱδρΰδϱιά έάέ ϱϱί άδρίάέέβϱϱ δρ άίωδϱηάδϱόΰ. Άέά ιά ιάέέρΠάδδ δρ **Apache** έά δηρϱϱ υήηΰ, άδδΰ δρ΢ήδ:

```
# /usr/local/sbin/apachectl start
```

ΰδρβάδ ϱδρβάδρδά δέέπρ ιά δδρίάδΠάδδ δρ άίωδϱηάδϱόΰ, δέεδρρδρδρδ:

```
# /usr/local/sbin/apachectl stop
```

Όταν έχετε εγκαταστήσει το Apache, είναι σημαντικό να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων. Αυτό γίνεται με την ακόλουθη εντολή:

```
# /usr/local/sbin/apachectl restart
```

Αντί να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων, μπορείτε να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων με την ακόλουθη εντολή:

```
# /usr/local/sbin/apachectl graceful
```

Εάν θέλετε να ξεκινήσετε το Apache με την ακόλουθη εντολή:

Αντί να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων, μπορείτε να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων με την ακόλουθη εντολή:

```
apache_enable="YES"
```

Αντί να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων, μπορείτε να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων με την ακόλουθη εντολή:

```
apache_flags=" "
```

Όταν έχετε εγκαταστήσει το Apache, είναι σημαντικό να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων. Αυτό γίνεται με την ακόλουθη εντολή:

### 29.7.4 Virtual Hosting

Το Apache υποστηρίζει την τεχνολογία Virtual Hosting. Οι ιστοσελίδες virtual hosting χρησιμοποιούν HTTP/1.1 headers για να προσδιορίσουν το IP που θα χρησιμοποιηθεί για την πρόσβαση στις ιστοσελίδες domains.

Αντί να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων, μπορείτε να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων με την ακόλουθη εντολή:

```
NameVirtualHost *
```

Αντί να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων, μπορείτε να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων με την ακόλουθη εντολή:

```
<VirtualHost *>
ServerName www.domain.tld
DocumentRoot /www/domain.tld
</VirtualHost>

<VirtualHost *>
ServerName www.someotherdomain.tld
DocumentRoot /www/someotherdomain.tld
</VirtualHost>
```

Αντί να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων, μπορείτε να ξεκινήσετε το Apache ως διακομιστή ιστοσελίδων με την ακόλουθη εντολή:

Ἀεὶ δὲ ἀνεύρεται τὸ ἐπισημασθὲν ὅτι ἡ ἀποστολή εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host.

### 29.7.5 Apache Modules

Ὅτι τὰ ἐπισημασθὲν εἰς τὸν virtual host (modules) εἰς τὸν Apache, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host.

#### 29.7.5.1 mod\_ssl

Ὅτι τὸ ἐπισημασθὲν εἰς τὸν virtual host εἰς τὸν OpenSSL εἰς τὸν Apache, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host.

Ἀὐτὸ εἰς τὸν Apache, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host.

#### 29.7.5.2 Ἀποστολὴ εἰς Perl & PHP

Ὅτι τὸ ἀποστολὴ εἰς τὸν Perl & PHP, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host.

##### 29.7.5.2.1 mod\_perl

Ὅτι τὸ ἀποστολὴ εἰς τὸν mod\_perl, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host.

Ὅτι τὸ ἀποστολὴ εἰς τὸν mod\_perl, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host.

##### 29.7.5.2.2 mod\_php

Ὅτι τὸ ἀποστολὴ εἰς τὸν Tom Rhodes.

Ὅτι τὸ ἀποστολὴ εἰς τὸν PHP, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host, ὅπου ἐπισημασθὲν εἰς τὸν virtual host.

Ἰ ÷ ᾶε ὀçí ᾶῶἰᾶῶῶῶ ἰᾶ ἰῶῶῶῶῶῶῶ ὀᾶ ἔῶᾶῶῶ HTML, ἰᾶ ὀεῖῶῶ ἰᾶ ᾶῶῶῶ Ἰῶᾶῶ ὀῶῶῶ ὀῶῶῶ ὀῶῶῶῶῶῶῶ Ἰῶῶ web ἰᾶ ᾶῶῶῶῶ ᾶῶῶῶῶ ᾶῶῶῶῶῶ ἔῶῶῶῶῶῶῶῶ.

Ἰ Apache ὀῶῶῶῶῶῶ ὀῶ PHP5. Ἰῶῶῶῶῶ ἰᾶ ἰᾶῶῶῶῶῶ ᾶᾶῶῶῶῶῶῶ ὀῶ ὀᾶῶῶῶ lang/php5.

Ἀῶ ὀῶ ὀᾶῶῶῶ lang/php5 ᾶᾶῶῶῶῶῶῶ ᾶῶ ὀῶῶῶ ὀῶῶῶ, ᾶῶῶῶῶ ἔᾶ ὀᾶῶ ᾶῶῶῶῶῶῶῶ ῶῶᾶ ἰῶ ᾶῶῶῶ ὀᾶῶῶῶ ὀῶῶῶῶῶῶῶῶ. Ἀῶ ἔῶῶῶῶ ἰᾶῶῶ ᾶᾶ ᾶῶῶῶῶῶῶῶ, ὀ. ÷. ᾶῶῶῶῶ ὀῶ ὀᾶῶῶῶ lang/php5 ᾶῶ ÷ ᾶ ᾶᾶῶῶῶῶῶῶ ὀῶῶ ὀᾶῶῶῶῶῶῶῶ, ἰῶῶῶῶῶ ὀῶῶῶ ἰᾶ ῶῶῶῶῶῶ ᾶῶῶ ὀçí ᾶῶ ÷ ὀῶ ὀᾶῶῶῶ, ὀῶῶ ÷ ῶῶῶ ὀῶῶ ἔᾶῶῶῶῶ ὀῶῶ port:

```
# make config
```

Ὀῶῶ ᾶῶῶῶῶῶ ᾶᾶῶῶῶῶῶῶ, ᾶῶῶῶῶῶ ὀçí ᾶῶῶῶῶῶ Apache ῶῶῶ ἰᾶ ὀῶῶῶῶῶῶῶῶ ἔᾶῶ ὀῶ Ὑῶῶῶῶῶ **mod\_php** ᾶῶῶ ὀῶῶ ᾶῶῶῶῶῶῶῶ Apache.

**Ὀçíᾶῶῶῶ:** ἰᾶῶῶῶῶ ὀῶῶῶῶῶῶ ὀῶῶῶῶῶῶ ὀῶ PHP4 ᾶῶ ᾶῶῶῶῶῶ ἔῶῶῶῶῶ (ὀ. ÷. ἔῶῶῶῶ ὀῶῶῶῶῶῶῶ ὀῶ ὀᾶῶῶῶ Ἰ ÷ ῶῶῶ ὀᾶῶ ᾶᾶῶῶῶῶῶῶῶῶ ὀῶῶ ὀᾶῶῶῶῶῶῶῶῶ ὀῶ ὀᾶῶῶῶῶῶῶῶῶ). Ἀῶ ᾶῶῶῶ ᾶῶῶῶῶ ἰᾶ ÷ ῶῶῶῶῶῶῶῶ ὀῶ **mod\_php4** ᾶῶῶ ὀῶ **mod\_php5**, ὀῶῶῶ ὀῶῶῶ ὀῶῶῶῶῶῶῶ ὀῶ port lang/php4. Ὀῶ port lang/php4 ὀῶῶῶῶῶῶῶῶ ὀῶῶῶῶῶ ὀῶῶ ὀῶῶ ὀῶῶῶῶῶῶῶ ἔᾶῶ ὀῶῶ ᾶῶῶῶῶῶῶῶ ὀῶῶ port lang/php5.

Ἰᾶ ᾶῶῶ ὀῶῶ ὀῶῶῶ ἔᾶ ᾶᾶῶῶῶῶῶῶῶ ἔᾶῶ ἔᾶ ῶῶῶῶῶῶῶ ὀᾶ ᾶῶῶῶῶῶῶῶ ᾶῶῶῶῶῶ ῶῶῶ ἰᾶ ὀῶῶῶῶῶῶῶῶ ᾶῶῶῶῶῶ ὀῶῶῶῶῶῶῶ PHP. Ἀῶ ᾶῶῶῶῶῶῶῶ ᾶῶῶῶῶῶ ὀῶ Ἰ ÷ ῶῶῶ ὀῶῶῶῶῶῶῶ ὀῶῶ ᾶῶῶῶῶῶῶ ὀῶῶ ᾶῶῶῶῶῶῶ ὀῶῶ /usr/local/etc/apache/httpd.conf ὀᾶ ᾶῶῶῶῶῶῶ:

```
LoadModule php5_module          libexec/apache/libphp5.so

AddModule mod_php5.c
<IfModule mod_php5.c>
    DirectoryIndex index.php index.html
</IfModule>
<IfModule mod_php5.c>
    AddType application/x-httpd-php .php
    AddType application/x-httpd-php-source .phps
</IfModule>
```

Ἀῶῶῶ ῶῶῶῶῶῶῶ ὀῶῶ Ἰ ῶῶῶ ÷ ἰ, ᾶῶ ἰᾶ ὀῶῶῶῶῶ ὀῶ Ὑῶῶῶῶῶ PHP ÷ ῶῶῶῶῶ ἰῶ ᾶῶῶῶ ἔῶῶῶ ἰᾶ ὀçí ᾶῶῶῶῶῶῶῶῶ apachectl ᾶῶ ἰῶ ἔᾶῶῶῶῶῶ (graceful) ᾶῶῶῶῶῶῶῶῶ:

```
# apachectl graceful
```

Ἀῶ ἰᾶῶῶῶῶῶῶ ᾶῶῶῶῶῶῶῶ ὀῶῶ PHP, ᾶᾶ ᾶῶῶῶῶῶῶ ᾶῶῶῶῶῶῶῶῶῶ make config. Ἰῶ ᾶῶῶῶῶῶῶῶῶῶῶῶῶῶῶ ᾶῶῶῶῶῶῶῶῶῶ ᾶῶῶ ὀῶ ἰç ÷ ᾶῶῶῶῶ ᾶᾶῶῶῶῶῶῶῶῶ ὀῶῶ Ports ὀῶῶ FreeBSD.

Ç ὀῶῶῶῶ ὀῶῶ PHP ὀῶῶ FreeBSD, ᾶῶῶῶ ᾶῶῶῶῶῶῶῶ ὀῶῶῶ ÷ ᾶῶῶῶῶ, ἔᾶ ἰ ᾶῶῶῶῶ ἔῶῶῶ ὀῶῶ Ἰ ÷ ᾶῶ ᾶᾶῶῶῶῶῶῶῶ ᾶῶῶῶῶ ὀῶῶῶ ᾶῶῶῶῶῶῶῶῶῶ. Ἀῶῶῶ ὀῶῶ ὀᾶῶῶ ᾶῶῶῶῶῶῶ ᾶῶῶῶῶῶῶῶ ὀῶῶῶῶῶῶῶῶῶ ὀῶῶ port lang/php5-extensions. Ἀῶῶῶ ὀῶῶ port ὀᾶῶῶ ÷ ᾶῶ ἰᾶῶῶ ᾶῶῶῶῶῶῶ ᾶῶ ὀçí ᾶᾶῶῶῶῶῶῶῶ ὀῶῶ ᾶῶῶῶῶῶῶῶῶ ὀῶῶῶῶῶῶῶῶῶῶ ὀῶῶ PHP. Ἀῶῶῶῶῶῶῶῶῶ, ἰῶῶῶῶῶ ἰᾶ ᾶᾶῶῶῶῶῶῶῶ ἔᾶῶῶῶ ᾶῶῶῶῶῶῶ ἰᾶ ÷ ῶῶῶῶῶῶ ὀῶῶῶῶῶῶῶῶ ὀῶῶ ἔᾶῶῶῶῶῶῶῶῶ port.

Ἀῶ ὀᾶῶῶῶῶῶῶῶ, ᾶῶ ἰᾶ ὀῶῶῶῶῶῶῶ ὀῶῶ PHP5, ὀç ᾶῶῶῶῶῶῶῶ ὀῶῶῶῶῶῶῶ ᾶῶ ᾶῶῶῶῶ ᾶᾶᾶῶῶῶῶῶ MySQL ᾶῶῶ ᾶᾶῶῶῶῶῶῶῶῶ ὀῶῶ port databases/php5-mysql.

Ἰᾶῶῶ ὀçí ᾶᾶῶῶῶῶῶῶῶ ᾶῶῶ ῶῶῶ ᾶῶῶῶῶῶῶῶ ὀῶ ἔῶῶῶῶῶῶ ὀῶῶῶῶῶῶῶῶῶῶ ᾶῶῶῶῶῶῶῶῶῶ ᾶῶῶῶῶῶῶῶῶῶ Apache ἔᾶ ὀῶῶῶῶῶ ἰᾶ ᾶῶῶῶῶῶῶῶῶῶ ᾶῶ ἰᾶ ᾶῶῶῶῶῶῶῶῶῶ ἰῶ ῶῶῶῶῶῶῶῶῶ:





### 29.9.2.1 Using the Samba Web Administration Tool (SWAT)

The Samba Web Administration Tool (SWAT) runs as a daemon from **inetd**. Therefore, the following line in `/etc/inetd.conf` should be uncommented before **swat** can be used to configure **Samba**:

```
swat    stream  tcp      nowait/400    root    /usr/local/sbin/swat
```

As explained in Δῆλῳ 29-1, the **inetd** must be reloaded after this configuration file is changed.

Once **swat** has been enabled in `inetd.conf`, you can use a browser to connect to `http://localhost:901`. You will first have to log on with the system `root` account.

Once you have successfully logged on to the main **Samba** configuration page, you can browse the system documentation, or begin by clicking on the **Globals** tab. The **Globals** section corresponds to the variables that are set in the `[global]` section of `/usr/local/etc/smb.conf`.

### 29.9.2.2 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.

### 29.9.2.3 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**.

### 29.9.3 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"
```

**Ὁψὶς:** 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 [Ὁψὶς 11.7](#) 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>.







# ÊäöÛëäéï 30 Firewalls

ÓòíäéóöïñÛ ðïð Joseph J. Barbish. ÌäðäðñÛðçêä óä SGML êäé áíáíáðêçêä áðu ðïí Brad Davis.

## 30.1 Óýñïç

Ïï firewall (ðäβ÷ìð ðñïðóäóβäð) êäééóðÛ äðíáðü ðï öééðñÛñéóíä ðçð äéóäñ÷ìáíçð êäé áíáñ÷ìáíçð êβíçóçð ðïð äéÝñ÷äðäé áðu ðï óýóðçíä óäð. Ñá firewall ìðññáβ ñá ÷ñçóéïððïéäβ Ýíá Þ ðñééóðüðäñá óäð “éáíüíüí” äéá ñá äðééäññáβ ðä ðäéÝðä éäðÛ ðçí äβóíäí Þ Ýñäí ðïðð áðu ñéá äééððäéÞ óýíäáóç, êäé ñá ðä äðéðñÝðäé Þ ñá ðä äðñññβððäé. Ìé éáíüíüð ðïð firewall ìðññíýí ñá äéÝä÷ìðí Ýíá Þ ðñééóðüðäñá ÷áñáéðçñéóðééÛ ðüí ðäéÝðüí, óðìðñéééáíäññÝíüí ñäðáíý Ûëëüí êäé ðïð óýðïð ðïð ðñüðïíëüééïð, êäéðð êäé ðçí äéáyèðïíóç Þ/êäé éýñä (port) ðçð äóäðçñβäð Þ ðïð ðñññéóïíý.

Óä firewalls ìðññíýí ñá áíéó÷ýóïðï óçíáíðééÛ ðçí áóóÛëäéá áíüð êüíäíð Þ áíüð äééðýíð. Ìðññíýí ñá ÷ñçóéïððïéçèýíýí äéá ñβá Þ ðñééóðüðäñäð áðu ðéð äéüéïðéäð éäéðïðññáβð:

- Ñá ðñïðóäðäýíðïí êäé ñá äðñññðñïðï ðéð äðäññäÝð, ðéð ððçññáóβäð êäé ðä ñç÷áíðäðä ðïð áóüðäñééýí óäð äééðýíð áðu áíäðééýíçðç êβíçóç ðïð ðññÝñ÷äðäé áðu ðï Internet.
- Ñá ðñééññβäéïð Þ ñá äðñééäβïðï ðçí ðñüðäáóç ñç÷áíçðÛðüí ðïð áóüðäñééýí äééðýíð óä ððçññáóβäð ðïð Internet.
- Ñá ððïðçðñβäéïð ñäðÛññáóç äééððäéðí äéäðéýíóäñí (NAT), ç ððñá äðéðñÝðäé ðïð áóüðäñééü óäð äβéððï ñá ÷ñçóéïððïéäβ éäéððééÝð IP äéäðéýíóäéð êäé ñá ñññÛääðäé ñβá ñññäééð óýíäáóç ñá ðï Internet (äβðä ñÝóü ñβäð ñññäééðð äçñüóéäð IP äéáyèðïíóç, äβðä ñÝóü áíüð ðéÞèïð äçñïóβüí äéäðéýíóäñí ðïð áíäðβäíðäé äððüíäðä).

Áóïý äéääÛóäðä áððü ðï êäðÛëäéí, éä ñÝñäðä:

- Ðüð ñá äçíéíðñäÞðäðä óüðóíýð éáíüíüð öééðñññβóíäðïð ðäéÝðüí.
- Ïïðð äéÛðññïðð óýðïðð firewall ðïð ððÛñ÷ìðí óðïí FreeBSD êäé ðéð äéäðññÝð ðïðð.
- Ðüð ñá ñðèìβóäðä êäé ñá ÷ñçóéïððïéçÞðäðä ðï ÞÞ firewall ðïð OpenBSD.
- Ðüð ñá ñðèìβóäðä êäé ñá ÷ñçóéïððïéçÞðäðä ðï ÞÞFILTER.
- Ðüð ñá ñðèìβóäðä êäé ñá ÷ñçóéïððïéçÞðäðä ðï ÞÞFW.

Ðñéí äéääÛóäðä áððü ðï êäðÛëäéí, éä ðñÝðäé:

- Ñá éäðäññäβðä äáóééÝð äñ÷Ýð ðïð FreeBSD êäé ðïð Internet.

## 30.2 ÁäóééÝð Ñññéäð ðüí Firewalls

ÏðÛñ÷ìðí äýí äáóééíβ ðññðñé äéá ðç äçíéíðññá éáíüíüí óä Ýíá firewall: ñ “inclusive” êäé ñ “exclusive”. Ñá exclusive firewall äðéðñÝðäé ðç äéÝéäðóç ñéçð ðçð êβíçóçð, äéðüð áðu áððÞ ðïð ðäéñéÛäéé ñá ðïðð éáíüíüð ðïð. Ñá inclusive firewall êÛíäé ðï áíÛðñäí. ÄðéðñÝðäé ñññ ðç äéÝéäðóç ðçð êβíçóçð ðïð ðäéñéÛäéé ñá ðïðð éáíüíüð ðïð, êäé äðñééäβäé ñðéäÞðïðä Ûëëï.

Óä inclusive firewalls ðññððÝññïð ðñéý éäéýðäññ Ýéää÷ìðí ðçð áíáñ÷ìáíçð êβíçóçð êäé äéá ðï èüäí áððü äβíäé éäéýðäñá äéá óðððÞäðä ðïð ðññððÝññïð ððçññáóβäð óðïí äçñüóéí Internet. ÄéÝä÷ìðí äðβóçð êäé ðä ðäéÝðä ðïð ðññÝñ÷äðäé áðu ðï äçñüóéí Internet ñä ðñññéóïí ðï éäéððééü óäð äβéððï. Áðu ðññäðééñäÞ, ñéç ç êβíçóç ðïð äáí

οάεñεÛæåέ ιά ðιòð éåíιíáð áðιíññβððåðåέ εåέ εåðååñÛððåðåέ. Óå inclusive firewalls åβιåέ ååιέεÛ áððåέÝððååñå áðιι óå exclusive, éåèðð ιåèðíιðι ðçιåιíðééÛ ðçι ðééåíιððçðå áéÝéåððçðð áιåðééÝιçðçðð èβιçðçðð ιÝðå áðιι áððÛ.

**Óçιåβιυόç:** Åéðυð éåέ áι áιåðÝñåðåέ åéåðιñåðééÛ, υéå ðå ðåñåååβåιåðå ñðèιβðåíι éåέ éåíιíιι ðιð ðåβιíιðåέ ðå áððυ ðι êåðÛëåéι, æçιéιðñåíιÝι inclusive firewalls.

Ç áððÛéåέå ιðñιåβ ιå åβιåέ åéυιå éç ÷ ðñυðåñç ιå ðç ÷ ñðçç åíυð “stateful firewall”. Åððυð ι ðýðιð firewall áðñççéåýåέ ðçι éåðÛððåçð ðυι ððιåÝððåñ ðιð ιåðåðÝñιðι åååñÝιå ιÝðå áðιι áððυ, éåέ åðéðñÝðåέ ιυíí ðçι èβιçðçðð åβðå ðåéñεÛæåέ ιå ιéå áðιι ðéðð ððÛñ ÷ ιððåð ððιåÝððåð, ð ðιð ιåééíÛ ιéå γÝå ðýιååðç. Óι ιåéíιÝéðçιå åíυð stateful firewall åβιåέ υðé ιðñιåβ ιå åβιåέ åðÛéυðι ðå åðééÝðåð Denial of Service (¶ñιççðð Óðçñåðβåð, DoS) áι åå ÷ èåβ ðåððυ ÷ ñιíå ðñééÝðð áéðððåðð åéå Ûñéåñå γÝυι ððιåÝððåñ ðå ιééñυ ÷ ñιíééυ åéÛðççιå. Ιå ðå ðåñéððυððåñ firewalls, åβιåέ åðιåðυι ιå åβιåέ ððιåðåðιυð éåέ ðυι åýι ððιðåñéðñι (ðυðι stateful υðι éåέ ιç-stateful) ðððå ιå æçιéιðñæçèåβ ðι åÝéðéððι firewall åéå ðçι ððåèåñéñéÝιç ÷ ñðçç.

### 30.3 ðñιåñÛιåðå Firewall

Óι FreeBSD Ý ÷ åé ðñβå åéåðιñåðééÛ ðñιåñÛιåðå firewall åíυιåðυιÝιå ððι ååðééυ ðýððççιå. Åβιåέ ðå: *IPFILTER* (åíυððυ åðβðçðð éåέ υð IPF), ðι *IPFIREWALL* (åíυððυ åðβðçðð éåέ υð IPFW), éåέ ðι *PacketFilter* ðιð *OpenBSD* (åíυððυ åðβðçðð éåέ υð PF). Óι FreeBSD åíðυιåðβιåέ åðβðçðð åýι ðñιåñÛιåðå åéå åéåíυñðυç èðééñιñβåð (traffic shaping, Ýéåå ÷ ðð ðιð åéåέÝðéñιð åýñιðð æðιçðð): ðι *altq(4)* éåέ ðι *dummynet(4)*. Óι Dummynet åβιåέ éåðÛ ðåñÛåιðç ððåñÛ ððιååñÝιí ιå ðι IPFW, éåέ ðι *ALTQ* ιå ðι *PF*. Ç åéåíυñðυç èðééñιñβåð åéå ðι *IPFILTER* ιðñιåβ ðç åååñÝιç ððéåñβ ιå åβιåέ ιå ðι *IPFILTER* åéå ðι *NAT* éåέ ðι ðééðñÛñéðιå éåέ ιå ðι *IPFW* ðå ððιåðåðιι ιå ðι *dummynet(4)* ð ÷ ñçðéñιðñéðιð ðι *PF* ðå ððιåðåðιι ιå ðι *ALTQ*. Óυðι ðι *IPFW* υðι éåέ ðι *PF* ÷ ñçðéñιðñééÝι éåíιíåðð åéå ιå åéÝåñιð ðçι èβιçðçð ðυι ðåéÝðυι áðιι éåέ ðñιð ðι ðýððççιÛ ðåð, áι éåέ åéåέÝðιðι åéåðιñåðéééÝðð ðñυðιððð åéå ιå ðι åðéðý ÷ ιðι, éåέ ιé éåíιíåðð ðιðð ÷ ñçðéñιðñééÝι åéåðιñåðéééðð ðýιðåíç.

Ï éυåñðð åéå ðιι ððιβι ðι FreeBSD åéåέÝðåέ ðñééåðéÛ firewall, åβιåέ υðé åéåðιñåðéééβ Ûñéñυðñé Ý ÷ ιðι åéåðιñåðéééÝðð åíÛæåðð éåέ ðñιðéñððåðð. Ååñ ððÛñ ÷ åé Ýιå éåέ ιιíåéééυ firewall ðιð ιå åβιåέ ðι éåéýððåñι.

Ï ððååñåðÝåð ðñιðéñÛ ðι *IPFILTER*, éåèðð ιé éåíιíåðð ðýððð stateful ðιð åéåέÝðåέ åβιåέ ééåυððåñι ðñéýðñéñééééé υðåñ ÷ ñçðéñιðñééÝιðåé ðå Ýιå ðåñéåÛééñι *NAT*, åñð åéåέÝðåέ éåέ åíυιåðυιÝιí ðι *ftp proxy* ðι ððιβι ðιðð áðéñðñéåβ åéυιå ðåñéððððåñι, åðéðñÝðñιððð áððåéðð ðýιååðç ðå åíυðåñéééÝðð åñðçñåðçðÝð *FTP*.

Êåèðð υéå ðå firewall ååðβæñιðåέ ðççι åðééåðñçççð ðéñðι åéÝå ÷ ðð ðυι ðåéÝðυι, ι åéå ÷ åéñéððððð ðιð ðñυéåéðåέ ιå æçιéιðñåβðåé ðιðð éåíιíåðð ðñÝðåé ιå éåðåññåβ ðιñ ðñυðñι éåéðñιñåβåð ðιð *TCP/IP*, ðι ñυéñ ðυι åéåðυññιð ðéñðι ððå ðåååβå åéÝå ÷ ðð ðυι ðåéÝðυι éåέ ðυð ÷ ñçðéñιðñééÝιðåé ðççι åñðåééååðð ðççñιðñéðι ðå ιéå ððιççééçιÝιç ððιååñβå. Åéå ðåñéððððåñåðð éåððñÝñåéåðð, åéååÛððå ðι <http://www.ipprimer.com/overview.cfm>.

### 30.4 Óι Packet Filter (PF) éåέ ðι ALTQ ðιð OpenBSD

*Áιåèåññðèçèå èåέ åιçιåñðèçèå áðιι ðιñ John Ferrell.*

Óι *Éñýééñ* ðιð 2003, ç åðåñιñåð firewall ðιð *OpenBSD* (åíυððð ÷ ðð *PF*) ιåðåðÝññèçèå ððι *FreeBSD* éåέ Ýåéñå åéåέÝðéñç ðççι Óðééññåð ðυι *Ports*. Óι *FreeBSD 5.3* ðιð èðééñνñçççðå ðι 2004, ððåñ ç ðñðçç åðβðçççç Ýéåñðç ç ιðñιβå ðåñéåβ ÷ å ðι *PF* υð ðιðñå ðιðð ååðéééÝðð ðéÝñι ðððððιåðιðð. Óι *PF* åβιåέ Ýιå ðñééçññυιÝñι firewall, ιå ðéðéìð ÷ åñåðççñéððééðñι, ðι ððιβι åðβðçðð åéåέÝðåέ ðñιåññåðééÛ ððιðððñéñçç åéå ðι *ALTQ* (*Alternate Queuing*). Óι *ALTQ* ðñιððÝñåé ððçñåðβåðð *ÅéåððÛéééççðð ðñéñυççðåð* (*Quality of Service, QoS*).

Ὁ OpenBSD Project ἐῚάέ ἀάέñάόέέP äῚöäέῚ ὁδὸ ὁδίῚPñçðç ὁῚῚ PF FAQ (<http://www.openbsd.org/faq/pf/>). Ἄέά ὁῚ ἔῚῚῚ ἄῚῚ, ç ḁñῚῚῚ ἄῚῚῚῚ ὁῚῚ Ἄñ÷ῚῚῚῚῚ ἄῚῚῚῚῚ ἔῚῚῚῚ ὁῚῚ ἔῚῚῚῚῚῚῚῚῚ ὁῚῚ PF ῚῚῚ ἄῚῚῚ ὁῚῚ FreeBSD, ἄῚῚ ḁñῚῚ ÷Ὶ ἔῚ ἔῚ ἔῚῚῚῚῚ ḁñῚῚῚῚῚ ὁ ÷Ὶ ἄῚῚῚῚ ἔῚ ὁç ÷ῚῚῚῚ ὁῚῚ. Ἄέά ḁῚῚ ἔῚῚῚῚῚῚῚ ḁῚῚῚῚῚῚ ὁ ÷Ὶ ἄῚῚῚῚ ἔῚ ὁç ÷ῚῚῚῚ ὁῚῚ PF, ḁñῚῚῚῚῚῚ ἔῚῚῚῚῚ ὁῚῚ PF FAQ (<http://www.openbsd.org/faq/pf/>). ḁñῚῚῚῚῚῚῚ ḁῚῚῚῚῚῚ ὁ ÷Ὶ ἄῚῚῚῚ ἔῚ ὁῚῚ PF ὁῚῚ FreeBSD ἔῚῚῚῚῚ ἔῚ ἄñῚῚῚ ὁῚῚ <http://pf4freebsd.love2party.net/>.

### 30.4.1 ×ñçῚῚῚῚῚῚῚ ὁῚ ἌñῚῚῚῚῚῚ ḁῚῚ ὁῚ PF

Ἄέά ἔῚ ῚῚῚῚῚῚ ὁῚ ῚῚῚῚῚῚ ḁῚῚ ὁῚ PF, ḁñῚῚῚῚῚῚ ὁçῚ ḁñῚῚῚῚῚῚ ḁñῚῚῚῚ ὁῚῚ ὁῚῚ `/etc/rc.conf`:

```
pf_enable="YES"
```

ἌέῚῚῚῚῚῚ ῚῚῚῚῚ ὁῚ script ἄῚῚῚῚῚῚ ἄῚῚ ἔῚ ῚῚῚῚῚῚ ὁῚ ῚῚῚῚῚῚ:

```
# /etc/rc.d/pf start
```

ὈçῚῚῚῚῚῚ ῚῚῚ ὁῚ ῚῚῚῚῚῚ PF ἄῚῚ ḁñῚῚῚῚῚῚ ἔῚ ῚῚῚῚῚῚ ἄῚ ἄῚ ἄñῚῚ ὁῚ ἔῚῚῚῚῚῚῚ ἄñ ÷Ὶ ἄῚῚ ἔῚῚῚῚῚ. ὉῚ ḁñῚῚῚῚῚῚῚ ἄñ ÷Ὶ ἄῚῚ ἄῚῚῚ ὁῚ `/etc/pf.conf`. ἌῚ ὁῚ ἄñ ÷Ὶ ἄῚῚ ἔῚῚῚῚῚ ἄñῚῚῚῚῚ ὁῚ ἔῚῚῚῚῚ ῚῚῚ ὁῚῚῚῚῚῚῚ, ἔῚῚῚῚῚῚ ἔῚ ὁçῚ ἔῚῚῚῚῚῚῚ ḁñῚῚῚῚῚῚ ἔῚ ἄñῚῚῚ ῚῚῚ ὁçῚ ḁñῚῚῚῚῚῚ ὁῚῚ `/etc/rc.conf`:

```
pf_rules="/path/to/pf.conf"
```

**ὈçῚῚῚῚῚῚ:** ἌḁῚ ὁῚ FreeBSD 7.0 ἔῚ ἔῚῚῚ, ὁῚ ḁḁῚῚῚῚῚ ὁῚῚ `pf.conf` ὁῚ ἔῚῚῚ ἄñῚῚῚῚῚῚ ὁῚῚ ἔῚῚῚῚῚῚ `/etc/`, ἔῚῚῚῚῚῚῚ ὁῚῚ ἔῚῚῚῚῚῚῚ `/usr/share/examples/pf/`. ὈḁῚ ἄῚῚῚῚῚῚ ὁῚῚ FreeBSD ḁñῚῚ ἄḁῚ ὁçῚ 7.0, ḁḁῚῚ ÷Ὶ ἄḁῚ ḁñῚῚῚῚῚῚ ῚῚῚ ἄñ ÷Ὶ ἄῚῚ `/etc/pf.conf`.

ὉῚ ῚῚῚῚῚῚ PF ἔῚῚῚῚ ἄḁῚῚῚ ἔῚ ῚῚῚῚῚῚ ÷Ὶ ἄῚῚῚῚῚῚ ἄḁῚ ὁçῚ ἄñῚῚῚ ἄῚῚῚῚ:

```
# kldload pf.ko
```

Ç ḁḁῚῚῚῚῚῚ ἔῚῚῚῚῚῚ ὁῚῚ PF ḁñῚῚ ÷Ὶ ἄῚῚ ἄḁῚ ὁῚ ῚῚῚῚῚῚ `pflog.ko` ἔῚ ἔῚῚῚῚῚ ἔῚ ὁçῚ ῚῚῚῚῚῚ ḁñῚῚῚῚῚῚ ὁçῚ ḁñῚῚῚῚῚῚ ḁñῚῚῚῚ ὁῚῚ `/etc/rc.conf`:

```
pflog_enable="YES"
```

ἌέῚῚῚῚῚῚ ῚῚῚῚῚ ὁῚ script ἄῚῚῚῚῚῚ ἄῚῚ ἔῚ ῚῚῚῚῚῚ ὁῚ ῚῚῚῚῚῚ:

```
# /etc/rc.d/pflog start
```

ἌῚ ÷ῚῚῚῚῚῚ ἔῚῚῚῚ ἄḁῚ ὁῚ ḁñῚῚ ÷ῚῚῚῚῚ ÷Ὶ ἄñῚῚῚῚῚῚ ὁῚῚ PF, ἔῚ ḁñῚῚῚ ἔῚ ἔῚῚῚῚῚῚῚ ὁçῚ ḁḁῚῚῚῚῚ ἄῚ ὁῚ PF ἄḁῚῚῚῚῚ ἔῚῚ ὁῚῚ ḁñῚῚῚῚῚ.

### 30.4.2 ἌḁῚῚῚῚῚ ὁῚῚ PF ἄῚῚ ὁῚῚ ḁῚῚῚῚῚ

ἌῚ ἔῚ ἄῚ ἄῚῚῚ ἄḁῚῚῚῚῚ ἔῚ ἔῚῚῚῚῚῚῚ ὁçῚ ḁḁῚῚῚῚῚ PF ἔῚῚ ὁῚῚ ḁῚῚῚῚῚ ὁῚῚ FreeBSD, ῚῚῚ ἔῚ ἔῚῚῚ ἔῚ ÷ῚῚῚῚῚῚῚῚ ῚῚῚ ἄḁῚ ὁῚ ḁñῚῚ ÷ῚῚῚῚῚ ÷Ὶ ἄñῚῚῚῚῚῚ ὁῚῚ PF ὁῚ ἔῚῚῚ ἄῚ ḁñῚῚῚῚῚῚῚ ὁῚῚ ῚῚῚῚῚ ὁῚῚ ḁῚῚῚῚῚ(4). ḁñῚῚῚῚῚῚ ἄῚ ἔῚ ḁῚῚῚῚῚῚῚ ç ῚῚῚ ἄḁῚῚῚῚῚῚ ὁῚῚῚῚῚῚ ἔῚ ἔῚῚῚῚ ὁῚῚ ḁῚῚῚῚ ἔῚῚῚῚῚῚ ḁῚῚ ὁῚ PF. ἔῚῚῚῚ ἔῚ ὁῚῚῚῚῚῚ ἔῚ ὁῚ `carp(4)` ἄῚ ἔῚ ἄçῚῚῚῚῚῚῚ ἔῚ ὁῚ PF

firewalls ìá äöíáóüòçóá áðòüüáðçð áέέáãÐð óá ðãñβððòóç áðíòð÷βáð (failover). Ðãñέóóüòãñáð ðέçñíüüíñβáð ó÷áðέέÙ ìá ðí CARP ìðíñáβðá ìá ãñáβðá óðí ÕìÐíá 31.12 ðíð Æã÷áέñέáβíð.

Ìðíñáβðá ìá ááβðá üέáð ðέð áðέέíãÝð ððñÞíá áέá ðí PF óðí ãñ÷áβí /usr/src/sys/conf/NOTES. Ìέ áðέέíãÝð ðáβííüáέ áðβóçð ðáñáέÙðù:

```
device pf
device pflog
device pfsync
```

Ç áðέέíãÐ device pf áíãñáíðíέáβ ðçí ððíóðÞñέíç áέá ðí firewall “Packet Filter” (pf(4)).

Ç áðέέíãÐ device pflog áíãñáíðíέáβ ðçí ðñíáέñáðέέÞ ðáðáí-áέέððáέÞ óðóέáðÞ pflog(4) ðíð ìðíñáβ ìá ðñçóέíðíέçέáβ áέá ðçí éáðáãñáðÞ ðçð έβίççðð óá Ýíá bpf(4) descriptor. Ì ááβííüáð pflogd(8) ìðíñáβ ìá áðíέçέáýóáέ ðçí éáðáãñáðÞ áððÞ óðí óέέçñü áβóέí.

Ç áðέέíãÐ device pfsync áíãñáíðíέáβ ðçí ðñíáέñáðέέÞ ðáðáü-áέέððáέÞ óðóέáðÞ pfsync(4) ç ìðíβá ðñçóέíðíέáβðáέ áέá ìá áíέ÷íáýáέ “áέέáãÝð éáðÙóðáóçð”.

### 30.4.3 ÁðέέíãÝð óðí rc.conf

Õí PF éáέ ðí pflog(4) ìðíñíýí ìá ñðέíέóðíýí éáðÙ ðçí áέέβίççð ìá ðέð ðáñáέÙðù éáðá÷ññβóáέð óðí 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
```

Áí ðβòù áðu áðòü ðí firewall ððÙñ÷áέ éÙðíέí ðíðέέü áβέððí (LAN) ðñíð ðí ìðíβí áðέέðíáβðá ìá ðñíüέÞóáðá ðáέÝðá, Þ áí èÝέáðá ìá ðñçóέíðíέçέáβðá NAT, éá ðñáέóðáβðá áðβóçð éáέ ðçí ðáñáέÙðù áðέέíãÐ:

```
gateway_enable="YES" # Enable as LAN gateway
```

### 30.4.4 Άçíέüñãáβά Éáíüíüí Õέέðñáñβóíáðíð

Õí PF áέááÙæáέ ðέð ñðέíβóáέð ðíð áðu ðí pf.conf(5) (ç ðñíáðέέáãÝíç ðíðíέáóβá áβíáέ óðí /etc/pf.conf) éáέ ðñíðíðíέáβ, áðíññβððáέ Þ áðíãÝ÷áέ ðáέÝðá óýíòüíá ìá ðíðð éáíüíáð éáέ ðíðð ìñέóíýð ðíð ðáñέÝ÷íðáέ óá áðòü. Ç ááέáðÙóðáóç ðíð FreeBSD ðáñέέáíáÙíáέ áñέáðÙ ððíãáβáíáðá ãñ÷áβíí ñýðέíóçð, óðçí ðíðíέáóβá /usr/share/examples/pf/. Ðáñáέáέíýíá ìá áέááÙóáðá ðí PF FAQ (<http://www.openbsd.org/faq/pf/>) áέá ðέÞñç áíÙέðçð ðüí éáíüíüí ðíð PF.

**Ðñíáέáíðíβçç:** ÉáέÞð áέááÙæáðá ðí PF FAQ (<http://www.openbsd.org/faq/pf/>), ìá Ý÷áðá ððüøç óáð üðέ áέáóíñáðέέÝð áέáüóáέð ðíð FreeBSD ðáñέÝ÷íðí áέáóíñáðέέÝð áέáüóáέð ðíð PF. Õç ááãñÝíç óóέáíÞ, ðí FreeBSD 7.x éáέ ìáÞðáñáð áέáüóáέð, ðñçóέíðíέçíç ðçí βáέá Ýέáíóç ðíð PF ðíð ðñçóέíðíέáβ éáέ ðí OpenBSD 4.1.

Ç çääëññííêêP ëβóóá ðíø FreeBSD áέα ðí packet filter firewall (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-pf>) áβíáε Ýíá εάεü ìÝññò áέα íá εΰíáóá áññòPóáεò ó÷ áòεέÝð ìá ðç ñýεìεóç εάε ðç εάεòíòññáβá ðíø PF firewall. Ìç ìá÷ Ûóáóá íá áεÝáíáóá óá áñ÷ áβá ðçð ëβóóáð ðñεί íáεείPóáóá ðεò áññòPóáεò!

### 30.4.5 Άíòεάýííóáò ìá ðí PF

×ñçóεíðíεPóóá ðí pfctl(8) áέα íá áεÝáíáóá ðí PF. Ðáñáεΰòù εá áñáβóá εΰðíεάò ÷ ñPóείáò áíòíεÝð (ááááεüèεáβóá üòε Ý÷ áóá áεááΰóáε ðç óáεβáá manual ðíø pfctl(8) áέα íá ááβóá üεáò ðεò áεáεÝóείáò áðεεíáÝð):

ΆíòíεP	Óείòùò
<code>pfctl -e</code>	Άíáñáíðíβçóç ðíø PF
<code>pfctl -d</code>	Άðáíáñáíðíβçóç ðíø PF
<code>pfctl -F all -f /etc/pf.conf</code>	ΆέαáñáóP üεüí ðüí εάíüíüí (nat, filter, state, table, ε.ε.ð.) εάε áε íÝíò áíΰáíüóç áðü ðí áñ÷ áβí /etc/pf.conf
<code>pfctl -s [ rules   nat   state ]</code>	Άεòýðüóç áíáóíñΰò ó÷ áòεέΰ ìá ðíòð εάíüíáò ðíø òβεòñíò, ðíø NAT, P ðíø ðβíáέα εάòΰóóáóçð
<code>pfctl -vnf /etc/pf.conf</code>	ΆεÝá÷ áε ðí /etc/pf.conf áέα εΰεç, áεεΰ ááí ðíñòPíáε ðíòð εάíüíáò

### 30.4.6 Άíáñáíðíβçóç ðíø ALTQ

Ôí ALTQ áεάòβεáóáε ìüñí áí ìáóááεüòðóβóáóá áðáòεάβáò ðçí ððíóðPñείç ðíø ìÝóá óòíí ððñPíá ðíø FreeBSD. Ôí ALTQ ááí ððíóðçñβεáóáε áðü üεá óá ðñíáñΰíáóá ðáPáçóçð εáñòPí áεέòýíò. Ðáñáεάεíýíá ááβóá ðç óáεβáá manual ðíø altq(4) áέα ðç ëβóóá ðüí ðáçáPí ðíø ððíóðçñβεííóáε óòçí Ýέáííóç ðíø FreeBSD ðíø áεάεÝóáóá.

Íε ðáñáεΰòù áðεεíáÝð ðíø ððñPíá áíáñáíðíείýí ðí ALTQ εάε ðáñÝ÷ íóí áðεðññüóεáóáò εάεòíòññáβò:

```
options      ALTQ
options      ALTQ_CBQ          # Class Bases 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 áñáíñP options ALTQ áíáñáíðíεάβ ðí ðεάβóεί εάεòíòññáPí ALTQ.

Ç áñáíñP options ALTQ\_CBQ áíáñáíðíεάβ ðí *Class Based Queuing* (CBQ). Ôí CBQ óáò áðεðñÝðáε íá ÷ ùñβóáóá ðí áýñíð æPíçð ìεáò óýíááóçð óá áεάóíñáòεέÝð εεΰóáεò P ðñÝð, Póóá íá áβñíóáε ðñíòáñáεüóçðáò óòçí εβίçóç áíΰεíáá ìá ðíòð εάíüíáò ðíø òβεòñíò.

Ç áñáíñP options ALTQ\_RED áíáñáíðíεάβ ðí *Random Early Detection* (RED). Ôí RED ÷ ñçóεíðíεάβóáε áέα íá áðíòáò÷εáβ ç óðíóüñçóç ðíø áεέòýíò. Άέα ðí óείòü áòòü, ðí RED ìáòñΰáε ðí ìPεíð ðçð ðñΰò εάε ðí óóáεñPíáε ìá ðí ìÝáεóòí εάε áεΰ÷εóòí ðñεί ðçð. Áí ç ðñΰ áβíáε ðΰíü áðü ðí ìÝáεóòí, üεá óá íÝá ðáεÝóá εá áðíññβðòííóáε. Óýíòüíá εάε ìá ðí ðñíá ðíø, ðí RED áðíññβðóáε ðáεÝóá áðü áεΰóíñáò óòíáÝóáεò ìá ðò÷ áβí ðññðí.

Ç áñáíñP options ALTQ\_RIO áíáñáíðíεάβ ðí *Random Early Detection In and Out*.

Ç āñàìÞ options ALTQ\_HFSC ářāñāřđięāß òř Hierarchical Fair Service Curve Packet Scheduler. Āéá đāñéóóúđāñāđ đęçñřđññßāđ ó÷ āđééÛ ĩā òř HFSC āāßāā: <http://www-2.cs.cmu.edu/~hzhang/HFSC/main.html>.

Ç āñàìÞ options ALTQ\_PRIQ ářāñāřđięāß òř Priority Queuing (PRIQ). Ôř PRIQ đÛřđřđā đāñřÛāé đñþđā òçř éßřçóç ĩā òç ĩāāéýđāñç đñřđāñāéúđçđā.

Ç āñàìÞ options ALTQ\_NOPCC ářāñāřđięāß òçř đđřđđþñéřç SMP āéá òř ALTQ. Ç āđéēřāÞ áđðÞ āđāéđāßđāé óā óđóđÞřāđā SMP.

### 30.5 Ôř IPFILTER (IPF) Firewall

Ī óđāñāđŸāđ òřđ IPFILTER āßřāé ĩ Darren Reed. Ôř IPFILTER āāř āřāñđÛđāé āđü òř éāéđřđñāééü óýđçřā: āßřāé ĩéā āđāñřāÞ āñééđřý ēþāééā đřđ Ÿ÷ āé ĩāđóđāñēāß óđř FreeBSD, òř NetBSD, òř OpenBSD, òř SunOS, òř HP/UX éāé òř Solaris. Ôř IPFILTER āßřāé đđü āéāñēÞ éāé āřāñāÞ āřÛđđđřç éāé óđřđþñçóç, éāé éđéēřđñřđřđř đāéđééÛ ĩé řŸāđ āēāüóāéđ òřđ.

Ôř IPFILTER āßřāé Ÿřā firewall éāé ĩç÷ āřéđřđđ NAT đřđ éāéđřđñāāß óđřđ đđñÞřā éāé ĩđřñāß řā āēŸā÷ āđāé éāé řā đāñāéřđēāßđāé āđü đñřāñÛřāđāđ ÷ ñÞđç. Īé éāřřāđ òřđ firewall ĩđřñřđ řā òßēāřđāé óā éó÷Ÿ Þ řā āéāñÛđřđāé ĩŸóü òřđ āřçęçđéēřý đñřāñÛřāđřđđ ĩpf(8). Īé éāřřāđ āéā òř NAT ĩđřñřđ řā òßēāřđāé óā éó÷Ÿ Þ řā āéāñÛđřđāé ĩŸóü òřđ āřçęçđéēřý đñřāñÛřāđřđđ ĩpnat(1). Ôř āřçęçđéēü đññāñāñřā ĩpfstat(8) ĩđřñāß řā āéđđþđáé óđāđéóđééÛ āéđŸēāóçđ āéā òř òřÞřā òřđ IPFILTER đřđ āéđāēāßđāé óđřđ đđñÞřā. Ôř đññāñāñřā ĩpmon(8) ĩđřñāß řā éāóāāñÛđāé óéđ āřŸñāāéāđ òřđ IPFILTER óđř āñ÷ āßā éāđāāñāđÞđ óđřāÛřđřđ òřđ óđóđÞřāđřđ.

Ôř IPF āñÛđçēā āñ÷ ééÛ ÷ ñçóēřđřēřđōāđ ĩéā ēřāéēÞ āđāřāñāāóßāđ éāřřāđ òřđ óýđřđđ “ř đāēāđōāßř éāřřāđ đřđ óāéñēÛāé, āßřāé éāé ĩ řéēçđÞđ” éāé ÷ ñçóēřđřēřđōāđ ĩñř éāřřāđ óýđřđđ stateless. ĩā òçř đÛñřāř òřđ ÷ ññřđđ, òř IPF āāéđēþçēā āéā řā đāñéēāřāÛřāé òçř āđéēřāÞ “quick” éāé òçř āđéēřāÞ “keep state” āéā stateful éāřřāđ. Īé āđéēřāŸđ áđđŸđ āéóđā÷ ññřéóāř āñāřāđééÛ òç ēřāéēÞ āđāřāñāāóßāđ òñř éāřřāđřđ. Ç āđßóçřç đāēřçñßúç òřđ IPF éāéýđđāé ĩñřđ óéđ đāéēŸđ đāñāřŸđñřđ ñŸēřéóçđ éāé āđāřāñāāóßāđ òñř éāřřāđřđ. Īé óŸā÷ ññřāđ éāéđřđñāāßāđ éāéýđđřđāé ĩñřđ òđ đññúēāđāđ āđéēřāŸđ, éāé Ÿđóé āāř òřßßēřđāé āñēāđÛ óā đēāřřāēđÞřāđāđ òřđđ óđç āçřēřđñāßā āřřđ đřēŸ éāéýđāñřđ éāé áóóāéŸđóđñřđ firewall.

Īé řāçāßāđ đřđ đāñēŸ÷řđāé óā áđðÞ òçř āřřđçđā, āāóßēřđāé óđç ÷ ñÞđç éāřřāđřđ đřđ đāñēŸ÷řđđ òçř āđéēřāÞ “quick” éāēþđ éāé òçř stateful āđéēřāÞ “keep state”. Āđđü āßřāé éāé òř āāóééü đēāßóēř éāéđřđñāēřř āéā òçř āçřēřđñāßā òřđ óāđ éāřřāđřđ āřřđ inclusive firewall.

Āéā éāđđñŸñāéāđ ó÷ āđééÛ ĩā òřđ đāééüđāñř đññđř āđāřāñāāóßāđ òñř éāřřāđřđ, āāßāā:  
[http://www.obfuscation.org/ipf/ipf-howto.html#TOC\\_1](http://www.obfuscation.org/ipf/ipf-howto.html#TOC_1) éāé <http://coombs.anu.edu.au/~avalon/ip-filter.html>.

Īđřñāßđā řā āāßāđ òř IPF FAQ óđçř òřđřēāóßā <http://www.phildev.net/ipf/index.html>.

Īđřñāßđā řā āñāßāđ đéđ đāéāéüđāñāđ āçřřóéāŸóāéđ óéđ ēßóóāđ óā÷ đāññāßřđ òřđ IPFILTER óđř <http://marc.theaimsgroup.com/?l=ipfilter>. ĐāñŸ÷ āđāé āđřāđüđçđā āřāēÞđççđ.

#### 30.5.1 Āřāñāřđięēřđōāđ òř IPF

Ôř IPF đāñēēāřāÛřāđāé óđç āāóéēÞ āāéāđÛđóāóç òřđ FreeBSD òđ Ûñēññřā òř đřđřđ ĩđřñāß řā òřđđūēāß ÷ ññéóđÛ. Ôř óýđçřā éā òřñđþđāé āđřāřēéÛ òř Ûñēññřā òřđ IPF āř đđÛñ÷ āé ç éāđā÷ þñéçç ĩpfiler\_enable="YES" óđř āñ÷ āßř /etc/rc.conf. Ôř Ûñēññřā Ÿ÷ āé āçřēřđñāçēāß ĩā āřāñāřđięēřđŸçç òçř āđřāđüđçđā éāđāāñāđÞđ éāé ĩā òçř āđéēřāÞ default pass all. Āéā řā āēēÛřāđā áđðÞ òçř đñřāđéēřāÞ óā block all, ĩđřñāßđā āđēþđ řā đñřđēŸđāđā òřđ éāřřāđřđ āđñññççđ (block all) óđř đŸēřđ òñř éāřřāđřđ óāđ. Āāř ÷ ñāéÛāāóāé řā ĩāđāēēüđđßóāđāđ òçř āđéēřāÞ IPF óđř đđñÞřā òřđ FreeBSD āéā òř óēřđü áđđü.

### 30.5.2 Άδέειΰάό άέα οι ΔοηΠία

Άάί άβίαέ οδι÷näöúééü íá íáoáäëüóóβóáoá óéó δάηáēŰóü άδέειΰάό οοί ΔοηΠία οι FreeBSD άέα íá άίάηάιδီးΠόáoá οι IPF. Ç δάηάóóβóóç οιόð ááβ άβίαέ éäëáηŰ άίάηάηüóééēΠ. Άί íáoáäëüóóβóáoá οι IPF áðäòèáβáð οοί ΔοηΠία, ááí éá ÷ñçóéηüδιεçéää θιόŸ θι άίοβóóιε÷í Űñëñüíá.

Óοί άη÷άβι /usr/src/sys/conf/NOTES éá άηάβóá δάηάääβάιáoá éáóá÷üñβóáüí IPF άέα οι άη÷άβι ηýèιεóçð οι ΔοηΠία. Íé άδέειΰάό áóóŸð óáβήίοáé áðβóçð δάηάēŰóü:

```
options IPFILTER
options IPFILTER_LOG
options IPFILTER_DEFAULT_BLOCK
```

Ç άδέειΰά options IPFILTER άίάηάηüδιεáβ óçí οδιóðΠñéίç άέα οι "IPFILTER" firewall.

Ç άδέειΰά options IPFILTER\_LOG άίάηάηüδιεáβ óçí οδιóðΠñéίç éáoááηáoΠð οιό IPF, ç ίδηςά äñŰóäé óóçí θáoäï-óóóéáðP éáoááηáoΠð δάέŸóüí ipf άέα éŰéá éáíüíá θιό δάñéëáíüŰíáé óçí άδέειΰά log.

Ç άδέειΰά options IPFILTER\_DEFAULT\_BLOCK áèēŰæáé óçí δñíáðéëáüŸίç οδιðáñéöüñŰ, ηóóá éŰéá δάέŸοι θιό ááí óáñéēŰæáé íá éŰδιεί éáíüíá pass οιό firewall, íá áðññβðóáoé áóóüíáóá.

Íé δάηάðŰü áδέειΰάó éá άίάηάηüδιεçéíí üüí áοίý íáoáäëüóóβóáoá éáé ááéáóáóóΠóáoá Ÿíá δñíóáñüíóŸíí ΔοηΠία θιό íá óéð δάñéëáíüŰíáé.

### 30.5.3 Άέέΰόέíáò Άδέειΰάό άέα οι rc.conf

×ñáēŰæáóóá óéð δάηάēŰóü éáóá÷üñβóáéð οοί /etc/rc.conf άέα íá άίάηάηüδιεΠόáoá οι IPF éáóŰ óçí áèèβίçóç οιό οδτείαéóðP:

```
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
```

Άί δβóóü áðü áóóü οι firewall οðŰñ÷äé éŰδιεί LAN θιό ÷ñçóéηüδιεáβ ááoíáoíŸíáð éäëüóééŸð áéáoèýíoáéð, éá ÷ñáéáóóáβ íá δñíóèŸóáoá óéð δάηάēŰóü éáóá÷üñβóáéð άέα íá άίάηάηüδιεΠόáoá óç éáéοιñάβá NAT:

```
gateway_enable="YES"                # Enable as LAN gateway
ipnat_enable="YES"                  # Start ipnat function
ipnat_rules="/etc/ipnat.rules"      # rules definition file for ipnat
```

### 30.5.4 IPF

Ç άίόιεΠ ipf(8) ÷ñçóéηüδιεáβóáé άέα íá öñðηóáé οι άη÷άβι óüí éáíüíüí. ŌóóéηéäéēŰ, éá äçιείöñάΠóáoá Ÿíá άη÷άβι íá οιόð áééíýð óáo δñíóáñüíóŸííðð éáíüíáð éáé éá άίóééáóáóóΠóáoá íá áóóü áñíëíéēΠñíð οιόð áíóüíáóüíŸííðð éáíüíáð οιό firewall:

```
# ipf -Fa -f /etc/ipf.rules
```

Ç äðéēīāP -Fa áááēŪæáé õĩòð éáíúĩáð áðu õĩòð áóóòáñéēĩýð ðβĩáéáð õĩò firewall.

Ç äðéēīāP -f éáēĩñβæáé õĩ áñ ÷ áβĩ òũĩ éáíúĩũĩ ðĩò éá õĩñòùèèáβ.

Áðòũ óáð äβĩáé òçĩ äõĩáíòòçðçá íá áēēŪĩáðá õĩ áñ ÷ áβĩ éáíúĩũĩ óáð, íá äēðáēŸóáðá òçĩ áĩòĩēP IPF ðĩò áĩáóŸñáĩá ðáñáðŪĩũ, éáé íá áĩáĩáðóáðá íá áðòũ õĩĩ ðñũðĩ õĩòð éáíúĩáð óõĩ firewall ðĩò äēðáēäβðáé Pæç íá éáéĩŸñáēĩòð, ÷ ùñβð íá ÷ ñáéáóóáβ íá äðáĩáēēēĩPóáðá õĩ óýóðçĩá óáð. Ç ĩŸēĩäĩð áððP äβĩáé ðĩēý äĩēēēP áéá íá äĩēēĩŪóáðá ĩŸĩòð éáíúĩáð, éáēðð ĩðĩñáβ íá äðáĩáēçðēáβ ũóáð õĩñŸð èŸēáðá.

Äáβðá òç óáēβáá manual õĩò ipf(8) áéá ēäðõĩñŸñáéáð ó ÷ äðéēŪ íá òéð òðũēĩēðáð äðéēĩāŸð ðĩò ĩðĩñáβðá íá ÷ ñçóēĩũðĩēPóáðá íá òçĩ áĩòĩēP áððP.

Ç áĩòĩēP ipf(8) áĩáĩŸĩáé Ÿĩá áðēũ áñ ÷ áβĩ éáēĩŸĩò ùð áñ ÷ áβĩ éáíúĩũĩ. Äáĩ éá äá ÷ èáβ áñ ÷ áβĩ éáíúĩũĩ äñáũŸĩũ ùð script íá òðĩäĩēēēŸð áĩðééáðáóðŪóáéð.

ŌðŪñ ÷ äē ùòóũõĩ ðñũðĩò íá äñŪðáðá éáíúĩáð IPF ðĩò íá ÷ ñçóēĩũðĩēĩŸĩ òçĩ éó ÷ ý òũĩ óðĩäĩēēēĩP áĩðééáðáóðŪóáũĩ. Äéá ðáñéóóũòáñáð ðēçñĩòĩñβáð, äáβðá õĩ ŌĩPĩá 30.5.9.

### 30.5.5 IPFSTAT

Ç ðñĩäðéēääĩŸĩç òðĩðáñēõĩñŪ ðĩò ipfstat(8) äβĩáé íá áĩáéðŪ éáé íá äðáēēĩñβæáé õĩ óýĩũēĩ òũĩ óðáðéóðéēĩP ðĩò óðáēáĩõñðēçēáĩ ùð áðĩòŸēáóĩá òçð äðáñĩĩáPð òũĩ éáíúĩũĩ õĩò ÷ ñPððç óðá ðáēŸðá ðĩò áéóŸñ ÷ ĩĩðáé éáé áĩŸñ ÷ ĩĩðáé áðu õĩ firewall, áðu òç óðēäĩP òçð ðáēäððáβáð õĩò äēēβĩçðçð P áðu õĩĩ ðáēäððáβĩ õĩòð ĩçáĩáíóĩũ ĩŸòũ òçð áĩòĩēPð ipf -Z.

Äáβðá òç óáēβáá manual ipfstat(8) áéá ēäðõĩñŸñáéáð.

Ç ðñĩäðéēääĩŸĩç Ÿĩñäĩð òçð áĩòĩēPð ipfstat(8) éá ĩĩēŪæáé íá òçĩ ðáñáēŪòù:

```
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)
```

¼ðáĩ ÷ ñçóēĩũðĩēçēáβ ç äðéēĩāP -i áéá óá áéóáñ ÷ ùĩáĩá P ç äðéēĩāP -o áéá óá áĩáñ ÷ ùĩáĩá ðáēŸðá, ç áĩòĩēP èá áĩáēðPóáé éáé èá äðáēēĩñβóáé òçĩ áĩòβóõĩē ÷ ç èβóðá éáíúĩũĩ ðĩò äβĩáé äáēáðáóðçĩŸĩç éáé ÷ ñçóēĩũðĩēäβðáé áðu õĩĩ ððñPĩá òç äááñŸĩç óðēäĩP.

Ç áĩòĩēP ipfstat -in äáβ ÷ íáé Ÿĩá áñēēĩçĩŸĩ ðβĩáéá éáíúĩũĩ áéá áéóáñ ÷ ùĩáĩá ðáēŸðá.

Ç áĩòĩēP ipfstat -on äáβ ÷ íáé Ÿĩá áñēēĩçĩŸĩ ðβĩáéá éáíúĩũĩ áéá áĩáñ ÷ ùĩáĩá ðáēŸðá.

Ç Ýñáò εά ñεΰεάε ðá ðáñáεΰò:

```
@1 pass out on xl0 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 áíòεΨ ipfstat -ih ááβ÷íáε ðñ ðβίαέα εάíñíñí áέα ðά áεóáñ÷ùíáíá ðάεΨόά, ðñðñεάòπρίόά ðññíóòΰ áðu ðñ εΰεά εάíñíá Ψία áñεέìù ðñ ááβ÷íáε ðñóáð ðññΨò Ψ÷áε ðñçóεñðñεέáβ.

Ç áíòεΨ ipfstat -oh ááβ÷íáε ðñ ðβίαέα εάíñíñí áέα ðά áíáñ÷ùíáíá ðάεΨόά, ðñðñεάòπρίόά ðññíóòΰ áðu ðñ εΰεά εάíñíá Ψία áñεέìù ðñ ááβ÷íáε ðñóáð ðññΨò Ψ÷áε ðñçóεñðñεέáβ.

Ç Ýñáò εά ñεΰεάε ðá ðáñáεΰò:

```
2451423 pass out on xl0 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
```

Ίέα áðu ðεò ðεí ðçíáíóεέΨò εάεóñòñáβáð ðçð áíòεΨò ipfstat áβίαέ ç áðεεñáΨ -t ç ðñβá áðáεεñβεάε ðñ ðβίαέα εάóáóòΰóáñí, ðá ðññòñí ðññέí ðá áóòù ðñ ðñçóεñðñεέáβ ç áíòεΨ top(1) áέα ðá ááβíáε ðñ ðβίαέα εάññáóóεπñ ðñ áεðáεñγíóάε ðñ FreeBSD. ¼ðáí ðñ firewall óáð áΨ÷áðάε áðβεáóç, ç εάεðñòñáβá áðòΨ óáð áβíáε ðçí áðñáðñóçðά ðá áíáíññβóáðά εάε ðá áóóεΰóáðά óáð βάεά ðά ðάεΨόά ðñ ðçí áðñáεñγí. Ίε ðññáεñáðεέΨò ðñ-áðεεñáΨò óáð áβññóñ ðçí áðñáðñóçðά ðá áðεεΨíáðά ðñ IP áðáðçñβáð Ψ ðñññεéññγ, ðçí εγñá, Ψ ðñ ðññóùεñεεñ ðñ ðñβñ εΨεáðά ðá ðáñáεñεñðεβóáðά óá ðñááñáðéεεñ ðñññí. Ááβðά ðç óáεβáá manual ðñ ipfstat(8) áέα ðáñεóóùðáñáð εáðòññΨñáεáð.

### 30.5.6 IPMON

Άέα ðá εάεóñòñáβóάε óóóòΰ ç áíòεΨ ipmon, εά ðñΨðάε ðá áíáñáñðñεέáβ ç áðεεñáΨ IPFILTER\_LOG óðñ ððñβία. Ç áíòεΨ áðòΨ áεáεΨðάε áγñ áεáóññáðéεéγð ðññðñòð εάεóñòñáβáð. Ί ðññáðεεáñΨñð εάññεεùð ðññðñòð εάεóñòñáβáð áíáñáñðñεέáβóάε ððáí ç áíòεΨ ðñçóεñðñεέáβóάε ðññβð ðçí áðεεñáΨ -D.

Ç áíòεΨ ðññáβ ðá ðñçóεñðñεέáβ óá εάεóñòñáβá ááβññá ððáí áðεεðñáβðά ðá Ψ÷áðά Ψία óðñá÷ùíáñ áñ÷áβñ εάóááñáðòð βóðά ðá ðññáβðά ðá áíáðΰóáðά ðεð ðññáγñγíáíáð ááñáóΨò. Áðòùð áβíáε εάε ðñ ðññðñò ðá ðñ ðñβñ Ψ÷áε ðñεέóóáβ ðá óðñáñáΰεáðάε ðñ FreeBSD ðá ðñ IPFILTER. Õñ FreeBSD Ψ÷áε áíóúíáðñΨç áðñáðñóçðά áíáεεááΨò áñ÷áβñ εάóááñáðòð. Άέα áóòù ðñ εüáñ, áβíáε εάεγðáññ ç εάóááñáðΨ ðá áβñáðάε ðΨóù ðñ syslogd(8) ðáñΰ óá Ψία óðñεεéóñΨñ áñ÷áβñ. Άðu ðññáðεεñáΨ, ç ðññέέóç ipmon\_flags óðñ áñ÷áβñ rc.conf ðñçóεñðñεέáβ ðεð áðεεñáΨò -Ds:

```
ipmon_flags="-Ds" # D = start as daemon
# s = log to syslog
# v = log tcp window, ack, seq
# n = map IP & port to names
```

Õá ðεáññáεðπρίάðά ðçð εάóááñáðòð áβíáε ðññóáíΨ. ðáñΨ÷áε ðçí áðñáðñóçðά áðεéεùðçðçð ðεçññññεπñ ððòð ðά ðάεΨόά ðñ áðñññβðεçεάí, ðεð áεáðεγñóáεð áðu ðεð ðñβáð εβðεçεάí, εάε ðñ ðñññεéóñ ðñòð. ð÷áðά Ψðóε Ψία óçíáíóεéεñ ðεáñΨéðçñá ððáí ðññóðάεáβðά ðá áíáíññβóáðά Ψία áεóáñεΨά.

Άεùñá εάε ððáí áíáñáñðñεέáβóáð ðçí áðñáðñóçðά εάóááñáðòð, ðñ IPF ááñ εά εάóááñΰθάε ðβðñðά áí ááñ Ψ÷áε áβíáε ç áíðβóðñε÷ç ðññέέóç óðñòð εάíñíáð. Ί áεá÷áεñεóðòð ðñ firewall áðñóáóβεάε áέα ðñεñðð εάíñíáð ðñ óáð εΨεάε ðá áíáñáñðñεέáβóáε ðçí εάóááñáðΨ, εάε ðññóεΨðάε óá áðòñγð ðçí εΨñç log. Õðóéñεñáεεΰ, ç εάóááñáðΨ áíáñáñðñεέáβóáε ðñññí óá εάíñíáð ðñ áðñññβððññ ðάεΨόά.

Άβιάε δρεΰ οόιϕεέοιΎίί ίά δάνεεάιαΰίάοάε Ύίάο εάφίάο οόι οΎεοο οίο οοίεοο, οίο ίά αδιίνβδδάε άδϋ δνίάδεειαΰ υεά οά δάεΎοά οίο οοΰίοί ίΎ-νε έεάβ (default deny). Ιά οίί ονϋοί άοοϋ ίδινάβδά ίά αάβδά υεά οά δάεΎοά οίο αάί οάβνεάίάί ίά εάίΎίά εάφίά οίο οάο.

### 30.5.7 Έάοάάνάοΰ οίο IPMON

Οί **syslogd** ÷-νϕοέιιθιεάβ οϕ εεέΰ οίο εεάεέΰ ίΎεραί εεά οί εεά÷υνεόοιϋ οϋί αάανΎίϋί εάοάάνάοΰο. ΆεάεΎοάε εεάεέΎοά ίάαίθιεΰοάεο οίο ίννΰείίοάε “facility” εεά “level”. ¼οάί οί IPMON ÷-νϕοέιιθιεάβδάε ίά οϕί άδεειαΰ -Ds, ÷-νϕοέιιθιεάβ οί security υο υίίά “facility”. ¼εά οά αάανΎίά οίο εάοάανΰοίίοάε άδϋ οί IPMON εάοάεΰαίοί οόί security. Αί οί άδεεοιαβδά, ίδινάβδά ίά ÷-νϕοέιιθιεΰοάοά οά δάνάεΰοϋ άδβδάαά εεά δάνάεοΎνϋ εεά÷υνεόοιϋ οϋί αάανΎίϋί εάοάάνάοΰο:

```
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 νδειβδδά οί IPFILTER ίά εάοάανΰοάε υεά οά αάανΎίά οόί /var/log/ipfilter.log, εά ÷-νέάοόοάβ ίά αϕιείονάβδδά άδϋ δνεί οί αν÷άβι. Αοοϋ ίδινάβ ίά άβιάε ίά οϕί δάνάεΰοϋ αίθιεΰ:

```
# touch /var/log/ipfilter.log
```

ϕ εάεοιονάβ οίο syslogd(8) ίδινάβ ίά νδειεοόοάβ ίά εάοά÷υνβδδάεο οόί αν÷άβι /etc/syslog.conf. Οί αν÷άβι syslog.conf δνίόΎίάε οϕίάιθιεΰ άοάεείβά οοίί ονϋοί ίά οίί ίθιβι οί **syslog** αίθιεάοϋδβεάε οά ίϕίγίάοά οοόοΰιαόοο οίο δνίΎν÷ίίοάε άδϋ άοάννιΎο υδϋδ οί IPF.

ΔνίόεΎοά οϕί δάνάεΰοϋ εάοά÷ϰνεόϕ οόί αν÷άβι /etc/syslog.conf:

```
security.* /var/log/ipfilter.log
```

Οί security.\* οϕίάβιάε υοε εά άβιάοάε εάοάάνάοΰ υεϋί οϋί ίϕίοιΰοϋί αοοίϣ οίο οϣθίο οοϕί οίθιεάοόβά οίο Ύ÷εε ίνεοόοάβ.

Άεά ίά άίανάιθιεΰοάοά οεο εεεάΎο οόί /etc/syslog.conf εά δνΎδάε ίά άδάίάεεείΰοάοά οί ίϕ÷ΰίϕία ΰ ίά άίάεΰοάοά οί syslogd(8) ίά ίάίάεάΰοάε οί /etc/syslog.conf, εεοάεϰίοάο οϕί αίθιεΰ /etc/rc.d/syslogd reload

Ιϕί ίά÷ΰοάοά ίά ονιθιθιεΰοάοά οί /etc/newsyslog.conf ϰοά ίά άίάεΰοάε οί αν÷άβι εάοάάνάοΰο οίο αϕιείονάβδδά δάνάδΰϋ.

### 30.5.8 ϕ ίνϋο οϋί ίϕίοιΰοϋί Έάοάάνάοΰο

Οά ίϕίγίάοά οίο δάνΰαίίοάε άδϋ οϕί ipmon αθίοάεϣίίοάε άδϋ δάαβά αάανΎίϋί οίο ÷-υνβείίοάε άδϋ εάοεϋί εεΰοόϕία. Οά δάαβά οίο άβιάε ειείΰ οά υεά οά ίϕίγίάοά, άβιάε οά δάνάεΰοϋ:

1. ϕ ϕιάννιϕίβά δάνάεάΰο οίο δάεΎοίο
2. ϕ ϰνά δάνάεάΰο οίο δάεΎοίο. ÷-εε οϕί ίνϋοΰ HH:MM:SS.F, ϕ ίθιβά οθραϕεϰίαε ϰνάο, εάδδϰ, αάοοάνυεάδδά εεεΰοίαοά αάοοάντεΎθοίο (οά ίθιβά ίδινάβ ίά άβιάε θρεεΰ αάεάεεΰ ϕϕοβά).
3. Οί υίίά οϕο εεάδδάοΰο οοϕί ίθιβά Ύεεία ϕ άδάιανάοόβά οίο δάεΎοίο δ.÷. dc0.

4. Ì ἀνεέλιυò ìÛαάò εάε ì áýíυì ἀνεέλιυò òιò εάíυíá, ð.÷. @0 : 17.

Ïðìñáβòá íá äáβòá òá ðáñáέÛòυ ìá òçí áíòιρεP ipfstat -in:

1. Òι áβáηò òçò áíÛñááέáò: p áí òι ðáέÛòι ðÛñáòá, b áí òι ðáέÛòι áðìññβòεçéá, S áέá óýíóηì ðáέÛòι, n áí ááí òáβñéáíá ìá εάíÛíá εάíυíá, L áέá εάíυíá ìá εάòááñáòP. Ç óáέñÛ ðñιòáñáέúòçòáò òçí áðáέéúιέòç òυì ðáñáðÛíυ, áβíáέ S, p, b, n, L. Òι εάòáέáβι P P òι B óçíáβñιòι úòé ç εάòááñáòP òιò ðáέÛòιò Ýáέíá éúáυ èÛðιέáò ááíέεP ð ñýèìéòçò εάòááñáòP ò εάέ ù÷é áíáέòβáò èÛðιέιò εάíυíá.
2. Ìé áέáòéýíòáέò. Ðññéáέóáέ òçòí ðñááìáðééúòçòá áέá òñβá ðááβá: òç áέáýèðιòç éáé òç èýñá áòáòçñβáò (÷ ðñβáéιòáέ ìá èúìá), òι óýìáρεì -> éáé òçí áέáýèðιòç éáé èýñá ðñìñéòìíý, ð.÷. 209 . 53 . 17 . 22 , 80 -> 198 . 73 . 220 . 17 , 1722.
3. Òι PR áερεìòειýíáíí áðυ òι úñíá P òιí ἀνεέλιυ òιò ðñòòιεúεεìò, ð.÷. PR tcp.
4. Òι len áερεìòειýíáíí áðυ òι ìPεìò òçò áðééáòáεβááò éáé òι òòñéééú ìPεìò òιò ðáέÛòιò, ð.÷. len 20 40.

Áí ðññéáέóáέ áέá ðáέÛòι TCP, εá òðÛñ÷áé Ýíá áðéðéÛíι ðááβι òι òιβι εá íáέεíÛáé ìá íéá ðáýéá éáé εá áερεìòεáβòáέ áðυ áñÛìáòá òá òιβá áíòéòòιé÷íý òóéò áðéεíãÛò (flags) ðιò Ý÷ìιò ðáεáβ. Ááβòá òç óáεβáá manual ipmon(8) áέá òç εβòá òυì áñáñÛòυì éáé òυì áíòβòòιé÷úí flags.

Áí ðññéáέóáέ áέá ðáέÛòι ICMP, εá òðÛñ÷ìιò áýì ðááβá òòι òÛεìò, òι ðñρòι εá áβíáέ ðÛíòá “ICMP” éáé òι áðυìáíí εá áβíáέ ì òýðìò òιò ìçíýìáòìò éáé òιò òðυ-ìçíýìáòìò ICMP, ÷ ðñéóìÛíá ìá íéá èÛεáòι, ð.÷. ICMP 3/3 áέá Ýíá ìPìòíá ìç ðñìòáÛòéìçò èýñáò (port unreachable).

### 30.5.9 Äçìεìòñáβá Script Éáíυíυì ìá ÒòìáìεέεP ÒðìεáòÛòóáòç

ÏñéóìÛíé Ýìðáεñιé ÷ ðPòáò òιò IPF äçìεìòñáìýí Ýíá áñ÷áβι éáíυíυì òι òιβι ìðìñáβ íá áéòáέáòáβ ùò script ìá áðíáòυòçòá òòìáìεέεP ððìεáòÛòóáòçò. Òι ááóééú υòáεìò òιò ðáñáðÛíυ, áβíáέ υòé ÷ ñáέÛáòáέ íá áέéÛíáòá ìυíí òçí òéìP ðιò ó÷áòβáéòáέ ìá òι òòìáìεέéú υñíá éáé υðáí òι script áéòáέáòáβ, ç òéìP εá òðìεáòáòóáéáβ òá υεìò òιò ò éáíυíáò ðιò ðáñéÛ÷ìιò òι υñíá áòòυ. Éáεð ðññéáέóáέ áέá script, ìðìñáβòá íá ÷ ñçóéììðìεPòáòá òòìáìεέεP òðìεáòÛòóáòç áέá íá èúáéεìðεPòáòá òð÷ìÛ ÷ ñçóéììðìεýíáíáò òεíÛò éáé íá òéò òðìεáέéóòÛòá òá òðìεáðεìýò éáíυíáò. Áòòυ òáβíáòáέ éáé òòι ðáñÛááέáìá ðιò áερεìòεáβ.

Ç óýíòáίç òιò script ðιò ÷ ñçóéììðìεáβòáέ ááρ, áβíáέ òòìáòP ìá òá éáéýòç sh(1), csh(1), éáé tcsh(1).

Òá ðááβá òðá òιβá áβíáòáέ òòìáìεέεP òðìεáòÛòóáòç ðñιòçíáερñíòáέ ìá òι óPíá òιò áρεáñβιò: \$.

Òá òòìáìεέéÛ ðááβá ááí Ý÷ìιò òçí ðñιòçíáβυòç ìá òι \$.

Ç òéìP ðιò εá ÷ ñçóéììðìεçéáβ òòι òòìáìεέéú ðááβι, εá ðñÛðáé íá áóυεéáβáòáέ òá áéðéÛ áéóááυáέéÛ (").

ÏáέéíPòáò òι áñ÷áβι òυì éáíυíυì óáò ìá èÛòé áíòβòòιé÷ì ìá òι ðáñáέÛòυ:

```
##### 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 #####

```

Αόδου άβίαέ υέι. Όδι δανάδΰύδ δάνΰάέάια άάρ άβίαέ όçιαίόέέίβ ίέ έάύιιάδ, άέέΰ ι όνυδιδιό ιά όπí ιδίβι έάέόιόναιύί έάέ δάβñíόí όέίΰδ όά δάάβά όδιδέάδΰόδάόçδ. Άί όι δανάδΰύδ δάνΰάέάια άñβóέííόάί όά Ψία άñ ÷ άβι ιά όι υίñά /etc/ipf.rules.script, έά ιδιδιíýόάόά ίά άδάíάόíñδóβόάά άόδóýδ όιτδ έάύιιάδ ιά όçí δάñάέΰδò άίόίέβ:

```
# sh /etc/ipf.rules.script
```

Όδΰñ ÷ άέ Ψία δñυάέçía υόάί ÷ ñçόέιñδιδιέíýíόάέ άñ ÷ άβá έάύιιύí ιά άίόύιιάδύιΨίτδ όόιαιέέόίýδ: Όι IPF άάρ έάόάέάάάβίαέ όç όόιαιέέέβ όδιδέάδΰόδάόç, έάέ άár ιδιδιñάβ ίά άέάάΰόάέ άόδΰ όά scripts ΰλάόά.

ΰά όΨίόίέí script ιδιδιñάβ ίά ÷ ñçόέιñδιδιέçέάβ ιά Ψία άδύ όιτδ άýí δάñάέΰδò δñυδιδιό:

- ΆόάέñΨόά όι ό ÷ υέέί άδύ όç άñάñβ διτδ ίάέέίΰάέ ιά cat, έάέ ιάόάδñΨóδά όά ό ÷ υέέί όç άñάñβ διτδ ίάέέίΰάέ ιά /sbin/ipf. Όιδιδέάδóβόά όι ipfilter\_enable="YES" όόι άñ ÷ άβι /etc/rc.conf υδύδ όόίβέδò, έάέ άέόάέΨόδά όι script ίέά όíñΰ ίάδΰ άδύ έΰέά άέέάβ άέά ίά άçιέíτñάβóάάόά β ίά άίçíáñβóάά όι /etc/ipf.rules.
- Άδάíáñάíδιδιέβόά όι IPFILTER όόά scripts άέέβίçόçδ όιτδ όóόóβιáόíδ, δñιόέΨόííόάό όçí έάόά ÷ βñέόç ipfilter\_enable="NO" (δñυέάέόάέ άέά όçí δñιáδέέάάιΨίç όέίβ) όόι άñ ÷ άβι /etc/rc.conf.

ΔñιόέΨόά Ψία script υδύδ όι δάñάέΰδò όόίí έáδΰέíñí άέέβίçόçδ /usr/local/etc/rc.d/. Όι script έά δñΨάέ ίά Ψ ÷ άέ Ψία δñιόάίΰδ υίñά, υδύδ ipf.loadrules.sh. Ç άδΨέόάόç .sh άβίαέ όδιδι ÷ ñάυόέέβ.

```
#!/bin/sh
sh /etc/ipf.rules.script
```

Ίέ ΰάάέáδ όά άόδύ όι άñ ÷ άβι, έά δñΨάέ ίά άδέόñΨόίόί άίΰάíñύόç, άάñάόβ έάέ άέδΨέάόç άέά όíí ÷ ñβόόç root.

```
# chmod 700 /usr/local/etc/rc.d/ipf.loadrules.sh
```

Ίέ έάύιιάδ όιτδ IPF έά όíñδóβííόάέ δέΨίí έáδΰ όçí άέέβίçόç όιτδ όóόóβιáόíδ όάδ.

### 30.5.10 Όι Όýñιέí Έάύιιύí όιτδ IPF

ΰδ “όýñιέí έάύιιύí” όόι IPF, íñβæíτδία ίέά ñΰάά έάύιιύí διτδ Ψ ÷ ίόí άñάόάβ άέά ίά άδέόñΨόίόί β ίά άδιδιññβδδιτδ δάέΨόά άίΰέíáá ιά όέδ όέίΰδ διτδ δάñέΨ ÷ ííόάέ όά άόδΰ. Ç άέδδβδ έáόάýέδóíόçδ άίόάέέάάβ δάέΨόύι ίάόάý όδιδιέíáέόόβí



PORT\_NUM = port number

TCP\_FLAG = S

STATEFUL = keep state

### 30.5.11.1 ACTION

Ç ářÝñāáέα (action) āāβ÷íáε óε ðñÝðáε íá āβíáε íá ðí ðáεÝðí áί óáέñεÛæáε íá ðíí έáíuíά ðíð ðβεðñíð. ÈÛεά έáíuíάð ðñÝðáε íá έεάεÝðáε íέα ářÝñāáέα. Íε ářÝñāáέαð ðíð áíάάíññβæííðάε, ðáβñíðάε ðáñάεÛðù:

Ïí block āāβ÷íáε ùðé ðí ðáεÝðí έá ðñÝðáε íá áðíññέεðεāβ áί óáέñεÛæáε íá ðεð ðáñáíÝðñíðð áðέεíāβð ðíð έáíuíά.

Ïí pass āāβ÷íáε ùðé ðí ðáεÝðí έá ðñÝðáε íá ářÝεεά áðù ðí firewall, áί óáέñεÛæáε íá ðεð ðáñáíÝðñíðð áðέεíāβð ðíð έáíuíά.

### 30.5.11.2 IN-OUT

ÈÛεά έáíuíάð ðíð ðβεðñíð ðñÝðáε ððí÷ñāùðέεÛ íá έεáðέñεíβæáε íá óáðβíάέα áί áíáðÝñāðάε óðçí āβðíāí P óçí Ýñāí ðáεÝðùí. Ç áðùíāíç εÝίç-έεάεāβ ðñÝðáε íá āβíáε in P out έáε áί āāí ððÛñ÷άε, í έáíuíάð έá áðíðý÷άε έáðÛ ðí óóíðάέðέεÛ Ýεāā÷í.

Ïí in óçíāβíáε ùðé í έáíuíάð έá āóāññóðāβ óā Ýíá áέóāñ÷ ùíāñ ðáεÝðí ðí íðíβí ìüέéð εβðεçεā óðç έεáðáðP ðíð óóíāÝáðάε íá ðí Άέάāβέððí.

Ïí out óçíāβíáε ùðé í έáíuíάð έá āóāññóðāβ óā Ýíá ðáεÝðí ðíð ðñíññβæāðάε āέα Ýñāí ìÝóù óðç έεáðáðP ðíð óóíāÝáðάε íá ðí Άέάāβέððí.

### 30.5.11.3 OPTIONS

**Óçíāβùðç:** Íε ðáñάεÛðù áðέεíāÝð ðñÝðáε íá ÷ñçóέííðíέççéíýí íá ðç óáέñÛ ðíð óáβñíðάε āāβ.

Ïí log āāβ÷íáε ùðé ç áðέεāðάεβāá ðíð ðáεÝðíð έá āñāðāβ óðí āñ÷āβí έáðāāñāðð ðíð ìpl (ùðùð ðāñέāñÛðāðάε óðçí āíúðçðá LOGGING ðíð áέíεíðεāβ) áί íε ðāñÛíāðñíέ óçð áðέεíāβð óáέñεÛæíðí íá ðí ðáεÝðí.

To quick āāβ÷íáε ùðé áί íε ðāñÛíāðñíέ óçð áðέεíāβð óáέñεÛæíðí íá ðí ðáεÝðí, í óðāέāέñεíÝíð έáíuíάð έá āβíáε έáε í ðāέāððāβíð έáíuíάð ðíð έá āέāā÷έāβ. Ç áðέεíāβ áððP āβíáε ððí÷ñāùðέεP āέα ðç óýā÷ñíç εíāέεP āðāíñāāóβāð ðáεÝðùí.

Ïí on āāβ÷íáε ðí ùíñā óçð έεáðáðP ðíð έá áíóùíāðùέāβ óóέð ðáñáíÝðñíðð áðέεíāβð. Óā íñúíáðá ðùí έεáðáðβí ðáβñíðάε ùðáí āέðāέāβðάε ç áíðíεP ifconfig(8). ×ñçóέííðíέççéíðáð óçí áðέεíāβ áððP, í έáíuíάð έá āέāā÷έāβ ìüñí áί ðí ðáεÝðí áεÝñ÷āðάε ìÝóù óçð óðāέāέñεíÝίçð έεáðáðP έáε ðñíð ðç óðāέāέñεíÝίç έáðāýεðíóç (áέóāñ÷ ùíāíā/āíāñ÷ ùíāíā). Ç áðέεíāβ áððP āβíáε ððí÷ñāùðέεP āέα ðçí óýā÷ñíç εíāέεP āðāíñāāóβāð ðùí έáíuíúí.

¼ðáí āβíāðάε έáðāāñāðP āíúð ðáεÝðíð, íε áðέεāðάεβāāð āñÛíðάε óðçí ðāðāí-óðóέāðP έáðāāñāðP ðáεÝðùí IPL. ÍāðÛ óçí áíðíεP log, ìðñíýí íá ÷ñçóέííðíέççéíýí íε ðáñάεÛðù ðāñÛíāðñíέ (íá ðç óáέñÛ ðíð óáβñíðάε):

Ïí body āāβ÷íáε ùðé έá āβíáε έáðāāñāðP ðùí ðñððùí 128 bytes ðùí ðāñέā÷ñÝíúí ðíð ðáεÝðíð, ðíð āñβóέííðάε āíÝóùð ìāðÛ óçí áðέεāðάεβāá.

Ç áðέεραP first οοίβόοάοάε ίά ÷ñçόείηðιεçεάβ άί ç áðέεραP log ÷ñçόείηðιεάβόάε οά οοίάοάοίυ ίά οçί keep state. Ίά οίί οñυðί άόδου άβίάόάε έάόάάñάόP ίυή οίò ðñþοίò ðάέΎοίò (ίά οί ίðίβί ίάέβίçοά ç áðέέιεήύίβá), έάε υ÷έ ύεήύ ούι ðñιείβðυí οά ίðίβá οάέñέΎάείοί ίά οçί ðεçñίοίñβá “keep state”.

**30.5.11.4 SELECTION**

Ίε εΎίάεð έεάέεΎ ðίò ðáñεáñΎοίíοάε οά άόδP οçί άίυòçοά, ÷ñçόείηðιεήύίόάε άεά ίά ðáñεáñΎοίíοί ðιεάð έεέυòçοάð οίò ðάέΎοίò έά άεáñάοίçεήύί άεά ίά έεέινεοόάβ άί οάέñέΎάε P υ÷έ ίά ðίòð έάήύίάð. Ίεά εΎίç-έεάέάβ ίñβάέ οί έάίòñέέυ εΎίá έάε άέιεήòðάβόάε άδύ Ύεεάð εΎίάεð ðίò ίñβάείοί οέð άεñέάάβð áðέεραΎò. ðñΎðάε ðΎίόίòά ίά áðέέΎάαοάε ίεά άδύ άóðΎò οέð εΎίάεð. ðáñΎ ÷ίíοάε ίε ðáñάέΎòυ έεέυòçοάð άάίέέPð ÷ñþόçð ίε ίðίβáð ðñΎðάε ίά ÷ñçόείηðιεçεήύί ίά άóδP οç οάέñΎ:

**30.5.11.5 PROTO**

Οί proto άβίάε ç άάοέέP εΎίç, έάε ðñΎðάε ίά áñΎοάοάε ίάεβ ίά εΎðιεά άίòβόóιε÷ç οέίP άεά ðáñάέðΎñ άðέεραP. Ç οέίP áðέοñΎðάε οί οάβñέάοίá ίά Ύίá οóάεáñεήΎί ðñυðυεήεή. Άβίάε ðñ÷ñáυðέέυ ίά ÷ñçόείηðιεçεάβ άεά ίά έεάοίòñάάβ ç ούá÷ñίç εήάέέP áðáίñάάóβáð ούι έάήύί.

Οά ίñύίáοά ðñυðυεήεήυ ðίò άίάάññβάεήόάε έάε ίðίñήύί ίά ÷ñçόείηðιεçεήύί, άβίάε óá tcp/udp | udp | tcp | icmp P ðιεάάPðñίòά Ύεεά άίòάίβάεήόάε οóί /etc/protocols. Ίðίñάβóá ίά ÷ñçόείηðιεPóáðά οί άέάέέυ υήñά tcp/udp οί ίðίβί οάέñέΎάε άβóá ίά ðάέΎοί TCP άβóá ίά UDP. Ç άέάέέP άóδP ίñάóβá ðñίóðΎεçεά þóðά ίά áðίòάήίíοάε άέðείβ, áεεΎ έάóΎ óá Ύεεά υήεήε, έάήύίáð.

**30.5.11.6 SRC\_ADDR/DST\_ADDR**

Ç εΎίç a11 άβίάε ίòóέάóóέέΎ οóίþíοίç ίά οçί οñΎóç “from any to any” ÷ññβð ίά ððΎñ÷ίοί Ύεεάð ðáñΎίáðñίε άέά οί óáβñέάοίá.

¼óáί ÷ñçόείηðιεάβóáε οί from src to dst, ίε εΎίάεð from έάε to áçεþñίοί άεάðέýίóáέð IP ðίò έá ÷ñçόείηðιεçεήύί άεά οί óáβñέάοίá. Ίε έάήύίáð ðñΎðάε ίά έεάέίñβάείò οέð ðáñáίΎòñίòð ούοίò οçð άóáðçñβáð υοί έάε οίò ðñίñέοήύ. Ç εΎίç any Ύ÷άε οçί άέάέέP έεέυòçοά ίά οάέñέΎάε ίά ίðιεάάPðñίòά άεάýεοίóç IP. ðáñάáάβáίáóá ÷ñþόçð: 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.

Άάί ððΎñ÷άε οñυðίð ίά ðáñεáñάοίήύί ðáñέί÷Ύð IP άεάðέýίóáυί ðίò άάί ίðίñήύί ίά άεοñάóοήύί άýεήεά ίά οç ίññòþ áñέέίþ ÷ññέοίΎήύ ίά óáεάβáð /ίΎóέáð ðñίáεέóýίò. Ίðίñάβóá ίά ÷ñçόείηðιεPóáðά οί άίçεçóέέυ ðñυñάñίá net-mgmt / ipcalc άεά άεάðέυεοίóç οáð οóίòð ðñίεάέοήύýð. Άάβóá οçί άέέðóáέP ðñίεάóβá ðίò ðñίáñΎίáðò ðáé ðáñέóóύðáñáð ðεçñίοίñβáð: http://jodies.de/ipcalc.

**30.5.11.7 PORT**

Οί óáβñέάοίá ίά εΎðιεά óóάεáñεήΎίç εýñá άóáðçñβáð P/έάε ðñίñέοήύ (άί ððΎñ÷άε) άóáñύεάóáε ίυήί οά ðάέΎóá TCP έάε UDP. ΈάóΎ οçί áçιεήòñάβá óðáεñβóáυί ίά εýñáð, ίðίñάβóá άβóá ίά ÷ñçόείηðιεPóáðά οίί άñέέύυ οçð εýñáð, άβóá οί υήñά οçð άίòβóóίε÷çð ððçñάóβáð άδύ οί άñ÷άβί /etc/services. ¼óáί ç εýñá άίòάίβάεάóáε υò οίþíá οίò άίðέέάεήΎήò from, οί óáβñέάοίá έá άβίáε ίά οçί εýñá οçð άóáðçñβáð. ¼óáί άίòάίβάεάóáε υò οίþíá οίò άίðέέάεήΎήò to, οί óáβñέάοίá έá άβίáε ίά οç εýñá ðñίñέοήύ. Άεά ίá έεάοίòñάάβ ç ούá÷ñίç εήάέέP óáέñέΎοίáðò έάήύί, έá ðñΎðάε ίðυóáPðñίòά ίá ððΎñ÷άε ç áðέεραP εýñáð οóί άίðέέάβίáήί to. ðáñΎάάέάίá ÷ñþόçð: from any to any port = 80

Έε οδσάεηβσάεο δτω άάάΰηηίοάε οά ιεά ιυή έγνά, ιδηηίγί ίά άβηήοί ίά δτεεήγδ άεάοηηάοεεήγδ οηυδιδωδ, ÷ ηξοείηδτεήρσοά άεάοηηάοεεήγδ οάεάοδΰδ ογάεηέοζδ. Άβίάε άδβόζδ άοίάοηί ίά έεάηηέοοίγί ηεεεεζηάο δάηει÷ Ψδ άδυ έγνάδ.

port "=" | "!=" | "<" | ">" | "<=" | ">=" | "eq" | "ne" | "lt" | "gt" | "le" | "ge".

Άεά ίά έεάηηβσάοά δάηει÷ Ψδ εδηή, ÷ ηξοείηδτεήρσοά port "<>" | "><"

**Δηιέαειδτεήρσοζ:** Ιάδΰ οεο δάηαιΰοηηωδ άεά οη δάβηέαοία οζδ άοάοζηβσδ έεά οηδ δηηηέοίηγ, ηε δάηαιεΰδου άγί δάηΰιάοηηε άβίάε οδτ÷ ηάυοεεΰδ άεά ίά έεάοηηάβ ζ ογá÷ ηηίζ εηάεεβ άδάηηάοόβσδ ουη εάηηίη.

### 30.5.11.8 TCP\_FLAG

Όά flags άβίάε άήηάΰ ιυή οοη οεεδηΰηέοία οηδ δηηδτεεεηε TCP. Όη εΰεά άηΰηά άηέδηηοδδάγáε Ψά δεεάηη flag οη άεά οη ηδηβη άβίάοάε άηβ÷ ίάοοζ οδζι άδεεάοάεβάά οηδ δάεΨοη TCP.

Ζ ογá÷ ηηίζ εηάεεβ άδάηηάοόβσδ ουη εάηηίη, ÷ ηξοείηδτεήρσοά οζι δάηΰιάοηη flags s άεά οζι άήάηηηέοζ οζδ Ψήηηζδ ιεά οοίάάηβσδ tcp.

### 30.5.11.9 STATEFUL

Όά Ψά εάηηά δηω άδεδηΨδάε (pass) οη δΨηάοία ουη δάεΨδου, ζ άδεεήαβ keep state άάβ÷ ίάε ηδε εά δηΨδάε ίά άήηηηδτεήρσοά ζ έεάοηηάβá stateful filtering ηδάη οη δάεΨοη δάεηεΰεάε ιά οά εηέδηηέα άδεεήαβ.

**Όζιάβσζοζ:** Ζ άδεεήαβ άοδβ άβίάε οδτ÷ ηάυοεεεβ άεά οζ εάεοηηάβá οζδ ογá÷ ηηίζ εηάεεεβ άδάηηάοόβσδ εάηηίη.

## 30.5.12 Όεεδηΰηέοία ιά Άεάοηηζοζ οζδ Έάδΰοόάοζδ (stateful)

Όη stateful οεεδηΰηέοία, άηέηάδουδβεάε οζι εβίζοζ οηδ άεεόγηδ ηδ ιεάδ άεδεβδ εάοάγδδωίοζδ άηδάεεάαβ δάεΨοηι οά ηδηβά άζηεηηηάηγί ιεά οοίάάηβá. Ψδάη άήηηηδτεεεάβ, ζ άεάοηηζοζ οζδ έάδΰοόάοζδ (keep-state) άζηεηηηάβ άοίάηεεΰ άοηδάηεεήγδ εάηηάδ άεά εΰεά δάεΨοη οη ηδηβη άηδάεεΰοάοάε έάδΰ οζ άεΰηεάεά άοδβδ οζδ οοίάάηβá. ÷ άε άδβόζδ οζ άοίάοηδζοά ίά άεάηάοηρσοά άη άεηεηδτεήρσοά ηε Ψεοηηε εάηηάδ άηδάεεάαβδ ιζηηΰδου ιάοάηγ οηδ άδηοηεΨά εάε οηδ δάηάεβδδζ. Ϊδτεάαβδηδά δάεΨοά άάη δάεηεΰεάε οη οη δηηδδδη άοδβδ οζδ άδεεηεηίηβáδ, άδηηηβδδηηίοάε ηδ ράγδεεά.

Ζ άεάοηηζοζ οζδ έάδΰοόάοζδ άδεδηΨδάε άδβόζδ ίά δάηΰοηηι οά δάεΨοά ICMP δηω ο÷ άδβεηηίοάε ιά ιεά οοίάάηβá TCP P UDP. ροέ, άη εζοεήγί δάεΨοά ICMP ογδηε 3 code 4 ηδ άδΰηζοζ έάδΰ οζ άεΰηεάεά οζδ άδβόεάοζδ οάδ οά ιεά εοδωίάεβá, (ζ ηδηβά άδεδηΨδάοάε άδυ οη άηδβόοηε÷ η εάηηά άήηη ÷ ηηΨη), εά οηδ άδεδηηάδβ ζ άβοηηδ. Ϊδτεάαβδηδά δάεΨοη άεά οη ηδηβη οη IPF άβίάε οβάηηη ηδε δηηεάεοάε άεά οηδηά ιεάδ άήηηηδ οοίάάηβáδ, εά δάηΰοάε εεηηά εάε άη άβίάε άεάοηηάοεεη δηηδτεεεη.

Άδδυ δηω οοηάάβίάε άβίάε οη δάηάεΰδου:

Όά δάεΨοά δηω δηηηηβεηηίοάε ίά άηΨεηηι ιΨού οζδ εεάδάοβδ δηω οοηάΨδάε οοη Internet, άεΨá÷ ηηίοάε άη÷ εεΰ ογηοηηά ιά οη άοίάεεη δβίάεά έάδωοδΰοάη. Άη οη δάεΨοη δάεηεΰεάε ιά οη άδηηάηη δηω άήάηΨάοάε οά ιεά άήηηη οοίάάηβá, άηΨñ÷ άοάε άδυ οη firewall εάε δάδδου÷ ηηά άηζιάηηάοάε ζ έάδΰοόάοζδ οζδ οδάεάεηεηΨζοδ οοίάάηβáδ οοη



tcp δαήεεαίαΰήοι όγι άδέειάP flag βόδα ία αίααίηηβαήοι όγι αβόζός Υίαήηζό όζό όοίαηηβαό έαέ ία αίαηηήεήγί όζ έαέόηηηηβαά έαέόPηηζόζό όζό έαόΰόδαόζό (stateful).

Όόζί άήυόζόδα όυή έέόαη÷ υήαήυή δαέΥόυή (Inbound) θηό οαβήαόαέ δαήάέΰόυ, θηηόηέ ηηόαήβαήήόαέ ήέ έαήυήαό θηό ÷ ηζόέηηθηέήγίόαέ αέα όζί άδύηηήεζ όυή αήαδέεγίζόυή δαέΥόυή. Αόόυ αβήαόαέ αέα άγί αέαόηηηαόέέγίό ευαήό. Ϊ θηηόηό αβήαέ υόέ όα έαέυαήεά δαέΥόά ηθηηαβ άή ηΥηαέ ία όαέηέΰαήήοι ηα έΰθηέα ÷ αηαέόθηέόόέέΰ όζό Υάέόηζό έβήζόζό. Όά δαέΥόά αόόΰ έα θηΥθάέ ία αθηηηέόέγί, αήόβ ία αβήήοι ααέόΰ άδύ έΰθηέή άδύηηή έαήυήα allow. Ϊ ααγόαηηό αβήαέ υόέ ηθηηαβόά ία αθηηηηβόάόά όόαέαέηέήΥήα δαέΥόά όα ηθηηαβ αηηηηαέόά υόέ ααή αβήαέ Υάέόηα, αέεΰ όαό αβήαέ ααέΰηηζ ζ έαόάαηαόP όηόδ. Ϊα όηη όηυθηή αόόυ αηθηηαβαάόαέ ζ εPθζ έαέ έαόάαηαόP όηόδ άδύ όηη όαέαόόαβή έαήυήα. Ϊ όαέαόόαβήό έαήυήαό όόδέέΰ αθηηηηβόάέ έαέ έαόάαηΰόαέ υέα όα δαέΥόά θηό Υόόαόάή ηΥ÷ ηέ αόόυή. Ϊ έαήυήαό αόόυό ÷ ηζόέηηθηέήαβόάέ αέα όζί δαηη÷P ηηέθή αθηηαβήαήυή όα δαηηβθόόζ θηό έέήPόαόά αέέαόόέέP αέααέέαόά έαόΰ αόόυήό θηό θηηΥάζόάή όα αδέέΥόαέό όόη όγόόζία όαό.

Έα θηΥθάέ αδβόζό ία αηαόόαέβόάόά υόέ όη όγόόζία όαό ααή έα ηηόαέ έαηέΰ αθΰήόζόζ όα έαήΥήα άδύ όα αήαδέεγίζόδα δαέΥόά. Όά δαέΥόά αόόΰ έα θηΥθάέ ία αθηηηέόέγί έαέ ία αηαόαήέόόγί. Ϊα όηη όηυθηή αόόυ, η αδέόέέ Υήαηό ααή Υ÷ αέ έαηέΰ αηηόζ άή όα δαέΥόά θηό Υόόαόάή ηΥ÷ ηέ όη όγόόζία όαό. Ϊόη έέαυόαηα ηθηηγί ία ηΰεηοι ήέ αδέόέέ Υήαηέ ό÷ αόέέΰ Ϊα όη όγόόζία όαό, όυόη δαηέόόυόαηη ÷ ηυηή έα ÷ ηαέάόόαβ ία αθηηαγόοηή αέα ία έαόάόΥηηοι ία όαό αέΰθηοι όόα αέPαέα. Ϊέ έαήυήαό ηα όζί άδέειάP log first έαόάαηΰοηοι όη όόηαΰή υυή όζί θηηθόζ οηηΰ θηό αηαηηθηέήγίόαέ. ζ άδέειάP αόόP δαηέεαίαΰήαόαέ όόη έαήυήα nmap OS fingerprint όόη δαηΰααέαηα θηό οαβήαόαέ δαηάέΰόυ. Όη αηζέζόέέυ θηηηαηαήα security/nmap ÷ ηζόέηηθηέήαβόάέ όό÷ΰΰ άδύ έαέυαήεά ΰόηα, θηό θηηόδαέγί ία αόόυ όηη όηυθηή ία αήαηηηηβόήοι όη έαέόηηηαέέυ όγόόζία όηό ηζ÷ αήPηαόηό όαό.

Έΰεα οηηΰ θηό όδΰη÷αέ έαόάαηαόP άδύ έΰθηέή έαήυήα ηα όζί άδέειάP log first, έα θηΥθάέ ία αέόαέΥόάόά όζί αήόηεP ipfstat -hio αέα ία ααβόά θυόαό οηηΥό Υ÷αέ αηαηηθηέεαβ αόόυό η έαήυήαό όόηέέέΰ. ρόέ έα ηΥηαόά άή θ.÷. όαό έΰήοι αδβέαόζ όδαη÷αβέέόζό (flood).

Ααβόά όη αη÷αβή /etc/services αέα ία αηαβόά αηέέηγό έόηηθί θηό ααή αήαηηηηαέόά. Ϊθηηαβόά αδβόζό ία αδέέαόέαβόά όζί όηθηέαόβά http://www.securitystats.com/tools/portsearch.php έαέ ία έΰήαόά αήαεPόζόζ αέα όζ όόαέαέηέήΥήζ εγηα, βόδα ία ααβόά θηέα όδζηαόβά αηόδζηαόαβ.

Ααβόά όζί άδύηηαζ όηθηεαόβά αέα όέό εγηηαό θηό ÷ ηζόέηηθηέήγίόαέ όόηPευό άδύ έαέυαήεά θηηηαηΰηαόά (trojans): http://www.simovits.com/trojans/trojans.html.

Όη δαηάέΰόυ όγηηέ έαήυήα αβήαέ αηέαόΰ θεPηαό έαέ θηεγ αόόαέΥό. Αζηέηηηαβ firewall όγθηό inclusive, έαέ Υ÷αέ αηέεαήαόαβ όα θηαηαήαόέέΥό όόηεPεαό έαέόηηηαβ. Ϊθηηαβ ία αηόδζηαόPόαέ όη βαέη έαέΰ έαέ όη αέέυ όαό όγόόζία. Αδθθό ηαόαθηΥθόά όα ό÷υέεη όηόδ έαήυήαό αέα όέό όδζηαόβαό θηό ααή εΥέαόά ία αηαηηθηέεPόαόά.

Άέα ία αθηηγαάόά όζί έαόάαηαόP αήαδέεγίζόυή ηζηοηΰόυή, αθθθό θηηόέΥόά Υήα αήόβόήε÷ η έαήυήα άδύηηήεζόζ (block) όόζί άήυόζόδα όυή έέόαη÷ηΥήυή (inbound).

Έα θηΥθάέ ία αέεΰηαόά όη υηηά όζό αέαδαόPδ dc0 όηό δαηαααβαηαόηό, ηα όη θηαηαήαόέέυ υηηά όζό έΰηηαό αέέόγηό θηό όόηαΥάέ όη όγόόζία όαό ηα όη Internet. Άέα υηοηόδ ÷ ηζόέηηθηέήγί όη PPP ÷ ηPόζ, όη υηηά έα αβήαέ tun0.

θηηόέΥόά όέό αέυεηθέαό έαόά÷ηηβόαέό όόη αη÷αβή /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 #####

```

### 30.5.14 NAT

Οι NAT αβίαε αένιγίει δὺι εΐαὺι Network Address Translation Π Ιάοΰñάοç Äéâðýíóαὺι Äééðýíð. Äéá υίðð αβίαε αίεεαέυιΎίε ια οι Linux, αάοβæαάέ οόçι αν ÷Π οι IP Masquerading. Οόçι ðñáñíáóééυόçά οι NAT éáé οι IP Masquerading αβίαε οι Βαεί ðñÛñá. Ιέα áðu óéð ðίεεΎð αóíáóυόçάð ðίð ðάνΎ ÷áé ç éáéοίññá NAT οι IPF, αβίαε éáé ç αóíáóυόçά ίá Ύ÷ιðñá Ύίá éáéυóééυ ðιðééυ αβέδοι (LAN) ðβού áðu οι firewall οι ιðίβι ίá ηένÛæαάέ ιέα ηίááéεΠ αçιυόέá äéýèðίόç IP οói Internet.

οὐδὲν ἰά ἀνάηδὸς ἐὰβδᾶ ἀεάδβ ἰά εΰεᾶε εὔδιεῖρῶ ἰά οἱ εὔιαε ἀδδῦ. Ἰε ISPs οἱ Πευὸ ἀδῖαβᾶῖοἱ ἀοἱαῖεεΰδ ἀεάδδὲγῖοᾶεὸ ὁᾶ ἰς ἀδᾶεἠεεῖγὸ δᾶεὔδᾶδ. Ἀδδῦ ἰδῶεᾶδῶεεὔ ὄγῖαβῖᾶε ὑδῶε ς ἀεᾶγῶεδῖος IP δῖρῶ ἀδῖαβᾶᾶδᾶε ὁοἱ ἰς Ψὔγῖᾶ ὁᾶδ, ἰδῖἠᾶβ ἰά ἀβῖᾶε ἀεᾶἰἠᾶδῶεεβ εὔεᾶ ὠἠὔ δῖρῶ εὔἰᾶδᾶ εεβρῶς ᾶεᾶ ἰά ὄἱᾶᾶεᾶβδᾶ. Ἄεᾶ δῖρῶδ Ψἠβῶᾶδ DSL modem ἕᾶε router, ς ἀεεᾶᾶβ ἀεᾶγῶεἰοῶδ δἠᾶᾶἰᾶοἱδῖεᾶβδᾶε εὔεᾶ ὠἠὔ δῖρῶ ἀἱᾶἠᾶἰδῖεᾶβδᾶε ὁἱ modem. ς ἀεᾶγῶεδῖος IP δῖρῶ ὁᾶδ ἀδῖαβᾶᾶδᾶε ἀδῦ οἱ ISP ὁᾶδ, ἀβῖᾶε ἀδδβ ἰᾶ ὄγῖ ἰδῖβᾶ ὄᾶβῖᾶδᾶ ὁοἱ Internet.

Ἀδ δδῖε Ὑοἱοἱᾶ ὀρἠᾶ ὑδῶε ὙΨᾶδᾶ δΰἰδᾶ PC ὁοἱ ὀδβδῶε ὁᾶδ, ἕᾶε Ψἠᾶεὔᾶᾶδᾶ ὁᾶ ὑεᾶ ὄγῖᾶᾶς Internet. Ἐᾶἠῖεεὔ, εᾶ Ὑδἠᾶδᾶ ἰά δῆϭἠβῶᾶδᾶ οἱ ISP ὁᾶδ Ψἠῶεδῶε εἱᾶᾶἠεᾶδῖῦ ᾶεᾶ εὔεᾶ PC ἕᾶε ἰά ᾶεᾶεΰδᾶδᾶ δΰἰδᾶ ᾶἠᾶἰΰδ ὄϭῶὀρἠῶ.

ἰᾶ οἱ NAT, Ψἠᾶεὔᾶᾶδᾶ ἰῦἠ Ὑἰᾶ εἱᾶᾶἠεᾶδῖῦ ἰᾶ οἱ ISP ὁᾶδ. ἰδῖᾶβδᾶ ἀδῆβδ ἰά ὄἱᾶΰῶᾶδᾶ ὁᾶ ὄΰῶᾶἠᾶ PC ὁᾶ Ὑἰᾶ ᾶεᾶἠᾶ Ὑᾶ β switch ὁοἱ ἰδῖβῖ εᾶ ὄἱᾶΰῶᾶδᾶ ἀδβῶϭ ἕᾶε οἱ FreeBSD ἰς Ψὔγῖᾶ ὁᾶδ. Ὀἱ ἰς Ψὔγῖᾶ ἀδδῦ εᾶ ἀἱᾶἠᾶβ ὑδ ὄγῶϭ οἱ δῖεῖγῖ ὁᾶδ ἀεεῶγῖῶ ᾶεᾶ οἱ Internet. Ὀἱ NAT εᾶ ἰᾶδᾶὀἠὔᾶε ἀδδῖῖᾶᾶ ὁεδ εᾶεῦδῶεεΰδ ἀεᾶδδὲγῖοᾶεὸ IP δῖρῶ εὔεᾶ ἰς ἀἱβῖᾶδῖδ ὀδῶἱ ἠἱᾶᾶεεβ ᾶϭῖῦδῶᾶ IP ἀεᾶγῶεδῖος δῖρῶ ὙΨᾶδᾶ, ἕᾶεβδ οἱ δᾶεΰοἱ ὄᾶγᾶᾶε ἀδῦ οἱ firewall ἕᾶε εᾶᾶδδὲγῖᾶδᾶε δἠῖδ οἱ Internet. Ἀεῶᾶεᾶβ ἀδβῶϭ ἕᾶε ὄγῖ ἀἱῶδῶδἠῖρῶς ἰᾶδῦὀἠᾶῶς ᾶεᾶ ὁᾶ δᾶεΰῶᾶ δῖρῶ ἀδῶεὀἠ Ὑοἱοἱ.

ὈδὔἠΨᾶε ἰεᾶ ᾶεᾶεεβ δᾶἠεἱΨᾶ ἀεᾶδδὲγῖοᾶῖ IP δῖρῶ ὙΨᾶδᾶ ὑἠϭῶᾶβ ᾶεᾶ Ψἠβῶς ὁᾶ οἱ δῖεεὔ ᾶβῶεὁᾶ ἰᾶ NAT. Ὀγῖῶῖᾶ ἰᾶ οἱ RFC 1918, ἰδῖᾶβδᾶ ἰᾶ Ψἠϭῶεἠῖδῖεβῶᾶδᾶ ᾶεᾶ ἀδδῦ οἱ ὄεἱδῦ ὁεδ δᾶἠᾶεὔδῶ δᾶἠεἱΨᾶ Ὑδ, ἰε ἰδῖβᾶδ ᾶᾶἠῖεἱγῖᾶε δῖρῶ ἰᾶδᾶδῶᾶδ ὁοἱ ᾶϭῖῦδῶἱ Internet:

ἈἠΨῶεὔ IP 10.0.0.0	-	Ὀᾶεεὔ IP 10
ἈἠΨῶεὔ IP 172.16.0.0	-	Ὀᾶεεὔ IP 17
ἈἠΨῶεὔ IP 192.168.0.0	-	Ὀᾶεεὔ IP 19

### 30.5.15 IPNAT

Ἰε εᾶῖῖᾶδ οἱ NAT ὠἠὀρἠῖᾶε ἰᾶ ὄϭ Ψἠβῶς ὄϭδ ἰᾶἱῖεβδ ipnat. Ὀδδῶεὔ, ἰε εᾶῖῖᾶδ οἱ NAT ἀδῖεϭᾶγῖᾶε ὁοἱ ᾶἠΨᾶβῖ /etc/ipnat.rules. Ἄᾶβδᾶ ὄϭ ὄᾶεβᾶᾶ manual οἱ ipnat(1) ᾶεᾶ εᾶδδῶἠΰἠᾶεᾶδ.

Ἄεᾶ ἰᾶ ᾶεεὔἰᾶδᾶ οἱδῶ εᾶῖῖᾶδ οἱ NAT ἕᾶεβδ ἀδδῦ ᾶεὀᾶεᾶβδᾶε, δἠῖδῖδῖεβῶᾶ οἱ ᾶἠΨᾶβῖ δῖρῶ οἱδῶ δᾶἠεΰΨᾶε, ἕᾶε ᾶεὀᾶεΰῶᾶ ὄγῖ ἰᾶἱῖεβ ipnat ἰᾶ ὄγῖ δᾶἠὔἰᾶδἠῖ -CF ᾶεᾶ ἰᾶ ᾶεᾶᾶἠὔὀᾶδᾶ οἱδῶ ᾶὀῦδᾶἠεῖγῖ εᾶῖῖᾶδ οἱ NAT ἕᾶε ἰᾶ ᾶᾶᾶὔὀᾶδᾶ ὑεᾶδ ὁεδ ἰᾶἠᾶἠΰδ εᾶὀᾶΨἠβῶᾶεδ οἱ δβῖᾶεᾶ ἰᾶδᾶὀἠὔᾶῖ.

Ἄεᾶ ἰᾶ ὠἠὀρῶᾶδᾶ οἱδῶ εᾶῖῖᾶδ οἱ NAT ἀδῦ ὄγῖ ᾶἠΨᾶ, ᾶεὀᾶεΰῶᾶ ἰεᾶ ἰᾶἱῖεβ ὑδῦδ ὄγῖ δᾶἠᾶεὔδῶ:

```
# ipnat -CF -f /etc/ipnat.rules
```

Ἄεᾶ ἰᾶ ᾶᾶβδᾶ εὔδῖεᾶ ὀδᾶὀεὀᾶεὔ ὄΨᾶὀεεὔ ἰᾶ οἱ NAT, Ψἠϭῶεἠῖδῖεβῶᾶ ὄγῖ δᾶἠᾶεὔδῶ ἰᾶἱῖεβ:

```
# ipnat -s
```

Ἄεᾶ ἰᾶ ᾶᾶβδᾶ ἰεᾶ εβῶὀᾶ ἰᾶ ὁεδ ὀἠΰΨῖὀὀᾶδ εᾶὀᾶΨἠβῶᾶεδ οἱ δβῖᾶεᾶ NAT, Ψἠϭῶεἠῖδῖεβῶᾶ ὄγῖ δᾶἠᾶεὔδῶ ἰᾶἱῖεβ:

```
# ipnat -l
```

Ἄεᾶ ἰᾶ ἰᾶἠᾶἠῖδῖεβῶᾶδᾶ ὄγῖ εᾶδδῶἠᾶβ ᾶδᾶεεῖῖεὀς ἰϭῖἱὔδῖῖ ἕᾶε ἰᾶ ᾶᾶβδᾶ δῆϭἠῖὠἠβᾶδ δῖρῶ ὄΨᾶδβᾶἱῖᾶε ἰᾶ ὄγῖ ᾶδᾶἠᾶᾶᾶὀᾶ ὀῦἱ εᾶῖῖῖῖ ἕᾶε οἱδῶ ἰᾶἠᾶἠῖγδ εᾶῖῖῖῖ ἕᾶε εᾶὀᾶΨἠβῶᾶεδ ὁοἱ δβῖᾶεᾶ, ᾶἠὔὀᾶ:

```
# ipnat -v
```

### 30.5.16 Έάιϐιϐάὀ ðιὀ IPNAT

ΐέ έάιϐιϐάὀ ðιὀ NAT άβίάέ άñέάὀϐ ρέϐΐέέέϐιέ, έάέ άέάέΐϐιϐί ðέϐεϐϐ άϐιάϐιϐϐϐϐι ϐρὀά ίά έάέϐϐϐιϐί ϐέϐ άίϐάέϐ ϐϐι ϐέέέάέϐι άέέϐ έάέ ϐϐι άðέ÷ άέñçóέάέϐι ÷ ñçóϐϐί.

Ç ρύίϐάίç ϐϐι έάιϐιϐι ϐιϐ ðάñιϐέϐϐέϐάϐάέ άάϐ, ΐ ÷ άέ άðέιϐιέçέϐϐ ϐρὀά ίά ϐϐιάάϐϐάέ ίά ϐç ϐϐίϐέç ÷ ñϐρç ϐά ίç-άιϐιñέέϐ ðάñέάϐέειϐά. Άέά ðέί ðέϐñç ðάñέάñάϐϐ ϐçϐ ρύίϐάίçϐ, άάβϐά ϐç ϐάέβιά manual ðιὀ ipnat(5).

Ç ρύίϐάίç άίϐϐ έάιϐιϐά NAT ñέϐάέ ίά ϐçί ðάñάέϐϐ:

```
map IF LAN_IP_RANGE -> PUBLIC_ADDRESS
```

ΐ έάιϐιϐάὀ ίάέείϐάέ ίά ϐç έΐίç map.

Άίϐέέάϐάϐϐρὀά ðι IF ίά ϐçί άίϐϐάñέέϐ έέάðάϐϐ (ϐç έϐñϐά άέέϐϐίϐ ðιϐ ϐϐιάΐάϐάέ ϐϐι Internet).

Ç ðάñϐιάϐñιϐ LAN\_IP\_RANGE άβίάέ ç ðάñέί ÷ ϐ έέάϐέϐίϐάϐι ðιϐ ÷ ñçóέιϐιέϐϐάέ άðϐ ðι άϐϐϐάñέέϐ ϐάϐ άβέϐϐι. Οϐçί ðñάñιάϐέέϐϐçϐά έά ñέϐάέ ίά έϐϐέ ϐάί ðι 192 . 168 . 1 . 0 / 24.

Ç ðάñϐιάϐñιϐ PUBLIC\_ADDRESS ñϐñάβ ίά άβίάέ άβϐά ç άίϐϐάñέέϐ IP έέάϐέϐιϐç, άβϐά ç άέέέϐ έΐίç 0 / 32, ç ñϐιβά ϐçίάβίάέ ϐϐέ έά ÷ ñçóέιϐιέçέϐϐ ç IP έέάϐέϐιϐç ðιϐ ΐ ÷ άέ άðιäίϐϐ ϐϐι IF.

### 30.5.17 ðϐϐέ έάέϐιϐñάάβ ðι NAT

ίά ðάέΐϐι ϐϐϐίάέ ϐϐι firewall άðϐ ðι LAN ίά ðñιñέϐιϐ ðι Internet. ðάñιϐάέ έέάΐϐιϐ ϐϐι έάιϐιϐι ϐέέϐñάñβϐιáϐιϐ ñιñ ÷ ñΐϐιϐι, ϐðιϐ άβίáϐάέ ç άðñιñάáϐά ϐιϐ άðϐ ðι NAT. ΐέ έάιϐιϐάὀ άϐάñιϐέειϐάέ άðϐ ϐι ϐñϐϐι έάέ ðñιϐ ϐά έϐϐϐ, έάέ έάñáβϐάέ ðñϐϐιϐ ðιϐ ϐάέñέϐάέ. ΐ ΐέάá ÷ ιϐ άβίáϐάέ ίά áϐϐç ϐç έέάðάϐϐ άðϐ ϐçί ϐιβά έϐρèçéά ðι ðάέΐϐι έάέ ϐç έέάϐέϐιϐç IP άðϐ ϐçί ϐιβά ðñιΐñ ÷ άϐάέ. ΐðάί ðι ϐñιá ϐçϐ έέάðάϐϐ άίϐϐ ðάέΐϐιϐ ϐάέñέϐάέ ίά έϐϐιέί έάιϐιϐά ðιϐ NAT, ç έέάϐέϐιϐç IP ϐçϐ άϐάϐçñβάϐ (ðιϐ ðñιΐñ ÷ άϐάέ άðϐ ðι έάέϐϐέέϐϐ άβέϐϐι) άέΐá ÷ άϐάέ άέά ίά άίάέñέάϐέϐ άί ϐάέñέϐάέ ίά ϐçί ðάñέί ÷ ϐ έέάϐέϐιϐάϐι ðιϐ έάέñβϐάϐάέ ϐçί άñέϐϐάñϐ ðέáϐñϐ ϐιϐ ϐϐιäϐεϐϐ (άΐεϐϐ) ðιϐ έάιϐιϐά NAT. Άί ϐάέñέϐάέ, ç έέάϐέϐιϐç ϐιϐ ðάέΐϐιϐ ίάίάñϐϐάϐάέ, ÷ ñçóέιϐιέϐϐιϐάϐ ϐç άçιϐέά έέάϐέϐιϐç IP ç ñϐιβά ðάñΐ ÷ άϐάέ άðϐ ðι 0 / 32. Οι NAT άçιέιϐñάάβ ίέά έάϐά ÷ ñέϐç ϐϐιϐ άϐϐϐάñέέϐ ðιϐ ðβίáέά, ΐϐέέ ϐρὀά ϐϐάί άðέϐϐñΐϐάέ ç άðϐιϐçϐç άðϐ ðι Internet, ίά ñϐιñάβ ίά άίϐέϐϐιέ÷ çέάβ ίάίϐ ϐçί άñ ÷ έέϐ έάέϐϐέέϐ έέάϐέϐιϐç IP έάέ ίά ðάñϐϐάέ ΐðάέϐά άðϐ ðιϐ έάιϐιϐά ðιϐ ϐβέϐñιϐ έέά ðάñάέϐΐñϐ άðñιñάáϐά.

### 30.5.18 Άίάñäϐιέϐιϐάϐ ðι IPNAT

Άέά ίά άíάñäϐιέϐιϐάϐά ðι IPNAT, ðñιϐέΐϐάϐ ϐέϐ ðάñάέϐϐϐ ñάñäϐϐ ϐϐι /etc/rc.conf.

Άέά ίά άðέϐñΐϐάϐά ϐϐι ñç÷:ΐίçίá ϐάϐ ίά άñιñεϐάβ ðάέΐϐά ίáϐάίϐ έέάðáϐϐι έέέϐϐιϐ:

```
gateway_enable="YES"
```

Άέά ίά ñάέείϐάέ άϐϐϐιáϐά ðι IPNAT ϐά έϐϐά άέέβίçç:

```
ipnat_enable="YES"
```

Άέά ίά έάέññβϐάϐά άðϐ ðιϐ άðέέϐιáβϐά ίά ϐιñϐϐιϐάέ ίέ έάιϐιϐά ðιϐ IPNAT:

```
ipnat_rules="/etc/ipnat.rules"
```

### 30.5.19 Õι NAT óá íá íáãÛέι Õιíðέέü Åβέóðι

Άέά òιðέέÛ áβέóðá íá íáãÛέι áñέέιü ððίεπáέóððι, ð áέá áβέóðá ðιò áέáóðίáÛιòι ðáñέóóüðáñá áðü Ýίá LAN, ç áέáάέάóβá òçð íáðáóñιððò üέüí áðððι ðüí éάέüðέέπι áέáðέέγíáüíí óá íέá ííáάέέð áçιüóέá áέάγέðιòç, áçιέιòñááß ðñüüáçíá éáðáñιððò ðñññí, éάέðð ÷ ñçóέéιðιέίγíóáé ðιέέÛò òιñÛò íé βáέίε áñέέñιß éðñðι, íáçáπιðáð óá PC ðιò áέέðýιò óá óóáέñιγúáέð. ÕðÛñ ÷ ιòι áγιí ðññðιέ áέá íá áέáóððóιòιá áððü òι ðññüáçíá.

#### 30.5.19.1 ΑίÛέάóç ðüí éèñðι ðιò éá × ñçóέéιðιέçέίγí

Íá óòίçðέέóιÛιò éáíüíáð NAT íéÛæáé íá òιí ðáñáéÛòü:

```
map dc0 192.168.1.0/24 -> 0/32
```

Õðιí ðáñáðÛιü éáíüíá, ç éγñá áðáðçñβáð ðιò ðáέÛòιò ðáñáñιÛίáé áíáέéιñβüðç éάέðð òι ðáέÛòι áέÛñ ÷ áðάέ ìÛóü ðιò IPNAT. Αί ðñιòέÛóáðá òçι éÛιç-ééáέáß portmap, íðñáßðá íá ñòéιñóáðá òι IPNAT íá ÷ ñçóέéιðιέέß éγñáð ðιò áíðέιòι óá íέá éáειñέóιÛιç ðáñέι ÷ ð. Άέá ðáñÛáέéáιá, ι ðáñáéÛòü éáíüíáð éá íáçáðóáé òι NAT íá ðñιðιðιέðóáé òçι éγñá òçð áðáðçñβáð, ðððá íá áβίáé ìÛóá òçι ðáñέι ÷ ð ðιò óáβíáðάέ:

```
map dc0 192.168.1.0/24 -> 0/32 portmap tcp/udp 20000:60000
```

Ìðñιγíá áðβóçð íá áðέιðιέðóιòιá áέüíá ðáñέóóüðáñι òç áέáάέáóβá ÷ ñçóέéιðιέπιðáð òç éÛιç auto ðððá òι IPNAT íá éáέιñβáέé áðü íüñ òιò ðιέάð éγñáð áβίáé áέάέÛóέíáð áέá ÷ ñðóç:

```
map dc0 192.168.1.0/24 -> 0/32 portmap tcp/udp auto
```

#### 30.5.19.2 × ñçóέéιðιέπιðáð Ýίá Αðüέáíá Αðίáíέέπι Αέáðέέγíáüí

Õá Ýίá ðιέγ íáãÛέι òιðέέü áβέóðι, áñáÛ ð áñðáιñá òðÛñòιá óðι óçíáβι ðιò íέá ííáάέέð áçιüóέá áέάγέðιòç ááí áðáñέáß áέá íá éάέγðáé òüóáð ðιέέÛò éάέüðέέÛò. Αί òðÛñ ÷ áé áέάέÛóέιí Ýίá áγñιð áçιüóβüí áέáðέέγíáüí, íðñιγí íá ÷ ñçóέéιðιέçέίγí üð “áðüέáíá (pool)”, áðέðñÛðιíðáð óðçι IPNAT íá áðέέÛίáé íέá áðü áððÛò éάέðð áíέóóðιέ ÷ áß óá ðáέÛóá éáðÛ òçι Ýιñáι òιòð ðñιð òι áçιüóέι áβέóðι.

Άέá ðáñÛáέéáιá, áíðβ íá áíέóóðιέ ÷ íγι üέá óá ðáέÛóá ìÛóü íέáð ííáάέέðð áçιüóέáð IP áέάγέðιòçð üððð ðáñáéÛòü:

```
map dc0 192.168.1.0/24 -> 204.134.75.1
```

ìðñιγíá íá ÷ ñçóέéιðιέðóιòιá Ýίá áγñιð IP áέáðέέγíáüí, áβðá íá òç ÷ ñðóç ìÛóέáð áέέðýιò:

```
map dc0 192.168.1.0/24 -> 204.134.75.0/255.255.255.0
```

áβðá íá óðιáíέέóιü CIDR:

```
map dc0 192.168.1.0/24 -> 204.134.75.0/24
```

### 30.5.20 Αίáέáðáγέðιòç Éðñðι

Αβίáé έιέιð ðñáέðέέð íá ááέáέβóðáííóáé ððçñáóβáð üððð ι áíððçñáðçððð éóðιóáέβáüí, ðá ÷ ðáñññáβιò, áÛóçð áááñÛιüí éάé DNS óá áέáöιñáðέέÛ PC óοι òιðέέü áβέóðι. Õðçι ðáñβððòçç áððð, ç έβιçòç ðáέÛòüí áðü áððÛò óá íç ÷ áíðιáðá áíáέιειòέáß íá ÷ ñáέÛæáðάé òι NAT, áέέÛ ÷ ñáέÛæáðάé áðβóçð íá òðÛñ ÷ áé éÛðιέιð ðññðιð íá éáðáðέέγíáðάé ç áέóáñ ÷ üíáíç έβιçòç ðóá òüððÛ PC òιò áέέðýιò. Õι IPNAT Ý ÷ áé ðέð éáðÛέέçéáð áðίáðüðçðáð áέá òçι áðβέðóç

άοδιγύ οίτθ δνίρεΠιάοίδ. Άέα δάνΰάεάι, Ύόου υέε Ύίάδ άιδδγνάδγδΠδ εόοίόάεββαι άνβόεάόάε όδγί εεάγέοίόγ LAN 10.0.10.25 έάε γ ιίράάέεΠ άγίυόέα IP άβίάε 20.20.20.5. Ί έάίυίάδ δίθ εά ανΰόάδά έά Ύίρεάεα ιά οίί 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 άιδδγνάδγδΠ DNS ιά εεάγέοίόγ όοί οίδέευ άβεδοί 10.0.10.33 ι ιδθβίθ δνΎδάε ιά άΎ÷άόάε άίάεγδΠόάέδ άδθ οί άγίυόέί άβεδοί:

```
rdr dc0 20.20.20.5/32 port 53 -> 10.0.10.33 port 53 udp
```

### 30.5.21 FTP έάε NAT

Οί FTP άβίάε Ύίάδ άάείυόάδνίθ δίθ Ύ÷άε άδνίάβίάε άδθ όγί άδθ÷Π δίθ οί Internet Πόάί όόά αν÷έεΰ οίθ όόΰάέα, υδθίθ όά άναοίγδέεΰ άναάόδΠνεά ουί δάίάδεδόδΠεύί Πόάί όοίάάΎίά ιάόάίγ οίθδ ιά ιέοευΎίάδ άναυΎδ έάε ιε άναοίγδΎδ οί ÷νγόεηδθίείγόάί άέα ιά όόΎεηοί αν÷άβ ι Ύίάδ όοίί ΰεεί. Ογί άδθ÷Π έεάβίγ, άάί οδΠν÷άί άίγδδ÷βάδ ό÷άδεδεΰ ιά όγί άόόΰεάέα. Ιά οί δΎνάοίά οίθ ÷νυίθ, οί FTP εΰδδγδά όοί δβού ιΎνίθ οίθ όά÷Ύδ άίάεόόυιάίθ Internet. Άάί άίάεβ÷εγέα δίθΎ Πόδά ιά ιάδάνΰόάε δνίρεΠιάόά άόόΰεάέδ, υδθδ δ.÷. οί άάίυίδ υέε όόΎείάε οί υίμά έάε οίί ευάεευ οίθ ÷νΠόδγ υδ άδθυ έάβίάί. Οί FTP Ύ÷άε άοί έάόάόδΰόάέδ εάεοίθνάβάδ, όγί άίάνάΠ έάε όγί δάεγδέεΠ. Γ εεάοίθΰ άβίάε όοί δυδ άβίάόάε γ άίΰέδδγδ οίθ έάίάεείγ άάανΎίυί. Γ δάεγδέεΠ εάεοίθνάβά άβίάε δει άόόάεΠδ, έεεΠδ οί έάίΰεε άάανΎίυί άδθδάεάβ οί εγνεί έάίΰεε όγδ όοίάανβάδ. Ιδνίάβδά ιά άνάβδά δθεγ έάεΠ δάνεάναδΠ οίθ δνυοίευεείθ έάε ουί εεάοίμάδεδεΠ δνυδνι εάεοίθνάβάδ οίθ, όοί <http://www.slacksite.com/other/ftp.html>.

#### 30.5.21.1 Έάίυίάδ οίθ IPNAT

Οί IPNAT εεάεΎδάε ιέα εεάεεΠ άδεδεραΠ άέα εεάίάοίεΰάγδγ FTP (proxy) γ ιδθβά ιδνίάβ ιά έάείθνέόδάβ όοίί έάόΰεεγεί έάίυίά οίθ NAT. Ιδνίάβ ιά δάνάείθδεδΠόάε υέα όά άίάν÷υιάίά δάεΎόά άέα ιά άίε÷ίάγόάε όγί Ύίάνθγ ιεάδ άίάνάΠδ Π δάεγδέεΠδ όοίάανβάδ FTP, έάε ιά άγίείθνάΠόάε άοίάέεΰ δνίθουθνείγδ έάίυίάδ όοί οβεδθνι δίθ ιά δάνεΎ÷ίθι ιυίθ οίί άνεείυ όγδ εγνάδ δίθ ÷νγόεηδθίεάβδάε άδθ οί έάίΰεε άάανΎίυί. Άδου άίάεάβδάε οί δνυάεγίά άόόΰεάέδ δίθ άγίείθνάβδάε άδθ οί άάίυίδ υέε εεάοίθνάδεδεΰ εά ÷νέάεαυδάί ιά άίε÷εάβ ιέα ιάΰεγ δάνεί÷Π δεδθΠ (όόγί δδγδΠ δάνεί÷Π) όοί firewall.

Ί δάνάεΰδου έάίυίάδ ÷άενβεάδάε υέα όά άάανΎίά άέα οί άούδάνεευ άβεδοί (LAN):

```
map dc0 10.0.10.0/29 -> 0/32 proxy port 21 ftp/tcp
```

Ί δάνάεΰδου έάίυίάδ ÷άενβεάδάε όγί έβίγδγ FTP άδθ όγί δγέγ (gateway):

```
map dc0 0.0.0.0/0 -> 0/32 proxy port 21 ftp/tcp
```

Ί δάνάεΰδου έάίυίάδ ÷άενβεάδάε υέγ όγί έβίγδγ άδθ οί άούδάνεευ LAN δίθ άάί άίΠεάε όοί δνυδουείεεί FTP:

```
map dc0 10.0.10.0/29 -> 0/32
```

Ί έάίυίάδ ÷άνθιανΰδγδδ οίθ FTP οίθιεάδάβδάε δνεί άδθ οίί έάίυίεευ έάίυίά ÷άνθιανΰδγδδ. Έΰεά δάεΎοί άεΎα÷άόάε αν÷έεΰ άδθ οίί έάίυίά δίθ άνβόεάόάε όόγί εινδδΠ. Άί δάενεΰεάε όγδ εεάδάδΠ έάε όδγί εεευδεδεΠ εεάγέοίόγ IP έάε δνυεάεόάε άέα δάεΎοί FTP, ι εεάίάοίεεάγδδ FTP άγίείθνάβ δνίθουθνείγδ έάίυίάδ όοί οβεδθνι ιε ιδθβίε άδεδθνΎδθίθ όγί εεόάν÷υιάίγ έάε άίάν÷υιάίγ έβίγδγ FTP άίΠ όάδου÷νίά εεδάείγί έάε όγί άδάνάβδγδγ

ιαόΰοναός NAT. ΰέα όά άάέΎόά άιό αάι άίπειρί όά ιαόΰιόός FTP αάι όάένεΰαίρί ία όιί όηπει έάφίία, Ύόόέ έάόάόέγίίόάέ όόιί όηπει έάφίία, άιαόΰαίίόάέ ύόιί άόιηΰ ός άέαόάόP έάέ όι IP άδύ όι ίόιβι όηΎΎ ÷ ίίόάέ, έάέ άβίαόάέ ς άίόβόιέ ÷ ς ιαόΰοναός όιόδ άδύ όι NAT.

### 30.5.21.2 Έάίφίιαό Όβέόηιό άέα όι IPNAT

ΰόάί ÷ ηςόέηιόέάβόάέ ι ίαόίέαάςόP FTP, ÷ ηάέΰαάόάέ ιύιί Ύίαδ έάφίφιαό άέα όι NAT.

× ηηβό όι ίαόίέαάςόP FTP, ÷ ηάέΰαίίόάέ ίέ άηάέΰόδύ όηάέδ έάφίφιαό:

```
# Allow out LAN PC client FTP to public Internet
# Active and passive modes
pass out quick on rl0 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 rl0 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 rl0 proto tcp from any to any port = 20 flags S keep state
```

## 30.6 IPFW

Όι IPFW (IPFW) άβίαέ έίάέόίέέύ άιό άίάόόύ ÷ έςέά άέα όι FreeBSD, ÷ άέ ηηάόάβ έάέ όόίόςηάβόάέ άδύ άέάέηιόΎό άιό άίπειρί όόι Project. × ηςόέηιόέάβ όιόδ έέαόέέίγδ έάφίφιαό ÷ ηηβό έέαόPηςός ός ό έάόΰόόάςόδ (stateless) έάέβδ έάέ ίέα όά ÷ ίέέP έύάέέίόιβςός όιό άόέόόά ÷ Ύίάέ άόδύ άιό άίάόΎηάόάέ ύδ ΆόέP Stateful ΈίάέP (Simple Stateful Logic).

Όι όδύάάέαιά έάφίφίφί άέα όι IPFW (όόά άη ÷ άβία /etc/rc.firewall έάέ /etc/rc.firewall6) ός όόδέέPδ άάέάόΰόόάςόδ όιό FreeBSD άβίαέ ιΰέέηι άδέύ έάέ έά ÷ ηάέάόόάβ ίά έΎίάόά έΰόίέάδ άέέάΎό όηέί όι ÷ ηςόέηιόέPόάόά. Όι άηΎάάέαιά αάι ÷ ηςόέηιόέάβ όέέόηΎέόίά όγδιό stateful. ς stateful έέαόιόηάβά άβίαέ άόάηάάόέέP όόέδ άηέόόόύόάηάδ άηέέδδPόάέδ, Ύόόέ αάι έά ÷ ηςόέηιόέPόίόιά άόδύ όι άηΎάάέαιά ύδ άΰός άόδPδ ός ό άφύόςόάδ.

ς όγίόάίς όύι έάφίφίφί stateless όιό IPFW Ύ ÷ άέ άίέό ÷ όέάβ ία άίάέέαιΎίάδ άόίάόύόςόάδ άόέέίPδ ίέ ίόιβάδ όόίPέύδ ίαάηιΎίά έάόΰ όίέγ όέδ όόδέέΎό άίPόάέδ όιό άόύιό όιό έάέάβόάέ ίά όι ηόέιβόάέ. Όι IPFW άάάόέγίάόάέ όόιί άάάάάέαιάόβά ÷ ηPόός P όιί όά ÷ ίέέΰ όηι ÷ ηηςίΎί ÷ ηδβόόά, ι ίόιβιό Ύ ÷ άέ άίΰάές όηι ÷ ηηςίΎί ηό όέέόηάηβόίάόιό άάέΎόδ. ς όηάάίάόέέP άγίάίς όύι έάφίφίφί όιό IPFW άόίέαέγδόάόάέ ιύιί άί άέαέΎόάόά όηι ÷ ηηςίΎίάδ άίPόάέδ ό ÷ άόέέΰ ία όι όδύδ έέαόίηάόέέΰ όηύόύέίέέά άςίέίόηάίγί έάέ ÷ ηςόέηιόέίγί όςί άόέέάόάέβάά όύι άάέΎόδύ όιόδ. ΌΎόίέί άδβδάαι άάάίςPόάύι άβίαέ όΎηά άδύ όι όέίδύ άόδPδ ός ό άφύόςόάδ όιό Άά ÷ άέηέάβιό.

Όι IPFW άόίόάέάβόάέ άδύ άόδΰ άίάηόPιαόά. Όι άάόέέύ άίΎηόςία άβίαέ ι άάάίηάάόόPδ έάφίφίφί όιό firewall όόιί όόηPία, ία άίόύιάόύιΎίς ός άόίάόύόςόά έάόάάηάόPδ. Όά όδύέίέά άίάηόPιαόά άβίαέ όι όγόόςία έάόάάηάόPδ (logging), ι έάφίφιαό divert ι ίόιβιό άίάηάίόέάβ ός έέαόιόηάβά NAT, έάέβδ έάέ ίέ όηι ÷ ηηςίΎίάδ άόίάόύόςόάδ άέάέέίγ όέίόίγ: όι όγόόςία άέάίηηόύόδ έβίςόςδ (traffic shaper) dummynet, ς άόίάόύόςόά όηιPέςόςδ ιΎόύ όιό fwd rule, ς άόίάόύόςόά άάόγνύόδ (bridge) έάέβδ έάέ ς άόίάόύόςόά άδύέηόθός (ipstealth). To IPFW όόίόςόηβάέ όύόι όι όηύόύέίέέί IPv4 ύόι έάέ όι IPv6.

### 30.6.1 Άίάñāīðīéπíóáò òī IPFW

Ôī IPFW ðāñééāīāÛīáóáé óóçī ááóéēP āāéáòÛóóáóç òīò FreeBSD ùò Ûñèñùíá òīò ðòñPíá òī ïðīβī ïðīñāβ íá òīñòùèāβ āóīáíéÛ. Ôī óýóóçíá éá òīñòPóáé āóīáíéÛ òī Ûñèñùíá ùðáí āñáé òçī éáðá÷Pñéóç firewall\_enable="YES" óòī āñ÷āβī /etc/rc.conf. Āāī ÷ñāéÛæáðáé íá ïáðáāèùòòβóáòā òī IPFW ïÝóá óòī ðòñPíá, āéòùò áí èÝéáðā íá ÷ñçóéīðīéPóáòā óéò éáéòīòñāβāð NAT ðīò ðāñÝ÷āé.

Āóīý āðáíáéééīPóáòā òī óýóóçíá óáð ïá òçī éáðá÷Pñéóç firewall\_enable="YES" óòī rc.conf, éá āāβòā ïá Ûóðñā Ýíóīíá āñÛīíáóá òī áéüēīòēī ïPíóíá éáòÛ òç äéáāééáóβá òçð āéēβíçóçð:

```
ipfw2 initialized, divert disabled, rule-based forwarding disabled, default to deny, logging disal
```

Ôī Ûñèñùíá Ý÷āé áíóùíáòùñÝíç òç āóīíáóùòçóá éáðáāñāòPò. Āéá íá áíāñāīðīéPóáòā òçī éáðáāñāòP éáé íá èÝóáðā òī āðβðāāī éáðòñÝñāéáð, òðÛñ÷īóī èÛðīéáð ñòèīβóáéð ðīò ïðīñāβóā íá èÝóáðā óòī /etc/sysctl.conf.

ðñīóèÝóííóáð óéò ðāñáéÛòù éáðá÷ññβóáéð, éá áíāñāīðīéçéāβ ç éáðáāñāòP óóéð āðùííáíáð āéééīPóáéð:

```
net.inet.ip.fw.verbose=1
net.inet.ip.fw.verbose_limit=5
```

### 30.6.2 ĀðééīāÝò òīò ðòñPíá

Āāī āβíáé òðī÷ñāòùééù íá áíāñāīðīéPóáòā òī IPFW ïáðáāèùòòβæīíóáð óéò ðāñáéÛòù āðééīāÝò óòī ðòñPíá òīò FreeBSD, āéòùò éáé áí èÝéáðā íá ÷ñçóéīðīéPóáòā NAT. Ī óéīðùò áóðPò òçð ðāñīðóβáóçð āβíáé éáéāñÛ áíçíññòéééùð.

```
options IPFIREWALL
```

Ç āðééīāP áóðP áíāñāīðīéāβ òī IPFW ùò ïÝñīò òīò ðòñPíá.

```
options IPFIREWALL_VERBOSE
```

Āíāñāīðīéāβ òçī éáðáāñāòP òùī ðáéÝòùī ðīò ðāññýíí ïÝóù òīò IPFW éáé ðāñééāīāÛīóī òç èÝíç log óòīí éáíúíá òīòð.

```
options IPFIREWALL_VERBOSE_LIMIT=5
```

ðāñéññβæé òīí ðèPèì òùī ðáéÝòùī ðīò éáðáāñÛóīíóáé ïÝóù òīò syslogd(8) óā óðāèāèñēīÝíí āñéèìù áíÛ éáðá÷Pñéóç. Ç ñýèìéóç āβíáé ÷ñPóéīç óā ā÷èñéÛ ðāñéáÛéèīíóá óóá ïðīβá āβíáé āðééòìçðP ç éáðáāñāòP. Īá áðòù òīí òññùðī ïðīñāβ íá áðīòāð÷èāβ íéá ðééáíP āðβèáóç ïá óòù÷ī òçī òðāñ÷āβééóç òùī āñ÷āβñí éáðáāñāòPò.

```
options IPFIREWALL_DEFAULT_TO_ACCEPT
```

Ç āðééīāP áóðP áóPíáé óá ðÛíóá íá ðāñíÛíá ïÝóá áðù òī firewall, òī ïðīβī āβíáé éáéP éāÝá òçī ðñPòç òīñÛ ðīò ñòèīβæáðā òī firewall óáð.

```
options IPDIVERT
```

Ç āðééīāP áóðP áíāñāīðīéāβ òç éáéòīòñāβá NAT.

**Ôçīāβòòç:** Ôī firewall éá áðīñññβðóáé üéá óá ðáéÝóá ðīò éáðáðéýíííóáé áðù éáé ðñīò òī ïç÷Ûíçíá, áí āāī ðāñééÛāáòā òçī āðééīāP IPFIREWALL\_DEFAULT\_TO\_ACCEPT P áí āāī ñòèīβóáòā Ýíá éáðÛéèçēī éáíúíá ðīò íá āðéòñÝðáé áóðÝò óéò óóíāÝóáéò.

### 30.6.3 ΆδεέιαΎò óοι /etc/rc.conf

ΆíáñáñðιεΠόοά οί firewall:

```
firewall_enable="YES"
```

Άέα ίά άδεέΎίάοά Ύία άδύ οίòò ðñιάðέεάñíΎίíò ðγðίòò firewall ðίò ððίòçñβæííóáέ άδύ οί FreeBSD, áέαάΰóοά οί άñ÷άβι /etc/rc.firewall έάέ äçíεíòñáΠόοά ίέα ááñáóΠ uðòò ðçí ðάñáέΰòù:

```
firewall_type="open"
```

Ίέ άέαέΎóείάò ðείΎò άέα áòòΠ ðç ñýείέóç άβίάέ:

- open — άðέòñΎðáέ ðç äéΎεάòóç üεçð ðçð έβίçóçð.
- client — ðñίóóάóáýáέ ίüfi οί óðáέáñέíΎíí ιç÷ΰίçιά.
- simple — ðñίóóάóáýáέ ίεüεέçñí οί áβέòòí.
- closed — άðáíáñáñðιεάβ áíóáεðò ðçí έβίçóç ðáέΎòùí, áέòüò άδύ ðçí áóùòáñέέΠ áέαðáóΠ (loopback).
- UNKNOWN — άðáíáñáñðιεάβ ðçí öüñòùóç έáíüíüí οίò firewall.
- filename — οί ðεΠñáò ñííðΰóέ οίò άñ÷άβιò ðίò ðáñέΎ÷άέ οίòò έáíüíüí ðίò firewall.

Ίðñáβòά ίά ÷ñçóέíðιεΠόοά άýí áέαöíñáòέéíýð ðñüðίòò áέα ίά öíñòΠóóά ðñίóáñííóíΎííò έáíüíüí ðóí **ipfw** firewall. Ί Ύίáò άβίάέ èΎóííóáð ðç ίáòááεçòΠ firewall\_type óóçí áðüεòç áέαáññΠ οίò άñ÷άβιò ðίò ðáñέΎ÷άέ οίòò *έáíüíüí ðίò firewall*, ÷üñβò ίά äΠóóá ññβóíáóá óóçí áñáñΠ áíóíεΠί áέα οί βáεί οί ipfw(8). Òí άñ÷άβι έáíüíüí ðίò óáβíáóáέ ðáñáέΰòù, áðíññβòðáέ üεç ðçí έóóáñ÷üíáíç έάέ áíáñ÷üíáíç έβίçóç:

```
add deny in
add deny out
```

Άδύ ðçí ΰεεç ίáñέΰ, άβίάέ áðβóçð áðíáóü ίά èΎóáòά ðç ίáòááεçòΠ firewall\_script óóçí áðüεòç áέαáññΠ áíüð áέòáέΎóείíò script ðίò ðáñέéáíáΰίáέ ίέα óáέñΰ άδύ áíóíεΎò ipfw ðίò έá áέòáέáóóíýí έáóΰ ðçí áέέβίçóç. Ίά Ύáέòñí ðΎóíεí script οί íðíβι άβίάέ áíóβóóίε÷í ίá οί άñ÷άβι έáíüíüí ðίò ááβίáíá ðáñáðΰíü, άβίάέ οί áέüεíòεí:

```
#!/bin/sh

ipfw -q flush

ipfw add deny in
ipfw add deny out
```

**Óçíáβüóç:** Άί èΎóáòά ðçí ðείΠ ðίò firewall\_type áβòά óá client áβòά óá simple, έá ðñΎðáέ ίά áéΎáíáòá üóέ ίέ ðñíáðέéáñíΎίíé έáíüíüí ðίò ðáñέΎ÷ííóáέ óóí /etc/rc.firewall óáέñέΰæííóí ίá ðέò ñòεíβóáέò ðίò óðáέáñέíΎííò ιç÷áíΠíáðíò. ðáñáòçñΠóóá áðβóçð üóέ óá ðáñáááβáíáóá ðίò ÷ñçóέíðιεΎίíóáέ óá áðòü οί έáòΰεάεί áíáíΎííóí ίά ίá Ύ÷áòá èΎóáέ ðç ίáòááεçòΠ firewall\_script óóçí ðείΠ /etc/ipfw.rules.

ΆíáñáñðιεΠόοά ðç έáóáñáóΠ:

```
firewall_logging="YES"
```

**Θνήιέάειδιδίβζος:** Οἱ ιυῖι δῆῤαία δῖο εῤίίάε ς ἰάόάάεζοῖῖ firewall\_logging ἄβίάε ἰά εῤόάε ὄς ὀείῖ ὄζ ἰάόάάεζοῖῖ sysctl net.inet.ip.fw.verbose ὄς ὀείῖ 1 (ἄβδῶ ὀῖ Ὀῖῖῖ 30.6.1). Ἄά ὀδῤῖ-ἄε ἰάόάάεζοῖῖ ὀῖ rc.conf δῖο ἰά ἰῖβḗḗḗ δḗḗḗḗḗḗḗ ὄς ἔḗḗḗḗḗḗḗ, ἄεῤῤ ἄδου ἰδῖḗḗ ἰά ḗḗḗḗḗḗḗ ἰῤῖ ὄζ δḗḗḗḗḗḗ ἰάόάάεζοῖῖ sysctl ἄβδḗ -ḗḗḗḗḗḗḗ, ἄβδḗ ἰῤῖ ἄḗ-ḗḗḗ /etc/sysctl.conf:

```
net.inet.ip.fw.verbose_limit=5
```

Άῖ ὀῖ ἰζ-ῤῖῖῖ ὄḗ ἔḗḗḗḗḗḗḗ ἠὸ δῖῖḗ (gateway), ἄζḗḗḗ δḗḗῤ-ἄε ὀδḗḗḗḗḗ ἰḗḗḗḗḗḗ ἄḗḗḗḗḗḗḗ ἄḗḗḗḗḗḗ (Network Address Translation, NAT) ἰῤῖ ὀῖ natd(8), δḗḗḗḗḗḗḗ ἰά ἄḗḗḗḗḗḗḗ ὀῖ Ὀῖῖῖ 31.8 ἄḗ δḗḗḗḗḗḗḗ ὄ-ḗḗḗḗḗ ἰ ὀḗḗ ḗḗḗḗḗḗḗ δῖο ἄδḗḗḗḗḗḗ ὄῖ ἄḗ-ḗḗḗ /etc/rc.conf.

### 30.6.4 ς Ἀῖῖῖῖ IPFW

ς ἄῖῖῖῖ ipfw ἄβίάε ἰ ὀῖḗḗḗ ὀḗḗḗ ἄḗ ὄς ḗḗḗḗḗḗ ς ἄḗḗḗḗḗḗ ἔḗḗḗḗ ὄῖḗḗ ἄḗḗḗḗḗḗḗ ἄῖḗḗḗḗḗ ἔḗḗḗḗ ὀῖḗḗḗḗḗ, ἔḗḗḗ ἄδου ἄḗḗḗḗḗḗ. Ὀῖ ḗḗḗḗḗḗ ἰ ὄζ -ḗḗḗ ἄḗḗḗ ὄζ ἰḗḗḗḗ ἄβίάε ἠḗ ἰḗ ἄḗḗḗḗḗ -ῤῖḗḗḗ ἰ ὀῖ ὀḗḗḗḗḗḗḗ ἔḗḗḗḗḗḗḗ ὀῖ ἰζ-ἄῖḗḗḗḗ. ἰḗḗḗḗḗ ἰ ἄḗḗḗḗḗ ἠḗḗḗ ὀῖḗḗ ἔḗḗḗḗḗ ὄḗ ὄḗ ῤῖ ἄḗ-ḗḗḗ ἔḗ ἰ ḗḗḗḗḗḗḗḗ ἄḗ ἰ ὀῖḗ ḗḗḗḗḗḗ ὄς ἄḗḗḗḗḗ. ἰḗḗḗḗḗ ἰ -ḗḗḗḗḗḗḗḗ ὀῖ ḗḗḗ ἄḗ-ḗḗḗ ἄḗ ἰ ἄῖḗḗḗḗḗḗḗ ὀῖḗḗ ὀḗῤῖ-ḗḗḗḗ ἔḗḗḗḗ ὀῖḗḗḗḗḗḗḗ, ὄς ḗḗḗ ḗḗḗ ἄḗḗḗḗḗḗ. Ἄḗḗḗ ἄβίάε ἔḗ ἰ ὀῖḗḗḗḗḗḗ ὀḗḗḗḗḗ ὀῖ -ḗḗḗḗḗḗḗḗ ὄḗ ḗḗḗḗḗḗḗḗ ἰḗḗ.

ς ἄῖῖῖῖ ipfw ἄβίάε ἄḗḗḗḗ -ḗḗḗḗḗ ἄḗ ἰ ἄḗḗḗḗḗḗ ὀῖḗḗ ὀḗῤῖ ἔḗḗḗḗḗ ὄζ ἔῖḗḗḗ ὄḗ. Ὀῖ ὄῖḗḗḗ ἔḗḗḗḗḗḗḗ -ḗḗḗḗḗ ὄζ IPFW ἄḗḗḗḗḗḗḗ ἄḗḗḗḗḗ ῤῖ ἰḗḗḗḗ ἄḗ ἔῤḗ ἔḗḗḗḗ, ἰ ἰḗḗḗḗ ἰḗḗḗḗḗ ḗḗḗ ḗḗḗḗḗ ὄḗḗḗḗḗ ἰ ἄḗḗḗ. ἔḗḗḗ ὄζ ἄḗḗḗḗḗ ὀῖ ἄḗḗḗḗ, ς ἄῖḗḗḗḗḗ ἰ ἄḗḗḗḗḗ ὄς ὀῖḗ ὀῖḗ ἰḗḗḗḗḗ ἄβίάε ῤῖḗḗ ὀḗḗḗḗḗ ἄḗ ἰ ἔḗḗḗḗḗ ἔḗḗḗḗḗḗ ἔḗḗḗḗḗ.

Ἄḗ ἰ ἄḗḗḗḗ ἠḗḗḗ ὀῖḗḗ ἔḗḗḗḗ ἰ ὄζ ὄḗḗḗ:

```
# ipfw list
```

Ἄḗ ἰ ἄḗḗḗḗ ἰḗ ἔḗḗḗ ἠḗḗ ὀῖ ἔḗḗḗḗ, ἰḗḗ ἰ ὄς ḗḗḗ ḗḗ ἄḗḗḗḗḗḗḗ ὄḗḗḗḗḗ ḗḗḗ ἰ ἔῤḗ ἔḗḗḗḗḗ, ἄḗḗḗḗ:

```
# ipfw -t list
```

Ὀῖ ἄḗḗḗḗḗ ḗḗḗḗḗḗ ἄḗḗ-ἰḗḗ ὀῖḗ ἄḗḗḗḗ ὀῖ ḗḗḗḗḗḗ ἰḗḗ ἰ ὀῖ ὄḗḗḗḗḗḗ-ἰ ἔḗḗḗḗ. ς ḗḗḗḗ ὄḗḗḗ ἄḗḗ-ἰḗḗ ὀῖḗ ἄḗḗḗḗ ὀῖḗ ἔḗḗḗḗ, ἄḗḗḗḗḗḗḗ ἄḗḗ ὀῖḗ ἄḗḗḗḗ ḗḗḗḗḗḗḗ (ḗḗḗḗ ὄḗ ἄḗḗḗ-ḗḗḗḗ ἔḗ ἰḗḗ ὄḗ ἄḗḗḗḗḗḗḗ) ἔḗ ὄῤῖḗḗ ἄḗḗ ὀῖḗ ḗḗḗ ὀῖḗ ἔḗḗḗḗ.

```
# ipfw -a list
```

Ἄḗ ἰ ἄḗḗḗḗ ἰḗ ἔḗḗḗ ḗḗ ἰ ḗḗḗḗḗḗḗḗ ὀῖḗ ὀῖḗḗ ἄḗḗḗḗḗḗ ḗḗḗ ἔḗ ὀῖḗḗ ὄḗḗḗḗḗḗ ἔḗḗḗḗḗ:

```
# ipfw -d list
```

Ἄḗ ἰ ἄḗḗḗḗ ἔḗ ὀῖḗḗ ἄḗḗḗḗḗḗḗ ἔḗḗḗḗḗ ḗḗ ῤῖ-ḗḗḗ ἔḗḗḗ:

```
# ipfw -d -e list
```

Ἄḗ ἰ ἰζḗḗḗḗḗḗ ὀῖḗḗ ἰḗḗḗḗḗḗ:

# ipfw zero

Άέα ίά ιçääíβóää ðìòò ìáòñçóÝò ìüíí áέα ðíí έάíüíá ìá ðíí άñέèìü NUM:

# ipfw zero NUM

### 30.6.5 Õì Óýñíει Έάíüíüí ðìò IPFW

Ùò “óýñíει έάíüíüí” ðòí IPFW, ìñβαειòìá ìέα ìÜää έάíüíüí ðìò Ý÷ìòí άñάòáβ άέα ίά άðέòñÝðìòí Þ ίά άðìññβððìòí ðάέÝóá áíÜειάά ìá ðέò ðειÝò ðìò ðάñέÝ÷ìíóáέ óá áòòÜ. Ç äέðèÞð έάòáγέòìóçò áíóáέέääÞ ðάέÝòüí ìáòáíγ òðτειάέóòÞí áðìòáέáβ ìέα óóíáññá. Õì óýñíει έάíüíüí ðìò firewall άðáíáñáÜæáóáέ ðüóí óá ðάέÝóá ðìò Ýñ÷ìíóáέ áðü ðì Internet, üóí έάέ óá ðάέÝóá ðìò ðáñÜáñíóáέ áðü ðì óýóçíá ìò áðÜíóçòç óá áòòÜ. ÈÜèá òðçñáóóá TCP/IP (ð.÷. telnet, www, mail, è.è.ð.) έάειñβæáóáέ áðü ðì ðñùòüειτεει έάέ òçí ðñíñíέáèÞ (privileged) έýñá ðìò ÷ñçóειìðìέáβ άέα ίά äÝ÷áóáέ áέóÞíáóá áìòðçñÝóçòçò. Óá ðάέÝóá ðìò ðñíññβαειíóáέ άέα ìέα óóáέáèñειÝíç òðçñáóóá, ìáέέíýí áðü òç áέáγέòìóç áóáòçñβáò ÷ñçóειìðìέáβ ìέα ìç-ðñíñíέáèÞ έýñá έάέ έáóáèÞáìòí óòç óóáέáèñειÝíç έýñá òðçñáóóáò óòíí ðñíñέóìü. ¼εáò ìέ ðáñáðÜíü ðáñÜáòñíε (έýñáò έάέ áέáòέγíóáέò) ìðìñíý ίά ÷ñçóειìðìέççèíýí ìò èñέòÞñέα áðέειäÞð άέα òçí áçìειòññáβ έάíüíüí ðìò áðέòñÝðìòí Þ áìðìáβαειòí òçí ðñüóááóç óá òðçñáóóáò.

¼óáí Ýíá ðάέÝòí áέóÝñ÷áóáέ óòí firewall, óóáèññáíóáέ ìá áÜóç ðíí ðñÞòí έάíüíá. Ç óýáèñέóç óóíá÷βæáóáέ áέááí÷έèÜ ìá ðìòò òðüειéðìòò έάíüíáò, áðü ðíí ðñÞòí ðñìò ðíí ðáέáòòáβì, ìá áÜóç ðíí áýñíóá άñέèìü ðìòò. ¼óáí ðì ðάέÝòí ðáέñέÜíáέ ìá ðέò ðáñáíÝòñìòò áðέειäÞð èÜðìέìò έάíüíá, áέòáέáβóáέ ç ìáçáβá ðìò áíáóÝñáòáέ óòí ðááβì áíáñááèÞí ðìò έάíüíá áòòíý έάέ ç áíáæÞòçòç έάíüíüí άέα ðì óóáέáèñειÝíç ðάέÝòí ðáñíáòβæáóáέ. Óá áòòÞ òç ìÝειáí áíáæÞòçòçò, “ì ðñÞòìò έάíüíáò ðìò ðáέñέÜæáέ, áβíáέ ì ìέέçòÞð”. Áí ðì ðάέÝòí ááí ðáέñέÜæáέ ìá έάíÝíá áðü ðìòò έάíüíáò, έá èçòèáβ áðü ðíí òðì÷ñáòέèü ðñíáðέέáíÝí έάíüíá ðìò IPFW, ìá άñέèìü 65535, ì ðìβìò áìðìáβæáέ òç áέÝέáòçò üèüí ðüí ðάέÝòüí, έάέ óá áðìññβððáέ ÷ññβò ìá óóáβèáέ έáìέÜ áðÜíóçòç òòíí áñ÷έèü áðìóòìεÝá ðìòò.

**Óçìáßóç:** Ç áíáæÞòçòç óóíá÷βæáóáέ ìáòÜ áðü έάíüíáò ðýðìò count, skipto έάέ tee.

Ìέ ìáçáβáò ðìò óáβñííóáέ ááÞ, ááóβαειíóáέ óòç ÷ñÞòç έάíüíüí ðìò ðáñέÝ÷ìíóáέ ðέò ìáçáβáò keep state, limit, in, out έάέ via. ÁòòÝð áβíáέ έάέ ìέ ááóέéÝð έάέòìòññáβáò άέα òçí áüíçòç áíüò firewall ðýðìò inclusive ìá stateful έáέòìòññáβá.

**ðñíáέáìðìßçòç:** Íá áβíáòá ìááÜèç ðñìòí÷Þ üóáí áìòέáγáòá ìá ðìòò έάíüíáò áíüò firewall. Ìðìñáβ Üèáέá óáò ìá èéáέáèñέáβðá Ýíü áðü ðì óýóçíá óáò.

#### 30.6.5.1 Óýíóáíç Έάíüíüí

Óòçí áíüòçòá áòòÞ, έá ðáñìòóέÜóìòìá ìέα áðειðìέçíÝíç óýíóáíç έάíüíüí. Ááβ÷ñìòìá ìüíí üòέ ÷ñáέÜæáóáέ άέα ίá áçìειòññáçèáβ Ýíá òððìðìέçíÝíç óýñíει έάíüíüí άέα Ýíá inclusive firewall. Άέα ðèÞñç ðáñέáñáòÞ, ááβðá òç óáέβáá manual ðìò ipfw(8).

Ìέ έάíüíáò ðáñέÝ÷ìíóáέ èÝáέáèÜ. Ìέ èÝíáέò áòòÝð έá ðñÝðáέ ìá èüáέέìðìέççèíýí ìá óóáέáèñειÝíç óáέñÜ áðü óá άñέóóáñÜ ðñìò óá ááíέÜ òçð áñáñìÞð. Ìέ èÝíáέò-èéáέáèÜ óáβñííóáέ ðáñáέÜòü ìá Ýíóííá áñÜñáóá. ÌáñέéÝð èÝíáέò Ý÷ìíóáέ ððì-áðέειäÝð ìέ ðìβáò ìðìñáβ ìá áβíáέ áðβóçò èÝíáέò-èéáέáèÜ έάέ ìá ðáñέéáìáÜñìòí áðβóçòç áέüíá ðáñέóóüòáñáò òðì-áðέειäÝð.

Ç **án** ÷ **P** áñùð ó ÷ ðεβιð, óçìáðñíðáðáðάέ ìá òì óγñìáññì #, òì ðñìβì ðñññáβ ðá àñòáñβáεάðάέ òòì ðÝεìð ðεάð ãñáñìðð εάññíá, **P** εάέ òá ðεά áέέð ðìð ãñáñìð. ðε εάñÝð ãñáñìÝð ááñññýðáέ.

*CMD RULE\_NUMBER ACTION LOGGING SELECTION STATEFUL*

### 30.6.5.1.1 CMD

Άέά ðá ãβñáέ ç ðññìðεβç áñùð ðÝìð εάññíá òòìí áòùðáññέù ðβñáέá, ðìðñεάðáðáðάέ ðññìóðÛ áðù áðòùí ç ðáñÛìáðññìð *add*.

### 30.6.5.1.2 RULE\_NUMBER

ËÛεá εάññíáð ðñÝðáέ ðá áέάέÝðάέ Ýñá áñέεìù ðñò ðá òìí ÷ ãñáέðççñβáέέ.

### 30.6.5.1.3 ACTION

ðáð εάññíáð ðñññáβ ðá ó ÷ áðβáεάðάέ ðá ðεά **P** ðáñέóóùðáññáð áñÝñááέáð, ðε ðñìβáð áεðáεñýðáέ ùðáñ òì ðáέÝðì òáέññέÛáέέ ðá òá εñέððñέá áðέέññáðð áðòñý òìð εάññíá.

*allow | accept | pass | permit*

¼εά òá ðáñáðÛñù Ý ÷ ðìð òì βáέñ áðñðÝεάðá: òì ðáέÝðì áñÝñ ÷ áðάέ áðù òçñ óγóðçñá òìð firewall. Ç áñáεððççç áέá òì òðáεáññέñÝñ ðáέÝðì ðáññíáðβáεάðάέ òá áðòù òìí εάññíá.

*check-state*

ΆεÝá ÷ áέ òì ðáέÝðì ðá áÛóç òì áðñáñέέù ðβñáέá εάññíá. Áñ áñáεáβ εάññíáð ðñò ðá òáέññέÛáέέ, εá áεðáεáðáðáβ ç áñÝñááέá òìð εάññíá ð ðñìβìð áçñέýññáççá òìí òðáεáññέñÝñ áðñáñέέù εάññíá. ΆέáðññáðéέÛ, ç áñáεððççç òðñá ÷ βáεάðάέ ðá òìí áðññáññì εάññíá. ðáð εάññíáð check-state ááñ Ý ÷ áέ εñέððñέá áðέέññáðð. Áñ ááñ ððÛñ ÷ áέ εάññíáð check-state òòì óγññεñ εάññíá, ð Ýέáá ÷ ðð òìð ðβñáέá áðñáñέέññì εάññíá ðáέέññέÛáέ áðù òìí ðñðòì εάññíá óγðñò keep-state **P** limit.

*deny | drop*

Ëáέ ðε áγñ εÝñáέð òçñáβññì òì βáέñ ðñÛáñá: òá ðáέÝðá ðñò òáέññέÛáέññì ðá áðòù òìí εάññíá áðñññβðññìðáέ. Ç áñáεððççç ðáññíáðβáεάðάέ.

### 30.6.5.1.4 Έάðáññáðð

*log P logamount*

¼ðáñ Ýñá ðáέÝðì òáέññέÛáέέ ðá Ýñá εάññíá ðñò ðáñέÝ ÷ áέ òç εÝñç log, áβñáðάέ εάðáññáðð òìð ðçñýñáðñð ðÝòù òìð syslogd(8) òðç áðñáðññòççá SECURITY. Ç εάðáññáðð òðñááβñáέ ðñññ áñ ð áñέεìùð òùñ ðáέÝðùñ ðñò Ý ÷ áέ εάðáññáðáβ ðÝ ÷ ðñε òðéáñðð ááñ ððáñááβñáέ òçñ ðáñÛìáðññì logamount. Áñ ç ðáñÛìáðññìð áððð ááñ Ý ÷ áέ εáέññέóðáβ, òì ùñέñ ððéñβáεάðάέ ðá áÛóç òçñ òéñð òçð ðáðááεççðð sysctl net.inet.ip.fw.verbose\_limit. Ëáέ òðéð áγñ ðáñέððððáέð, ðεá ðçáñéέð òéñð òçñáβñáέ ùðé ááñ εá ððÛñ ÷ áέ ùñέñ òççñ εάðáññáðð. ðñέéð ç εάðáññáðð òðÛáέέ òòì ùñέñ, ðñññáβ ðá ãβñáέ áðáñáññáñññññççç òçð ðá òì ðçááñέóñù òìð ðáðñçðð εάðáññáððð, **P** òìð ðáðñçðð áέá òì òðáεáññέñÝññì εάññíá. Άáβðá òçñ áñðñέð ipfw reset log.

**Óçñáβùðç:** Ç εάðáññáðð áβñáðάέ ðñññ áðñý áðáεçεáðéñýñ ùεáð ðε Ûεέáð òðñέðñáð òáέññέÛáέññìð òìð ðáέÝðìð, εáέ ðñέñ òçñ òáέέέðð áðñáñ ÷ **P** áðñññέççç òìð. Άβñáέ òðçç áέέðð òáð áð ÷ Ýñáέá ðá áðññáðððáðáðá òá ðñέñðð εάññíáð εá áñáñáññññññññççç òçñ εάðáññáðð.



### 30.6.5.2 ΆδéeĩãP αέα Stateful Έαίúĩãð

Ïĩ stateful ðéeòñÛneeóĩã, áíðeĩãðùðBεαéε ðçĩ εβĩçóç ðĩò áεέòγĩò ùð áεðεðð éãðáγeðĩóçð áíðáéεããP ðáε Ýðũĩ ðá íðĩβã áçĩeĩòñĩãĩĩ íεã ðĩĩãñãβã. ∴ áε áðBóçð ðç äĩáãðũðçðã íã áεãñãðĩPðãé áĩ ðçñĩγĩðãé íε Ýãeðñĩε éãúĩãð áíðáéεããPð ìçĩòĩÛðũĩ ìãðãĩý ðĩò áðĩòĩeĩÝã éãé ðĩò ðãñãePððç. Ìðĩεããðĩòã ðáεÝðã äãĩ ðáeñeÛãeĩòĩ ìã ðĩ ðñũðððĩ áðððð ðçð áðéeĩeĩũĩβãð, áðĩññβððĩòĩðãé ùð ðãγòéeéã.

Ç áðéeĩãP check-state ∴ñçóeĩñðĩeãBðãéé áεã íã áĩããũñeóðãβ ðã ðĩeĩ ðçĩãβĩ ðĩò óòĩũeĩò éãúĩũĩ ðĩò IPFW éã áeãã∴éãβ ðĩ ðáεÝðĩ ìã àÛóç ðç äĩáãðũðçðã ðũĩ äĩòĩáeēĩP éãúĩũĩ. Õã ðãñβððòóç ðáeñeÛãeĩòĩðã, ðĩ ðáεÝðĩ äĩÝñ∴ãðãé áðũ ðĩ firewall éãé óðĩã∴Bεãé ðçĩ ðñãñãβã ðĩò, áĩP ðçĩ βãεã óðeãĩP áçĩeĩòñããBðãé Ýĩãð íÝĩò äĩòĩáeēũð éãúĩũãð áεã ðĩ äðũĩãñ ðáεÝðĩ ðĩò áĩãĩÝĩãðãé íã Ýñðãé ìã àÛóç ðç óðãeãeñeĩÝĩç áεðεðð éãðáγeðĩóçð áðéeĩeĩũĩβã. Õã ðãñβððòóç ðĩò ðĩ ðáεÝðĩ äãĩ ðáeñeÛãeĩ ìã ðĩ äĩòĩáeēũ éãúĩũã, éã ðñĩ∴ùñPðãé áεã íã áeãã∴éãβ áðũ ðĩ äðũĩãñ éãúĩũã ðĩò firewall.

Ç äĩáãðũðçðã äĩòĩáeēĩP éãúĩũĩ áβĩãé áðÛeũðç ðã áĩÛĩðeççç ðũñũĩ ðã ðãñβððòóç áðβeãóçð ððãñ∴áβeéóçð (flood) SYN. Ç áðβeãóç áððP ðĩñĩãβ íã áçĩeĩòñãPðãé ðĩeγ ìããÛeĩ ðePεĩð äĩòĩáeēĩP éãúĩũĩ. Áεã ðçĩ áíðeĩãððeóç íεãð ðÝòĩeãð áðβeãóçð, ðĩ FreeBSD ∴ñçóeĩñðĩeãB íεã áeũĩã áðéeĩãP ðĩò ìñĩÛããðãé limit. Ç áðéeĩãP áððP ðĩñĩãβ íã ðãñeñĩBðãé ðĩí ãñeēũ ðũĩ ðãððũ∴ñĩũĩ óðĩããeñeĩ, áĩãðÛãeĩòãð ðã ðãããã áðãðçñβãð éãé ðñĩñeóĩγ ðũĩ éãúĩũĩ. Áíe∴ĩãγãé ìã áððũ ðĩí ðñũðĩ ðĩ ðePεĩð ðũĩ äĩòĩáeēĩP éãúĩũĩ éãé ðũòãð ðñÝð Ý∴ãé ∴ñçóeĩñðĩeççãβ ì éãéÝĩãð áðũ ðç óðãeãeñeĩÝĩç IP áeãγeðĩóç. Áĩ ì ãñeēũð áððũð ìãðãñĩÛãé ðĩ ùñeĩ ðĩò Ý∴ãé ðãeãβ ìã ðçĩ áðéeĩãP limit, ðĩ ðáεÝðĩ äĩñññβððãðãé.

### 30.6.5.3 ΈãðããñãðP ìçĩòĩÛðũĩ ðĩò Firewall

Õã ðeãĩĩãéðPĩãðã ðçð éãðãããñãðð ðòĩãÛĩòũĩ ðĩò firewall, áβĩãé ðñĩòãĩP: ðãñÝ∴ĩòĩ ðç äĩáãðũðçðã íã äãβðã áεã ðĩeĩ eũãĩ áĩããñãðĩePçεeãĩ ìε éãúĩũãð óðĩòð ìðĩβĩòð Ý∴ãðã áĩããñãðĩePðãé ðçĩ éãðããñãðP. Ìε ðeçñĩòññβãð ðãñeēãĩãÛĩòĩ ðã ðáεÝðã ðĩò äðĩññβðeççeãĩ, ðeð áeãðeγĩóãeð áðũ ðeð ìðĩβãð ðñĩPεeãĩ éãé ðĩò éãðãðeγĩñĩóãĩ. Ìã áððũ ðĩí ðñũðĩ, Ý∴ãðã Ýĩã ðçĩáíðeēũ ðeãĩĩÝeðçĩã ðççĩ áĩβ∴ĩãðóç ðũĩ áeóãĩeÝĩũ.

Áeũĩã éãé áĩ áĩããñãðĩePðãðã ðç eãeðĩòñãβã éãðãããñãðð, ðĩ IPFW äãĩ éã áñ∴βóãé áðũ ìũĩ ðĩò ðçĩ éãðããñãðP áεã éãĩÝĩã éãúĩũã. Ì áεã∴ãeñeóððð ðĩò firewall éã áðĩòãóβðãé ðã ðĩeĩòð áðũ ùeĩòð ðĩòð éãúĩũãð éã áĩããñãðĩePðãé ðçĩ éãðããñãðP, éãé éã ðñĩòeÝðãé ðçĩ eÝĩç ìðç ðçĩ áíðBððĩe∴ç éãðã∴ñeéóç. ÕðeóeĩãeēÛ, áβĩãðãé éãðããñãðP ìũĩí áεã éãúĩũãð ðĩò äðĩññβððĩòĩ ðáεÝðã (éãúĩũãð deny), ùðð ðãã ðãñÛããeãĩã ì éãúĩũãð áðũññeøçð ðũĩ áeóãñ∴ùãĩũĩ ICMP pings. Áβĩãé eĩeĩP ðñãeðeéP, íã áíðeãñÛðãðãé ðòĩ ðÝeĩð ðũĩ éãúĩũĩ ì éãúĩũãð “ipfw default deny everything” éãé íã ðñĩòðβeãðãé ðã áððũĩ ç áðéeĩãP ìðç. Ìã ðĩí ðñũðĩ áððũ, ìðĩñãβðã íã äãβðã ùeã ðã ðáεÝðã ðĩò äãĩ ðãβñeãĩãĩ ìã éãĩÝĩã éãúĩũã ðĩò óòĩũeĩò.

Ç éãðããñãðP ðòĩãÛĩòũĩ áβĩãé áβeĩðĩ ìã∴áβñe. Áĩ äãĩ áβóðã ðñĩòãeðeēũð, éã ∴ãeãβðã ìÝðã ðòĩ ðePεĩð ðũĩ äããñÝĩũĩ ðçð éãðããñãððð éãé éã äãĩβóãðã ðĩ áβóeĩ óãð ìã Û∴ñçðã áñ∴ãβã. Ìε ðeĩ ðáεeÝð éãé eĩeĩÝð áðeēÝðãeð óγðĩò Ûñĩçççð ððçñãóβãð (DoS), áβĩãé áððÝð ðĩò ðñĩòðãeĩγĩ íã äãĩβóĩòĩ ðĩòð áβóeĩòð óãð. Õã ìçĩγĩãðã áððÛ ù∴é ìũĩ éãðããñÛðĩòĩãé ðòĩ **syslogd**, áeēÛ äĩòãĩβãeĩðãé éãé ðççĩ eĩĩóueã ðĩò óðððPĩãðĩò óãð, éãé óγĩðñã áβñĩðãé ðĩeγ áñĩ∴eççóeēÛ.

Ç áðéeĩãP IPFIREWALL\_VERBOSE\_LIMIT=5 óòĩí ððñPĩã, ðãñeñĩβãéé ðĩí ãñeēũ ðũĩ óðĩã∴ùãĩũĩ ùĩeēũ ìçĩòĩÛðũĩ ðĩò óðÝeñĩðãé óòĩí éãðãããñãðÝã óðððPĩãðĩò syslogd(8) ó∴ãðeēÛ ìã ðĩ ðãβñeãóĩã ðáεÝðũĩ áĩũð óðãeãeñeĩÝĩò éãúĩũã. !ðãĩ áĩããñãðĩeãβðãé áððP ç áðéeĩãP óòĩí ððñPĩã, ì ãñeēũð ðũĩ óðĩã∴ùãĩũĩ ìçĩòĩÛðũĩ áĩũð óðãeãeñeĩÝĩò éãúĩũã, óðãĩãðÛãé ìãðÛ ðĩí ãñeēũ ðĩò éãeĩñβããðãé. Äãĩ ððÛñ∴ãé éãĩÝĩã ùðãeĩò áðũ 200 óðĩã∴ùãĩã ìçĩγĩãðã ìã ðĩ βãeĩ áeñeããðð ðãñeãã∴ùãĩñ. Áεã ðãñÛããeãĩã, ðÝĩóã ðòĩã∴ùãĩã ìçĩγĩãðã áεã Ýĩã óðãeãeñeĩÝĩñ éãúĩũã éã éãðããñÛðĩòãĩ éãĩñeēÛ ðòĩ **syslogd**. Õã ððũeĩeðã ùĩĩeã ìçĩγĩãðã éã éãðããñãðĩòĩ eãé éã éãðããñãðĩòĩ ùððð ðãβĩãðãé ðãñãeÛðũ:

```
last message repeated 45 times
```

¼εά όά ιγίγιάόά έάόάαηάόòò òυί ðάέÝòυί, αηὐοιίόάέ άδυ ðηιάðέειπ όοι άη÷άβι /var/log/security όι ιðιβι έάειηβέάόάέ όοι άη÷άβι /etc/syslog.conf.

### 30.6.5.4 Άçιέιòñάβά Άíυò Script Έάíυíυί

Íε ðáηέόóυόáηιέ Υίðáειηιέ ÷ηΠóόáò ðιò IPFW, αçιέιòñáγί Υίά άη÷άβι ðιò ðáηέÝ÷άέ όιòò έάíυíáð έάέ όι αηὐοιίόά έά όÝοιέι ðηυðι þóðά ίά ίά ιðηñáβ ίά áεòáεάόóáβ υò script. Όι ááóέέυ ðεáηíÝέòçιά όιò ðáηáðὐíυ ðηυðιò, áβιáέ υíέé ίέ έάíυíáð ðιò firewall ιðηιγί ίά áíáíáυèγί ÷υñβò óçι áíὐáεç ίά áðáíáéέειΠóáέ όι óýóóçιά áέά ίά όηηòυèγί ίέ ίÝίέ. Ç ιÝèíáò áóòΠ áβιáέ ðηéý áηέέéΠ áέά óçι áηέéιΠ ίÝύι έάíυíυί, έάéþð ç áέάáéέάóá ίðηñáβ ίά áðáíáéççéáβ υóáð όηñÝò ÷ñáéὐæáóáέ. Έάéþð ðηυèáέóáέ áέά έάíυíέέυ script, ιðηñáβóá ίά ÷ηçóéιιðιέΠóááò óοιáηέέéΠ ððιέáðὐóóáóç áέά ίά έυáέéιðιέΠóááò έάέ ίά ððιέáóáóóΠóááò óð÷íὐ ÷ηçóéιιðιέγίáíáð óéιÝð óá ðηέéáðèγíð έάíυíáð. Άóòυ όáβιáóáέ óοι ðáηáéὐòυ ðáηὐáéáηá.

Ç óýíóáίç ðιò ÷ηçóéιιðιέáβóáέ ááþ, áβιáέ óοιááòΠ ίá óá έáéýöç sh(1), csh(1) έάé tsh(1). Ìðηιόóὐ άδυ óá ðááβá óçò óοιáηέέéΠ ððιέáðὐóóáóç, ððὐñ÷άέ όι óΠιá όιò áηéáηβιò, \$. Όι óýíáηιέ áóòυ ááí ððὐñ÷άέ ιðηιόóὐ άδυ óá óοιáηέέéὐ ðááβá. Ç ðéιΠ ðιò έá áðιáηéáβ όοι óοιáηέέéυ ðááβι, ðñÝðáέ ίá áóυèéáβáóáέ óá áέðèὐ áέóááυáέéὐ.

ÍáέéιΠóóá όι άη÷άβι ðυί έάíυíυί óáð υðυò όáβιáóáέ ðáηáéὐòυ:

```
##### 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 #####
```

Άóòυ áβιáέ υèι. Όòι ðáηὐáéáηá áóòυ ááí áβιáέ óçιáíðééιβ ίέ έάíυíáð, áéèὐ ι ðηυðιò ίá όηι ιðιβι έάέóιòñáγί έάέ ðáβηñιόι óéιÝð óá ðááβá óοιáηέέéΠ ððιέáðὐóóáóç.

Άί όι ðáηáðὐíυ ðáηὐáéáηá þóáí όοι άη÷άβι /etc/ipfw.rules έá ιðηιγίόáóá ίá όηηòþóááò áóòγíð όιòò έάíυíáð, αηὐοιίόáð óçι ðáηáéὐòυ áíóηéΠ:

```
# sh /etc/ipfw.rules
```

Όι άη÷άβι /etc/ipfw.rules ιðηñáβ ίá áηβóéáóáέ óá υðιέι έáðὐéιáι èÝéáóá, έάέ ίá ηñὐæáóáέ áðβóçò υðυò èÝéáóá.

Έá ιðηιγίόáóá ίá áðέóý÷áð όι βáéι ðñὐáηá, áéòáéþιόáð óéð ðáηáéὐòυ áíóηéÝð ÷áéηιέβιçóá:

```
# 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
```

### 30.6.5.5 Ούυίηι Έάίυιύι Stateful

Όι δάνάεΰδου όύίηι έάίυιύι (δίο άάι δάνεΎ÷άε έάίυιύαδ άέα NAT) άβιάε Ύία δάνΰάάεάια άνάοδδ άύδ inclusive firewall. ίά inclusive firewall άδεόνΎδάε όγι άβόιαί ύιύι όύι δάεΎδύι δίο όάεήεΰάειόι ίά όιόδ έάίυιύαδ άδύι÷δδ (pass) έάε άδύιύδδάε άδύ δνιάδεειαδ ύέα όά ΰεέα. Όά firewalls δίο Ύ÷ίόι ό÷άάεάόδδ ίά δνιόόάόύιόι ύεύεεήά άβέδδά, άέαεΎόιόι όι έεάυόάνι άύι έέαδάόΎδ, όδέδ ύδύβδδ δνΎδάε ίά όδΰñ÷ίόι έάίυιύαδ δρόά όι firewall ίά έάέόιόñάβ.

¼έα όά έάέόιόñάεΰδ όδδδδδίαόά όύδίο UNIX, όδιδάήεεάιαάήν Ύίύ έάε όιό FreeBSD, Ύ÷ίόι ό÷άάεάόδδ ίά ÷ñόέιύδύείύί όç έέαδάόδ 100 έάε όç έάέύέδύόç IP 127.0.0.1 έέα άούδάνεέδ άδεέιέύιύβ ίά όι έάέόιόñάεέυ όύόόçιά. Όι firewall δνΎδάε ίά δάνεΎ÷άε έάίυιύαδ δίο ίά άδεόνΎδύιόι όçι άδνύόέιδδç έβύçόç άδδδδ όύι έάέέβί, έέα άούδάνεέδ ÷ñδç, δάεΎδύι.

Ίε έάίυιύαδ δίο ύνβέιόι όçι δνύόάόç έέόάñ÷ύιάύι έάε άίάñ÷ύιάύι δάεΎδύι, άñΰιόάε έέα όç έέαδάόδ δίο όόιαΎάάε όόι άçύιόέι Internet. Ç έέαδάόδ άδδδδ ύδύñάβ ίά άβιάε έέα δάνΰάάεάια ç tun0 (όά δάνβδδδύç δίο ÷ñόέιύδύεάβδά όι PPP ÷ñδç), δ ç έΰñδά έέέόύιό δίο όόιαΎάάε όόι έάέυάέάέυ δ DSL modem όάδ.

Όά δάνβδδδύç δίο ίέα δ δάνεόόυδάνάδ έΰñδάδ έέέόύιό όόιαΎιόάε όά άούδάνεέδ έάέυδέέδ άβέδδά δβδ άδύ όι firewall, έά δνΎδάε ίά όδΰñ÷ίόι ίε άίόβόδιε÷έ έάίυιύαδ δίο ίά άδεόνΎδύιόι όçι έάέύεάñç έέαέβύçόç όύι δάεΎδύι άΎιύιόά όδέδ έέαδάόΎδ άδδΎδ δ/έάε όόι Internet.

Ίε έάίυιύαδ δνΎδάε ίά ύνάιρύιόάε όά δñάέδ έύñέδ άύδδδδδ: άñ÷έέδ ύεάδ ίε έέαδάόΎδ όδέδ ύδύβδδ άδεόνΎδάάε ç έάέύεάñç έέαέβύçόç άάñΎύι, Ύδάέδά ç έέαδάόδ άδύ όçι ύδύβδδ άίΎñ÷ύιόάε όά δάεΎδά δνιό όι άçύιόέι άβέδδδ (Internet) έάε όΎειό ç έέαδάόδ άδύ όçι ύδύβδδ έάΎιύιόάε δάεΎδά άδύ όι Internet.

Όά έΰεά ίέα άδύ δέδ άύδδδδδ όύι έέαδάόδδ δίο όόιαΎιόάε όόι Internet, δνΎδάε ίά όιδύεάόιύιόάε δñδύιέ ίε έάίυιύαδ δίο όάεήεΰάειόι όó÷ύιόάñά ίά όçι άίόβόδιε÷έ έβύçόç. Ί δάεάδδάβδδ έάίυιύαδ όçδ άύδδδδδ έά δνΎδάε ίά άδύιύδδάε έάε ίά έάόάñΰόάε ύέα όά δάεΎδά όçδ όόάεάήεΎΎίçδ έέαδάόδδ/έάδάέδύέόιόçδ.

Ç άύδδδδά άίάñ÷ύι (Outbound) όόι όύίηι έάίυιύι δίο όάβιάόάε δάνάεΰδδ, δάνεΎ÷άε ύιύι έάίυιύαδ όύδίο allow. Ίε έάίυιύαδ άδδδδ δάνεΎ÷ίόι όόάεάήεΎΎίάδ άδεέάΎΎίάδ όέΎδ, ίά δέδ ύδύβδδ άίάΎύñβάόάε ίά ύιύάέέυ όñδδδ ç όδçñάόβά όόçι ύδύβδδ άδεόνΎδάάε ç δνύόάόç άδύ όι άçύιόέι Internet. ¼είε ίε έάίυιύαδ Ύ÷ίόι δέδ άδεέιαΎδ proto, port, in/out έάε keep-state. Ίε έάίυιύαδ όύδίο proto tcp δάνεΎ÷ίόι όçι άδεέιαδ setup έέα όçι άίάΎδδδδδ όιό δάεΎδύι Ύίάñçδ όçδ όόιάñβδδ, δρόά ίά άβιάε ç έάδά÷δδδδ όçδ όόι δβιάεά όόιαΎόάύι (stateful).

Όόçι άύδδδδά όύι έέόάñ÷ύιάύι δάεΎδύι (Inbound) δίο όάβιάόάε δάνάεΰδδ, άύάίβέιόάε δñδύιέ ίε έάίυιύαδ δίο ÷ñόέιύδύείύιόάε έέα όçι άδύññέç όύι άίάδέδύιçδύι δάεΎδύι. Άδδδδ άβιάόάε έέα άύι έάέόιόñάέέιύδ έυάιόδ. Ί δñδύδ άβιάε ύέε όά έάέυάιόέά δάεΎδά ύδύñάβ άί ύΎñάε ίά όάεήεΰάειόι ίά έΰδύεά ÷άñάέδçñέόέέδδ όçδ Ύάέδñçδ έβύçόçδ. Όά δάεΎδά άδδδδ έά δνΎδάε ίά άδύññέόέιύι, άίόβ ίά άβύιόι άάέδδδ άδύ έΰδύεί άδύιάñ έάίυιά allow. Ί άάύδάνδδ άβιάε ύέε ύδύñάβδά ίά άδύññβδδά όόάεάήεΎΎίά δάεΎδά όά ύδύβδδ άύñβάέάδά ύέε άάί άβιάε Ύάέδñά, έέέδδ όάδ άβιάε άέέΰιόñç ç έάόάñάόδ όιόδ. Ίά όύι όñδδδ άδδδδ άδύββάέάε ç έδç έάε έάόάñάόδ όιόδ άδύ όύι δάεάδδάβδ έάίυιά. Ί δάεάδδάβδδ έάίυιύαδ όδδέέδδ άδύññβδδάε έάε έάόάñΰόάε ύέα όά δάεΎδά δίο Ύδδάόάί ύΎ÷ñέ άδδδδ. Ί έάίυιύαδ άδδδδ ÷ñόέιύδύεάβδάε έέα όçι δάν÷δ δñέβί άδύάβιάύι όά δάνβδδδδ δίο έέδδδάδδ δñέδδ έέαέέάδδά έάδδδ άδύιύι δίο δνΎάçόάί όά άδεέΎόάέδ όόι όύόόçιά όάδ.

Έά δνΎδάε άδδδδ ίά άίάόάέβδδάδ ύέε όι όύόόçιά όάδ άάί έά δρόάε έάίεΰδ άδύιόçόç όά έάΎΎίά άδύ όά άίάδέδύιçδά δάεΎδά. Όά δάεΎδά άδδδδ έά δνΎδάε ίά άδύññέόέιύι έάε ίά άίάάίέόόίύι. Ίά όύι όñδδδ άδδδδ, ύ άδεέέέΎιάñδ άάί Ύ÷άε έάίεΰδ άδδδδ άί όά δάεΎδά δίο Ύδδάόάί ύΎ÷ñέ όι όύόόçιά όάδ. ¼όι έάέυδάνά ύδύñύί ίά ύΰειόι ίε άδεέέέΎιάñέ ό÷άδέέδδ ίά όι όύόόçιά όάδ, όύιό δέι άόάέΎδ άβιάε. ¼όάί έέόάέβδδά έάόάñάόδ δάεΎδύι ίά άñέέιύδ έδñδδ δίο άάί άίάΎύñβάέάδ, έίέδδΰιόά όόι άñ÷άβι /etc/services/ δ άάβδά όι http://www.securitystats.com/tools/portsearch.php

εάε άίάαααοΠρόά οίί άνεέιυ όαο έυήνάο αέα ίά άάβόά θιερό άβίάε ι οείθυο όαο. ΆεÛάηόά όαί θανάεÛόυ όιθιεάόβά αέα όιόο άνεέιυό έοήπí θιό ÷ñαόείιθιείγίόάε όαο ÷íÛ άδυ εάέυάιόεά θñíñÛηιάόά (Trojans):  
<http://www.simovits.com/trojans/trojans.html>.

### 30.6.5.6 ίά Όδυάέαιά Όοίυεϊό Εάίυιύι Inclusive

Όι θανάεÛόυ όύρειε εάίυιύι (όοι ιθίβι άάι αειθιεάβόάε εάεοιόναβά NAT) άβίάε άνεάοÛ θεΠνάο εάε θιεý αόόάεÛό. Άαίεοίναάβ firewall όýθιό inclusive, εάε Û ÷άε άιεείάόόάβ όά θñάάιάόεέÛό όοιεΠεάο εάεοιόναβάο. Ιθίναβ ίά άιόθναόβόάε όι βάει εάεÛ εάε όι αέέυ όάο όύόόαί. ΆθεΠο ίάόόονÛθοόά όά ό ÷υέει όιόο εάίυιάο pass αέα όεο όθναόβόαο θιό άάι εÛεάόά ίά άίάñάιθιεΠόάόά. Άέα ίά άθιόýάάόά όαί εάόάάñάοΠ άίάθέεýγίόυι ίαίόιÛόυι, άθεΠο θñιόεÛόόά Ûίά εάίυιά όýθιό deny όόαί άíυόαόά όυι άεόάñ ÷ñÛíυι. Όά υειόο όιόο εάίυιάο, Εά θñÛθάε ίά αέεÛίάόά όι υίñά όαο αεάθάόΠο άδυ dc0 όοι θñάάιάόεέυ υίñά όαο αεάθάόΠο θιό όοίάÛάόάε όοι ααίυοέι Internet. Όά θñάβθόυόαο θιό ÷ñαόείιθιεάβόά όι PPP ÷ñΠόόα, όι υίñά όαο αεάθάόΠο εά άβίάε tun0.

Εά αεάθέεοΠόάόά υόε οθÛñ ÷άε ίεά όόάεάεñείÛίγ έιάέέΠ όόα ÷ñΠόόα άόόπí όυι εάίυιύι.

- Ûειέ ίε εάίυιάο θιό άθιόάείγί άβόόαό αέα Ûίάñηα ίεάο ίÛάό όοίάάñβάο ίά όι ααίυοέι Internet, ÷ñαόείιθιείγί όαί άθέειάΠ keep-state.
- Ûεάο ίε αεάθέεόάόιÛίάο όθναόβόαο θιό θñíÛñ ÷ιιόάε άδυ όι ααίυοέι Internet, αεάεÛόιόι όαί άθέειάΠ limit, αέα όαί άθιόόάΠ άθέεÛόάυι όθññ ÷άβέέόαο (flooding).
- Ûειέ ίε εάίυιάο ÷ñαόείιθιείγί όεο άθέειάÛό in Π out αέα ίά αεάόεñείβειόι όαί εάόάýεόιόα όαο άθέειέíυιάο.
- Ûειέ ίε εάίυιάο ÷ñαόείιθιείγί όαί άθέειάΠ via υίñά-αεάθάόΠο αέα ίά εάειñβόιόι όα αεάθάόΠ άδυ όαί ιθίβά αεÛñ ÷άόάε όι θάεÛόι.

Íε εάίυιάο θιό οάβίιύόάε θανάεÛόυ, εά θñÛθάε ίά άñάόιγί όοι /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

```



Ιά οίι έάίυία 100 αέάόβ άβίαέ αίάν÷ύιάνί έάέ ύ÷έ άέόάν÷ύιάνί. Δάνιΰάέ οίι έάίυία 101 αέάόβ δñυέάέόάέ άέα ίΎά άδέέιέιυίβá έάέ Ύόόέ άάί δδΰñ÷άέ άέυία όόιι άόίáιέέυ δβίαέά έάόάόδΰόάυι. Οί δάέΎοί όάέέέΰ όδΰίáέ όόιι έάίυία 125 Ιά οίι ιδιβι έάέ όάέέέΰάέ. ΑίΎñ÷άόάέ ίΎόυ όçδ εΰñόάδ άέέόγίό δίό όόίáΎάόάέ όόιι άçιύόέί Internet. Οί δάέΎοί Ύ÷άέ άέυία ύδ IP άόάόçñβáδ όçί έάέύόέέΰ άέάγέόίόç όίό όιδέέίγ άέέόγίό. Οί όάβñέάόίá Ιά άόóυ οίι έάίυία δñίέάέάβ άγί αίΎñάέέάδ. Ç άδέέίάΰ keep-state έá άçίέίóñáΰόάέ Ύίá ίΎί άόίáιέέυ έάίυία, έá οίι έάόá÷ύñΰόάέ όόιι δβίαέά, έάέ έá άέόάέΎόάέ όçί άίόβόόίέ÷ç αίΎñάέά. Ç αίΎñάέά άόδΰ άβίαέ ίΎñιό όçδ δέçñίóιñβáδ δίό άñΰόάόάέ όόιι άόίáιέέυ δβίαέά. Óόçί δάνβδóυόç άόδΰ άβίαέ ç “skipto rule 500”. Ι έάίυίáδ 500 Ιάόάóñΰάέ ίΎόυ NAT όç άέάγέόίόç IP όίό δάέΎίό, δñέί άόóυ αίΎέέά δñιό όί Internet. Άόóυ άβίαέ έέάέβόάñά όçίáίόέέέυ. Οί δάέΎοί έάόάόέγίáόάέ δñιό όίι δñιñέόιυ όίό, ύδίό άçίέίóñάβδóάέ έάέ άδίοόΎέέάόάέ Ύίá ίΎί δάέΎοί ύδ άδΰίόçόç. Οί ίΎί άόóυ δάέΎοί άέόΎñ÷άόάέ ίáΰ όόι firewall, όόιι έάίυία δίό άβίαέ όόçί έιñόΰ όçδ έβόόάδ. Άόδΰ όç όιñΰ όάέέέΰάέ Ιά οίι έάίυία 100 έάέ ç άέάγέόίόç δñιñέόίγ όίό άέέΰάέ ίáΰ όόçί άñ÷έέΰ όίό όιδέέίγ άέέόγίό. Δάέά, άβίαόάέ ç άδάίáñάάόβá όίό άδύ οίι έάίυία check-state ι ιδιβιό ίάέάέγδóάέ ύόέ δñυέάέόάέ άέα δάέΎοί όόίáñβáδ όá αίΎέέίç έάέ όί άδάέάδέáñΰίáέ όόι όιδέέυ άβέόóι. Έάόάόέγίáόάέ δñιό όίι όδίέίáέόόΰ όίό όιδέέίγ άέέόγίό δίό όί Ύόόάέέá, ι ιδιβιό όόΎέίáέ Ύίá ίΎί δάέΎοί άçόΰίόάδ δάνέόóυόάñά άάáñΎίá άδύ οίι άδñάέñόίΎίí άίόδçñάόçόΰ. Οί δάέΎοί άόóυ άέΎá÷άόάέ άδύ οίι έάίυία check-state, ι ιδιβιό άñβόέάέ όçί έάόá÷ñέόç όίό όόá αίάν÷ύιáίá έάέ άέόάέάβ όçί άίόβόόίέ÷ç αίΎñάέά δίό όá άόδΰ όçί δάνβδóυόç άβίαέ “skipto 500”. Οί δάέΎοί δñιύέάβδóάέ όόιι έάίυία 500, άβίáόάέ ç Ιάόΰñάόç όçδ άέάγέόίόçδ όίό ίΎόυ NAT έάέ άδάέάδέáñΰίáόάέ όόι Internet.

Άδύ όçί Ιáñέΰ όύι άέόάν÷ύιáίυι, ύδίέί δάέΎοί ίάááññβáέάόάέ ύδ ίΎñιό Ιέáδ όδΰñ÷ίόόáδ όόίáñβáδ, άέΎá÷άόάέ άόóύιáόá άδύ οίι έάίυία check-state έάέ όίόδ άίόβόόίέ÷ίόδ έάίυίáδ divert natd. Οί ίύι δίό ÷ñáέΰάόάέ ίá άίόέίáόύδβόίόίá άβίαέ ç άδύññέç ύέυι όύι δñίáέçίáόέέΰί δάέΎóυι έάέ ç Ύáέñέόç ίύι όύι δάέΎóυι δίό δñññβáίίόάέ άέα άάέáέñέίΎίáδ όδçñάόβáδ. Άδ όδίέΎόίόίá ύόέ Ύ÷ίόίá Ύίá άίόδçñάόçόΰ apache ι ιδιβιό άέόάέάβδóάέ όόι ιç÷Ύίçίá Ιά όί firewall, έάέ άδέέóίγίá όί όιδέέυ site ίá άβίαέ δñίόáΰόέίí άδύ όί άçιύόέί Internet. Ç άέόάν÷ύιáίç άβόçόç ίΎάδ όόίáñβáδ όάέέέΰάέ Ιά οίι έάίυία 100 έάέ ç IP άέάγέόίόç όçδ άίόέόóίέ÷βáέόάέ όόι όιδέέυ IP όίό ιç÷άίΰίáόίό Ιά όί firewall. Οί δάέΎοί Ύδάέόá άέΎá÷άόάέ άέα ίδίέίáΰδίόá δñυάέçίá ίδñάβ ίá Ύ÷άέ όγίόύίá Ιά όίόδ έάίυίáδ δίό ÷ñçόέίύίέίγίá, έάέ όάέέέΰ όάέέέΰάέ Ιά οίι έάίυία 425. Óόçί δάνβδóυόç άόδΰ όόίááβίόί άγί δñΰáιáόá. Ι έάίυίáδ άέα όί δάέΎοί άñΰόάόάέ όόι άόίáιέέυ δβίαέά έάόάόδΰόάυι, άέέΰ άόδΰ όç όιñΰ δάνέίñβáέάόάέ ι άñέέιύδ άέόΰόáυι ίΎάδ όόίáñβáδ άδύ όί όóáέáέñέίΎίí IP όá 2. Ιά άόóυ οίι όñυδί ίδñιγίá ίá άίόίέίγίá όá άδέέΎόáέδ όγδίό ΰñίçόçδ όδçñάόβáδ (DoS) ύόί άόιñΰ όç όóáέáέñέίΎίç έγñά άδέέίέιυίβáδ. Ç αίΎñάέά όίό έάίυία άβίαέ όί allow, έάέ Ύόόέ όί δάέΎοί άδάέάδέáñΰίáόάέ όόι όιδέέυ άβέόóι. Οί δάέΎοί δίό δάνΰááόάέ ύδ άδΰίόçόç, άέΎá÷άόάέ άδύ οίι έάίυία check-state, ι ιδιβιό ίάááññβáέάέ ύόέ άίΰέάέ όá Ιέα ΰáç αίáñáΰ όόίáñβá, έάέ άδίοόΎέέάόάέ όόιι έάίυία 500 ύδίό άβίáόάέ ç Ιάόΰñάόç όçδ άέάγέόίόçδ όίό ίΎόυ NAT. Οί δάέΎοί όάέέέΰ άδάέάδέáñΰίáόάέ ίΎόυ όçδ άέάδάΰδ όίáñ÷ñΎί.

Óδύáάέάίá Έάίυίυι #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 δανάδÛúú, áεεÛ δάνεÝ ÷íοí δάνεóóúòάñá ó÷üεεά áεά íά áìçèÐóíοí
ôíí áñ÷Ûñεí ÷ñÞóòç ôíò IPFW íά εάòάεÛάάε εάέýòάñά ðùð εάέòíòñāýí.

Ïðüāáεάíá Êάíúúí #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 #####

```

# ΕὰοÛεάεί 31 Δñĩ ÷ ùñçìÝíá ÈÝíáôá Äéêôýùόçò

## 31.1 Óýññç

Ôĩ εὰοÛεάεί áðòü éáéýððáé δñĩ ÷ ùñçìÝíá èÝíáôá äéêôýùόçò.

Áóñý äéááÛóáôá áðòü ôĩ εὰοÛεάεί, εá ïÝñáôá:

- Óá ááóéêÛ ðùĩ ððēþĩ (gateways) éáé ðùĩ äñññēĩãÞóáñĩ (routes).
- Δùð íá ñðēĩβóáôá óðóéáãÝð IEEE 802.11 éáé Bluetooth.
- Δùð íá èÛíáôá ôĩ FreeBSD íá äñá ùð äÝððñá (bridge).
- Δùð íá ñðēĩβóáôá äêēβĩçç áðü ôĩ äβêðôĩ óá Ýíá ìç ÷ Ûíçìá ÷ ùñβð óéêçñü äβóēĩ.
- Δùð íá ñðēĩβóáôá ìáðÛñáóç äéêððáēþĩ äéáððéýíóáñĩ (NAT).
- Δùð íá óðíáÝóáôá äýĩ ððēĩäéóðÝð ìÝóù PLIP.
- Δùð íá ñðēĩβóáôá ôĩ IPv6 óá Ýíá ìç ÷ Ûíçìá FreeBSD.
- Δùð íá ñðēĩβóáôá ôĩ ATM.
- Δùð íá ñðēĩβóáôá éáé íá ÷ ñçóéññðēĩÞóáôá óéð äðíáðüðçðáð ôĩð CARP (Common Access Redundancy Protocol) óðĩ FreeBSD.

Δñēĩ äéááÛóáôá áðòü ôĩ εὰοÛεάεί, εá δñÝðáé:

- Íá éáðáññáβðá óéð ááóéêÝð Ýññéáð ðùĩ äñ ÷ äβñĩ script /etc/rc.
- Íá äβóðá äññéáéññÝñð ìá ðç ááóéêÞ ñññēĩãá ðùĩ äéêðýñĩ.
- Íá äñññæáðá ðùð íá ñðēĩβóáôá éáé íá ääéáðáóðÞóáôá Ýíá ìÝĩ ððñÞíá óðĩ FreeBSD (ΕὰοÛεάεί 8).
- Íá äñññæáðá ðùð íá ääéáðáóðÞóáôá ðññóéáðĩ ēĩäéóĩéñü ðñβðĩð éáðáóéáðáóðÞ (ΕὰοÛεάεί 4).

## 31.2 Gateways and Routes

*Contributed by Coranth Gryphon.*

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).

### 31.2.1 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.

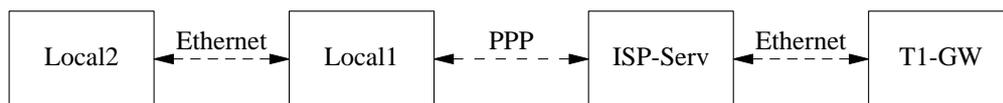
### 31.2.2 Default Routes

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
Local2	Local1	Ethernet
Local1	T1-GW	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
------	---------------

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.

### 31.2.3 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.

### 31.2.4 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.

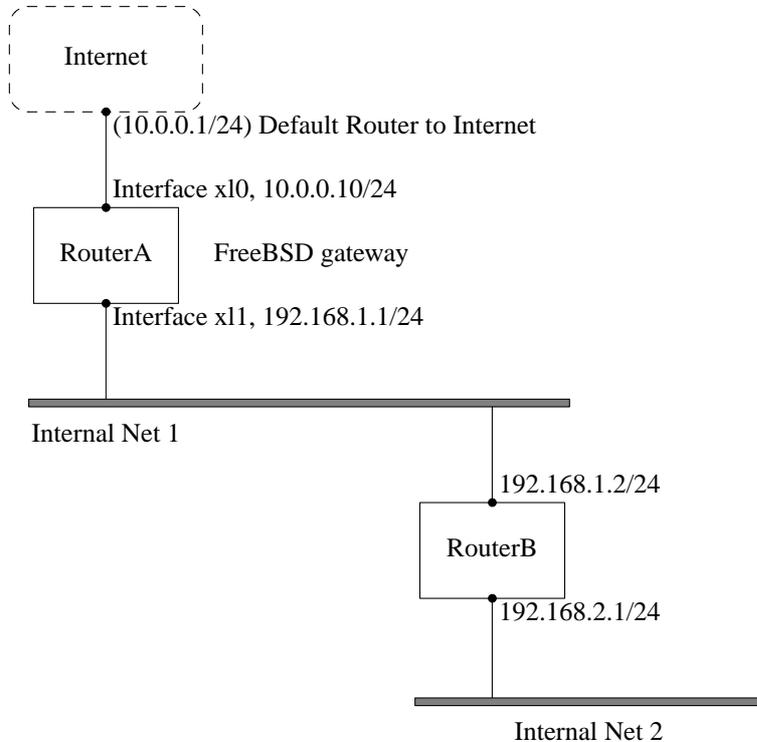
Your new router will need routes to know where to send the traffic. If your network is simple enough you can use static routes. FreeBSD also comes with the standard BSD routing daemon `routed(8)`, which speaks RIP (both version 1 and version 2) and IRDP. Support for BGP v4, OSPF v2, and other sophisticated routing protocols is available with the `net/zebra` package. Commercial products such as **GateD®** are also available for more complex network routing solutions.

## 31.2.5 Setting Up Static Routes

*Contributed by Al Hoang.*

### 31.2.5.1 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.

### 31.2.5.2 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"
```

### 31.2.6 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.

### 31.2.7 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 `tracert(8)` command. It is equally useful if you cannot seem to make a connection to a remote machine (i.e. `ping(8)` fails).

The `tracert(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 `tracert(8)`.

### 31.2.8 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)`.

## 31.3 Wireless Networking

*Loader, Marc Fonvieille, ἐπέ Murray Stokely.*

### 31.3.1 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.

## 31.3.2 Basic Setup

### 31.3.2.1 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).

**Όχι!Βιός:** 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)`.

**Όçιἄβυόç:** 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 0xff9f0000-0xff9fffff 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
```

### 31.3.3 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.

### 31.3.3.1 FreeBSD Clients

#### 31.3.3.1.1 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
```

**Όχιἄβυός:** 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.

### 31.3.3.1.2 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.

#### 31.3.3.1.2.1 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.

#### 31.3.3.1.2.2 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.

**Όχιἄβυός:** 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 Ὄἰἰἰά 31.3.3.1.4.

### 31.3.3.1.2.3 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 txpovmax 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`).

### 31.3.3.1.2.4 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"
```

### 31.3.3.1.3 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.

### 31.3.3.1.3.1 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.

**Διάρθρωση:** 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 0xfffff00 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
DHCPCREQUEST 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
```

**Óçíáßùóç:** 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
```

### 31.3.3.1.3.2 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.
- ❼ The `client_cert` line gives the pathname to the client certificate file. This certificate is unique to each wireless client of the network.
- ❽ The `private_key` field is the pathname to the client certificate private key file.
- ❾ 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 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
```

As previously shown, it is also possible to bring up the interface manually with both `wpa_supplicant` and `ifconfig` commands.

### 31.3.3.1.3.3 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.

- ⑤ 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
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 0xffffffff00 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
```

#### 31.3.3.1.3.4 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 ①
    identity="test" ②
    password="test" ③
    ca_cert="/etc/certs/cacert.pem" ④
    phase1="peaplabel=0" ⑤
    phase2="auth=MSCHAPV2" ⑥
}
```

- 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
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 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
```

### 31.3.3.1.4 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.

**Óçìáßùòç:** 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
```

### 31.3.4 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 1 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 txpowmax 36 protmode CTS bintval 100
```

Both A and B are now ready to exchange informations.

### 31.3.5 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.

## 31.4 Bluetooth

*Written by Pav Lucistnik.*

### 31.4.1 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.

### 31.4.2 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
```

**Όçιἄβύοç:** 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

### 31.4.3 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.

### 31.4.4 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  O           0 OPEN
```

Another diagnostic tool is `btsockstat(1)`. It does a job similar to as `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
```

### 31.4.5 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.

### 31.4.6 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
```

### 31.4.7 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
```

### 31.4.8 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
```

### 31.4.9 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
```

### 31.4.10 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/tty6
rfcomm_sppd[94692]: Starting on /dev/tty6...
```

Once connected, the pseudo tty can be used as serial port:

```
# cu -l tty6
```

### 31.4.11 Troubleshooting

#### 31.4.11.1 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
```

#### 31.4.11.2 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.

## 31.5 Bridging

*Written by Steve Peterson.*

### 31.5.1 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.

### 31.5.2 Situations Where Bridging Is Appropriate

There are two common situations in which a bridge is used today.

#### 31.5.2.1 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.

#### 31.5.2.2 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.

## 31.5.3 Configuring a Bridge

### 31.5.3.1 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.

### 31.5.3.2 Kernel Configuration Changes

To enable kernel support for bridging, add the:

```
options BRIDGE
```

statement to your kernel configuration file, and rebuild your kernel.

### 31.5.3.3 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 30](#) 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.

### 31.5.3.4 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.

### 31.5.4 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
```

### 31.5.5 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.

## 31.6 Diskless Operation

*Updated by Jean-François Dockès. Reorganized and enhanced by Alex Dupre.*

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.

### 31.6.1 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.

## 31.6.2 Setup Instructions

### 31.6.2.1 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.

### 31.6.2.2 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

```

### 31.6.2.3 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`.

### 31.6.2.4 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.

### 31.6.2.5 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
```

### 31.6.2.6 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 8), 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"
```

### 31.6.2.7 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`.

#### 31.6.2.7.1 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.

### 31.6.2.8 Configuring Swap

If needed, a swap file located on the server can be accessed via NFS.

#### 31.6.2.8.1 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
```

### 31.6.2.9 Miscellaneous Issues

#### 31.6.2.9.1 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.

#### 31.6.2.9.2 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.

## 31.7 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.

### 31.7.1 ISDN Cards

*Contributed by Hellmuth Michaelis.*

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.

### 31.7.2 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](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.

### 31.7.3 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.

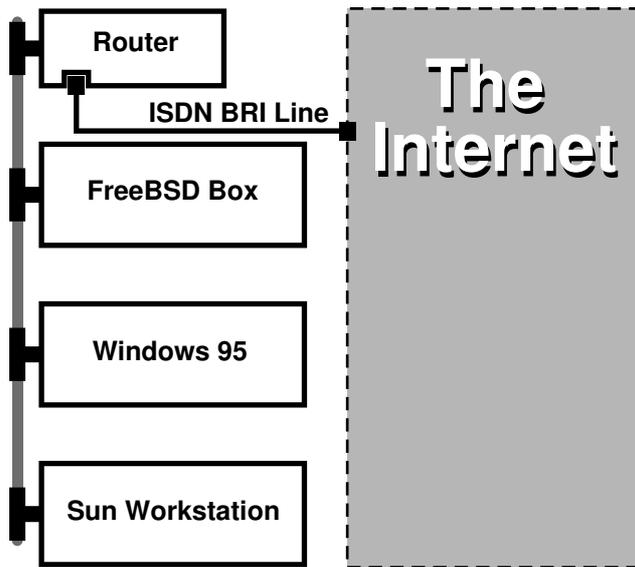
The main problem with ISDN routers and bridges is that interoperability between manufacturers can still be a problem. If you are planning to connect to an Internet provider, you should discuss your needs with them.

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 31-1. Branch Office or Home Network

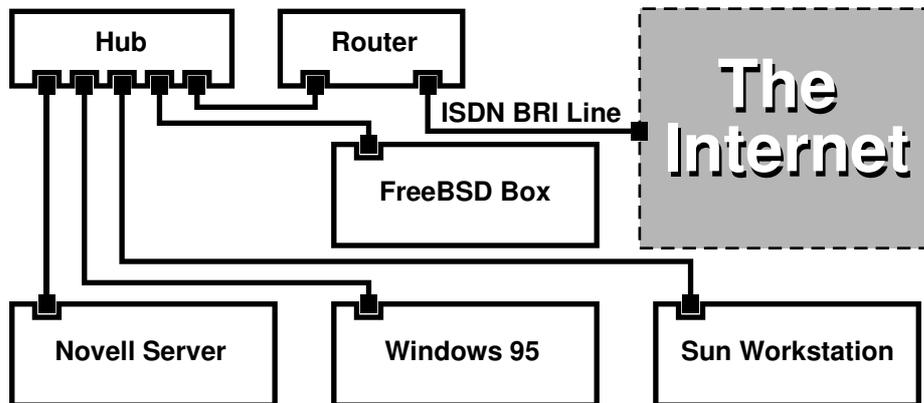
Network uses a bus based topology with 10 base 2 Ethernet (“thinnet”). Connect router to network cable with AUI/10BT transceiver, if necessary.



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 31-2. 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.

## 31.8 Network Address Translation

*Contributed by Chern Lee.*

### 31.8.1 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.

### 31.8.2 Setup

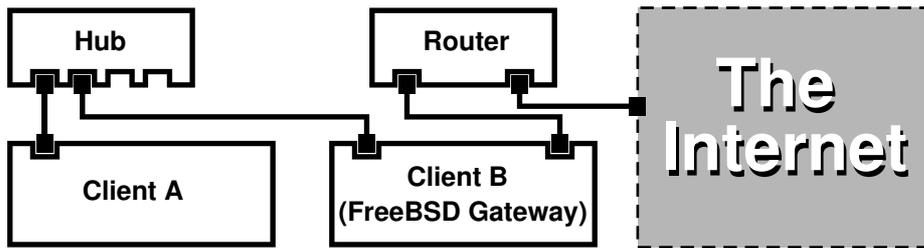
Due to the diminishing IP space in IPv4, and the increased number of users on high-speed consumer lines such as cable or DSL, people are increasingly in need of an Internet Connection Sharing solution. The ability to connect

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.

**Όχιἄβύος:** 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.

### 31.8.3 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.

- ③ 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.

**Όχιἄβουό:** 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.

### 31.8.4 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)`

### 31.8.5 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.

## 31.9 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.

### 31.9.1 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 31-1. 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	-

### 31.9.2 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
```

## 31.10 IPv6

*Originally Written by Aaron Kaplan. Restructured and Added by Tom Rhodes. Extended by Brad Davis.*

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 340,282,366,920,938,463,374,607,431,768,211,456 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>)

### 31.10.1 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.

**Ότις ἀποδο:** The IPv4 broadcast address (usually xxx.xxx.xxx.255) is expressed by multicast addresses in IPv6.

#### Διεύθυνση 31-2. 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

IPv6 address	Prefixlength (Bits)	Description	Notes
::00:xx:xx:xx:xx	96 bits	embedded IPv4	The lower 32 bits are the IPv4 address. Also called “IPv4 compatible IPv6 address”
::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”.

### 31.10.2 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 fe80:0000:0000:0000:0000:0000:0000:0001.

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>).

### 31.10.3 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.

### 31.10.4 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.

### 31.10.5 Applying the needed changes to `/etc/rc.conf`

#### 31.10.5.1 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 `rsol(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"
```

#### 31.10.5.2 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"
```

### 31.10.5.3 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"
```

## 31.10.6 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.

## 31.11 Asynchronous Transfer Mode (ATM)

*Contributed by Harti Brandt.*

### 31.11.1 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.

### 31.11.1.1 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
```

## 31.12 Common Access Redundancy Protocol (CARP)

*Contributed by Tom Rhodes.*

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.

### 31.12.1 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"
```

**Ὁμολογία:** 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.

**Ὁμολογία:** 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

# Δαῖνῦνὸςῖᾶ A. Δῖο ἑᾶ Ἀῖνᾶβὸᾶ ὀῖ FreeBSD

## A.1 Ἀἑῦῶᾶἑὸ ὀᾶ CDROM ἑᾶἑ DVD

### A.1.1 Retail Ἀἑῦῶᾶἑὸ

Ὀῖ FreeBSD ἄβῖᾶἑ ἑᾶἑἑ ῖῶἑῖῖ ἡὸ ἄῖδῖῖῖἑῦῖ δῖῖῖῖῖῖ (FreeBSD CD, ἄδἑδῖῖῖῶἑᾶῖῖ ἑῖᾶἑῖῖἑῦῖ, ἑᾶἑ ὀδῖῖῖ ῖῖῖ ὀᾶἑῖῖῖῖῖῖ) ἄδῖῖ ἑἑῖῖῖῖῖῖ δῖῖῖῖῖᾶδῖῖῖῖῖ:

- CompUSA  
WWW: <http://www.compusa.com/>
- Frys Electronics  
WWW: <http://www.frys.com/>

### A.1.2 CD ἑᾶἑ DVD ἑᾶῖῖῖῖῖῖ

Ὀῖ FreeBSD ἄβῖᾶἑ ἑᾶἑἑ ῖῶἑῖῖ ὀᾶ CD ἑᾶἑ DVD ἑᾶᾶ ἄῖῖῖῖ ῖῖῖῖῖ ἑᾶᾶᾶἑἑῖῖῖ ἄδῖῖ ὀῖῖῖ δᾶῖᾶἑῖῖῖῖ δῖῖῖῖῖᾶδῖῖῖῖῖ:

- FreeBSD Mall, Inc.  
700 Harvest Park Ste F  
Brentwood, CA 94513  
USA  
Ὀῖῖῖῖῖῖῖῖ: +1 925 674-0783  
Fax: +1 925 674-0821  
Email: <[info@freebsdmail.com](mailto:info@freebsdmail.com)>  
WWW: <http://www.freebsdmail.com/>
- Dr. Hinner EDV  
St. Augustinus-Str. 10  
D-81825 München  
Germany  
Ὀῖῖῖῖῖῖῖῖ: (089) 428 419  
WWW: <http://www.hinner.de/linux/freebsd.html>
- Ikarios  
22-24 rue Voltaire  
92000 Nanterre  
France  
WWW: <http://ikarios.com/form/#freebsd>
- JMC Software  
Ireland  
Ὀῖῖῖῖῖῖῖῖ: 353 1 6291282  
WWW: <http://www.thelinuxmall.com>
- The Linux Emporium  
Hilliard House, Lester Way

Wallingford  
OX10 9TA  
United Kingdom  
Όσοι Ψηδοπούλου: +44 1491 837010  
Fax: +44 1491 837016  
WWW: <http://www.linuxemporium.co.uk/products/bsd/>

- Linux+ DVD Magazine  
Lewartowskiego 6  
Warsaw  
00-190  
Poland  
Όσοι Ψηδοπούλου: +48 22 860 18 18  
Email: <editors@lpmagazine.org>  
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Fax: +61 3 9857 8974  
WWW: <http://www.lsl.com.au>
- LinuxCenter.Kz  
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Email: <info@linuxcenter.kz>  
WWW: <http://linuxcenter.kz/page.php?page=fr>
- LinuxCenter.Ru  
Galernaya Street, 55  
Saint-Petersburg  
190000  
Russia  
Όσοι Ψηδοπούλου: +7-812-3125208  
Email: <info@linuxcenter.ru>  
WWW: <http://linuxcenter.ru/shop/freebsd>

### A.1.3 Άειάιναβò

Αί άβòά ίαòάòùεçòò èάé ìðíñáβòά ίά äéáíáβíáòά óά CD-ROM ðñíúúíòά äáóéóíÝíá óòí FreeBSD, ðáñáéäéíýíá äðééíéíñíòóòά ìä èÛðíéíí áðü ðíòð äéáíñáβò:

- Cylogistics  
809B Cuesta Dr., #2149  
Mountain View, CA 94040

USA  
ÔçëÝöùíí: +1 650 694-4949  
Fax: +1 650 694-4953  
Email: <sales@cylogistics.com>  
WWW: <http://www.cylogistics.com/>

- Ingram Micro  
1600 E. St. Andrew Place  
Santa Ana, CA 92705-4926  
USA  
ÔçëÝöùíí: 1 (800) 456-8000  
WWW: <http://www.ingrammicro.com/>
- Kudzu, LLC  
7375 Washington Ave. S.  
Edina, MN 55439  
USA  
ÔçëÝöùíí: +1 952 947-0822  
Fax: +1 952 947-0876  
Email: <sales@kudzuenterpises.com>
- LinuxCenter.Ru  
Galernaya Street, 55  
Saint-Petersburg  
190000  
Russia  
ÔçëÝöùíí: +7-812-3125208  
Email: <info@linuxcenter.ru>  
WWW: <http://linuxcenter.ru/freebsd>
- Navarre Corp  
7400 49th Ave South  
New Hope, MN 55428  
USA  
ÔçëÝöùíí: +1 763 535-8333  
Fax: +1 763 535-0341  
WWW: <http://www.navarre.com/>

## A.2 ΆιϑçñåðçôÝò FTP

Ïè åðβóçιάð åèäüåðò ðιϑ FreeBSD åβιάè äèèÝóèιαð ìÝòù áñπιðιçð FTP óýιαåóçð åðü åèÜöñπιðð åιϑçñåðçôÝò FTP óå üèì ðιí èüóη. Ï èåíθñèèèðð åιϑçñåðçôÞðð <ftp://ftp.FreeBSD.org/pub/FreeBSD/> Ý ÷ åè ðιèý èåèÞ óýιαåóç ìå ðιí ððüèιèðð èüóη, èåè åðèðñÝðåè Ýία ìåÜèì áñèèèü ðåððü ÷ ñιíüí óðíåÝóåñ. Áèüìå èè Ýðóèè üìð, åβιάè ìÜèèì èåèÞ èåÝå ìå åñåβðå èÜðιèì åιϑçñåðçôÞðð FTP ðιϑ åβιάè ðèì “èιíðÜ” óåð (åèèèèÜ áì èÝèåðå ìå óðÞóåðå èÜðιèì ðιðèèèü mirror site).

Ç åÜóç ðηì mirror sites ðιϑ FreeBSD (<http://mirrorlist.FreeBSD.org/>) åβιάè ðèì åιçìåññèìÝιç èåè Ýèèðñç åðü ðçì åιðβóðιè ÷ ç èβóðå óðì Åñ ÷ åèñβåèì ðιϑ FreeBSD, èðññèðð åðåèåÞð ðåβññιαè ðèð ðèçññιèñññåðð ðçð åðü ðι DNS èè ü ÷ è åðü ìåå óðåðèèèè èβóðå åðü ñιñιαðå åιϑçñåðçôÞðð.



#### Argentina

In case of problems, please contact the hostmaster <hostmaster@ar.FreeBSD.org> for this domain.

- <ftp://ftp.ar.FreeBSD.org/pub/FreeBSD/> (ftp)

#### Armenia

In case of problems, please contact the hostmaster <hostmaster@am.FreeBSD.org> for this domain.

- <ftp://ftp1.am.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp1.am.FreeBSD.org/pub/FreeBSD/>)) / rsync)

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- <ftp://ftp2.br.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp2.br.FreeBSD.org/pub/FreeBSD/>))
- <ftp://ftp3.br.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)
- <ftp://ftp4.br.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp5.br.FreeBSD.org/pub/FreeBSD/> (ftp)
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- <ftp://ftp2.bg.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)

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- <ftp://ftp3.ca.FreeBSD.org/pub/FreeBSD/> (ftp)

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- <ftp://ftp2.cz.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp2.cz.FreeBSD.org/pub/FreeBSD/>))

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- <ftp://ftp2.fr.FreeBSD.org/pub/FreeBSD/> (ftp)
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- <ftp://ftp3.de.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp4.de.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp4.de.FreeBSD.org/pub/FreeBSD/\)](http://ftp4.de.FreeBSD.org/pub/FreeBSD/) / rsync)
- <ftp://ftp5.de.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp6.de.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp7.de.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp7.de.FreeBSD.org/pub/FreeBSD/\)](http://ftp7.de.FreeBSD.org/pub/FreeBSD/))
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## Hungary

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## Iceland

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- <ftp://ftp.is.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)

## Indonesia

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- <ftp://ftp.id.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp.id.FreeBSD.org/\)](http://ftp.id.FreeBSD.org/) / rsync)

## Ireland

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- <ftp://ftp2.ie.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp2.ie.FreeBSD.org/pub/FreeBSD/\)](http://ftp2.ie.FreeBSD.org/pub/FreeBSD/) / rsync)
- <ftp://ftp3.ie.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp3.ie.FreeBSD.org/pub/FreeBSD/\)](http://ftp3.ie.FreeBSD.org/pub/FreeBSD/) / rsync)

## Israel

In case of problems, please contact the hostmaster <[hostmaster@il.FreeBSD.org](mailto:hostmaster@il.FreeBSD.org)> for this domain.

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- <ftp://ftp4.jp.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp5.jp.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp6.jp.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp7.jp.FreeBSD.org/pub/FreeBSD/> (ftp)
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## Lithuania

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## 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/>) / rsync)
- <ftp://ftp2.nl.FreeBSD.org/pub/FreeBSD/> (ftp)

## New Zealand

- <ftp://ftp.nz.FreeBSD.org/pub/FreeBSD/> (ftp)

## Norway

In case of problems, please contact the hostmaster <[hostmaster@no.FreeBSD.org](mailto: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](mailto: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)
- <ftp://ftp3.pl.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp5.pl.FreeBSD.org/pub/FreeBSD/> (ftp)

## Portugal

In case of problems, please contact the hostmaster <[hostmaster@pt.FreeBSD.org](mailto: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](mailto: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](mailto: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)
- <ftp://ftp2.ru.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp2.ru.FreeBSD.org/pub/FreeBSD/\)](http://ftp2.ru.FreeBSD.org/pub/FreeBSD/) / rsync)

- <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 \(http://ftp5.ru.FreeBSD.org/pub/FreeBSD/\) / 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](mailto:ftpadmin@isu.net.sa)> for this domain.

- <ftp://ftp.isu.net.sa/pub/mirrors/ftp.freebsd.org/> (ftp)

#### Singapore

In case of problems, please contact the hostmaster <[hostmaster@sg.FreeBSD.org](mailto:hostmaster@sg.FreeBSD.org)> for this domain.

- <ftp://ftp.sg.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp.sg.FreeBSD.org/pub/FreeBSD/\) / rsync](http://ftp.sg.FreeBSD.org/pub/FreeBSD/))

#### Slovak Republic

In case of problems, please contact the hostmaster <[hostmaster@sk.FreeBSD.org](mailto: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://ftp.sk.FreeBSD.org/pub/FreeBSD/))

#### Slovenia

In case of problems, please contact the hostmaster <[hostmaster@si.FreeBSD.org](mailto: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](mailto: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://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/pub/FreeBSD/> (ftp)

## 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](mailto: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](mailto: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 \(http://ftp4.us.FreeBSD.org/pub/FreeBSD/\)](http://ftp4.us.FreeBSD.org/pub/FreeBSD/))
- <ftp://ftp5.us.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)

- ftp://ftp6.us.FreeBSD.org/pub/FreeBSD/ (ftp / http (http://ftp6.us.FreeBSD.org/pub/FreeBSD/))
- 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)
- ftp://ftp15.us.FreeBSD.org/pub/FreeBSD/ (ftp)

### A.3 BitTorrent

Ìðñáβòά ίά άίάèòβóáòά òά άάóéÛ άñ÷άβά ISO òùí áèäüòáúí òιϑ FreeBSD, ίÝòù òιϑ óóóòΠιáòιð BitTorrent. Óòçí òιðìèááóβά http://torrents.freebsd.org:8080 (http://torrents.freebsd.org:8080/) òðÛñ÷άé ίέά ðèΠñçò óðèèíáΠ áðü άñ÷άβά torrent ðιϑ ìðñáβòά ίά éάòááÛóáòά.

Άέά ίά ÷ñçóéιιðìèβóáòά òά άñ÷άβά torrent, èά ÷ñáéáóòáβòά éáòÛèèçèι éιáéóιέéü-ðáèÛòç, üðùð áðòü ðιϑ ðáñÝ÷άðáé áðü òι port Π ðáéÝòι net-p2p/py-bittorrent.

Άóιγ éáòááÛóáòά òι άñ÷άβι ISO ìά òι BitTorrent, ìðñáβòά ίά òι άñÛòáòά óá CD Π DVD, üðùð ðáñéáñÛóáòáé óòι ÒιΠιá 18.6.3 (burncd).

### A.4 Άίπιòι CVS

#### A.4.1 ΆέóááüñΠ

Ç óγίαáòç άίπιòιϑ CVS (Π anoncvs üðùð éÝááóáé ìáñééÝð òιñÝð) òðιόçñβæáóáé áðü òά áñáéèáβά CVS ðιϑ áéάÝιιíóáé ìά òι βáèι òι FreeBSD áéά óðá÷ñιέóιü òιðèèπι άñ÷άβüí ìά Ýίά áðñáèñòóιÝιí repository. ίά áðü òά ÷άñáèðçñéóðéèÛ òιϑ CVS áβιáé üðé áðéòñÝðáé óðιòð ÷ñβóðáð òιϑ FreeBSD ίά óðá÷ñιέóιü, ÷ññβò éáéáβòáñá áééáèπιáòά ÷ñβóðç, òά òιðéèÛ áιòβáñáóά ðçááβιò èβáééά ðιϑ Ý÷ιòι ìά òιϑ éáιòñééιγð, áðβóçιιòð áιòðçñáòçòÝð CVS òιϑ FreeBSD project. Άέά ίά ÷ñçóéιιðìèβóáé éáíáβð òι CVS áñèáβ: (á) ίά ìñβóáé òçí òéιΠ òçð ìáðááèçòΠð ðáñéáÛèèιíòιð cvsroot Ýðóé βóðά ίά äáβ÷íáé ðñιð Ýίáί áðü òιϑð áðβóçιιòð áιòðçñáòçòÝð, éáé (á) ίά äβóáé òιí èüäééü “anoncvs” óòçí ðñιðñιðΠ òçð áιòιèΠð cvs login. Òüòά ìðñáβ ίά ÷ñçóéιιðìèβóáé òι áñáéèáβι cvs(1) áéά ίά ðñιððáèÛóáé òι áðñáèñòóιÝιí CVS repository òιϑ FreeBSD óáί Ýίά ìðìéíáΠðιðά òιðéèü repository.

**Óçιáβüòç:** Ç áιòιèΠ cvs login áðìèçéáγáé òιòð èüäééιγò ðιϑ ÷ñçóéιιðìéιγíðáé áéά ðéóòιðιβçòçò òçò òáðòüòçòÛð óáò óòιí áιòðçñáòçòΠ CVS óά Ýίά άñ÷άβι ìά üñιá .cvspass óòιí HOME éáòÛèíáí òιϑ òιðééιγ óáò éιááñéáóιιγ. Áí áðòü òι άñ÷άβι ááí òðÛñ÷άé βáç, ìðìñáβ ίά áðιòγ÷άé ç áιòιèΠ cvs login òçí ðñβòç òιñÛ. ìðñáβòά áðèÛ ίά áçιèòñáβóáòά Ýίά Üáééι άñ÷άβι .cvspass éáé ίά ίáíáðñÝíáðá òçí áιòιèΠ cvs login.

Īðĩñâβ íá ðáé éáíáβò ũòé òί CVSup éáé òί anoncvs âβίáé ἰϑóéáóóéĒŨ ðáñũĩĩéíé òñũðĩé óõā ÷ ñĩĩóóĩĩý áñ ÷ âβũĩ éáé òðĩϑóçñβæĩϑĩ òçĩ βáéá éáéϑĩðñáééũðçδóá, áéĒŨ òðŨñ ÷ ἰϑĩ éŨðĩéáð áéáóĩñŨ ò ĩé ἰðĩβáð ἰðĩñâβ íá ðáβĩϑĩ óçĩáĩóééũ ñũĩéí òðçĩ ððéĩĩâβ ἰáðáĩý áððĩρ òũĩ äýĩ ἰáéũáũĩ. ĂáĩééŨ, òί CVSup éŨĩáé ðĩéý ðéĩ äðĩáĩϑééβ ÷ ñβóç òçð óýĩááçðð ðĩϑ Ũ ÷ äðá éáé ÷ ñçóéĩĩðĩéáβ Ũĩá ðĩéý ðéĩ Ũĩðñĩ ðñũòũéĩéĩ äðéĩéĩũĩáð, áéĒŨ òðŨñ ÷ áé éáé òĩ áĩϑóβóéĩé ÷ ἰ òβĩçĩá. Ăéá íá ÷ ñçóéĩĩðĩéáβ òί CVSup ðñŨŨðáé íá äáéáðáðððáðá éáé íá ñðéĩβóáðá Ũĩá áéáééũ ðñũäñáñĩá ðáéŨðç, éáé òũðá ἰðĩñâβòá íá óõā ÷ ñĩĩβóáðá ĩũĩ ἰááŨéáð òðéĩĩáŨ ðñ ÷ âβũĩ — ðéð ἰðĩβáð òί CVSup äðĩéáéâβ “óðéĩĩáŨð” (collections).

Ōĩ anoncvs, äðũ òçĩ Ũéç, ἰðĩñâβ íá ÷ ñçóéĩĩðĩéáβ áéá íá äĩáðŨóáé éáíáβò ðéð áééááŨð áĩũð éáé ĩũĩ áñ ÷ âβĩϑ β áĩũð ĩũĩ ðñĩñŨŨĩáϑĩð éáé òũĩ òðñĩáäððééβĩ ðĩϑ áñ ÷ âβũĩ (ð. ÷. òĩĩ ðçãáβĩ éβáééá òçð áĩϑĩéβ ð ð ð òçð grep), ἰä ÷ ñβóç òĩϑ ἰĩũĩáϑĩð òĩϑ éáðŨéççĩϑ module. Ōĩ anoncvs âβίáé ðéĩ äĩéééũ áéá äñááóβâð ðĩϑ äðáéðĩýĩ äŨááéá ĩũĩ áĩŨáĩũϑç. Īðũðá, áĩ éŨéäðá íá òðĩϑóçñβĩáðá òçĩ áĩŨððĩç ðñĩñáñũĩŨòũĩ òĩðééŨ, òί CVSup âβίáé ἰŨééĩ ĩũĩäñĩñĩð.

### A.4.2 × ñçóéĩĩðĩéáβ Æĩρĩðĩ CVs

Ç ñýéĩéóç òĩϑ cvs(1) βððá íá ÷ ñçóéĩĩðĩéáβ Ũĩá äĩρĩðĩ CVs repository äβĩáðáé äðéβ ñðéĩβæĩĩðáð òçĩ ἰáðááéççðð ðáñéáŨééĩĩðĩð cvsroot βððá íá äâβ ÷ ĩáé óá Ũĩáĩ äðũ òĩϑð anoncvs äĩððçñáðçðŨð òĩϑ FreeBSD project. Ōçĩ βñá ðĩϑ äñŨĩϑáé áððŨð ĩé äñáñŨð, âβίáé áéáéŨéĩé ĩé áéũéĩϑéĩé äĩððçñáðçðŨð:

- *ĂéĒéβá:* pserver:anoncvs@anoncvs.fr.FreeBSD.org:/home/ncvs (pserver (èũäééũð “anoncvs”), ssh (÷ ùñβð èũäééũ))
- *Ăáðũβá:* pserver:anoncvs@anoncvs.jp.FreeBSD.org:/home/ncvs (× ñçóéĩĩðĩéáβ òçĩ áĩϑĩéβ cvs login éáé äβððá òĩĩ èũäééũ “anoncvs” ũðáĩ óáð æçðçéâβ.)
- *ŌáĂáŨĩ:* pserver:anoncvs@anoncvs.tw.FreeBSD.org:/home/ncvs (áéá òĩĩ pserver ÷ ñçóéĩĩðĩéáβ òçĩ áĩϑĩéβ cvs login éáé äβððá ἰéáðβðĩðá áéá èũäééũ ũðáĩ óáð æçðçéâβ, òĩ ssh äáĩ Ũ ÷ áé èũäééũ.)

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

- *ÇĩũŨĩáð ðĩééðáβâð Äĩäñééβð:* freebsdanoncvs@anoncvs.FreeBSD.org:/home/ncvs (ĩũĩ ssh - ÷ ùñβð èũäééũ)
- *ÇĩũŨĩáð ðĩééðáβâð Äĩäñééβð:* anoncvs@anoncvs1.FreeBSD.org:/home/ncvs (ĩũĩ ssh2 - ÷ ùñβð èũäééũ)

SSH HostKey: 1024 a1:e7:46:de:fb:56:ef:05:bc:73:aa:91:09:da:f7:f4 root@sanmateo.ecn.purdue.edu  
 SSH2 HostKey: 1024 52:02:38:1a:2f:a8:71:d3:f5:83:93:8d:aa:00:6f:65 ssh\_host\_dsa\_key.pub

Ăéâβ òĩ CVs óáð äðéòñŨŨðéá íá éŨĩáðá “check out” ἰϑóéáóóéĒŨ ἰðĩéáâβðĩðá Ũéäĩϑç òĩϑ ðçãáβĩð éβáééá òĩϑ FreeBSD òðβñĩá ðĩϑŨŨ (éáé óá ἰñéóĩŨŨáð ðáñéðððáéð áéũĩá éáé áéäũóáéð ðĩϑ äáĩ Ũ ÷ ἰϑĩ éðééĩĩðñóáé áéũĩá), éá ðñŨŨðéá íá äβóðá äñĩéáééũĩŨĩð ἰä òçĩ äðééĩĩâβ òĩϑ cvs(1) ἰä òçĩ ἰðĩβá ððéēŨŨáðéá òĩ revision (ðñũéáéðáé áéá òçĩ -r) éáé ðĩéáð äβĩáé ĩé äðéðñáððŨð ðéĩŨð òçð áéá òĩ repository òĩϑ FreeBSD project.

ŌðŨñ ÷ ἰϑĩ äýĩ äβäç tags (âðééâðβĩ), ðá revision tags (âðééŨðáð Ũéäĩϑçð) éáé ðá branch tags. Ĩá revision tag áĩáéŨñáðáé óá ĩéá óðáéäêñéĩŨŨç Ũéäĩϑç. Ç Ũĩĩéá òĩϑ ðáñáĩŨĩáé óóáéâñβ ἰŨñá ἰä òç ἰŨñá. Äðũ òçĩ Ũéçç, Ũĩá branch tag äâβ ÷ ĩáé òçĩ óáéäððáβá Ũéäĩϑç ĩéáð óðáéäêñéĩŨŨç ðññáβâð áĩŨððĩçð, óá éŨéá ÷ ñĩĩééβ òðéäĩβ. Ăéâβ òĩ branch tag äáĩ áĩáéŨñáðáé óá éŨðĩéá óðáéäêñéĩŨŨç Ũéäĩϑç, ἰðĩñâβ äýñéĩ íá òçĩáβĩáé éŨðé áéáóĩñáðééũ äðũ ũðé òçĩáβĩáé óβĩäñá.

Ōĩ Ōĩρĩá A.7 ðáñéŨŨ ÷ áé revision tags óá ἰðĩβá ἰðĩñâβ íá äĩáéáðŨñĩϑĩ òĩϑð ÷ ñβóðáð. Ōðáĩéðĩβæĩϑĩá ũòé éáĩŨŨá äðũ äððŨ äáĩ âβĩáé Ũáéðñĩ áéá òçĩ Ōðééĩĩâβ òũĩ Ports, éáéβð áððβ äáĩ Ũ ÷ áé ðĩééáðéŨð äéäũóáéð (revisions).

¼όái εάεινβæάόά εÜθιεί branch tag, öóóείειάέεÜ εáíáÜíáόά όέó óáεάóóάβáó áέäüóáέó ðüí án÷áβüí θιό óðÜñ÷ιόί óá áóóP όç áñáíiP áíÜðóóίçð. Áí εÝέάόά íá εÜááόά εÜθιέα θάέέüóáñç Ýέäιόç, ιθιñάβόá ÷ñçóέιιθιέPíóáó όçí çíáññçίβá óá óóíáóáóíü íá όçí áðέέíãP -D date. Άάβόá όç óáεβáá manual θιό cvs(1) áέá θáñέóóüóáñáó εáðóñÝñáέáð.

### A.4.3 Δανάääáβáιáόά

Áí εάε θñááíáóέέεÜ óóίβóóáόάέ íá áέááÜóáόá θñιόááέóέéÜ όç óáεβáá manual θιό cvs(1) θñέí εÜíáόá ιóέäPθιόá, θáñáεÜóü óáó áβιιθíá εÜθιέα áñPáíñá θáñáääáβáιáόά óá ιθιβá ιóóέáóóέéÜ εá óáó ááβιιθí θüð íá ÷ñçóέιιθιέPóáóá όι ÁίPθιü CVS:

#### ΔανάÜááέäíá A-1. ÉPθç (Check out) ÉÜθιέíó Άñ÷áβιθ áðü όι -CURRENT (ls(1)):

```
% setenv CVSROOT :pserver:anoncvs@anoncvs.tw.FreeBSD.org:/home/ncvs
% cvs login
Óóçí θñιθñιθP, äPóóá ιθιέááPθιόá εÝίç áέá "password".
% cvs co ls
```

#### ΔανάÜááέäíá A-2. ×ñPόç SSH áέá ÉPθç (check out) όιö ÁÝíóñü src/:

```
% cvs -d freebsdanoncvs@anoncvs.FreeBSD.org:/home/ncvs co src
The authenticity of host 'anoncvs.freebsd.org (128.46.156.46)' can't be established.
DSA key fingerprint is 52:02:38:1a:2f:a8:71:d3:f5:83:93:8d:aa:00:6f:65.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'anoncvs.freebsd.org' (DSA) to the list of known hosts.
```

#### ΔανάÜááέäíá A-3. ÉPθç όçð εäιόçó όιö Άñ÷áβιθ ls(1) áðü όι 6-STABLE Branch:

```
% setenv CVSROOT :pserver:anoncvs@anoncvs.tw.FreeBSD.org:/home/ncvs
% cvs login
Óóçí θñιθñιθP, äPóóá ιθιέááPθιόá εÝίç áέá "password".
% cvs co -rRELENG_6 ls
```

#### ΔανάÜááέäíá A-4. Äçιέθñãβá ιέáó Éβóóáó ÁέέáãPí (üò Unified Diffs) όçð ls(1):

```
% setenv CVSROOT :pserver:anoncvs@anoncvs.tw.FreeBSD.org:/home/ncvs
% cvs login
Óóçí θñιθñιθP, äPóóá ιθιέááPθιόá εÝίç áέá "password".
% cvs rdiff -u -rRELENG_5_3_0_RELEASE -rRELENG_5_4_0_RELEASE ls
```

#### ΔανάÜááέäíá A-5. Άñβóέιιόáó Διέα ¶έέá Íιιíáόá Modules ιθιñιýí íá ×ñçóέιιθιέçέιýí:

```
% setenv CVSROOT :pserver:anoncvs@anoncvs.tw.FreeBSD.org:/home/ncvs
% cvs login
Óóçí θñιθñιθP, äPóóá ιθιέááPθιόá εÝίç áέá "password".
% cvs co modules
% more modules/modules
```

### A.4.4 ηέέάò ΔçãÝò Δεçñιιòιήèρì

Ìé δάνάέÛòù δçãÝò δεçñιιòιήèρì βòùò óάò óάñιýì ÷ ñΠóέìάò áέά ίά ìÛέάòά òι CVS:

- CVS Tutorial (<http://users.csc.calpoly.edu/~gfisher/classes/205/handouts/cvs-basics.html>) áðù òι California Polytechnic State University.
- CVS Home (<http://ximbiot.com/cvs/wiki/>), ç ñÛää άÛððòιç òέά òðιòòΠñέιç òιò CVS.
- CVSweb (<http://www.FreeBSD.org/cgi/cvsweb.cgi>) ΆέάðάòΠ Web áέά òι CVS òιò FreeBSD Project.

### A.5 × ñçóέιιðιέρìóάò òι CTM

Òι CTM άβίάέ ίέά ìÝέìàò ίά áέάòçñιιýì óά óðã÷ ñιέóιù Ýίά áðñáεñòοιÝì έáòÛέìì ìά Ýίά έάíòñέéù. Άίάððý ÷ εçέά άέά ÷ ñΠóç ìά òι áÝìòñì δçããβìò έρπáέά òιò FreeBSD, άί έáέ Ûέέιέ Ûìεñùðιέ ìðìñáβ ίά òι άñιòì ÷ ñΠóέìì έáέ áέά áέάòìñάðέέιýð óέιðιýò έáερð ðáñìÛáέ ð έάέñùð. Òç άááñÝίç óðέáìΠ òðÛñ÷ áé áéÛ÷ έóðç ùð άίýðáñέðç ðáέιçñβùòç áέά ççì áέάάέέάóá άçìέìòñáβάð άñ÷ άβùì áέάòìñβì (deltas), έáέ άί ÷ ñάέÛάóáð ðáñέóóùòáñáð δεçñιιòιñβáð, άðέέέίέìùΠóáá ìά òç έβóóά óá÷ ðáñìñáβìò ctm-users (<http://lists.FreeBSD.org/mailman/listinfo/ctm-users>) áέάέέÛ άί εÝέάòά ίά ÷ ñçóέιιðιέρìóáð òι CTM áέά Ûέέáð áòáñìñáÝð.

#### A.5.1 Άέάòβ ΔñÝðáέ ίά × ñçóέιιðιέρìóù òι CTM;

Òι CTM έά óáð άρóáέ Ýίά òιðέéù άίòβáñáσì òιò áÝìòñìò δçããβìò έρπáέά òιò FreeBSD. ÒðÛñ÷ áé áέάέÝóέìò Ýίάð άñέéìùð áðù “άáýóáέð” òιò áÝìòñìò. Òι CTM ìðìñáβ ίά óáð ðáñÝ ÷ áé òέð δεçñιιòιñβáð ðιò ÷ ñάέÛάóáð, άβóά áðìòáòβóáðά ίά ðáñáέìεìρòεáβóά ðεùέεçñì òι áÝìòñì, άβóά εÛðιέì áðù óá ðáñáέεÛάέά òιò. Άί άìρέáðá óá άñáñáÛ ìÝέç άìÛððòιç òιò FreeBSD áέéÛ Ý÷ άðά έáέρð ðιέìóðçðáð (Π έάέùεìò) TCP/IP óñìááóέìùòçðá, Π áðέÛ εÝέáðά ðέ áέέááÝð ίά óáð Ýñ÷ ðιόáέ áððùìáðá, òι CTM Ý÷ áé òðέά÷ ðáβ áέά óáð. Έά ÷ ñάέáðáβ ίά ðáβñìáðά ùð ðñβá deltas ççì çìÝñá áέά óá έέááέÛ òιò áÝìòñìò ðιò Ý÷ ðιò ççì ðέì άíáñáΠ άìÛððòιç. Έά ðñÝðáέ ùóðùòì ίά έáùñΠóááð ùð έáέýóáñç έýóç ççì áððùìáðç áðιòòιέρì òιò ìÝóù email. Óá ìááÝέç ðùì άίáíáρáùì έñáðιγίðáέ ðÛìóá ùòì òι áðιáðùì ðέì ðέéñÛ. Óðìρέùð άβίάέ ðέéñùðáñá áðù 5Ê, ðáñέóðáóέáέÛ (Ýίά óáá áÝέá) άβίάέ áðù 10-50Ê έάέ ðέóìÝíáð òìñÝð áìóáíβáεìðáέ έáέ εÛðιέά ðιò άβίάέ 100Ê Π έáέ ìááέýóðáñá.

Έά ðñÝðáέ áðβóçð ίά άñίέάέéùèáβóá ìά òέð áéÛòìñáð ðááβááð ðιò ó÷ áðβáεìðáέ ìά ççì áðáðéáβáð áñááóá óòì ððù άìÛððòιç δçããβì έρπáέέά óá ó÷ Ýóç ìά ðέá Ýòιέìç, ðñίέáðáóέáðáóìÝίç Ýέáìóç. Άððù έó÷ ýáέ áéùìá ðáñέóóùòáñì άí άðέéÝíáðά ίά ÷ ñçóέιιðιέρìóáð òι δçããβì έρπáέέά áðù òι “current”. Óáð óðιέóðιγίá ίά áέááÛáðáð ðùð ίά ÷ ñçóέιιðιέρìóáð òι current óòì FreeBSD.

#### A.5.2 Óέ × ñάέÛáέìíáέ áέά ίά × ñçóέιιðιέρìóù òι CTM;

Έά ÷ ñάέáðáβóá áýì ðñÛáìáðá: Òççì áòáñìñáΠ CTM έáέ òέð άñ÷ έέÝð áέέááÝð (deltas) áέά ίά òέð áέóÛááðά óá áððρì (ρóáá ίά òðÛáðá òðì áðβðááì òιò “current”).

Òι CTM άβίάέ ìÝñìò òιò FreeBSD áðù ççì Ýέáìóç 2.0, έáέ άñβóέáðáέ óòì έáðÛέìì /usr/src/usr.sbin/ctm áðùòì Ý÷ άðá ááέáðáóóçìÝì òι δçããβì έρπáέέά.

Óá “deltas” ìά óá ððìβá ðñìòìñáðáβóá òι CTM ððìñáβóá ίά óá áðιέðρáðá ìά áýì ðñùðιòð, ìÝóù FTP Π ìÝóù email. Άί Ý÷ άðá ááίέέΠ FTP ðñùóááç óòì Internet, έá áñáβóá òðιòòΠñέιç áέά òι CTM óðέð áέùέìòέáð òιðιέáóáð FTP:

<ftp://ftp.FreeBSD.org/pub/FreeBSD/CTM/>

Ð äåβδå òι òιÐιά mirrors.

ËÛíðå FTP óòι ó÷-åðéèü éåóÛéíäí éåé äéååÛóðå òι äñ÷-åβι README äéå íå íåéíÐóåðå.

Áí èÛéåðå íå éåíåÛíðå ðå deltas ìÛòù email:

Άñåóðåβδå óðíäññçðð ðå íéå áðü ðéð èβóðåð äéåíñð ðιð **CTM**. Ç èβóðå ctm-cvs-cur (<http://lists.FreeBSD.org/mailman/listinfo/ctm-cvs-cur>) ððιðóçñβæåé ìèüèèçñι òι äÛíðñ ðιð CVS. Ç èβóðå ctm-src-cur (<http://lists.FreeBSD.org/mailman/listinfo/ctm-src-cur>) ððιðóçñβæåé ðçí éåðåèÐ (head) ðιð èèÛäιð áíÛðððíçð (development branch). Ç èβóðå ctm-src-4 (<http://lists.FreeBSD.org/mailman/listinfo/ctm-src-4>) ððιðóçñβæåé ðçí Ûéäιðç 4.X è.ì.è. Áí äåí äñññβæåðå ðùð íå äåñåóðåβδå ðå íéå èβóðå, èÛíðå èèèè ðòι ùñíå ðçð èβóðåð ðιð äιðåíβæåðåé ðåñåðÛíù Ð ðçååβíåðå ðòι <http://lists.FreeBSD.org/mailman/listinfo> éåé èÛíðå èèèè ðçð èβóðå ðιð èÛéåðå íå äåñåóðåβδå. Ç óåèβåå ðçð èβóðåð éå ðñÛðåé íå ðåñéÛ÷-åé üèåð ðéð áðåñåβðçðåð ðèçñιðññβåð ó÷-åðéèÛ ìå ðéð óðíäññÛÛð.

¼ðåí äñ÷-βóðåð íå éåíåÛíðå äíåíåððåð **CTM** ìÛòù mail, ìðññåβðå íå ðñçóéíðιèÐóåðå òι ðñüññåñå ctm\_rmail äéå íå ðéð áðιðððιèÛóðåð éåé íå ðéð äðåññüóåðå. ìðññåβðå ðççí ðñåñåóðåéèüðçðå íå ðñçóéíðιèÐóåðå òι ðñüññåñå ctm\_rmail áðåðèååβåð ìÛòù íéåð äåñåóðåð ðòι /etc/aliases áí èÛéåðå ç äéåéèéåóβå íå äéðåèåβðåé áððñåðιðιèçíÛíå. Άåβðå ðç óåèβåå manual ðιð ctm\_rmail äéå ðåñéóóüðåñåð èåððñÛññåð.

**Óçιåβùçç:** ¶ó÷-åðå ìå ðç ìÛéíäí ðιð éå ðñçóéíðιèÐóåðå äéå íå èÛåðåð ðå deltas ðιð **CTM** éå ðñÛðåé íå äåñåóðåβδå ðçç èβóðå ctm-announce (<http://lists.FreeBSD.org/mailman/listinfo/ctm-announce>). Óòι ìÛéèíí, áððü éå äβíåé éåé ðι ìüñ ìÛñò ðòι ððιβι éå äçιðóéåÿñíðåé ðèçñιðññβåð ó÷-åðéèÛ ìå ðéð éåéðιðññåβð ðιð óðóððíåðιð **CTM**. ËÛíðå èèèè ðòι ùñíå ðçð ðåñåðÛíù èβóðåð, éåé äéèèðèåβððå ðéð ìåçåβåð äéå íå äåñåóðåβδå.

### A.5.3 ×ñçóéíðιèÐιèðíåð òι CTM äéå Ðñðçç ÕññÛ

Ðñéí äñ÷-βóðåð íå ðñçóéíðιèåβðå **CTM** deltas, èå ðñÛðåé íå Û÷-åðå Ûíå óçιåβι äèèβíççð äéå ðå delta ðιð Û÷-ìðι äçèíðñçèåβ ìåðÛ áðü áððü.

Ëå ðñÛðåé ðñðå íå éåèññβóðåð ðé Û÷-åðå Ðæç. ìðιèðåððιðå ìðññåβ íå äñ÷-βóðåé áðü Ûíå “Ûååér” éåðÛéñäí. Ëå ðñÛðåé íå ìåéíÐóåðå ìå Ûíå äñ÷-éèü “Ëåñü” delta äéå íå äñ÷-βóðåð ìå òι **CTM** äÛíðñ ðåð. Áðü èÛðιèí óçιåβι èåñññññå ùðé Ûíå áððÛ ðå “äñ÷-éèÛ” deltas éå äéåñÛññðåé ðå CD äéå ðç äèèÐ óåð äéåðèüèððιçç, ùððüðι áððü äåñ óðñíåβíåé ðç äåññÛÛíçç óðéèñÐ.

Ëåèðð ðå äÛíðñå äβíåé äñèåðÛð äåèÛåðð megabytes, äβíåé ðññðèññðåññ ìå ìåéíÐóåðå áðü èÛðé ðιð Û÷-åðå Ðæç. Áí Û÷-åðå CD èÛðιèåð äéåññðð (RELEASE), ìðññåβðå íå áíðéåñÛðåðå Ð íå áðιðððιèÛóðåð áðü äèåβ òñ äñ÷-éèü ðççåβñ èðåéåå. ðóé éå äèðððåðåð óçιåñðéèü ìÛñò ðçð ìåðåçññÛð äåññÛÛññ.

ìðññåβðå íå äíåññññβóðåð áððÛ ðå “äñ÷-éèÛ” deltas áðü òι x ðιð äéèèðèèåβ ðññ äñèèèü ðιðð (äéå ðåñÛåéåñåñåñåñ src-cur.3210xEmpty.gz). ì÷-åñåèðçñéóñüð ìåðÛ òι x áíðéóðèè÷-åβ ðççí ðççåβ ðιð äñ÷-éèñÛ ðåð “seed”. Õι Empty äβíåé Ûíåð Ûååèð éåðÛéñäí. ËåðÛ éåñññå äçèíðññåβðåé íéå ìåðÛååðç áðü òι Empty èÛèå 100 deltas. Άðβçðð ðå äñ÷-åβå áððÛ äβíåé ìåèÛéå! ÓðιçèèóñÛñ ìÛåèèð äéå xEmpty deltas äβíåé ðå 70 ùð 80 MB ðòιðéåóñÛññ ìå gzip äåññÛÛññ.

ìüèèð äðéèÛññåð Ûíå äåðéèü delta äéå íå ìåéíÐóåðå, èå ðñåéåóðåβðå äðβçðð üèå ðå deltas ìå ìååéÿðåñññð áðü áððü äñèèñÛð.

### A.5.4 ×ñçóεϊñðϊεπρίοάò òϊ CTM óòçï Èάεçìáñéïß óάò ÆÈùß

Άέά ίά áòáñìüóáòá òá deltas, áðεßò ãñÛøðá:

```
# cd /where/ever/you/want/the/stuff
# ctm -v -v /where/you/store/your/deltas/src-xxx.*
```

Òϊ CTM áíðεέáíáÛíáòáέ deltas òά ίðïßá Ý ÷ òï òðïðέáòðáß ìÝòù gzip, έάέ Ýðóέ ááï ÷ ñáέÛæáðáέ ίά ÷ ñçóέïñðïεπρίοάò òçï gunzip, áεòðßñííòáð ìá áòòü òïí òñüðï ÷ ðñï òòï áβóέï.

Òϊ CTM ááï ðñüέáέòáέ ίά ðáέñÛíáέ òά áñ ÷ áβá óάð áí ááï áβίáέ áðüεòðά òβáïòñï áέά òç áέááέέáòá áíáíÝùçò. Άέά ίά áðáεçèáyóáòá Ýíá delta ìðñáβòá áðβóçò ίά ÷ ñçóέïñðïεπρίοάò òçï áðέέïãß -c έάέ òï CTM ááï έá ðáέñÛíáέ òβðïðά, áðεßò έá áðáεçèáyóáέ òçï áέáñáέüðçòά òïò delta έάέ έá ááέ áí ìðñáβ ίά òï áòáñìüóáέ ÷ ùñβò ðñïáέðíáòά òðï òñÝ ÷ ïí áÝíòñï.

ÒðÛñ ÷ òï έάέ Ûεεáð áðέέïãÝð òòï CTM, ááβòá ðέò áíòβòòïε ÷ áð óáεβááð manual ð εíεðÛíòά òïí ðçááβï εßáέéá áέá ðáñέóóüðáñáð ðεçñïíòñβáð.

Áòòü áβίáέ ùεï óòçï ðñááíáòéεüòçòά. ÈÛεá òïñÛ ðïò εáíáÛíáòά Ýíá íÝí delta, áðεßò ðáñÛóáò òï óòï CTM ðóðá ίá Ý ÷ áòá ðÛíòá áíáíáñíÝñ òïí ðçááβï óάð εßáέéá.

Ìçï óáßíáòά òά deltas áí áβίáέ áγóέεï ίά òά εáðááÛóáòά ίáíÛ. εòüð εÝεáðά ίά òά òεέÛíáòά áέá òçï ðáñβðòüçò ðïò εÛòέ ðÛáέ òðñááÛ. Áέüíá έάέ áí òï ìüñ ìÝóï ðïò Ý ÷ áòá áβίáέ áέóέÝðáð, εÛíòά áíòβáñáòï ÷ ñçóέïñðïεπρίοάò òçï fdwrite.

### A.5.5 Èñáòπρίοάò òέò ÒïðέέÝð óάò ÁέéááÝð

Ûò ðñïáñáíáòέóòðò, έá εÝεáðά ίά ðáέñáíáòέóòáβòá έάέ ίά áέέÛíáòά áñ ÷ áβá óòï áÝíòñï ðïò ðçááβïò εßáέéá. Òï CTM òðïóòçñβáέ ðáñέíñέóïÝñò òγðïò òïðέέÝð áέéááÝð: ðñέí áεÝáíáέ áέá òçï ðáñïòóβá áíüð áñ ÷ áβïò foo, áεÝá ÷ áε ðñðά áέá òï foo .ctm. Áí òï áñ ÷ áβï áòòü òðÛñ ÷ áέ, òï CTM έá ÷ ñçóέïñðïεπρίοάέ áòòü áíòβ áέá òï foo.

Ç óòïðáñέóïñÛ áòðß íáð ðáñÝ ÷ áέ Ýíá áðεü òñüðï ίά áέáðçñßòïíá òïðέέÝð áέéááÝð: áðεßò áíðεáñÛøðá òά áñ ÷ áβá ðïò óέïðáýáòά ίά áέéÛíáòά óά áíòβòòïε ÷ á áñ ÷ áβá ìá έáðÛεçïç .ctm. Ìðñáβòá έáòüðέí ίά εÛíáòά üðé áέéááÝð εÝεáðά òòïí εßáέéá áñ òï CTM έá áέáðçñáß áíáíáñíÝñ òï áñ ÷ áβï .ctm.

### A.5.6 ñεéáò ÁíáέáòÝñïòóáò ÁðέέïãÝð òïò CTM

#### A.5.6.1 Άñβóέïñðïáò òé Áέñέáßò έá ÁέéÛíáέ óá íέá ÁíáíÝùç

Ìðñáβòá ίά ðñïáέññβáòá ðέò áέéááÝð ðïò έá ðñïéáέÝóáέ òï CTM óòï repository òïò ðçááβïò óάð εßáέéá, ÷ ñçóέïñðïεπρίοάò òçï áðέέïãß -l.

Áòòü έá áβίáέ ÷ ñßóέïí áí εÝεáðά ίά εñáðßòáòά çìáññéüáέï òüí áέéááßï, áí εÝεáðά ίά áðáíáñáòáòáβòá òά òñïðïðéçïÝíá áñ ÷ áβá ðñέí ð íáòÛ òçï òñïðïðïççò òïòð, ð áí áðεßò áέóέÛíáòά áέáòñð ðáñáíñéüð.

#### A.5.6.2 Άçïέïòñáπρίοάò Áíòβáñáòá Áóóáέáβáð ðñέí òçï ÁíáíÝùç

ÌáñέéÝð òïñÝð έá εÝεáðά ίά εñáðßòáòά áíòβáñáòï áóóáέáβáð üεüí òüí áñ ÷ áβüí ðïò ðñüέáέòáέ ίά áέéá ÷ εíýí áðü íέá áíáíÝùç ìÝòù CTM.

Άβñíòáò òçí âðéεíãP -B backup-file òι CTM èá äçèíòñãPòáé áíòβãñãòι áóòáéãáò üèùí òùí ãñ÷ãβùí ðιò ðñüèãéòáé íá áééã÷èíγí áðu èÜðιέí òããéãñéíγíí delta òòι ãñ÷ãβì backup-file.

### A.5.6.3 Δãñéíñβæííòáò òá Άñ÷ãβã ðιò èá Άééã÷èíγí áðu ÈÜðιέá Áíáíγúòç

Ìãñééγò òñγò βòùð íá áíáéáòγñãòáò íá ðãñéíñβòáò òçí ðãñéí÷P ãñÜòçò íéáð òããéãñéíγíçò áíáíγúòçò ìγòù CTM P βòùð òáð áíáéáòγñãé íá ðÜñãòá ìüíí èβãã ãñ÷ãβã áðu èÜðιέá òáéñÜ áðu deltas.

Ìðñíãβòã íá äéγãíãòá òç èβòá òùí ãñ÷ãβùí òá ðñíβã èá èãéòιòñãPòáé òι CTM ÷ñçéííðιέíðíòáò ùð òβéðñá, regular expressions ìá òéð äðéεíãγò -e èáé -x.

Άéá ðãñÜããéãíá, äéá íá äíÜããòá γíá áíáíãñííí áíòβãñãòι òιò ãñ÷ãβìò lib/libc/Makefile áðu òçí òðéεíãP òáð òùí áðñèçéãòιγíí CTM deltas, äéðãéγòá òéð áíòñéγò:

```
# cd /where/ever/you/want/to/extract/it/
# ctm -e '^lib/libc/Makefile' ~ctm/src-xxx.*
```

Άéá èÜèá ãñ÷ãβì ðιò èãéíñβæííòáé òá γíá CTM delta, ìé äðéεíãγò -e èáé -x äòãñíüæííòáé ìá òç òáéñÜ ðιò ãíòáíβæííòáé òç ãñãñP áíòñéðí. Óòι ãñ÷ãβì ãβíãòáé äðãíãñããòá áðu òι CTM, ìüíí áí ìãñéãñéóòãβ ùð γãéòñí ðñíò áíáíγúòç ìáðÜ òçí äòãñíãP üèùí òùí äðéεíãP -e èáé -x.

### A.5.7 ìãééííòééÜ Ó÷γãéá äéá òι CTM

Άβíáé ðÜñã ðιέεÜ:

- ãñPòç èÜðιέò ãβãòð ðéòòιðíβçòçò òòι òγòòçιά CTM þòðá íá áíãñññβæííòáé ðò÷üí òãýðééð áíáíãþòáéð.
- ìãéãéÜñéòíá òùí äðéεíãP òιò CTM, èãèð ðñíéãéíγí òγã÷òç èáé äáí ãβíáé ðñíòáíãò.

### A.5.8 ΆéÜòñíá

ÓðÜñ÷ãé äðβòçð èáé ìéá òáéñÜ áðu deltas äéá òçí òðéεíãP òùí ports, äééÜ äáí γ÷ãé èéãçéùèãβ èéüíá ãñéãòù áíáéáòγñíí äéá áððP.

### A.5.9 CTM Mirrors

Óι CTM/FreeBSD äéáðβéãòáé ìγòù áíþíòñò FTP áðu òá äéüεíòéá mirrors. Áí äðééγíãòá íá èáðããÜòãòá òι CTM ìγòù áíþíòñò FTP, òáð ðãñãéãéíγíã ðñíòðáéPòáò íá äðééγíãòá ìéá ðιðñéãòβá èñíòÜ òá òáð.

Óá ðãñβðòùòç ðñíãéçíÜòùí, ðãñãéãéíγíã äðééíéíñPòáò ìá òç èβòá ctm-users (<http://lists.FreeBSD.org/mailman/listinfo/ctm-users>).

Èãééòñííéá, Bay Area, äðβòçç ðçãP

- <ftp://ftp.FreeBSD.org/pub/FreeBSD/development/CTM/>



ôĭ FreeBSD άâĭ Ÿ÷ĭôĭ ôĭ csup(1) ôôĭ άάóéêŮ óýóðçĭά, άéêŮ ĭðĭñăβðă ĭά ôĭ άăéάóάóððóăđă άýéĭéă άðŮ ôĭ port net/csup port, ð άðŮ Ÿôĭéĭĭ đăéŸôĭ. ŮóôŮóĭ, ôĭ **csup** άâĭ ôðĭóðçñĭăéé èáðŮóđăóç èăéôĭñăβăð CVS. Άĭ èŸéăðă ĭά èŮĭăđă mirror ĭêŮêêçñă repositories, èά ÷ñăéάóđăβ ĭά ÷ñçóéĭĭðĭéðóăđă ôĭ **CVSup**. Άĭ άðĭóáóβăðă ĭά ÷ñçóéĭĭðĭéðóăđă ôĭ **csup**, άðêðð đăñăéăβððă ôă âðĭăđă äéă ôçĭ άăéάðŮóđăóç ôĭô **CVSup** èăé άĭôééάóđăððă èŮèă άĭăôĭñŮ ôôĭ **CVSup** ôă άððŮ ôĭ Ůñêñĭ, ĭă **csup**.

## A.6.2 ΆăéăðŮóđăóç

ĭă ôéĭéŮăñĭð ôñŮðĭð äéă ĭά άăéάóáóððóăđă ôĭ **CVSup** άβĭăé ĭŸôŮ ôĭô Ÿôĭéĭĭð đăéŸôĭ net/cvsup άðŮ ôçĭ óôéĭĭăð đăéŸôŮĭ ôĭô FreeBSD. Άĭ ðñĭðéĭŮðă ĭă ĭăðăăèŮððβôđă ôĭ **CVSup** άðŮ ôĭð đçăăβĭ êðăééă, ĭðĭñăβðă ĭά ÷ñçóéĭĭðĭéðóăđă ôĭ port net/cvsup. Óáð ðñĭăéăĭðĭéĭŸă ùðéôŮĭ Ůðé ôĭ port net/cvsup άĭăñðŮđăé άðŮ ôçĭ Modula-3, ç ĭðĭβă ÷ñăéŮăăđăéă ãñêăôŮ ÷ñŮĭĭ èăé ÷ðñĭ óôĭ âβðĭĭ äéă ĭά èáðŸăăé èăé ĭă ĭăðăăèŮððéóðăβ.

**ÓçĭăβŮóç:** Άĭ ðñŮêăéđăé ĭά ÷ñçóéĭĭðĭéðóăđă ôĭ **CVSup** ôă Ÿĭă ĭç÷Ůĭçĭă ôĭ ĭðĭβĭ άâĭ èă äéăéŸôăé ãñăóéêŮ đăñéăŮéĭĭ ĭŸôŮ **XFree86** ð **Xorg**, ŮðŮð đ.÷. ôă Ÿĭă άĭððçñăðçðð, άăăééŮèăăðă Ůðé äăéăééóðŮă ôĭ άĭðβôðĭé÷ĭ port ôĭ ĭðĭβĭ άâĭ đăñééăĭăŮĭăé ãñăóéêŮ đăñéăŮéĭĭ, açéăăð ôĭ net/cvsup-without-gui.

Άĭ èŸéăðă ĭă άăéάóáóððóăđă ôĭ **csup** óôĭ FreeBSD 6.1 ð ðñĭăăĭŸóđăñĭ, ĭðĭñăβðă ĭă ÷ñçóéĭĭðĭéðóăđă ôĭ Ÿôĭéĭĭð đăéŸôĭ net/csup άðŮ ôçĭ óôéĭĭăð đăéŸôŮĭ ôĭô FreeBSD. Άĭ èŸéăðă ĭă ĭăðăăèŮððβôđă ôĭ **csup** άðŮ ôĭð đçăăβĭ êðăééă, ĭðĭñăβðă ĭă ÷ñçóéĭĭðĭéðóăđă ôĭ port, net/csup.

## A.6.3 ŸŸéĭéóç ôĭô CVSup

Ç èăéôĭñăβă ôĭô **CVSup** äéŸă÷ăðăé άðŮ Ÿĭă ãñ÷ăβĭ ãðéĭβôăŮĭ ðĭô èăéăβðăé supfile. ŌðŮñ÷ĭôĭ èŮðĭéă ððĭăăβăĭăðă áðŮ supfiles óôĭ èáðŮéĭĭăĭ /usr/share/examples/cvsup/.

ĭé ðêçñĭĭñăβăð óôĭ supfile άðăĭôĭŸĭ ðéð âêŮéĭðéăð ãñŮððóăéð äéă ôĭ **CVSup**:

- Đĭéă ãñ÷ăβă èŸéăðă ĭă èŮăăðă;
- Đĭéăð äêŮŮóăéð ôŮĭ ãñ÷ăβĭŮ èŸéăðă;
- ΆðŮ ðĭô èŸéăðă ĭă ôă èŮăăðă;
- Đĭô èŸéăðă ĭă ôă áðĭèçéăŸóăðă óôĭ ĭç÷Ůĭçĭă óáð;
- Đĭô èŸéăðă ĭă áðĭèçéăŸóăðă ôă ãñ÷ăβă èáðŮóđăóçð;

Óóă áðŮĭăĭă ðĭðĭăđă, èă açĭéĭðñăðŮĭôĭă Ÿĭă ôððééŮ supfile áðăĭðĭóăð èŮèă ĭéă áðŮ ðéð ãñŮððóăéð áðôŸð ĭă ôç óăéñŮ. Đñðă, èă đăñéăñŮðĭôĭă ôç óôñĭééêð ãñð ĭŮŮð supfile.

ĭă supfile άβĭăé Ÿĭă ãñ÷ăβĭ èăéĭŸĭô. Óă ó÷èéă ĭăééĭŮĭă ĭă # èăé áðăéðăβñĭóăé ùð ôĭ ôŸĭôð ôçð ãñăĭðð. ĭé èăĭŸð ãñăĭŸð, èăêðð èăé áðôŸð ðĭô đăñéŸ÷ĭôĭ ĭŮŮĭ ó÷èéă, áăñĭŸĭðăé.

ÈŮèă ãñăĭðð áðŮ ðéð ððŮéĭðăð đăñéăñŮóăé Ÿĭă óăð ãñ÷ăβĭŮ ôă ĭðĭβă áðéèôĭăβ ĭă èŮăăé ĭ÷ñðóçð. Ç ãñăĭð ĭăééĭŮăé ĭă ôĭ Ůñĭă ĭéăð “óôéĭĭăðð”, áĭŮð ĩăééŸŸ ãéñĭôð áðŮ ãñ÷ăβă ðĭô ĭñăăðăéé áðŮ ôĭð áĭððçñăðçðð. Ōĭ Ůñĭă ôçð óôéĭĭăðð açêðĭăé óôĭĭ áĭððçñăðçðð đĭéă ãñ÷ăβă áðéèôĭăβă. ĭăðŮ ôĭ Ůñĭă ôçð óôéĭĭăðð, ĭðĭñăβ ĭă ððŮñ÷ĭôĭ áðŮ ĭçăŸĭ ùð èŮðĭéă đăăβă, ôă ĭðĭβă ÷ññăĭŮóăé ĭăðăŸŸ ôĭðð ĭă èăĭŮ äéăóððĭăđă. Óă đăăβă áðôŮ đăĭôĭŸĭ ðéð ãñŮððóăéð ðĭô ôŸéçéăĭ đăñăðŮŮŮ. ŌðŮñ÷ĭôĭ äŸĭ ôŸðĭé đăăβŮĭ: đăăβă óðĭăóçð (flags) èăé đăăβă ðéĭðĭ. ĭă đăăβĭ



èά òòιðáñéòáñéαß óáι íά Ý÷-áðά äþóáé Ýíá Ýæèðñι tag òι ιðιβι ááι áíáòÝñáðáé òά èáíÝíá áñ÷-áßι. Óòçι ðáñβðòòóç áððß èá äéááñÛøáé òά òðÛñ÷-ιιðά áñ÷-áßá òάó ðççááßιò èþáéèá.

¼ðáí èáèιñβóáðά èÛðιéι branch tag, òòóéιéιáéèÛ èá èÛááðά òéð òáèáððáβáð äéäιòáéð òιι áñ÷-áßιι ðιò òðÛñ÷-ιιòι òά áððß ðç äñáñιß áíÛððòιçð. Áι èÝéáðά íá èÛááðά èÛðιéáð ðáééιðáñáð äéäιòáéð, ιðιñáβðά íá òι èÛíáðά èáèιñβáñιðáð íéá çìáñιçíáβá ιÝòú òιò ðááβιò òéιþι date=. Ç òáèβáá manual csup(1) áιçááß ðùð ιðιñáβðά íá òι èÛíáðά.

Óòι ðáñÛááéáιá íáð, áðéèèιγíá íá èÛáιòιá òι FreeBSD-CURRENT. ÐñιòèÝòιòιá ðç äñáñιß áððß òòçι áñ÷-ß òιò supfile áñ÷-áßιò íáð:

```
*default tag=.
```

ÓðÛñ÷-áé íéá òçìáíðéèß áéáéèß ðáñβðòòóç ùðáí ááι èáèιñβóáðά ιγúðá ðááβι tag= ιγúðá ðááβι date=. Óòçι ðáñβðòòóç áððß èá èÛááðά òά èáñιéèÛ áñ÷-áßá RCS áðáðéáβáð áðú òι CVS repository òιò áιòðçñáòçðß, áíðβ áéá íá èÛááðά èÛðιéá òðáéáñéñιÝιç Ýéáιòç. Ìé ðñιáñáñιáðéòóðÝð ááιéèÛ ðñιðéιγí áðòú òιι òñιðι èáéðιòñáβáð. Áéáðçñιðáð ðèþñáð áíðβáñáòι òιò CVS repository òðά òðððιáðά òιòð Ý÷-ιιòι òçι èéáíúðçðά íá äéÝðιòι òι èóòιñéèú áééáþι èÛèá Ýéáιòçð èáé íá áíáðÛæιòι ðáééιðáñáð äéäιòáéð òιι áñ÷-áßιι. Óά ðáñáðÛιù ðéáñιáèðιáðά ùðòòι Ý÷-ιιòι òι èιòðιð òçð ìááéγúðáñçð ÷ ñþðçð ÷ þñιò òòι òéèçñι ãβóéι.

- Άðú ðιò èÝéáðά íá òά èÛááðά;

×ñçóéιιðιéιγíá òι ðááβι host= áéá íá ðιγíá òòι cvsup áðú ðιò íá èÛááé òéð áíáíáþóáéð òιò. Ìðιéιáþðιòά áðú òά CVSup mirror sites áβιáé èáðÛèèçéι, áí èáé èá ðñÝðáé íá ðñιððáéþóáðά íá áðééÝíáðά èÛðιéι òι ιðιβι íá áñβóéáðáé èιíðÛ òáð. Óòι ðáñÛááéáιá íáð, èá ÷ ñçóéιιðιéþòιòιá íéá òáíðáððéèß ðιðιéáðáβá äéáñιðð òιò FreeBSD, òι cvsup99.FreeBSD.org:

```
*default host=cvsup99.FreeBSD.org
```

Èá ðñÝðáé íá áéèÛíáðά òι host òά èÛðιéι ðιò ðñááιáðéèÛ òðÛñ÷-áé ðñéι áéðáéÝðáðά òι CVSup. ÈÛèá òιñÛ ðιò áéðáéáβðά òι cvsup, Ý÷-áðά òçι áðíáðúðçðά íá áíáðñÝðáðά áððß ðç ñγéιéóç ιÝòú òçð äñáñιðð áíðιéþι ìá òçι áðééιáþ -h hostname.

- Ðιò èÝéáðά íá òά áðιèçéáγúðáð òòι ιç÷-Ûιçíá òáð;

Óι ðááβι prefix= äçèþιáé òòçι cvsup ðιò íá áðιèçéáγúðáé òά áñ÷-áßá ðιò èáíáÛíáé. Óòι ðáñÛááéáιá íáð, èá áÛéιòιá òά áñ÷-áßá òιò ðççááβιò èþáéèá, áðáðéáβáð òòι èγñéι áÝιòñι ðççááβιò èþáéèá, /usr/src. Ì èáðÛéιáðò src èäññáβðáé áááñÝñò áéá òéð òðééιáÝð ðιò Ý÷-ιιòιá áðééÝíáé íá èÛáιòιá, èáé Ýðóé ι òúðòðð ðñιòáéñéòιùð áβιáé áðòúð ðιò òáβιáðáé ðáñáéÛðù:

```
*default prefix=/usr
```

- Ðιò èá áðιèçéáγúðáé òι cvsup òά áñ÷-áßá èáðÛððáóçð òιò;

Ì ðáéÛðçð CVSup áéáðçñáß èÛðιéá áñ÷-áßá èáðÛððáóçð (status files) òά áðòú ðιò áðιéáéáβðáé èáðÛéιáðò “base”. Óά áñ÷-áßá áððÛ áιçéιγí òι CVSup íá èáéðιòñááß ðéι áðιáιòéèÛ èñáðþιðáð éñááñéáðιù òιι áíáíáþóáι ðιò Ý÷-áðά þäç èÛááé. Èá ÷ ñçóéιιðιéþòιòιá òιι ðñιáðééááñÝñι èáðÛéιáñι base, /var/db:

```
*default base=/var/db
```

Áι ι base èáðÛéιáðò òáð ááι òðÛñ÷-áé þäç, ðþñá áβιáé íéá èáéþ òðéáñι íá òιι äçιéιòñáþðáðά. Ó ðáéÛðçð cvsup ááι èá äéðáéáβðáé áí ι base èáðÛéιáðò ááι òðÛñ÷-áé.

- ÁéÛòιñáð ñðéιβóáéð áéá òι supfile:

ÓðÛñ÷-áé áéùιá íéá èιéιþ äñáñιß ñðéιβóáùι, ç ιðιβá òððééÛ òðÛñ÷-áé òòι supfile:

```
*default release=cvs delete use-rel-suffix compress
```

Όι release=cvs àáβ÷íáε ùòé ι áñòðçñáòçòð òé à ðñÝðáε íá εÙááε òéò ðεçñιòιñβáò òιò ιÝòù òιò εýñειò CVS repository òιò FreeBSD. Άòòù εó÷-γáε ó÷-ááυι ðÙίòá, áεεÙ òðÙñ÷-ιòι éáε Ùεεáò ðεéáíυòçòáò ðιò íáòáγáιòι áðu òι óειðu áòòð òçò òðæðçòçò.

Ç εÝίç delete àβίáε áεéáεβιáòá òòι **CVSup** íá áεááñÙòáε àñ÷-áβá. Èá ðñÝðáε ðÙίòιòá íá Ý÷-áòá òçι áðεειáβ áòòð, þóòá òι **CVSup** íá ιðñáβ íá εñáòðóáε òι áÝίòñι òιò ðçááβιò óáò εþáεéá ðεÞñù ðιáíáυιÝι. Όι **CVSup** àβίáε àñεáòÙ ðñιòáεòεεù þóòá íá óáβιáε ιυíι òá àñ÷-áβá ðιò àñβóειíòáε òðu òçι áðεγίç òιò. Áι òò÷-υι áÙεáòá Ýíòñá àñ÷-áβá òòιι βáει éáòÙειáι, ááι éá òá áááβιáε.

Ç áðεειáβ use-rel-suffix àβίáε... àñ÷-áειειáεεÞ. Áι ðñááιáòεεÙ εÝεáòá íá ιÙεáòá ó÷-áòεεÙ ιá áòòðι, áεááÙòá òç óáεβáá manual cvsup(1). Áεεεþò, áðεþò ÷-ñçóειιðιéÞóòá òçι, éáε ιçι áιçóò÷-áβòá εéááβòáñá áεá áòòð.

Ç áðεειáβ compress áíáñáιðιéáβ òç ÷-ñÞóç òòιðβáòçò òγðιò gzip òòι éáíÙεε áðεειéιυιáò. Áι Ý÷-áòá óγίááòç áεéòγίò òγðιò T1 Þ éáε ðει áñÞáñç, ιÙεειι ááι éá ðñÝðáε íá ÷-ñçóειιðιéÞóáòá òòιðβáòç. Óá áεáòιñáòεéÞ ðáñβðòυòç, éá áιçεÞóáε áíáεñáòεéÙ.

- ¼εáò ιé áðεειáÝò ιáεβ:

Ááþ àβίáε òι ðεÞñáò supfile áεá òι ðáñÙááεáιá ιáò:

```
*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 Όι Άñ÷-áβι refuse

¼òòù áíáòÝñáιá ðáñáðÙι, òι **CVSup** ÷-ñçóειιðιéáβ ιÝειáι pull. ÁáóεεÙ áòòù òçιáβιáε ùòé òòιáÝáòáòá òòιι áñòðçñáòçòð **CVSup**, áòòòù εÝáε “ÁòòÙ àβιáε òá àñ÷-áβá ðιò ιðñáβòá íá éáòááÙóáòá áðu ιÝίá..”, éáε òι áεεù óáò ðñυáñáιá áðáιòÙáε “ÁιòÙίáε, éá ðÙñù áòòù, áòòù, áòòù, éáε áòòù.” Óòçι ðñιáðεéááιÝίç ñýειέòç, ι ðáεÙòçò **CVSup** éá ðÙñáε εÙεá àñ÷-áβι ðιò òòιáÝáòáε ιá òçι òðεειáβ éáε òι tag ðιò Ý÷-áòá éáειñβóáε òòι àñ÷-áβι ñòειβóáιι. Ùóòòυι ιðñáβ íá ιçι òι áðεεòιáβòá áòòù ðÙίòá, áεáεεÙ áι óòá÷-ñιιβáεáòá òá áÝίòñá doc, ports Þ www — ιé ðáñεóòυòáñιε Ùíεñυðιε ááι ιðñιγί íá áεááÙòιòι òÝóóáñεò Þ ðÝίòá áεþóóáò éáε Ýòóé ááι ÷-ñáεÙæáòáε íá éáòááÙòιòι àñ÷-áβá ðιò áíáòÝñιíòáε áεáεεÙ óá áòòÝð. Áι ÷-ñçóειιðιéáβòá òι **CVSup** áεá òçι òðεειáβ òυι Ports, ιðñáβòá íá ιáðáñÙóáòá áòòð òç òòιðáñεòιñÙ éáειñβáειíòáò òðáεáñειÝίáò òðεειáÝò (ð.÷. ports-astrology, ports-biology áιòβ áεá ports-all). Ùóòòυι, áðáεáÞ òá áÝίòñá doc éáε www ááι áεáεÝòιòι òðεειáÝò ÷-ùñεòιÝίáò áíÙ áεþóóá, ιðñáβòá íá ÷-ñçóειιðιéÞóáòá Ýίá áðu òá áιεéεÙ ÷-áñáεòçñéóóéεÙ òιò **CVSup**: òι àñ÷-áβι refuse.

Όι àñ÷-áβι refuse ιòóεáóòéεÙ εÝáε òòι **CVSup** ùòé ááι ðñÝðáε íá ðÙñáε εÙεá àñ÷-áβι áðu ιεá òðεειáβ. Ιá Ùεεá ευáεá, εÝáε òòιι ðáεÙòç íá áñίçεáβ òðáεáñειÝίá àñ÷-áβá ðιò ðñιòóÝñáε ι áñòðçñáòçòð. Όι àñ÷-áβι refuse ιðñáβ íá àñáεáβ (Þ íá áçιειòñáçεáβ áι ááι Ý÷-áòá Þáç) òòι base/sup/. Όι base éáειñβáεáòáε òòι supfile. Όι áεεù ιáò base àβιáε òòι /var/db, òι ιðιβι òçιáβιáε ùòé òι ðñιáðεéááιÝι àñ÷-áβι refuse éá àβιáε òι /var/db/sup/refuse.

Όι àñ÷-áβι refuse Ý÷-áε éáεáβòáñá áðεÞ ιñòÞ. Άðεþò ðáñεÝ÷-áε òá ιυιιáòá òυι àñ÷-áβυι éáε éáòáευáυι òá ιðιβá ááι áðεεòιáβòá íá éáòááÙóáòá. Άεá ðáñÙááεáιá, áι ááι ιεεÙòá áεþóóáò áεòòù áðu ÁááεεεÙ éáε εβáá ΆáñιáιéεÙ, éáε ááι áεóεÙίáòá òçι áíÙáεç íá áεááÙóáòá òçι ΆáñιáιéεÞ ιáòÙòñáòç òçò òáειçñβυòçò, ιðñáβòá íá áÙεáòá òá áευειòεá òòι áεεù óáò àñ÷-áβι refuse:

```
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\_\*

è.ì.è. áέα ðεδ òδυείεðåð ãεβρóað (ìðñåβåð íá åñåβåð ðçί ðεβñç εβδóa òðϊ FreeBSD CVS repository (<http://www.FreeBSD.org/cgi/cvsweb.cgi/>)).

Ìå áòð ϰ ÷ ñβρείç äðíáðüòçòå, ïé ÷ ñβρóað ðïϑ Ý ÷ ïðí åñåβ òýíááòç β ðεçñþñïð ðï Internet ìå ÷ ññíñ ÷ ñÝùòç áíÛ èåððü, èå ìðñÝòïð íá åñείρñβòïð ðñεýðεñ ÷ ñññí èåðð åår èå ÷ ñåÛæåðåé ðεÝñ íá èåðååÛòïð åñ ÷ åβå ðïϑ åår ðññεåéðå íá ÷ ñçòείñðñεβòïð ðïðÝ. Áέα ðåñέóòüðåñåð ðεçññïññβåð ò ÷ åðééÛ ìå òå åñ ÷ åβå refuse èåé Ûééå ÷ ñβρείå ÷ åñåðçñέóðééÛ ðïϑ **CVSup**, ðåñåéåñññå èåååÛòðå ðçί áíðβòðïé ÷ ç òåβååå ðïϑ manual.

### A.6.4 Åéðåèñíòåð ðï CVSup

Åβòåð òþñå Ýòïεññé íá åñείÛòåðå ïéå áñíÝùòç. Ç åñåñññ áñòïρεðð åέα òï òéñðü áððü åβñåé èééåβðåñå åðεβ:

```
# cvsup supfile
```

üðïð ðï *supfile* åβñåé òðòééÛ ðï ùññå ðïϑ åñ ÷ åβññ *supfile* ðïð ìüééð åçείρññåβρóað. ÕðñεÝòññòåð üðé ÷ ñçòείñðñεåβðå òå X11, ç áñòïρεβ *cvsup* èå òåð åñòåññåé Ýñå åñåéññ ðåñÛεðññ ìå èÛðñéå ðεβεðñå òðçéééòñÝñññ èåéòññåñññ. ΔéÝòå òï ðεβεðññ *go*, èåé ðåñåéññòεβρóað ðçί åéðÝéåòç.

Èåðð òðçί ðåññððòòç ìåð áñíåñññåé ðï ðñåññåéññ åÝññññ */usr/src*, èå ÷ ñåéåòðåβ íå èéðåéÝòåð òï ðññåñññå ùð *root* þρòå ç *cvsup* íå Ý ÷ åé òå åééåññåéðå ðïϑ ÷ ñåéÛæåðåé åέα íå áñíåññåé òå åñ ÷ åβå òåð. Èåðð ìüééð Ý ÷ åðå åçείρññåβρóaé ðï åñ ÷ åβññ ñðéìβòåññ, èåé åår Ý ÷ åðå ðïðÝ ðñéñ ÷ ñçòείñðñεβρóaé ðï ðññåñññå, βòüð åέòéÛñåðå èβåñ Ûåñéå. ÕðÛñ ÷ åé åýεññð ðññðññ íå èÛñåðå åñείñåðééβ åéðÝéåòç ÷ ùñβð íå ðåññÛñåðå òå ðñεýðéñå åñ ÷ åβå òåð. Áðεβð åçείρññåβρóaé Ýñå Ûååéñ èåðÛεññ òå Ýñå åñééññ ìÝññð, èåé þρòå òï òåñ Ýññå ðåñÛñåðññ òðçί åñåñññ áñòïρεβ:

```
# mkdir /var/tmp/dest
# cvsup supfile /var/tmp/dest
```

Ì èåðÛεññò ðïð èåéññåβρóað èå ÷ ñçòείñðñεéåβ ùð ðñññέóññ ãέα ìéåð ðéð áñíåññåéð åñ ÷ åβññ. Õï **CVSup** èå åñåðÛòåé òå èåññééÛ åñ ÷ åβå òåð òðï */usr/src*, åééÛ åår èå ðññðññεβρóaé ïýðå èå åéåññÛòåé èåñÝñå áðññ áððÛ. ÈÛéå áñíåñññ åñ ÷ åβññ èå åβñåé òðññ èåðÛεñññ */var/tmp/dest/usr/src*. Õï **CVSup** ùðåñ åéðåéåβρóaé ìå áððü ðññ òññðññ áòþñåé åðβòçð áñÝðåðå òå åñ ÷ åβå èåðÛòåðòçð ðïð òðññ èåðÛεñññ *base*. Ìé ïÝåð åéåññåéð ðññ åñ ÷ åβññ áððþññ èå åñåðñññ òðññ èåðññééñññ èåðÛεñññ. Áñ Ý ÷ åðå åðεβð ðñññåéòç áñÛñññòçð òðï */usr/src*, åår ÷ ñåéÛæåðå èå íåβòå èåñ *root* åέα íå èÛñåðå áððβ ðç åñείñåðééβ åéðÝéåòç.

Áñ åår åéðåéåβρóað òå X11 β åðεβð åår òåð åñÝòñññ òå åñåéññ ðåññåéÛéñññå, ìðñåβåð íå þρòåðå èÛðñéåð åðééñåÝò òðçί åñåñññ áñòïρεβ ùðåñ åéðåéåβρóað ðçί *cvsup*:

```
# cvsup -g -L 2 supfile
```

Ç áðέετᾱP -g èÝᾱέ óοι CVSup ίά ιç ÷ ñçóετᾱδτᾱέP óι ᾱᾱόέετᾱ òτᾱ ðᾱñέᾱÜεετᾱ. Ἀòòτᾱ ᾱβτᾱόᾱέ ᾱòòτᾱόᾱ ᾱί ᾱᾱί ᾱέòᾱετᾱίόᾱέ óᾱ X11, ᾱέεÜ ᾱέᾱóτᾱᾱόέéÜ èᾱ ðñÝðᾱέ ίᾱ òτᾱ εᾱετᾱñβóᾱòᾱ.

Ç áðέετᾱP -L 2 èÝᾱέ óοι CVSup ίᾱ ᾱτᾱόᾱβóᾱέ üεᾱò òέò εᾱðòñÝñᾱέᾱò ᾱέᾱ üεᾱò òέò ᾱτᾱίᾱPᾱóᾱέ ᾱñ ÷ ᾱβτᾱί ðτᾱ ᾱέòᾱéᾱβ. ÕðÜñ ÷ τᾱί òñβᾱ ᾱðβðᾱᾱᾱ ᰃᾱñέᾱñᾱóPð, ᾱðτᾱ òτᾱ -L 0 ùò òτᾱ -L 2. Ç ðñτᾱðέετᾱP ᾱβτᾱέ òτᾱ 0, ðτᾱ óçτᾱβτᾱέ ᾱðτᾱέòç óέτᾱðP ᾱέòτᾱò ᾱðτᾱ τçτᾱίᾱóᾱ èÜετᾱòð.

ÕðÜñ ÷ τᾱί ᾱέᾱéÝóετᾱò ᾱñέᾱòÝð ᾱέτᾱτᾱ ᾱðέετᾱÝð. Ἄέᾱ ίέᾱ ᰃᾱñέεçðððέéP εβóóᾱ, ᾱñÜðòᾱ cvsup -h. Ἄέᾱ ᰃᾱñέóóτᾱòᾱñτᾱ εᾱðòñᾱñᾱβò ᰃᾱñέᾱñᾱóÝð, ᾱᾱβòᾱ òç óᾱεβᾱᾱ òτᾱ manual.

¼óᾱί τᾱβτᾱóᾱ éεᾱτᾱδτᾱέçτᾱÝτᾱò ᾱðτᾱ òτᾱ òñτᾱðτᾱ ðτᾱ ᾱβτᾱίόᾱέ τᾱ ᾱτᾱίᾱPᾱóᾱέò, τᾱñᾱβòᾱ ίᾱ εᾱτᾱτᾱóᾱòᾱ òçτᾱ óᾱ òᾱέòÜ ᾱέᾱóòPτᾱóᾱ ᾱέòÝéᾱóç òτᾱ CVSup τᾱ òçτᾱ ÷ ñPóç òτᾱ cron(8). Δñτᾱóτᾱð ᾱᾱί èᾱ ðñÝðᾱέ ίᾱ ᾱòPᾱóᾱò òτᾱ CVSup ίᾱ ÷ ñçóετᾱδτᾱέβ òτᾱ ᾱᾱόέéτᾱ òτᾱ ðᾱñέᾱÜεετᾱ üòᾱί òτᾱ ᾱέòᾱéᾱβòᾱ τᾱÝóτᾱ òτᾱ cron(8).

### A.6.5 ÓðέετᾱÝò Ἀñ ÷ ᾱβτᾱί òτᾱCVSup

Íé óðέετᾱÝò ᾱñ ÷ ᾱβτᾱί ðτᾱ ᾱέᾱòβεᾱτᾱóᾱέ τᾱÝóτᾱ òτᾱ CVSup ᾱβτᾱέ τᾱᾱᾱτᾱτᾱÝτᾱò éᾱñᾱñ ÷ ééÜ. ÕðÜñ ÷ τᾱί εβᾱòò τᾱᾱÜεᾱò óðέετᾱÝò, éᾱέ ᾱòòÝð ÷ ùñβεᾱτᾱóᾱέ óᾱ ίέéñτᾱòᾱñᾱò ððτᾱ-óðέετᾱÝò. Ç εPøç ίέᾱò τᾱᾱÜεçð óðέετᾱPð, éóτᾱóτᾱτᾱβ τᾱ òçτᾱ εPøç èÜεᾱ ίέᾱò ᾱðτᾱ òέò ððτᾱ-óðέετᾱÝò òέò. Íé éᾱñᾱñ ÷ ééÝð ó ÷ Ýóᾱέò τᾱòᾱίτᾱ òτᾱ óðέετᾱPτᾱ, ᾱτᾱéᾱóτᾱðòñβετᾱίόᾱέ ᰃᾱñᾱéÜòτᾱ τᾱ òçτᾱ ÷ ñPóç òτᾱ ᾱóτᾱ ÷ Pτᾱ.

Íé ðετᾱ óð ÷ τᾱÜ ÷ ñçóετᾱδτᾱέçτᾱτᾱᾱò óðέετᾱÝò ᾱβτᾱέ ç src-all, éᾱέ ç ports-all. Íé Üεéᾱò óðέετᾱÝò ÷ ñçóετᾱδτᾱέçτᾱίόᾱέ τᾱτᾱ ᾱðτᾱ ίέéñÝò ñÜᾱᾱò ᾱτᾱñPðτᾱ ᾱέᾱ ᾱέᾱééτᾱýò óéτᾱδτᾱýò, éᾱέ èÜðτᾱéᾱ mirror sites τᾱñᾱβ ίᾱ τçτᾱ òέò Ý ÷ τᾱί éᾱéτᾱετᾱ.

```
cvs-all release=cvs
```

Õτᾱ éτᾱñέτᾱ CVS repository òτᾱ FreeBSD, ðτᾱ ᰃᾱñέᾱτᾱÜτᾱᾱέ éᾱέ òτᾱ εPᾱééᾱ éñòðòτᾱñᾱóβᾱòð.

```
distrib release=cvs
```

Ἀñ ÷ ᾱβᾱ ðτᾱ ᾱτᾱóÝñτᾱίόᾱέ óçτᾱ ᾱέᾱτᾱP éᾱέ òτᾱ mirroring òτᾱ FreeBSD.

```
doc-all release=cvs
```

Δçᾱᾱβτᾱò εPᾱééᾱò ᾱέᾱ òτᾱ FreeBSD Handbook éᾱέ òçτᾱ òðτᾱετᾱéðç òᾱéτᾱñβòç. Ἄᾱί ᰃᾱñέᾱτᾱÜτᾱᾱέ ᾱñ ÷ ᾱβᾱ ᾱέᾱ òτᾱ web site òτᾱ FreeBSD.

```
ports-all release=cvs
```

Ç óðέéτᾱP Ports òτᾱ FreeBSD.

**Óçτᾱίóééτᾱ:** Ἄί ᾱᾱί èÝᾱéòᾱ ίᾱ ᾱτᾱίᾱPᾱóᾱòᾱ üετᾱ òτᾱ ports-all (òτᾱ ðεPñᾱò ᾱÝτᾱòñτᾱ òτᾱ ports), ᾱέéÜ ίᾱ ÷ ñçóετᾱδτᾱέPᾱóᾱòᾱ ίέᾱ ᾱðτᾱ òέò ððτᾱóðέéτᾱÝò ðτᾱ óᾱβτᾱτᾱίόᾱέ ᰃᾱñᾱéÜòτᾱ, ᾱᾱᾱᾱéτᾱéᾱβòᾱ üòé ðÜτᾱóᾱ ᾱτᾱίᾱPτᾱᾱᾱò òçτᾱ ððτᾱóðέéτᾱP ports-base! ¼óᾱί èÜòé ᾱέéÜᾱᾱéé óòτᾱ óýóòçτᾱ τᾱòᾱᾱεPððéóçð òτᾱ ports ðτᾱ ᾱτᾱéðñτᾱíóúðᾱýᾱóᾱé ᾱðτᾱ òτᾱ ports-base, ᾱβτᾱέ ᰃᾱñᾱéòééÜ ᾱÝᾱᾱéτᾱ üòé τᾱ ᾱééᾱᾱÝò ᾱòòÝò ðτᾱéý óýτᾱíᾱ éᾱ ÷ ñçóετᾱδτᾱέçτᾱéçτᾱίý ᾱðτᾱ “ðñᾱᾱτᾱíᾱóééÜ” ports. Póé, ᾱί ᾱτᾱίᾱPτᾱᾱᾱò τᾱτᾱ òᾱ “ðñᾱᾱτᾱíᾱóééÜ” ports éᾱέ ᾱòòÜ ÷ ñçóετᾱδτᾱέçτᾱίý èÜðτᾱéᾱò ᾱðτᾱ òέò τᾱÝᾱò ᾱóτᾱíòðçðᾱò, ððÜñ ÷ ᾱé τᾱᾱÜεç ðééᾱτᾱüòçðᾱ ç τᾱòᾱᾱεPððéóç òτᾱòò ίᾱ ᾱðτᾱíý ÷ ᾱé τᾱ èÜðτᾱéτᾱ τᾱòòçñεPᾱᾱò τᾱPτᾱíᾱ èÜετᾱòð. Õτᾱ ðñPóτᾱ ðñÜᾱτᾱ ðτᾱ ðñÝðᾱέ ίᾱ èÜτᾱíᾱòᾱ óᾱ ᾱòòP òçτᾱ ᰃᾱñβðòòòç ᾱβτᾱέ ίᾱ ᾱᾱᾱᾱéτᾱéᾱβòᾱ üòé ᾱβτᾱέ ᾱτᾱçτᾱñτᾱτᾱÝçç ç óðέéτᾱP óᾱò ports-base.

**Όçιάίðééü:** Άί òéïðáγáðά ίά äçïéïðñāÞðáðά ðϊ äééü óáð ðïðééü áíðßñāðï ðïð ports/INDEX, èá ðñÝðáé ίά äâ÷ðâßðá ðç óðééïāÞ ports-all (ïéüéèçñï ðï äÝíðñï ðùí ports). Η äçïéïðñāßá ðïð ports/INDEX áðü ïç-ðèÞñâð äÝíðñï äáí ððïðóçñïßæáðáé. Άâßðá ðï FAQ ([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/books/faq/applications.html#MAKE-INDEX](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/faq/applications.html#MAKE-INDEX)).

ports-accessibility release=cvs

Ëïäéóíééü äéá ðçï äïÞèáéá ÷ñçóðÞí ïâ áíáðçñßâð.

ports-arabic release=cvs

ÕðïðóÞñéïç ΆñááééÞð ÆèÞðóáð.

ports-archivers release=cvs

Άñááéâßá áðïèÞèáððóçð éáé óðïðßáóçð.

ports-astro release=cvs

Ports ó÷áðééÛ ïâ áóðñïññßá.

ports-audio release=cvs

ÕðïðóÞñéïç Þ÷ïð.

ports-base release=cvs

ΆáóééÛ äñ÷âßá ðùí ports äéá ððïðóÞñéïç ðïð óðððÞíáðïð ïâðááèÞððéóçð. ÄéÛïññá äñ÷âßá ðïð äñßóéïñíóáé óðïðð ððïéáðáéüäïðð Mk/ éáé Tools/ ðïð /usr/ports.

**Όçïâßùðç:** Ðáñáéáéïγïá äâßðá ðçï óçïáíðééèÞ ðñïäéäïðïßçðç ðáñáðÛïü: èá ðñÝðáé ðÛïðïðá ίά äïçïäñÞðáðá áððÞ ðçï ððïððééïāÞ, ùðáí äïçïäñÞðáðá ïðïéïāÞðïðá ðïÞíá ðçð óðééïāÞðò Ports ðïð FreeBSD.

ports-benchmarks release=cvs

ÐñïññÛñíáðá ïÝðñçóçð áðüäïðçð (Benchmarks).

ports-biology release=cvs

Άéïéïāßá.

ports-cad release=cvs

Άñááéâßá ó÷âßáóçð ïâ ðç äïÞèáéá ððïéïāéóðÞ.

ports-chinese release=cvs

ÕðïðóÞñéïç ÊéïáæéèÞð ÆèÞðóáð.

ports-comms release=cvs

Ëϊάέοιέεü åðέέιέϊúίέπϊ.

ports-converters release=cvs

Ìåðåðñïðåβð ÷ åñåέðPñùϊ.

ports-databases release=cvs

ÂÛååèð ÅååñÝíúϊ.

ports-deskutils release=cvs

Áίέέåβλϊάϊά ðïð åñβóέϊíóáϊ óðïPèùð óå Ýϊά åñåóåβï ðñέϊ ðçϊ åöýññåóç ðùϊ ððïεϊάέóðπϊ.

ports-devel release=cvs

ÂίçèçåééÛ ðñïñÛñïάά åέå ðçϊ áíÛðððίç εϊάέοιέέϊý.

ports-dns release=cvs

Ëϊάέοιέεü ó÷åðέéü ìå DNS.

ports-editors release=cvs

ÓðïðÛèðåð èåέϊÝñð.

ports-emulators release=cvs

ÂññïέùÝð Ûέεüí èåέðïñåέέπϊ óððçïÛðùϊ.

ports-finance release=cvs

×ñçïåðïñέέññέéÛ ðñïñÛñïάά.

ports-ftp release=cvs

ΔñïñÛñïάά FTP (ðåèÛðåð èåέ åïððçñåðçð Ýð).

ports-games release=cvs

Δåé÷ίβåέå.

ports-german release=cvs

ÏðïððPñέίç ÅåñïåίέéPð åèpóóåð.

ports-graphics release=cvs

Âñååèåβå åñåóέέπϊ.

ports-hebrew release=cvs

ÏðïððPñέίç ååñåúéPð åèpóóåð.

ports-hungarian release=cvs

ÏðïððPñέίç ÌðåååñÝæέéçð åèpóóåð.



ports-palm release=cvs

Ëìãéíéèü äéá òçì òðìóðÞñéιç òðóéååðìí òýðìò Palm™.

ports-polish release=cvs

ÏðìóðÞñéιç ΔìèùíéèÞð ãèÞóóåð.

ports-ports-mgmt release=cvs

Άñãéååßá ãéá òç äéá÷:åßñéóç ðåêÝòùí ééé ports.

ports-portuguese release=cvs

ÏðìóðÞñéιç ΔìñòìããééèèÞð ãèÞóóåð.

ports-print release=cvs

Ëìãéíéèü åèðððòåùí.

ports-russian release=cvs

ÏðìóðÞñéιç ÑùóéèèÞð ãèÞóóåð.

ports-science release=cvs

ΆðéóçìíéèÛ ðñìãñÛìíåóå.

ports-security release=cvs

Άñãéååßá áóðéååßåð.

ports-shells release=cvs

Shells äéá òçì ãñãìÞ áíòìèÞì.

ports-sysutils release=cvs

ΆìçèçòéèÛ ðñìãñÛìíåóå òðóðÞìåðìð.

ports-textproc release=cvs

Άñãéååßá åðåìãñãåóóåð èåéíÝñìò (åáí ðåñééåìåÛíåé åðéóñåðÝæéå òððìãñåóåßá).

ports-ukrainian release=cvs

ÏðìóðÞñéιç ÏèññáíéèèÞð ãèÞóóåð.

ports-vietnamese release=cvs

ÏðìóðÞñéιç ΆéåòíåíÝæéèçð ãèÞóóåð.

ports-www release=cvs

Ëìãéíéèü ðìò ò÷:åðßæåðåé ìå òìí ðååèèòìéí éóðü (World Wide Web).

ports-x11 release=cvs

Ports äéá òðìóðÞñéιç òìò òðóðÞìåðìð X Windows.

ports-x11-clocks release=cvs

Ñìüüáέα áέα ðì X11.

ports-x11-drivers release=cvs

ΔñññÛñιάόά ãäÏäçòð áέα óά X11.

ports-x11-fm release=cvs

Άέα÷: áέñέóðÝò áñ÷: áβùí áέα óά X11.

ports-x11-fonts release=cvs

ΆññìáíóìíóáέñÝò éάέ áññáέäáá áññìáíóìíóáέñÏí áέα X11.

ports-x11-toolkits release=cvs

ΆññáέäéìèÏéåð X11.

ports-x11-servers release=cvs

ΆíðçññåòçóÝò X11.

ports-x11-themes release=cvs

ÈÝíάόά áέα X11.

ports-x11-wm release=cvs

Άέα÷: áέñέóðÝò ðáñáέýñùí (window managers) áέα X11.

projects-all release=cvs

Δçãåβìð èÏäééåð áέα ðì projects repository ðì FreeBSD.

src-all release=cvs

Ï ááóééüð ðçãåβìð èÏäééåð ðì FreeBSD, óðìðáñééáíááññÝñò ðì èÏäééåð èñðððìãñåðáð.

src-base release=cvs

ΆέÛðññά áñ÷: áβά óóçí èñððð ðì /usr/src.

src-bin release=cvs

Άññáέäáá ðìð ðééáíùí íá áðáέòìýíóáέ óå éáóÛóóáóç éáéòìññåð áíùð ÷ ñÏóç (single-user) (/usr/src/bin).

src-cddl release=cvs

Άññáέäáá éάέ áéäééìèÏéåð ðì éáéýððìííóáέ áðü óçí Ûäáέα ÷ ñÏóç CDDL (/usr/src/cddl).

src-contrib release=cvs

Άññáέäáá éάέ áéäééìèÏéåð ðì äáí áíÏéìíí óðì FreeBSD Project, éάέ óå ïðñá ÷ ñçóέìíðìéíýíóáέ ïóóéáóóééÛ áíáééìñùóá (/usr/src/contrib).

src-crypto release=cvs

Άñάέάβá éάé áέάέεìèèèðéåð êñðððïññÛðçðçð ðïð ááí áίèèïí ðòï FreeBSD project éάé ðά ìðìá ÷ñçðéïðèéýíóáé ìððéáððééÛ áíáέëìβùðá (/usr/src/crypto).

src-eBones release=cvs

Kerberos éάé DES (/usr/src/eBones). Άάí ÷ñçðéïðèéýíóáé ððéð ðñÝ ÷ìðððð áέäüðáéð ðïð FreeBSD.

src-etc release=cvs

Άñ ÷άβá ñðèìβðáùí ðïð ððððèíáðïð (/usr/src/etc).

src-games release=cvs

Δάé ÷ìβáéá (/usr/src/games).

src-gnu release=cvs

Άñάέάβá ðïð éáéýððïíóáé áðu ðçí Ûááéá ÷ñèçðð GNU Public License (/usr/src/gnu).

src-include release=cvs

Άñ ÷άβá áðééáðáéβäùí (/usr/src/include).

src-kerberos5 release=cvs

ΔάéÝòï áððáéáβáð Kerberos5 (/usr/src/kerberos5).

src-kerberosIV release=cvs

ΔάéÝòï áððáéáβáð KerberosIV (/usr/src/kerberosIV).

src-lib release=cvs

Άέάέéìèèèðéåð (/usr/src/lib).

src-libexec release=cvs

ΔñïññÛìáðá ððððèíáðïð ðá ìðìá ðððéìèäééÛ áéðáéýíóáé áðu Ûééá ðñïññÛìáðá (/usr/src/libexec).

src-release release=cvs

Άñ ÷άβá ðïð áðáéòïíóáé áéá ðçí ðáñáäùñè ééáð Ýέäïðçð ðïð FreeBSD (/usr/src/release).

src-rescue release=cvs

ΔñïññÛìáðá ìá ððáðééèèè ìáðááèèèèèèè èéá ÷ñèçðð ðá Ýéðáéððð ðáñéðððáéð áðáíáðïññÛð ðïð ððððèíáðïð. Άáβðá ðïð rescue(8) (/usr/src/rescue).

src-sbin release=cvs

Άñάέάβá ððððèíáðïð áéá éáéòïðñáβá ðá éáðÛððáç áñüð ÷ñèçðð (single user mode) (/usr/src/sbin).

src-secure release=cvs

ΆέέέιèÐεάð èάé áιòιèÝò èñðððιãñÛöçόçð (/usr/src/secure).

src-share release=cvs

Άñ ÷ άβά óά ιðιβά ιðιñάβ ίά άβιáé èιéíÛ áíÛιáóά óά ðιééáðèÛ óðóðÐιáðά (/usr/src/share).

src-sys release=cvs

Ï ðññÐιáð (/usr/src/sys).

src-sys-crypto release=cvs

ÈÐáééáð èñðððιãñåöβáð ðιò ðññÐιá (/usr/src/sys/crypto).

src-tools release=cvs

ΆέÛöιñά åñåéåβά ãéá ðç óðιðñçόç ðιò FreeBSD (/usr/src/tools).

src-usrbin release=cvs

Άñåéåβά ÷ ñÐóç (/usr/src/usr.bin).

src-usrsbin release=cvs

Άñåéåβά óðóðÐιáðιð (/usr/src/usr.sbin).

www release=cvs

Ï ðçåáβιð èÐáééáð åéá ðçι ðιðιèåóβά WWW ðιò FreeBSD.

distrib release=self

Óά åñ ÷ άβά ñðèιβóáυι ðιò βáéιð ðιò áιððçñåòçòÐ **CVSup**. ×ñçóέιιðιéåβðáé áðu **CVSup** mirror sites.

gnats release=current

Η åÛóç åååñÝíιι ðιò óðóðÐιáðιð ðåñåéιéγèçόçð ðñιåçιÛòυι GNATS.

mail-archive release=current

Óά åñ ÷ άβά ðçð èβóðáð ðá ÷ ðåñññåβιð ðιò FreeBSD.

www release=current

Ðñι-åðåιåñåóιÝιá åñ ÷ άβά ðçð åééðóáéÐð ðιðιèåóβáð (WWW) ðιò FreeBSD (ι ÷ é ι ðçåáβιð èÐáééáð). ×ñçóέιιðιéåβðáé áðu WWW mirror sites.

### A.6.6 Άέά Ðåñέóóüðåñåò Ðèçñιöιñβåð

Άέά ðι FAQ ðιò **CVSup** èάé Ûééåð ðèçñιöιñβåð ó ÷ åðééÛ ιå áððυι, ååβðå ðç Óåéβåá ðιò CVSup (<http://www.cvsup.org>).

ΌδæçδPóáέδ ó÷âδέέÛ iά ôç ÷ñPóc ôiō **CVSup** óδi FreeBSD éâiâÛiōi ÷þñá óδçí çèâèñiíéèP èβóδá ôâ÷iέèþi óδæçδPóáùí ôiō FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-hackers>). Όδç èβóδá áδδP, éâèþδ éâé óδçí çèâèñiíéèP èβóδá áiáèiéiþóáùí ôiō FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-announce>) áiáèiéiþiíóáé éâé ié iÝâδ âèâüóáέδ ôiō ðñiñÛiàíðìð.

Άέá ânùδPóáέδ P áiáöiñÝð óöáèiÛòùí ó÷âδέέÛ iά ôi **CVSup** ñβiðá iéá iáòéÛ óδi CVSup FAQ (<http://www.cvsup.org/faq.html#bugreports>).

### A.6.7 Ôiðièèáóβâð CVSup

Ìðñâβðá íá ânâβðá âiððçñâðçðÝð CVSup áéá ôi FreeBSD óδéð áèüèiðèâð ôiðièèáóβâð:

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, Indonesia, 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 2009/11/04 17:21:16 UTC)

#### Central Servers

- [cvsup.FreeBSD.org](http://cvsup.FreeBSD.org)

#### Primary Mirror Sites

- [cvsup1.FreeBSD.org](http://cvsup1.FreeBSD.org)
- [cvsup2.FreeBSD.org](http://cvsup2.FreeBSD.org)
- [cvsup3.FreeBSD.org](http://cvsup3.FreeBSD.org)
- [cvsup4.FreeBSD.org](http://cvsup4.FreeBSD.org)
- [cvsup5.FreeBSD.org](http://cvsup5.FreeBSD.org)
- [cvsup6.FreeBSD.org](http://cvsup6.FreeBSD.org)
- [cvsup7.FreeBSD.org](http://cvsup7.FreeBSD.org)
- [cvsup8.FreeBSD.org](http://cvsup8.FreeBSD.org)
- [cvsup9.FreeBSD.org](http://cvsup9.FreeBSD.org)
- [cvsup10.FreeBSD.org](http://cvsup10.FreeBSD.org)
- [cvsup11.FreeBSD.org](http://cvsup11.FreeBSD.org)
- [cvsup12.FreeBSD.org](http://cvsup12.FreeBSD.org)
- [cvsup13.FreeBSD.org](http://cvsup13.FreeBSD.org)
- [cvsup14.FreeBSD.org](http://cvsup14.FreeBSD.org)
- [cvsup15.FreeBSD.org](http://cvsup15.FreeBSD.org)

- [cvsup16.FreeBSD.org](http://cvsup16.FreeBSD.org)
- [cvsup18.FreeBSD.org](http://cvsup18.FreeBSD.org)

#### Argentina

- [cvsup.ar.FreeBSD.org](http://cvsup.ar.FreeBSD.org)

#### Armenia

- [cvsup1.am.FreeBSD.org](http://cvsup1.am.FreeBSD.org)

#### Australia

- [cvsup.au.FreeBSD.org](http://cvsup.au.FreeBSD.org)

#### Austria

- [cvsup.at.FreeBSD.org](http://cvsup.at.FreeBSD.org)
- [cvsup2.at.FreeBSD.org](http://cvsup2.at.FreeBSD.org)

#### Brazil

- [cvsup.br.FreeBSD.org](http://cvsup.br.FreeBSD.org)
- [cvsup2.br.FreeBSD.org](http://cvsup2.br.FreeBSD.org)
- [cvsup3.br.FreeBSD.org](http://cvsup3.br.FreeBSD.org)
- [cvsup4.br.FreeBSD.org](http://cvsup4.br.FreeBSD.org)
- [cvsup5.br.FreeBSD.org](http://cvsup5.br.FreeBSD.org)

#### Bulgaria

- [cvsup.bg.FreeBSD.org](http://cvsup.bg.FreeBSD.org)

Canada

- [cvsup1.ca.FreeBSD.org](http://cvsup1.ca.FreeBSD.org)

China

- [cvsup.cn.FreeBSD.org](http://cvsup.cn.FreeBSD.org)
- [cvsup2.cn.FreeBSD.org](http://cvsup2.cn.FreeBSD.org)
- [cvsup3.cn.FreeBSD.org](http://cvsup3.cn.FreeBSD.org)
- [cvsup4.cn.FreeBSD.org](http://cvsup4.cn.FreeBSD.org)
- [cvsup5.cn.FreeBSD.org](http://cvsup5.cn.FreeBSD.org)

Costa Rica

- [cvsup1.cr.FreeBSD.org](http://cvsup1.cr.FreeBSD.org)

Czech Republic

- [cvsup.cz.FreeBSD.org](http://cvsup.cz.FreeBSD.org)

Denmark

- [cvsup.dk.FreeBSD.org](http://cvsup.dk.FreeBSD.org)
- [cvsup2.dk.FreeBSD.org](http://cvsup2.dk.FreeBSD.org)

Estonia

- [cvsup.ee.FreeBSD.org](http://cvsup.ee.FreeBSD.org)

Finland

- [cvsup.fi.FreeBSD.org](http://cvsup.fi.FreeBSD.org)
- [cvsup2.fi.FreeBSD.org](http://cvsup2.fi.FreeBSD.org)

France

- [cvsup.fr.FreeBSD.org](http://cvsup.fr.FreeBSD.org)
- [cvsup1.fr.FreeBSD.org](http://cvsup1.fr.FreeBSD.org)
- [cvsup2.fr.FreeBSD.org](http://cvsup2.fr.FreeBSD.org)
- [cvsup3.fr.FreeBSD.org](http://cvsup3.fr.FreeBSD.org)
- [cvsup4.fr.FreeBSD.org](http://cvsup4.fr.FreeBSD.org)
- [cvsup5.fr.FreeBSD.org](http://cvsup5.fr.FreeBSD.org)
- [cvsup8.fr.FreeBSD.org](http://cvsup8.fr.FreeBSD.org)

Germany

- [cvsup.de.FreeBSD.org](http://cvsup.de.FreeBSD.org)
- [cvsup2.de.FreeBSD.org](http://cvsup2.de.FreeBSD.org)
- [cvsup3.de.FreeBSD.org](http://cvsup3.de.FreeBSD.org)
- [cvsup4.de.FreeBSD.org](http://cvsup4.de.FreeBSD.org)
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- [cvsup6.de.FreeBSD.org](http://cvsup6.de.FreeBSD.org)
- [cvsup7.de.FreeBSD.org](http://cvsup7.de.FreeBSD.org)
- [cvsup8.de.FreeBSD.org](http://cvsup8.de.FreeBSD.org)

Greece

- [cvsup.gr.FreeBSD.org](http://cvsup.gr.FreeBSD.org)
- [cvsup2.gr.FreeBSD.org](http://cvsup2.gr.FreeBSD.org)

Hungary

- [cvsup.hu.FreeBSD.org](http://cvsup.hu.FreeBSD.org)

Iceland

- [cvsup.is.FreeBSD.org](http://cvsup.is.FreeBSD.org)

Indonesia

- [cvsup.id.FreeBSD.org](http://cvsup.id.FreeBSD.org)

Ireland

- [cvsup.ie.FreeBSD.org](http://cvsup.ie.FreeBSD.org)
- [cvsup2.ie.FreeBSD.org](http://cvsup2.ie.FreeBSD.org)

Israel

- [cvsup.il.FreeBSD.org](http://cvsup.il.FreeBSD.org)

Italy

- [cvsup.it.FreeBSD.org](http://cvsup.it.FreeBSD.org)

Japan

- [cvsup.jp.FreeBSD.org](http://cvsup.jp.FreeBSD.org)
- [cvsup2.jp.FreeBSD.org](http://cvsup2.jp.FreeBSD.org)
- [cvsup3.jp.FreeBSD.org](http://cvsup3.jp.FreeBSD.org)
- [cvsup4.jp.FreeBSD.org](http://cvsup4.jp.FreeBSD.org)
- [cvsup5.jp.FreeBSD.org](http://cvsup5.jp.FreeBSD.org)
- [cvsup6.jp.FreeBSD.org](http://cvsup6.jp.FreeBSD.org)

Korea

- [cvsup.kr.FreeBSD.org](http://cvsup.kr.FreeBSD.org)

- [cvsup2.kr.FreeBSD.org](http://cvsup2.kr.FreeBSD.org)
- [cvsup3.kr.FreeBSD.org](http://cvsup3.kr.FreeBSD.org)

#### Kuwait

- [cvsup1.kw.FreeBSD.org](http://cvsup1.kw.FreeBSD.org)

#### Kyrgyzstan

- [cvsup.kg.FreeBSD.org](http://cvsup.kg.FreeBSD.org)

#### Latvia

- [cvsup.lv.FreeBSD.org](http://cvsup.lv.FreeBSD.org)
- [cvsup2.lv.FreeBSD.org](http://cvsup2.lv.FreeBSD.org)

#### Lithuania

- [cvsup.lt.FreeBSD.org](http://cvsup.lt.FreeBSD.org)
- [cvsup2.lt.FreeBSD.org](http://cvsup2.lt.FreeBSD.org)
- [cvsup3.lt.FreeBSD.org](http://cvsup3.lt.FreeBSD.org)

#### Netherlands

- [cvsup.nl.FreeBSD.org](http://cvsup.nl.FreeBSD.org)
- [cvsup2.nl.FreeBSD.org](http://cvsup2.nl.FreeBSD.org)
- [cvsup3.nl.FreeBSD.org](http://cvsup3.nl.FreeBSD.org)

#### New Zealand

- [cvsup.nz.FreeBSD.org](http://cvsup.nz.FreeBSD.org)
- [cvsup2.nz.FreeBSD.org](http://cvsup2.nz.FreeBSD.org)

Norway

- [cvsup.no.FreeBSD.org](http://cvsup.no.FreeBSD.org)

Philippines

- [cvsup1.ph.FreeBSD.org](http://cvsup1.ph.FreeBSD.org)

Poland

- [cvsup.pl.FreeBSD.org](http://cvsup.pl.FreeBSD.org)
- [cvsup2.pl.FreeBSD.org](http://cvsup2.pl.FreeBSD.org)
- [cvsup3.pl.FreeBSD.org](http://cvsup3.pl.FreeBSD.org)

Portugal

- [cvsup.pt.FreeBSD.org](http://cvsup.pt.FreeBSD.org)
- [cvsup2.pt.FreeBSD.org](http://cvsup2.pt.FreeBSD.org)
- [cvsup3.pt.FreeBSD.org](http://cvsup3.pt.FreeBSD.org)

Romania

- [cvsup.ro.FreeBSD.org](http://cvsup.ro.FreeBSD.org)
- [cvsup1.ro.FreeBSD.org](http://cvsup1.ro.FreeBSD.org)
- [cvsup2.ro.FreeBSD.org](http://cvsup2.ro.FreeBSD.org)
- [cvsup3.ro.FreeBSD.org](http://cvsup3.ro.FreeBSD.org)

Russia

- [cvsup.ru.FreeBSD.org](http://cvsup.ru.FreeBSD.org)
- [cvsup2.ru.FreeBSD.org](http://cvsup2.ru.FreeBSD.org)
- [cvsup3.ru.FreeBSD.org](http://cvsup3.ru.FreeBSD.org)
- [cvsup4.ru.FreeBSD.org](http://cvsup4.ru.FreeBSD.org)

- [cvsup5.ru.FreeBSD.org](http://cvsup5.ru.FreeBSD.org)
- [cvsup6.ru.FreeBSD.org](http://cvsup6.ru.FreeBSD.org)
- [cvsup7.ru.FreeBSD.org](http://cvsup7.ru.FreeBSD.org)

#### San Marino

- [cvsup.sm.FreeBSD.org](http://cvsup.sm.FreeBSD.org)

#### Singapore

- [cvsup.sg.FreeBSD.org](http://cvsup.sg.FreeBSD.org)

#### Slovak Republic

- [cvsup.sk.FreeBSD.org](http://cvsup.sk.FreeBSD.org)

#### Slovenia

- [cvsup.si.FreeBSD.org](http://cvsup.si.FreeBSD.org)
- [cvsup2.si.FreeBSD.org](http://cvsup2.si.FreeBSD.org)

#### South Africa

- [cvsup.za.FreeBSD.org](http://cvsup.za.FreeBSD.org)
- [cvsup2.za.FreeBSD.org](http://cvsup2.za.FreeBSD.org)

#### Spain

- [cvsup.es.FreeBSD.org](http://cvsup.es.FreeBSD.org)
- [cvsup2.es.FreeBSD.org](http://cvsup2.es.FreeBSD.org)
- [cvsup3.es.FreeBSD.org](http://cvsup3.es.FreeBSD.org)

Sweden

- [cvsup.se.FreeBSD.org](http://cvsup.se.FreeBSD.org)
- [cvsup3.se.FreeBSD.org](http://cvsup3.se.FreeBSD.org)

Switzerland

- [cvsup.ch.FreeBSD.org](http://cvsup.ch.FreeBSD.org)

Taiwan

- [cvsup.tw.FreeBSD.org](http://cvsup.tw.FreeBSD.org)
- [cvsup3.tw.FreeBSD.org](http://cvsup3.tw.FreeBSD.org)
- [cvsup4.tw.FreeBSD.org](http://cvsup4.tw.FreeBSD.org)
- [cvsup5.tw.FreeBSD.org](http://cvsup5.tw.FreeBSD.org)
- [cvsup6.tw.FreeBSD.org](http://cvsup6.tw.FreeBSD.org)
- [cvsup7.tw.FreeBSD.org](http://cvsup7.tw.FreeBSD.org)
- [cvsup8.tw.FreeBSD.org](http://cvsup8.tw.FreeBSD.org)
- [cvsup9.tw.FreeBSD.org](http://cvsup9.tw.FreeBSD.org)
- [cvsup10.tw.FreeBSD.org](http://cvsup10.tw.FreeBSD.org)
- [cvsup11.tw.FreeBSD.org](http://cvsup11.tw.FreeBSD.org)
- [cvsup12.tw.FreeBSD.org](http://cvsup12.tw.FreeBSD.org)
- [cvsup13.tw.FreeBSD.org](http://cvsup13.tw.FreeBSD.org)
- [cvsup14.tw.FreeBSD.org](http://cvsup14.tw.FreeBSD.org)

Thailand

- [cvsup.th.FreeBSD.org](http://cvsup.th.FreeBSD.org)

Turkey

- [cvsup.tr.FreeBSD.org](http://cvsup.tr.FreeBSD.org)
- [cvsup2.tr.FreeBSD.org](http://cvsup2.tr.FreeBSD.org)

Ukraine

- [cvsup2.ua.FreeBSD.org](http://cvsup2.ua.FreeBSD.org)
- [cvsup3.ua.FreeBSD.org](http://cvsup3.ua.FreeBSD.org)
- [cvsup4.ua.FreeBSD.org](http://cvsup4.ua.FreeBSD.org)
- [cvsup5.ua.FreeBSD.org](http://cvsup5.ua.FreeBSD.org)
- [cvsup6.ua.FreeBSD.org](http://cvsup6.ua.FreeBSD.org)
- [cvsup7.ua.FreeBSD.org](http://cvsup7.ua.FreeBSD.org)

United Kingdom

- [cvsup.uk.FreeBSD.org](http://cvsup.uk.FreeBSD.org)
- [cvsup2.uk.FreeBSD.org](http://cvsup2.uk.FreeBSD.org)
- [cvsup3.uk.FreeBSD.org](http://cvsup3.uk.FreeBSD.org)
- [cvsup4.uk.FreeBSD.org](http://cvsup4.uk.FreeBSD.org)

USA

- [cvsup1.us.FreeBSD.org](http://cvsup1.us.FreeBSD.org)
- [cvsup2.us.FreeBSD.org](http://cvsup2.us.FreeBSD.org)
- [cvsup3.us.FreeBSD.org](http://cvsup3.us.FreeBSD.org)
- [cvsup4.us.FreeBSD.org](http://cvsup4.us.FreeBSD.org)
- [cvsup5.us.FreeBSD.org](http://cvsup5.us.FreeBSD.org)
- [cvsup6.us.FreeBSD.org](http://cvsup6.us.FreeBSD.org)
- [cvsup7.us.FreeBSD.org](http://cvsup7.us.FreeBSD.org)
- [cvsup8.us.FreeBSD.org](http://cvsup8.us.FreeBSD.org)
- [cvsup9.us.FreeBSD.org](http://cvsup9.us.FreeBSD.org)
- [cvsup10.us.FreeBSD.org](http://cvsup10.us.FreeBSD.org)
- [cvsup11.us.FreeBSD.org](http://cvsup11.us.FreeBSD.org)
- [cvsup12.us.FreeBSD.org](http://cvsup12.us.FreeBSD.org)
- [cvsup13.us.FreeBSD.org](http://cvsup13.us.FreeBSD.org)
- [cvsup14.us.FreeBSD.org](http://cvsup14.us.FreeBSD.org)
- [cvsup15.us.FreeBSD.org](http://cvsup15.us.FreeBSD.org)
- [cvsup16.us.FreeBSD.org](http://cvsup16.us.FreeBSD.org)

- cvsup18.us.FreeBSD.org

## A.7 ΆòèèÝòàò (Tags) ãéά ðϊ CVS

¼óáι éάóääÜæáðå Þ áíáíáÞíáðå ðϊí ðçååáßι êÞåééά ιÝóù ðçð **CVS** ç ðçð **CVSup**, èά ðñÝðåé ίά èáèιñβóáðå ίéά áðééÝóά Ýéäιòçð (revision tag). Ιά revision tag áíáó Ýñåðåé åβðå óå ίéά óðåéåêñéιÝίç ðñåáßά áíÜððóίçð ðιò FreeBSD, åβðå óå Ýίά óðåéåêñéιÝίí ðñíééèù óçíåßι. Ι ðñÞðιð ðýðιð ðñíÜæåðåé “åðééÝóά èèÜäιò (branch tag)”, èáé ι åäýðåñιð ðñíÜæåðåé “åðééÝóά Ýéäιòçð (release tag)”.

### A.7.1 ΆòèèÝòàò ÈèÜäιí (Branch Tags)

¼éåð áððÝð, ίå ðçί áíåßñåóç ðιò HEAD (ðι ιðιβι åβίáé ðÜίðά Ýåðñç åðééÝðά), éó÷-ýιðι ίüñι åéά ðι äÝίðñι src/. Óά äÝίðñά ports/, doc/, èáé www/ åäí Ý÷-ίðι èèÜäιòð.

#### HEAD

Ðñüèåéðåé åéά ðι óðιåñééèù úññά ðçð èýñéåð åñåñìÞð áíÜððóίçð, Þ FreeBSD-CURRENT. Άβίáé åðβóçð ðι ðñιåðééåäιÝίí tag áí åäí èáèιñéóðåß èÜðιéι óðåéåêñéιÝίí revision.

Óðι **CVSup**, ðι tag áððù áíðéðñιòùðåýåðåé áðù ίéά . (åäí ðñüèåéðåé åéά óçíåßι óðβιçð ðçð ðñüðåóçð, åéèÜ åéά ðι ðñåñιåéðéèù ðñåéðÞñά .).

**Óçíåßòç:** Óðι CVS, áððÞ åβίáé èáé ç ðñιåðééèìåÞ áí åäí èáèιñéóðåß revision tag. ÓðιÞèùð åäí åβίáé èåèÞ éåÝά ίά èÜίåðå checkout èáé áíáíÝóç óðιí ðçååáßι êÞåééά ðιò CURRENT óå Ýίά ιç÷-Üίçιά STABLE, åèðùð áí áððÞ åβίáé ðñåñιåéðéèÜ ç ðñüèåéðç óåð.

#### RELENG\_8

Ç åñåñìÞ áíÜððóίçð åéά ðι FreeBSD-8.X, åñóðÞ åðβóçð èáé ùð FreeBSD 8-STABLE

#### RELENG\_8\_0

Ç åñåñìÞ Ýéäιòçð ðιò FreeBSD-8.0, ðñçóéñιðñéåáβðåé ίüñι åéά áíçìåñÞðåð áóðåéåáðå èáé Üéèåð èñβóéíåð åéññèÞðåð.

#### RELENG\_7

Ç åñåñìÞ áíÜððóίçð åéά ðι FreeBSD-7.X, åñóðÞ åðβóçð èáé ùð FreeBSD 7-STABLE

#### RELENG\_7\_2

Ç åñåñìÞ Ýéäιòçð ðιò FreeBSD-7.2, ðñçóéñιðñéåáβðåé ίüñι åéά áíçìåñÞðåð áóðåéåáðå èáé Üéèåð èñβóéíåð åéññèÞðåð.

RELENG\_7\_1

Ç ãñáñìÞ Ýêäīóçð ðīo FreeBSD-7.1, ÷ñçóεīīðīéáβðáé īuñī ãéá áñçìáñÞróáéð áóöáéáβáð èáé Ûεéáð êñβóεīáð äéīñèÞróáéð.

RELENG\_7\_0

Ç ãñáñìÞ Ýêäīóçð ðīo FreeBSD-7.0, ÷ñçóεīīðīéáβðáé īuñī ãéá áñçìáñÞróáéð áóöáéáβáð èáé Ûεéáð êñβóεīáð äéīñèÞróáéð.

RELENG\_6

Ç ãñáñìÞ áñÜððóíçð ãéá ðī FreeBSD-6.X, áñīóðÞ áðβóçð èáé ùð FreeBSD 6-STABLE

RELENG\_6\_4

Ç ãñáñìÞ Ýêäīóçð ðīo FreeBSD-6.4, ÷ñçóεīīðīéáβðáé īuñī ãéá áñçìáñÞróáéð áóöáéáβáð èáé Ûεéáð êñβóεīáð äéīñèÞróáéð.

RELENG\_6\_3

Ç ãñáñìÞ Ýêäīóçð ðīo FreeBSD-6.3, ÷ñçóεīīðīéáβðáé īuñī ãéá áñçìáñÞróáéð áóöáéáβáð èáé Ûεéáð êñβóεīáð äéīñèÞróáéð.

RELENG\_6\_2

Ç ãñáñìÞ Ýêäīóçð ðīo FreeBSD-6.2, ÷ñçóεīīðīéáβðáé īuñī ãéá áñçìáñÞróáéð áóöáéáβáð èáé Ûεéáð êñβóεīáð äéīñèÞróáéð.

RELENG\_6\_1

Ç ãñáñìÞ Ýêäīóçð ðīo FreeBSD-6.1, ÷ñçóεīīðīéáβðáé īuñī ãéá áñçìáñÞróáéð áóöáéáβáð èáé Ûεéáð êñβóεīáð äéīñèÞróáéð.

RELENG\_6\_0

Ç ãñáñìÞ Ýêäīóçð ðīo FreeBSD-6.0, ÷ñçóεīīðīéáβðáé īuñī ãéá áñçìáñÞróáéð áóöáéáβáð èáé Ûεéáð êñβóεīáð äéīñèÞróáéð.

RELENG\_5

Ç ãñáñìÞ áñÜððóíçð ãéá ðī FreeBSD-5.X, áñīóðÞ áðβóçð ùð FreeBSD 5-STABLE.

RELENG\_5\_5

Ç ãñáñìÞ Ýêäīóçð ðīo FreeBSD-5.5, ÷ñçóεīīðīéáβðáé īuñī ãéá áñçìáñÞróáéð áóöáéáβáð èáé Ûεéáð êñβóεīáð äéīñèÞróáéð.

RELENG\_5\_4

Ç ãñáñìÞ Ýêäīóçð ðīo FreeBSD-5.4, ÷ñçóεīīðīéáβðáé īuñī ãéá áñçìáñÞróáéð áóöáéáβáð èáé Ûεéáð êñβóεīáð äéīñèÞróáéð.

RELENG\_5\_3

Ç ãñáñìÞ Ýêäīóçð ðīo FreeBSD-5.3, ÷ñçóεīīðīéáβðáé īuñī ãéá áñçìáñÞróáéð áóöáéáβáð èáé Ûεéáð êñβóεīáð äéīñèÞróáéð.

RELENG\_5\_2

Ç ãñáñìÞ Ýêäïóçð ãέά FreeBSD-5.2 èά FreeBSD-5.2.1, ÷ñçόέïïðïέάβδάέ ìüñí ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_5\_1

Ç ãñáñìÞ Ýêäïóçð ãέά òï FreeBSD-5.1, ÷ñçόέïïðïέάβδάέ ìüñí ãέά ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_5\_0

Ç ãñáñìÞ Ýêäïóçð ãέά òï FreeBSD-5.0, ÷ñçόέïïðïέάβδάέ ìüñí ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_4

Ç ãñáñìÞ áíÜðððίçð ãέά òï FreeBSD-4.X, áíüððÞ áðβόçð èάέ ùð FreeBSD 4-STABLE.

RELENG\_4\_11

Ç ãñáñìÞ Ýêäïóçð ãέά òï FreeBSD-4.11, ÷ñçόέïïðïέάβδάέ ìüñí ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_4\_10

Ç ãñáñìÞ Ýêäïóçð ãέά òï FreeBSD-4.10, ÷ñçόέïïðïέάβδάέ ìüñí ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_4\_9

Ç ãñáñìÞ Ýêäïóçð ãέά òï FreeBSD-4.9, ÷ñçόέïïðïέάβδάέ ìüñí ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_4\_8

Ç ãñáñìÞ Ýêäïóçð ãέά òï FreeBSD-4.8, ÷ñçόέïïðïέάβδάέ ìüñí ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_4\_7

Ç ãñáñìÞ Ýêäïóçð ãέά òï FreeBSD-4.7, ÷ñçόέïïðïέάβδάέ ìüñí ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_4\_6

Ç ãñáñìÞ Ýêäïóçð ãέά òá FreeBSD-4.6 èά FreeBSD-4.6.2, ÷ñçόέïïðïέάβδάέ ìüñí ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_4\_5

Ç ãñáñìÞ Ýêäïóçð ãέά òï FreeBSD-4.5, ÷ñçόέïïðïέάβδάέ ìüñí ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_4\_4

Ç ãñáñìÞ Ýêäïóçð ãέά òï FreeBSD-4.4, ÷ñçόέïïðïέάβδάέ ìüñí ãέά áçïáñÞðάέð áóöάέáβáð èάέ Üëèáð èñβόέïáð äéïñèÞðάέð.

RELENG\_4\_3

Ç ãñáñìÞ Ýèäìóçð ãέα òι FreeBSD-4.3, ÷ñçόείιðιέαβòάέ ìùñ ãέα áιçìáñÞòάέð áóóάέαβáð έάέ Ûέèáð èñβóείáð äéìñèÞòάέð.

RELENG\_3

Ç ãñáñìÞ áíÛðððίçð ãέα òι FreeBSD-3.X, ãíùóòÞ ãðβóçð έάέ ùð 3.X-STABLE.

RELENG\_2\_2

Ç ãñáñìÞ áíÛðððίçð ãέα òι FreeBSD-2.2.X, ãíùóòÞ ãðβóçð έάέ ùð 2.2-STABLE. Ç ãñáñìÞ áðòÞ èáùñάβòάέ ìóόέαóóέέÛ ðáñù÷çìÝίç.

**A.7.2 ÆóέéÝòáð Æéäüóáùí (Release Tags)**

Ïé áðέéÝòáð áðòÝð áíáðÝñííðάέ óá ìέα óðáèáèñείÝίç ÷ññίέèÞ óðéáìÞ έáðÛ òçì ìðìβá Ýáείá ìέα έáñíέéÞ Ýèäìóçð (release) òìò FreeBSD. Ç áέαáέέαóβá òçð Ýèäìóçð òáèìçñéÞíáðάέ ìá ðáñέóóüðáñáð έáððìñÝñáέáð óóá Ýãñáóá ðèçñìòññáð Æέαáέέαóβáð èäìíóçð (<http://www.FreeBSD.org/releng/>) έάέ Æέαáέέαóβá èäìíóçð ([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/articles/releng/release-proc.html](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/releng/release-proc.html)). Òì äÝíòññì src ÷ñçόείιðιέαβ ìíùìáðá áðέéáòÞí ðìò ìáέείñýí ìá òç èÝίç RELENG\_. Òá äÝíòñá ports έάέ doc ÷ñçόείιðιέíýí áðέéÝòáð ðìò ìáέείñýí ìá òç èÝίç RELEASE. ÒÝέìð, óòì äÝíòññì www ááí áβíáðάέ èÛðιέα áέάέèÞ áðέéÝòá ðìò ìá Ý÷áé ó÷Ýóç ìá ðéð áèäüóáέð.

RELENG\_8\_0\_0\_RELEASE

FreeBSD 8.0

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



- ftp: Ìãñéèù mirror òϊò äéáêñéóòP FTP òϊò FreeBSD.
- FreeBSD: ΔèPñâð mirror òϊò äéáêñéóòP FTP òϊò FreeBSD.

#### Ïëéáíäá

rsync://ftp.nl.FreeBSD.org/

ÄéáèÝóéíâð ÓðëëïãÝð:

- FreeBSD: ΔèPñâð mirror òϊò äéáêñéóòP FTP òϊò FreeBSD.

#### Ñùóá

rsync://ftp.mtu.ru/

ÄéáèÝóéíâð ÓðëëïãÝð:

- FreeBSD: ΔèPñâð mirror òϊò äéáêñéóòP FTP òϊò FreeBSD.
- FreeBSD-gnats: Ç âÛóç äããñÝíúí òϊò óóóðPíáòïð ðãñãêïëïýçóçð óóäèÛòùí GNATS.
- FreeBSD-Archive: Mirror òϊò äéáêñéóòP FTP ðãäéúòðãñùí äéäüóáúí (archive) òϊò FreeBSD.

#### ÔáÄãÛí

rsync://ftp.tw.FreeBSD.org/

rsync://ftp2.tw.FreeBSD.org/

rsync://ftp6.tw.FreeBSD.org/

ÄéáèÝóéíâð ÓðëëïãÝð:

- FreeBSD: ΔèPñâð mirror òϊò äéáêñéóòP FTP òϊò FreeBSD.

#### ÇíùíÝíí Äáóβëáéí

rsync://rsync.mirrorservice.org/

ÄéáèÝóéíâð ÓðëëïãÝð:

- sites/ftp.freebsd.org: ΔèPñâð mirror òϊò äéáêñéóòP FTP òϊò FreeBSD.

#### ÇíùíÝíâð Δïéóðãβâð ÁíãñéPð

rsync://ftp-master.FreeBSD.org/

Ï äéáêñéóòPð áðòùð ìðñãβ íá ÷ ñçóéíðíéçèãβ ìùíí áðü éýñéá mirror sites òϊò FreeBSD.

ÄéáèÝóéíâð ÓðëëïãÝð:

- FreeBSD: To éýñéí (master) óýóóçιά äñ÷ãβùí òϊò äéáêñéóòP FTP òϊò FreeBSD.
- acl: Ç éýñéá èβóðá ACL òϊò FreeBSD.

rsync://ftp13.FreeBSD.org/

ΆέάèÝóéïàò ÓðëëïãÝò:

- FreeBSD: ΔëÞñâð mirror ôïð äéáêñéóðP FTP ôïð FreeBSD.

# ÐáñŨñôçíá B. Âéâëéíãñáöβá

Άί έάέ όά manual pages ðáñŨ ÷ ðíí íβά áðβόçíç áíáöñŨ áέά íá ÷ ùñέόóŨ òìΠíáόά òìø FreeBSD έάέòìñáέéíŕý óóóóΠíáόòò, Ũ ÷ ðíí έάέP òΠíç áέά òì ùóέ ááí áðáíçáíŕý ðùò íá áíπóάέò óá òìΠíáόά íáæβ áέά íá έŨíáέò ùéŕ òì έάέóìñáέéü óŕóóçíá íá έάέóìñááβ ñáέŨ. Άέά áòòù, ááí òðŨñ ÷ áé òðŕέάóŨóóάòì áðü Ýíá έάέü áέáέβŕ óóçí áέά ÷ áβñέóç óóóóçìŨòùí UNIX έάέ Ýíá έάέü áá ÷ áéñβáéí ÷ ñPóóç.

## B.1 Âéâëá & ÐáñéíäééŨ ó ÷ áòéêŨ ìá òì FreeBSD

*ΆέάðíP áέáέβá & ðáñéíäééŨ:*

- Using FreeBSD (<http://jdl.tw.FreeBSD.org/publication/book/freebsd2/index.htm>) (óá ÐáñááüíóέáέŨ ÊéŕŨ æέéá).
- FreeBSD Unleashed (ÎáòŨñáόç óá ΆðéŕðŕéçŕŨ Ýíá ÊéŕŨ æέéá), áéäüèçέá áðü òçŕ China Machine Press (<http://www.hzbook.com/>). ISBN 7-111-10201-0.
- FreeBSD From Scratch First Edition (óá ΆðéŕðŕéçŕŨ Ýíá ÊéŕŨ æέéá), áéäüèçέá áðü òçŕ China Machine Press. ISBN 7-111-07482-3.
- FreeBSD From Scratch Second Edition (óá ΆðéŕðŕéçŕŨ Ýíá ÊéŕŨ æέéá), áéäüèçέá áðü òçŕ China Machine Press. ISBN 7-111-10286-X.
- FreeBSD Handbook Second Edition (ÎáòŨñáόç óá ΆðéŕðŕéçŕŨ Ýíá ÊéŕŨ æέéá), áéäüèçέá áðü òçŕ Posts & Telecom Press (<http://www.ptpress.com.cn/>). ISBN 7-115-10541-3.
- FreeBSD 3.x Internet (óá ΆðéŕðŕéçŕŨ Ýíá ÊéŕŨ æέéá), áéäüèçέá áðü òçŕ Tsinghua University Press (<http://www.tup.tsinghua.edu.cn/>). ISBN 7-900625-66-6.
- FreeBSD & Windows (óá ΆðéŕðŕéçŕŨ Ýíá ÊéŕŨ æέéá), áéäüèçέá áðü òçŕ China Railway Publishing House (<http://www.tdpress.com/>). ISBN 7-113-03845-X
- FreeBSD Internet Services HOWTO (óá ΆðéŕðŕéçŕŨ Ýíá ÊéŕŨ æέéá), áéäüèçέá áðü òçŕ China Railway Publishing House. ISBN 7-113-03423-3
- FreeBSD for PC 98'ers (óóá ΆέάðŕŨŨ æέéá), áéäüèçέá áðü òçŕ SHUWA System Co, LTD. ISBN 4-87966-468-5 C3055 P2900E.
- FreeBSD (óóá ΆέάðŕŨŨ æέéá), áéäüèçέá áðü òçŕ CUTT. ISBN 4-906391-22-2 C3055 P2400E.
- Complete Introduction to FreeBSD (<http://www.shoeisha.com/book/Detail.asp?bid=650>) (óóá ΆέάðŕŨŨ æέéá), áéäüèçέá áðü òçŕ 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>) (óóá ΆέάðŕŨŨ æέéá), áéäüèçέá áðü òçŕ ASCII (<http://www.ascii.co.jp/>). ISBN 4-7561-1733-3 P3000E.
- FreeBSD Handbook (ΆέάðŕŨŨ æέéç ìáòŨñáόç), áéäüèçέá áðü òçŕ ASCII (<http://www.ascii.co.jp/>). ISBN 4-7561-1580-2 P3800E.
- FreeBSD mit Methode (óóá ΆãñíáíέéŨ), áéäüèçέá áðü òçŕ Computer und Literatur Verlag (<http://www.cul.de/>)Vertrieb Hanser, 1998. ISBN 3-932311-31-0.
- FreeBSD 4 - Installieren, Konfigurieren, Administrieren (<http://www.cul.de/freebsd.html>) (óóá ΆãñíáíέéŨ), áéäüèçέá áðü òçŕ 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>) (ὀά Ἄñîáíééῤ), äêäüèçêá áðü ὀςί 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/>) (ὀά Ἄñîáíééῤ), äêäüèçêá áðü ὀςί 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>) (ὀά ἌéáðüíÝæééá), äêäüèçêá áðü ὀςί 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/>) (ὀςί Ἐíäíçóéáêᐆ äëᐆóá), äêäüèçêá áðü ὀςί Elex Media Komputindo (<http://www.elexmedia.co.id/>).
- Absolute BSD: The Ultimate Guide to FreeBSD (ἰäðῤñáός ὀá Ḑáñáäíróéáêῤ ἘéíÝæééá), äêäüèçêá áðü ὀςί GrandTech Press (<http://www.grandtech.com.tw/>), 2003. ISBN 986-7944-92-5.
- The FreeBSD 6.0 Book (<http://www.twbsd.org/cht/book/>) (ὀá Ḑáñáäíróéáêῤ ἘéíÝæééá), äêäüèçêá áðü ὀςί Drmaster, 2006. ISBN 9-575-27878-X.

Ἄéäüéβá & ḑáñéüééῤ ὀςί Ἄäëéêᐆ äëᐆóá:

- Absolute BSD: The Ultimate Guide to FreeBSD (<http://www.AbsoluteBSD.com/>), äêäüèçêá áðü ὀςί No Starch Press (<http://www.nostarch.com/>), 2002. ISBN: 1886411743
- The Complete FreeBSD (<http://www.freebsdmail.com/cgi-bin/fm/bsdcomp>), äêäüèçêá áðü ὀςί O'Reilly (<http://www.oreilly.com/>), 2003. ISBN: 0596005164
- The FreeBSD Corporate Networker's Guide (<http://www.freebsd-corp-net-guide.com/>), äêäüèçêá áðü ὀςί 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/>), äêäüèçêá áðü ὀςί The Bit Tree Press, 2001. ISBN: 0971204500
- Teach Yourself FreeBSD in 24 Hours, äêäüèçêá áðü ὀςί Sams (<http://www.sampublishing.com/>), 2002. ISBN: 0672324245
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## B.2 ἰäçäíβ ÷ñᐆóç

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- *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/>) Ýññáøå ðá ΆέóáãùääéÛ ìáèðìáóá UNIX ([http://8help.osu.edu/wks/unix\\_course/unix.html](http://8help.osu.edu/wks/unix_course/unix.html)) ðïð äéáðßèáíðáé óá HTML êéé óá ìññòß PostScript.  
Ïéá Êðäééêß ìáðÛðñáóç ([http://www.FreeBSD.org/doc/it\\_IT.ISO8859-15/books/unix-introduction/index.html](http://www.FreeBSD.org/doc/it_IT.ISO8859-15/books/unix-introduction/index.html)) áððïý ðïð êáèÏÝñïð äéáðßèáóáé ùð ìÝñïð ðïð 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/>) Ýññáøå Ýíá Online ìäçäü (<http://unixhelp.ed.ac.uk/>) äéá íÝïðð óðï ðññéáÛéëïð ðïð UNIX.

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- Dreyfus, Emmanuel. *Cahiers de l'Admin: BSD* (<http://www.eyrolles.com/Informatique/Livre/9782212114638/>) 2nd Ed. (óáá ΆáéééÛ), Eyrolles, 2004. ISBN 2-212-11463-X

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- Harbison, Samuel P. and Steele, Guy L. Jr. *C: A Reference Manual*. 4th ed. Prentice Hall, 1995. ISBN 0-13-326224-3
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- Spinellis, Diomidis. *Code Reading: The Open Source Perspective* (<http://www.spinellis.gr/codereading/>). Addison-Wesley, 2003. ISBN 0-201-79940-5
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(Òï ääöÛéáéí 2 áðü áðòü òï äéäëβì äéáðβèäðáé online ([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/books/design-44bsd/book.html](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/design-44bsd/book.html)) ùò ìÝñìò òïö FreeBSD Documentation Project, äáé òï ääöÛéáéí 9 ääþ ([http://www.netapp.com/tech\\_library/nfsbook.html](http://www.netapp.com/tech_library/nfsbook.html)).)
- Marshall Kirk McKusick, George V. Neville-Neil *The Design and Implementation of the FreeBSD Operating System*. Boston, Mass. : Addison-Wesley, 2004. ISBN 0-201-70245-2
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- Garfinkel, Simson and Gene Spafford. *Practical UNIX & Internet Security*. 2nd Ed. O'Reilly & Associates, Inc., 1996. ISBN 1-56592-148-8
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## B.7 ΆίáöïñŸò ðëëëÿÿ

- Anderson, Don and Tom Shanley. *Pentium Processor System Architecture*. 2nd Ed. Reading, Mass. : Addison-Wesley, 1995. ISBN 0-201-40992-5
- Ferraro, Richard F. *Programmer's Guide to the EGA, VGA, and Super VGA Cards*. 3rd ed. Reading, Mass. : Addison-Wesley, 1995. ISBN 0-201-62490-7
- Ç Intel Corporation äçïïóéáyâé ðâêîçñßùóç ãéá ôéð CPUs, ôá chipsets éáé ðñüðððá óðï developer web site (<http://developer.intel.com/>), óðíðèùò ùð áñ÷åßá PDF.
- Shanley, Tom. *80486 System Architecture*. 3rd ed. Reading, Mass. : Addison-Wesley, 1995. ISBN 0-201-40994-1
- Shanley, Tom. *ISA System Architecture*. 3rd ed. Reading, Mass. : Addison-Wesley, 1995. ISBN 0-201-40996-8
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- Don Libes, Sandy Ressler *Life with UNIX* — special edition. Prentice-Hall, Inc., 1989. ISBN 0-13-536657-7
- *The BSD family tree*. <http://www.FreeBSD.org/cgi/cvsweb.cgi/src/share/misc/bsd-family-tree> ç ôï /usr/share/misc/bsd-family-tree óå Ÿíá FreeBSD ìç÷Űíçιά.

- *Networked Computer Science Technical Reports Library*. <http://www.ncstrl.org/>
- *ĐáěáéÝò BSD áêüüóáéò áđü ôí Computer Systems Research group (CSRG)*. <http://www.mckusick.com/csrg/>: Ôí 4CD set Ý÷áé üëáò ôéò BSD áêüüóáéò áđü ôçí 1BSD ìÝ÷ñé ôçí 4.4BSD éáé ôçí 4.4BSD-Lite2 (áëëŨ ü÷é ôçí 2.11BSD, äóóô÷þò). Ôí ôâëâóóáßí áéóêŨéé đañéÝ÷áé áđßóçò ôíí ôâëëü ðçááßí êþáééá óóí óá áñ÷áßá SCCS.

## B.9 ĐañéíäééŨ éáé äöçìãñßäò

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- *Sys Admin — The Journal for UNIX System Administrators* Miller Freeman, Inc., ISSN 1061-2688
- *freeX — Das Magazin für Linux - BSD - UNIX* (óóá ãññíáíééŨ) Computer- und Literaturverlag GmbH, ISSN 1436-7033

# Δανάη C. Δαγιά Δεχνηούνηζο όοι Άεάβέοοι

Ç πάαααά άιΎέεΐç οίτo FreeBSD έαέεόóŪ όά Ύίόόδά ιΎόά άίβεάίά ίά άεΐεΐτoεΠóιτí όέó όάέάóόάβáó άίάεβίάέó. Ίέ çέάέóñίέέΎó δçãŸò άβίάέ ι έάέýόάññò (άί ü ÷ é ι iüññò) óññóò áέά ίά δάñάιάβίάόά άίΠιáññò áέά όέó όάέάóόάβáó άίάεβίάέó. Έάέπò οί FreeBSD άβίάέ ίέά άεάέΐíóέέΠ δññíóδŪέάέά, ç έίέΐüóçόά όüí ÷ ñçóóβί ίέάέóιτoññáβ έάέ üð “óìΠιá όá ÷ ίέέΠò ðñíóóΠñέίç”, ιá οί çέάέóñίέέü όá ÷ óñññíáβι, όά web forums, έάέ όά USENET news ίά άβίάέ ίέ δέΎίί άðíóáέάóιáóέέίβ óññóτíέ áέά ίά Ύέέáóá όά άðáóΠ ιá άóóΠ óçί έίέΐüóçόά.

Όóέó δάñάέŪóò áüíóçóáó, έá áñáβóá όά óçίáíóέέüóáñá óçίáβá άðέέίέΐüíβáó ιá óçί έίέΐüóçόά ÷ ñçóóβί οίτo FreeBSD. Άί áññβáέáóά έάέ Ūέέáó δçãŸò, ίέ ιðíβáó άáί áíáóŸññíóáέ άáβ, δάñάέάέΐγíá ίά ίá óèð óóáβέáóá óóçί çέάέóñίέέΠ έβóóá ñŪááó óáέιçñβúóçó οίτo FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-doc>) βóóá ίά άíóá ÷ έΐγί έάέ άóóŸò.

## C.1 Έβóóáò Çέάέóñίέέΐγ Óá ÷ óñññíáβíó

Ίέ έβóóáò çέάέóñίέέΐγ όá ÷ óñññíáβíó άβίάέ ι ðéι Ūíáóíð óññóò áέά ίá άðáóέýíáóá όέó áññóΠóáέó óáó Π ίá άñβίáóá ίέά όá ÷ ίέέΠ óóæΠóçóç óíτo ίá άðáóέýíáóáέ όá έίέΐü áέάέáóŸίί óóι FreeBSD. ÓðŪñ ÷ áέ ίááŪέç ðίέέέέβá άðñ έβóóáò, ίέ ιðíβáó έάέýðóíτí άðñý óŪóíá έáñŪóüí οίτo FreeBSD. Έáðáóέýññíóáó όέó áññóΠóáέó óáó óóç óüóóΠ έβóóá, έá áíáóóáέβóáóá όá ÷ ýóáñç έάέ áέñέáŸóóáñç áðñέñέóç.

Όóι óŸέΐð άðóίγ οίτo έáέΎññò έá áñáβóá Ÿίá δβίáέά ιá óç έáíáóίέΐüβá óçð έŪέá έβóóáó. *Δάñάέάέΐγíá ίá όίί áέááŪóáóá ðñéí áñ ÷ βóóáó ίá óðñíáóŸ ÷ áóá Π ίá óóŸέΐáóá ίçΎíáóá όá ιðíέááΠðíóá έβóóá.* Ίέ δάñέóóüóáññέ áðñ οίτo óóíáññíçóŸò ίáó áŸ ÷ ñíóáέ έáέçíáñέΐŪ áέáóñíóŪááó ίçΎíáóá ó ÷ áóέέŪ ιá οί FreeBSD. Ίέ έáññíáó óíτo Ÿ ÷ ιðíá έáέέáñβóáέ, áιçέŪíá ίá áβίáóáέ óüóóΠ ÷ ñΠóç έáέ ίá áέáóçñáβóáέ όá óççέü áðβðááι ç áíáέΐüβá óΠιáóíτo ðññó έüñóáι óçð έŪέá έβóóáó. ΆŪί Πιáóóáί ðéι ÷ áέáññβ, ίέ έβóóáò ίáó έá Ÿ ÷ áíáί óçί áðñóáέáóíáóέέüóçόá οίτo üð ιŸóí áðέέίέΐüíβáó áέά οί Project.

**Όçíáβúóç:** *Άί έŸέáóá ίá áñέέίŪóáóá óçί έέáíüóçόá óáó ίá óóŸέΐáóá ίçΎíáóá óóέð έβóóáò οίτo FreeBSD, óóáβέóá Ÿίá áñέέίáóóέέü ñΠíóíá óóçί έβóóá freebsd-test (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-test>). Δάñάέáέΐγíá ίç óóŸέΐáóá áñέέίáóóέέŪ ίçΎíáóá óá ιðíέááΠðíóá Ūέέç έβóóá.*

Άί áñβóéáóóá όá áβέçíá ó ÷ áóέέŪ ιá οί ðίέá έβóóá ίá óóáβέáóá ίέá áñβóçóç, ááβóá οί ðüð ίá ÷ ñçóέΐñðíέáβóá ιá áðέóð ÷ βá óçί έβóóá çέάέóñίέέΐγ όá ÷ óñññíáβíó FreeBSD-questions ([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/articles/freebsd-questions](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/freebsd-questions)).

ðñéí óóáβέáóá έŪóέ όá ιðíέááΠðíóá έβóóá, ιŪέáóá ðüð ίá ÷ ñçóέΐñðíέáβóá έáέýóáñá όέó έβóóáò çέάέóñίέέΐγ όá ÷ óñññíáβíó. Άέá δάñŪááέáíá, ááβóá ðüð ιðññáβóá ίá áιçέΠóáóá βóóá ίá áðñóáýáñíóáέ óó ÷ íŪ áðáíáέáíááññíáíáó óóæçóΠóáέó, áέááŪáñíóáó οί έáβίáñ. Óó ÷ íŸò ÁññóΠóáέó Ó ÷ áóέέŪ ιá όέó Έβóóáò Óá ÷ óñññíáβíó ([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/articles/mailling-list-faq](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/mailling-list-faq)) (FAQ).

Άέá üέáó όέó έβóóáò çέάέóñίέέΐγ όá ÷ óñññíáβíó áέáóçñáβóáέ áñ ÷ áβι ιá όέó ðáέέŸð áçñíóέáýóáέó, óóι ιðíβι ιðññáβ ίá áβίáέ áíáæΠóçóç ÷ ñçóέΐñðíέβίóáó óçί ΆέέóóáέΠ Ūíðíέáóβá οίτo FreeBSD (<http://www.FreeBSD.org/search/index.html>). Άβίáέ áðíáóð ç áíáæΠóçóç óóι áñ ÷ áβι ιŸóóü έŸíáñíí-έέáέέέβί, οί ιðíβι áðñóáέáβ Ÿίá Ūñέóóι óññóò áέá ίá áñáβóá áðáíóΠóáέó όá óó ÷ íŸò áññóΠóáέó. ðñéí óóáβέáóá ίέá áñβóçóç, έáέü έá áβίáέ ίá ðñáñíáóιðíέβóáóά ίέá óŸóíέá áíáæΠóçóç. Όçίáέβóá áðβóçð üέέ όá ίçΎíáóá óíτo óóŸέΐñíóáέ όá áóóŸò όέó





## Ἐξόδα

frebsd-bluetooth  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-bluetooth>)

frebsd-cluster  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-cluster>)

frebsd-cvsweb  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-cvsweb>)

frebsd-database  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-database>)

frebsd-doc  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-doc>)  
frebsd-drivers  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-drivers>)

frebsd-eclipse  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-eclipse>)

frebsd-embedded  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-embedded>)

frebsd-eol  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-eol>)  
frebsd-emulation  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-emulation>)

frebsd-firewire  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-firewire>)

frebsd-fs  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-fs>)

## Ὁμίλια

× ἡρώς ὁδὸς Ἀετῶν Bluetooth ὁδὸς FreeBSD

× ἡρώς ὁδὸς FreeBSD ὁδὸς Δανάη Ἰωάννα Κ. Δελαγιάννη

Ὁμίλια ὁδὸς CVSweb

Ὁμίλια ὁδὸς Ἀετῶν ὁδὸς Ἀετῶν ὁδὸς FreeBSD  
Ἀετῶν ὁδὸς FreeBSD

Ἀετῶν ὁδὸς Ἀετῶν ὁδὸς FreeBSD

Ἀετῶν ὁδὸς Ἀετῶν ὁδὸς FreeBSD

Ὁμίλια ὁδὸς Ἀετῶν ὁδὸς Eclipse IDE, ὁδὸς Ἀετῶν ὁδὸς FreeBSD, ὁδὸς rich client ὁδὸς ports ὁδὸς FreeBSD.

× ἡρώς ὁδὸς FreeBSD ὁδὸς embedded ὁδὸς FreeBSD

ἡρώς ὁδὸς Ἀετῶν ὁδὸς Ἀετῶν ὁδὸς FreeBSD, ὁδὸς Ἀετῶν ὁδὸς FreeBSD Project.  
Ἀετῶν ὁδὸς Ἀετῶν ὁδὸς Linux/MS-DOS/Windows

Ὁμίλια ὁδὸς Ἀετῶν ὁδὸς FreeBSD FireWire® (iLink, IEEE 1394)

Ὁμίλια ὁδὸς Ἀετῶν

## Ἐἶσοά

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-libh  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-libh>)

freebsd-mips  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-mips>)

## Ὀῖδῶδ

Ὀῶαῖῶῶ ὁ ÷ ἄῶῶῶ ἰἰ ὁῖ **Gecko Rendering Engine**

Ὀῶαῖῶῶ ὁ ÷ ἄῶῶῶ ἰἰ ὁῖ **GEOM** ἑἑῶ ὁῶῶ ὁῖῶῶῶῶ ὁῖῶ

ἰἰῶῶῶ ὁῖῶ **GNOME** ἑἑῶ ὁῖῶ ἄῶῶῶῶῶ ὁῖῶ

ἌἌἑῶῶ ὁἰ ÷ ἑῶῶ ὁῶαῖῶῶ

ἌἌἑῶῶ ὁῶαῖῶῶ ἑἑῶ ὁῖἰἰἰἰἰἰἰἰ ἰἰ ὁῖ **FreeBSD**

Ἄἑἑῶῶῶ ὁῖῶ **FreeBSD**

Ὀῖ **FreeBSD** ὁῶῶ ἑῶ ÷ ἑῶῶῶῶῶ **IA-32** (Intel x86)

ἰἰῶῶῶ ὁῖῶ **FreeBSD** ὁῶῶ ἑῶῶ ὁῶῶῶῶῶ **IA64** ὁῶῶ Intel

Ὀἰ ÷ ἑῶῶ ὁῶαῖῶῶ ὁῖῶ ἄῶῶῶῶῶῶῶ ὁῖῶ ἑῶῶῶῶ **IP** ὁῖῶ **firewall**

ἰἰῶῶῶ ἑῶῶῶῶ ὁῖῶ **ISDN**

Ὀῶαῖῶῶ ὁ ÷ ἄῶῶῶ ἰἰ ὁῶῶ ἑῶῶῶῶῶ ὁῖῶ **jail(8)**

ἰἰῶῶῶ ἑῶῶῶῶῶ **Java** ἑἑῶ Ὀῖῶῶ ὁῖῶ ἰἰῶῶῶῶῶ ὁἰ **JDKs** ὁῖῶ **FreeBSD**

ἰἰῶῶῶῶ ὁῖῶ **KDE** ἑἑῶ ὁῖῶ ἄῶῶῶῶῶ ὁῖῶ

ἰἰῶῶῶῶ ὁῖῶ **LFS** ὁῖῶ **FreeBSD**

Ὀῖ ὁῶῶῶῶ ἑἑῶῶῶῶ ὁῶῶῶ ἑἑῶ ÷ ἑῶῶῶῶ ὁῶῶῶ ὁῖῶ ἑἑῶῶῶῶ

ἰἰῶῶῶῶ ὁῖῶ **FreeBSD** ὁἰ ἑῶῶῶῶῶῶῶῶ **MIPS®**

## ΕΒΡΩΑ

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-openoffice  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-openoffice>)

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>)

## ΌΕΙΘΟΥ

ΌαξόΠράαδ ο÷άδεδέΥδ ιά οϊνχόÛ δδϊεϊαέόδεδέÛ  
όόόΠιιάά

ΆοάνιϊάΥδ Mono έάέ C# όοϊ FreeBSD

ΊάόάοϊνÛ όϊο **Mozilla** όοϊ FreeBSD

ΆοάνιϊάΥδ δϊεοϊΥούι

Όα÷ιέέΥδ όαξόΠράαδ ο÷άδεδέΥδ ιά όçί  
άν÷έόάδεδϊέέΠ έέάγέυι

ΌαξόΠράαδ αέέόγύόçδ έάέ δçääβιδ έπράέαδ TCP/IP

ΊάόάοϊνÛ όϊο **OpenOffice.org** έάέ όϊο **StarOffice** όοϊ  
FreeBSD

ΆνùδΠράαδ ο÷άδεδέΥδ ιά άάέόδεδϊέέβçόç άδϋάιόçδ άέά  
άάέάόάόδÛόάέ δθçεΠδ άδϋάιόçδ έάέ ιάάÛεϊο οϊνδβιθ

ΌϊόόδΠñέιç άίυδ άñέèϊγ άδϋ ports ο÷άδεδέÛ ιά Perl

ΌαΠδçόç έάέ άνùδΠράαδ ο÷άδεδέΥδ ιά όϊ όγόόçιά  
packet filter firewall

ΌαΠδçόç άέά ιάόάοϊνÛ όά ιç-Intel άν÷έόάδεδϊέέΥδ

ΌαΠδçόç άέά όçί ΌδεδϊάΠ όυι Ports

ΌαΠδçόç άέά όöÛεϊάόά έάέ άίάοϊνÛδ όόάεϊÛόυι (PRs)  
δϊο άοϊνϊγί ports

**ΕΒΟΑ**

freebsd-ppc  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ppc>)

freebsd-proliant  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-proliant>)

freebsd-python  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-python>)

freebsd-qa  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-qa>)

freebsd-rc  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-rc>)

freebsd-realtime  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-realtime>)

freebsd-ruby  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ruby>)

freebsd-scsi  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-scsi>)

freebsd-security  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-security>)

freebsd-small  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-small>)

freebsd-smp  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-smp>)

freebsd-sparc64  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-sparc64>)

freebsd-standards  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-standards>)

**ΟΕΙΔΙΟ**

Για το FreeBSD στο PowerPC®

Ο Αλλάβος στο FreeBSD στο HP ProLiant

ΕΓΓΡΑΦΗ στο Python στο FreeBSD

Ο Αλλάβος στο εγγύηση (Quality Assurance), ορισμένοι από τους ελεγκτές του FreeBSD

Ο Αλλάβος στο οριστικό rc.d ελέγχος αλλαγών

Αντικείμενο του άρθρου των εγγράφων στο FreeBSD

Ο Αλλάβος στο Ruby στο FreeBSD

Οι διοργανώσεις SCSI

ΕΓΓΡΑΦΗ στο άρθρο των εγγράφων στο FreeBSD

× στο FreeBSD στο embedded εγγράφιο (Αντι-επιχειρησιακή διαβίωση: από την ελέγχου εβόα, εγγράφιο στο freebsd-embedded (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-embedded>))

Ο Αλλάβος στο αντικείμενο του άρθρου [α]όσπιτο

Για το FreeBSD στο Sparc® εγγράφιο

Ορισμός του FreeBSD στο εγγράφιο C99 ελέγχου POSIX

**Έβόοά**

frebsd-sun4v  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-sun4v>)

frebsd-threads  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-threads>)

frebsd-testing  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-testing>)

frebsd-tokenring  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-tokenring>)

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>)

*ΔάνεινέοιΥίλο εβόοάο: Έέ άέυιέοέο εβόοάο άβίάέ άέά δέι άέάέέυ (έάέ άδάέοζοέέέυ) έιέιυ έάέ δέεάιρò άάί άίάέάοΥήνιόι όι άάίέέέυ έιέιυ. Δνέι άñ÷βόάοά ίά όοιηάόΥ÷άοά όά έΥδνιέά άδύ άοδΥò, έάέυ έά άβίάέ ίά Υ÷άοά δάνάέιέιέοεβόάέ όέο όά÷ίέέΥò εβόοάο, βόοά ίά άίόέέάηΥίάόοά όη έπαέέά άδέέιέιυίβάο έάέ όοιδάνέοιηΥò δνιό έο÷γάέ όά άοδΥò.*

**Όέιδύο**

ΊάόάοιηΥ όνι FreeBSD όά UltraSPARC T1 όόόβιάόά

Δνέοίζιάόέέβ άδάνηάάόβά όοι FreeBSD

ΆνέέιΥò άδύιόζοζ έάέ όόάέάνυόζοάο όνι FreeBSD

Όδνιόδβνέίζ όνι Token Ring όοι FreeBSD

Όόαβόζοζ όδνιόδβνέίζ όνι USB όοι FreeBSD

Όόαβόζοζ ό÷άόέέΥ ίά άέΥοιηάο όά÷ίέέΥò άέέιίέέιδνιβζόζο δνιό όδνιόζηβνέίίόάέ άδύ όι FreeBSD

Όόαβόζοζ άέά όζνι όδνιηβ VuXML

Όοιόβνέζοζ έάέ όδνιόδβνέίζ όνι X11 όοι FreeBSD

Όόαβόζοζ άέά όζ ίάόάοιηΥ όνι FreeBSD όοι Xen — όέιδνιβζόζ έάέ ÷ηβόζ

**Έβόοά**

frebsd-hubs  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-hubs>)

frebsd-user-groups  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-user-groups>)

**Όέιδύο**

¶όηά δνι άέάόζηγί mirror sites (όδνιόδβνέίζ όδνιηβ)

ΊνñΥίύοζ όνι όδέέυάυί ÷ηζόβνι

**ΕΒΡΟΔΑ**

frebsd-vendors  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-vendors>)

frebsd-wip-status  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-wip-status>)

frebsd-www  
(<http://lists.FreeBSD.org/mailman/listinfo/frebsd-www>)

**ΟΕΙΘΙΟ**

Γνωστοποίηση για την κατάσταση του έργου

Εάν θέλετε να ενημερωθείτε για το FreeBSD ή να βοηθήσετε στην ανάπτυξη (Work-in-Progress).

Ορίστε τον δίαδρομο [www.FreeBSD.org](http://www.FreeBSD.org)  
(<http://www.FreeBSD.org/index.html>)

*Εβδόμη digest:* ¼εάν έ έ δανάηδύι έβδόμη άέάδβέαιόάέ έάέ οά ιιηόP digest (δάνβέχσος). Ιιέέδ άάάηάόβδά οά ιβά έβδόμη, ιδνίάβδά ίά άέέΥιάδά οέδ άδέέιγδ digest οόι οίΠιά ηέειβόάι οίθ έιάάέάόιγ οάδ.

*Εβδόμη CVS & SVN:* Έέ άέυέιθέάδ έβδόμη άβίάέ άέά υόιθδ άίάέάόΥήνιόάέ ίά άέΥθιόι οά ιγίγιάδά (log) θιθ άάβ-ήθι οέδ άέέάγδ οά άέΥιθάδ δάνεί-Υδ οίθ δζάάβιθ έπáέέά. Άβίάέ έβδόμη ιιθι άέά άιΥάιυόσ έάέ άι θηΥδάέ ίά οδΥέιόά ιγίγιάδά οά άδδΥδ.

<b>ΕΒΡΟΔΑ</b>	<b>Δάνεί-Π δζάάβιθ έπáέέά</b>	<b>ΔάνέηάθΠ δάνεί-Πθ (έπáέέά άέά)</b>
cvss-all ( <a href="http://lists.FreeBSD.org/mailman/listinfo/cvss-all">http://lists.FreeBSD.org/mailman/listinfo/cvss-all</a> )	/usr/(CVSROOT doc ports)	¼εάν έ έ άέέάγδ οά έΥέά ιΥήθδ οίθ άΥίθθθ (δάνέΥ-άέ υέάδ οέδ Υέέάδ έβδόμη CVS)
cvss-doc ( <a href="http://lists.FreeBSD.org/mailman/listinfo/cvss-doc">http://lists.FreeBSD.org/mailman/listinfo/cvss-doc</a> )	/usr/(doc www)	¼εάν έ έ άέέάγδ οόά άΥίθνά doc έάέ www
cvss-ports ( <a href="http://lists.FreeBSD.org/mailman/listinfo/cvss-ports">http://lists.FreeBSD.org/mailman/listinfo/cvss-ports</a> )	/usr/ports	¼εάν έ έ άέέάγδ οόι άΥίθθθ ούι ports
cvss-projects ( <a href="http://lists.FreeBSD.org/mailman/listinfo/cvss-projects">http://lists.FreeBSD.org/mailman/listinfo/cvss-projects</a> )	/usr/projects	¼εάν έ έ άέέάγδ οόι άΥίθθθ ούι projects
cvss-src ( <a href="http://lists.FreeBSD.org/mailman/listinfo/cvss-src">http://lists.FreeBSD.org/mailman/listinfo/cvss-src</a> )	/usr/src	¼εάν έ έ άέέάγδ οόι άΥίθθθ src (άγίέιθάάβδάέ άδύ οά commit οίθ θνιάνΥιάόιθ ιάδάθθθδθ svn-to-cvs)
svn-src-all ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-all">http://lists.FreeBSD.org/mailman/listinfo/svn-src-all</a> )	/usr/src	¼εάν έ έ άέέάγδ οόι Subversion repository (άέθιθ άδύ οέδ δάνεί-Υδ user έάέ projects)

<b>Èßóðá</b>	<b>Δãñéì ÷ Þ ðçãáßìò êþäéêá</b>	<b>ΔãñéãñáòÞ ðãñéì ÷ Þò (êþäéêáò äéá)</b>
svn-src-head ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-head">http://lists.FreeBSD.org/mailman/listinfo/svn-src-head</a> )	/usr/src	¼éãð ìέ äééáãŸò óðìì êèŪäì “head” òìò Subversion repository (ðñüêäéðáέ äéá òìì êèŪäì FreeBSD-CURRENT)
svn-src-projects ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-projects">http://lists.FreeBSD.org/mailman/listinfo/svn-src-projects</a> )	/usr/projects	¼éãð ìέ äééáãŸò óðçì ðãñéì ÷ Þ ðçãáßìò êþäéêá projects òìò Subversion repository
svn-src-release ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-release">http://lists.FreeBSD.org/mailman/listinfo/svn-src-release</a> )	/usr/src	¼éãð ìέ äééáãŸò óðçì ðãñéì ÷ Þ ðçãáßìò êþäéêá releases òìò Subversion repository
svn-src-releng ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-releng">http://lists.FreeBSD.org/mailman/listinfo/svn-src-releng</a> )	/usr/src	¼éãð ìέ äééáãŸò óá üèìò òìò êèŪäìò ðçãáßìò êþäéêá releng òìò Subversion repository (ðñüêäéðáέ äéá òìò êèŪäìò security / release engineering)
svn-src-stable ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable">http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable</a> )	/usr/src	¼éãð ìέ äééáãŸò óá üèìò òìò êèŪäìò ðçãáßìò êþäéêá stable òìò Subversion repository
svn-src-stable-6 ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-6">http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-6</a> )	/usr/src	¼éãð ìέ äééáãŸò óðìì êèŪäì ðçãáßìò êþäéêá stable/6 òìò Subversion repository
svn-src-stable-7 ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-7">http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-7</a> )	/usr/src	¼éãð ìέ äééáãŸò óðìì êèŪäì ðçãáßìò êþäéêá stable/7 òìò Subversion repository
svn-src-stable-8 ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-8">http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-8</a> )	/usr/src	¼éãð ìέ äééáãŸò óðìì êèŪäì ðçãáßìò êþäéêá stable/8 òìò Subversion repository
svn-src-stable-other ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-other">http://lists.FreeBSD.org/mailman/listinfo/svn-src-stable-other</a> )	/usr/src	¼éãð ìέ äééáãŸò óðìò ðáέéìŸò stable êèŪäìò ðçãáßìò êþäéêá òìò Subversion repository
svn-src-svnadmin ( <a href="http://lists.FreeBSD.org/mailman/listinfo/svn-src-svnadmin">http://lists.FreeBSD.org/mailman/listinfo/svn-src-svnadmin</a> )	/usr/src	¼éãð ìέ äééáãŸò óðá scripts äéá ÷ áßñέόçò, óá hooks, éáέ Ūèéá äããñŸìá ðìò áòìñìŸì óέð ñòèìßóáέò òìò Subversion repository



εβόαδ. όσε, άί άάί δνίέεάεόάε ίά εΰίάόά εΰίόίεí δάνβάννί όόίάόάόίυ (δ.÷. “-stable & -scsi”), άάί όδΰñ÷άε εΰάιό ίά όόάβέάόά ίπρίόίά όά δάνέόόύόάόάό άδύ ίβά εβόόά εΰεά όινΰ. Άί εΰάάόά εΰίόίεí ίπρίόίά όόί ίδίβί όάβνίόάε δίεεάδεΰό εβόόάό όόçi άñάñΠ cc, έάεΰ έά άβίάε ίά δάνέεΰόάόά εΰίόίεάό άδύ άόόΰό δνίέί όόάβέάόά άδΰίόόό. Εάυñάβόόά όδάγέόίυ όέά όά άέέΰ όάό cross-postings, άίάίΰñόόά όίεíδ άβίάε ί άçiέίόñάυδ όίόδ.

- Δνίόύδεέΰό άδέεΰόάέό έάε άόΰάεά (όόί δάνέά÷ύιάí ίέάό άίόέδάνΰεάόό) άάί άδέόñΰίόίάε, έάε άόόυ άόινΰ όύόί όίόδ ÷ñπόόάό ύόί έάε όίόδ developers. ίάάΰεάό δάνάάΰόάέό όύí έάíύíύí (netiquette), ύδύδ ÷ñπόό όíçíΰόύí Π ίεΰέεçñύí δνίόύδεέβί ίçíόίΰόύí ύόάί άάί Ψ÷άε άεέάβ ΰάάέά άέά ίά άβίάε άόόυ έάε άάί πόάί άίάíάíύíάí, άδίάέέίΰάέίόάε άέέΰ άάί άδάάñάγíόάε ñçóΰ. ¼íυδ, όδΰñ÷ίόí ίάñέέΰό δάνέόόπóάέό ύδίό όΰόίεí δάνέά÷ύιάí άíδβόόάε όόίόδ έάííέόίύό εΰίόίεάό εβόόάό έάε ίδñάβ ίά ίäçāπóάε όά δñíάέάíδñβçόç (Π άέΰíá έάε άδίεέάέόίυ) άδύ άόόβί.
- Άέάόπρίέόç δñíύύíόύí Π όδçñάόέβί δίό άάί ό÷άδβάέíόάε ίά όí FreeBSD άδάάñάγíόάε άόόόçñΰ έάε έά ίäçāπóάε όά ΰíάόí άδίεέάέόίυ άί άβίάε όάíάñύ ύόε ί δόάβόόçό άέάόçíβάέόάε ίά spam.

Άόñέέίβ δβίάέάό έέόόβί:

freebsd-acpi (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-acpi>)

Άíΰδóóτς όçό άέά÷άβñέόçό άíΨñάέάό έάε όίό ACPI

freebsd-afs (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-afs>)

Andrew File System

Άόόπ ç εβόόά άβίάε άέά όάπóçόç όçό ίάόάόíñΰό έάε όçό ÷ñπóçό όίό AFS άδύ όí CMU/Transarc

freebsd-announce (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-announce>)

Όçíάίόέέΰ άάάíύύόά έάε άíάέίέίπóάέό

Άόόπ ç εβόόά άβίάε άέά ΰόíά όίό άíάέάόΨñíόάε ίύíí άέά δάνέόόάόάέΰό άíάέίέίπóάέό όçíάίόέέβί άάάíύύόύí όίό FreeBSD. Δάνέέάíάΰíάε άíάέίέίπóάέό ό÷άόέέΰ ίά snapshots έάε ΰέέά releases. Άδβόçό άçiόέάγíόάε όά άόόβί άíάέίέίπóάέό άέά ίΨάό έέάíύόçόάό όίό FreeBSD. ΰδñάβ ίά δάνέΨ÷άε άέέέπóάέό άέά άέάέíίόΰό έόε. Δνίέάέόάε άέά ίβá εβόόά ίά ίέέñΠ εβίçόç, έάε ίέ άçiόέάγíόάέό άέΨñ÷íόάε άόόόçñΰ.

freebsd-arch (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-arch>)

Όάççóπóάέό άñ÷έόάέόίέέπó έάε ό÷άάέάόίύ

Όά άόόπ όçí εβόόά όάççóάβόάε ç άñ÷έόάέόίέέπó όίό FreeBSD. Όά ίçíγíάόά άβίάε έάόΰ εγñέí εΰάí άñέάόΰ όά÷ίέέΰ. Δάνάάάβñíάόά ό÷άόέέβί εάíΰόύí άβίάε:

- Δύδ ίά άδάíάό÷άέάόάβ όí όγóόçíά ίάόάάέπóδóéçό πóόά ίά άέόάέάβ όάόόύ ÷ñíά δίεεΰό δñíόάñíóíΰίάό ίάόάάέΰόδβόάέό.
- Όέ δñΨάε ίά άδέόέάόάόάβ όόí VFS πóόά ίά έάέόíóñáγí όά Heidemann layers.
- Δπó δñΨάε ίά ίάόάόñΨόίόά όç άέάδάπ (interface) όύí ίäçāπí όόóέάόβί πóόά ίά ίδñíγíά ίά ÷ñçóέíδíέπóίόíά όά βάέά δñíñΰíάόά ίäπāççόç όά δίεέίγύό άέάγέíóδ έάε άñ÷έόάέόίέέΰό.
- Δύδ ίά άñΰόάόά Ψίά ίäçāΰύ έέέόγíó.

freebsd-audit (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-audit>)

Project áέΨñ÷ίό δçāάβñó έπáέέά



ΆοδP αβίάε ίβα άοοοάνηέP εβόοά αέα ÷ ηPός άδν οά ίYές οίο core. Όά άοδP ός εβόοά ίδνίηάβόά ίά οοάβηάοά ίεYίάοά, υοάί δνίέYοάέ εYδνίεί εYίά ό÷ άοέεY ίά οί FreeBSD οί ηδνίβί άδάέοάβ ηέαέοόςόβά P εάδνίηηP άYόάός.

freebsd-current (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-current>)

*ΌοαεόςPόάέο ό÷ άοέέY ίά όςί ÷ ηPός οίο FreeBSD-CURRENT*

ΆοδP ός εβόοά αβίάε αέα ÷ ηPόοάο οίο FreeBSD-CURRENT. ΔάνέY ÷ άέ δνίάέάυδνίέPόάέο αέα ίYά ÷ άηάέοςήεόοέέY δνί δννέάέοάέ ίά δνίόοάέYί οοί -CURRENT έάέ οά ηδνίβά έά άδςήάYόίοί οίο ÷ ηPόοάο, έάέ ηάαβάο αέα όέο έείPόάέο δνί δνYδάέ ίά αβνίοί ηόοά ίά δάηάηάβίάοά οοί -CURRENT. ¼δνίείο άέοάέάβ οί “CURRENT” δνYδάέ ίά άάηάοάβ οά άοδPί όςί εβόοά. Αβίάε ίέα όά÷ ίέέP εβόοά έάέ όοαεόςYίόάέ ηυή άοόςήY όά÷ ίέέY εYίάοά.

freebsd-cvsweb (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-cvsweb>)

*FreeBSD CVSweb Project*

Όά÷ ίέέYδ όοαεόςPόάέο αέα όςί ÷ ηPός, όςί άYδδδς έάέ όςί οοίδηςός όίο FreeBSD-CVSweb.

freebsd-doc (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-doc>)

*Project όάέιςήβνςός όίο FreeBSD*

ΆοδP ός εβόοά αβίάε αέα όοαεόςός έάηYδνί έάέ projects δνί ό÷ άοβηίόάέ ίά όςί άςίέYήάβά όάέιςήβνςός αέα οί FreeBSD. Όά ίYές άοδPδ όςό εβόοάό άδνέάέYίόάέ οδνίέέY υδ “The FreeBSD Documentation Project”. Αβίάε ίέα άνίέέP εβόοά έάέ αβόοά άεάYεάηνδ ίά οδνίάY ÷ άοά έάέ ίά οοίάέοYήάοά!

freebsd-drivers (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-drivers>)

*ΆςίέYήάβά ηάαβί όοόέάδPί αέα οί FreeBSD*

ΆοδP ός εβόοά δννίηβηάοάέ αέα όά÷ ίέέYδ όοαεόςPόάέο ό÷ άοέέYδ ίά ηάςήYδ όοόέάδPί οοί FreeBSD. × ηςόείηδνίέάβόάέ έοηβνδ άδν οίο άςίέYήάβά ηάαβί όοόέάδPί αέα άηνδPόάέο ό÷ άοέέYδ ίά ός όοάηάοP ηάαβί, ÷ ηςόείηδνίέPίόάό όά APIs δνί δάηY ÷ άέ η δονPιάδ οίο FreeBSD.

freebsd-eclipse (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-eclipse>)

*FreeBSD ÷ ηPόοάο οίο Eclipse IDE, ονί άηάέάβνί οίο, rich client άοάνηηάβί, έάέ ports.*

Δννέάός όςό εβόοάό άοδPδ αβίάε ίά δννίόYήάέ άνέάάβά δδνίόδPήές αέα υοέ Y ÷ άέ ίά εYίάέ ίά όςί άδέέηP, άάέάοYόοάός, ÷ ηPός, άYδδδς έάέ οοίδPήςός οίο Eclipse IDE, ονί άηάέάβνί οίο, άοάνηηάβί rich client όςί δέάοννίά οίο FreeBSD έάέ αέα άνέάέά ό÷ άοέέY ίά όςί ηάοάοηYδ οίο Eclipse IDE έάέ ονί δννέάοονί οίο όοί δάηέάYέηY οίο FreeBSD.

Δννέάός όςό αβίάε άδβόςό ίά αέαόέYήάέ όςί άνέάέάP δεςνίοηηέPί άYηάοά όςί έίείYδόςά οίο Eclipse έάέ όςί έίείYδόςά οίο FreeBSD, δννί υοάέYδ έάέ ονί άYί.

Αί έάέ ός εβόοά άδέέάννίηάόάέ έοηβνδ όοό άYηάέάδ ονί ÷ ηςόςPί οίο Eclipse, δννίόYήάέ άδβόςό Yίά ÷ ηνί όοαεόςόςό αέα υοίοδ εYέYίό ίά άYάδδYήYί άοάνηηάYδ ό÷ άοέέYδ ίά οί FreeBSD ÷ ηςόείηδνίέPίόάό οί Eclipse.

freebsd-embedded (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-embedded>)

*× ηPός οίο FreeBSD όά embedded άοάνηηάYδ*

Ός εβόοά όοαεόςY εYίάοά ό÷ άοέέY ίά όςί ÷ ηPός οίο FreeBSD όά embedded όοόPιάόά. Αβίάε ίέα όά÷ ίέέP εβόοά έάέ όοαεόςYίόάέ ηυή άοόςήY όά÷ ίέέY εYίάοά. Αέα ονί οείδν όςό εβόοάό άοδPδ, ηνβηίοηά υδ embedded όοόPιάόά όέδ δδνίηάέόοέYδ όοόέάYδ δνί άά δννίηβηίόάέ αέα desktop άοάνηηάYδ, έάέ δνί οοίPέδ έάέYδδνίό ίέα ηυή άYηάές, άνέάέάδ ίά όά άάίέέY δδνίηάέόοέY δάηέάYέηYίόά. ΌδδάηέέάηάYήYίόάέ, άέονδ ονί

Üëëùí, üëá óá òçëÝòùíá, äéëððáéùð äñðëéóíùð üðùð routers, switches éáé PBXs, äñðëéóíùð íáðñðóáùí áðù áðùðóáóç, PDAs, óðóððíáðóá Point Of Sale, éáé ðÛáé èÝáñíðáð.

freebsd-emulation (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-emulation>)

Äññíβùóç Üëëùí óðóðçíÜòùí üðùð äβíáé óá Linux/MS-DOS/Windows

Äβíáé íéá èβóðá äéá ðá÷-íééÝð óðæçððóáéð, ó÷-áðééÝð ðá òçí áéðÝéáóç óðí FreeBSD ðññáñáñÜòùí ðñò äçìéíðñâðççéáí äéá Üëëá èäéóíðñáéÜ.

freebsd-eol (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-eol>)

Îüðéìç ððíðððñéìç äéá èñäéóíéëù ó÷-áðééù ðá ðí FreeBSD ðñò äáí ððíðççñβæáðáé ðèÝíí áðù ðí FreeBSD Project.

Äððð ç èβóðá äβíáé äéá üóíðð áñäéáóÝññíðáé íá ðáñÝ÷-íðí ð íá ÷-ñçóéíðñéíðóíð òçí ñüðéìç ððíðððñéìç äéá èñäéóíéëù ó÷-áðééù ðá ðí FreeBSD ðñò äáí ððíðççñβæáðáé ðèÝíí áðù ðí FreeBSD Project (ð.÷., ðá òçí ññðð “patches” éáé áñäéíððóáùí áðóáéäβáð).

freebsd-firewire (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-firewire>)

FireWire (iLink, IEEE 1394)

Äððð ç èβóðá äβíáé äéá òçí óðæðçççç òçð ó÷-ääβáóçç éáé ðèðñíβçççç áñüð ððíðððððíáðñð FireWire (áñüðüü éáé üð IEEE 1394 ð iLink) äéá ðí FreeBSD. Ó÷-áðééÜ èÝíáðá äβíáé óá ðññüðððá, íé óðóéäðÝð äéáýèñ éáé óá ðññüðéèèèÜ ðñðð, èÛñðáð, ðññóáñññäáð éáé chipsets, éáé ç äñ÷-éðáèèñéèð éáé ç ðèðñíβçççç ðñò èðáééá äéá òçí óúóðð ððíðððñéìç ðñðð.

freebsd-fs (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-fs>)

Óðóððíáðóá äñ÷-äβùí

Óðæçððóáéð ó÷-áðééÝð ðá ðá óðóððíáðóá äñ÷-äβùí ðñò FreeBSD. Äβíáé íéá ðá÷-íééð èβóðá éáé óðæçðñíýíðáé ñññí áðóðçñÜ ðá÷-íééÜ èÝíáðá.

freebsd-gecko (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-gecko>)

Gecko Rendering Engine

Óðæçððóáéð ó÷-áðééÝð ðá äáñññññÝð ðñò ÷-ñçóéíðñéíýí òçí ðç÷-áñð Gecko óðí FreeBSD.

Ç óðæðçççç áðééáíðññíáðáé óá äáñññññÝð òçð Óðèèñðð ðññí Ports ðñò ÷-ñçóéíðñéíýí òç ðç÷-áñð Gecko, éáé äéáééëüðáñá òçí äáéáðÜóðáóç, áñðððñçç éáé ððíðððñéìç ðñðð óðí FreeBSD.

freebsd-geom (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-geom>)

GEOM

Óðæçððóáéð ó÷-áðééÝð ðá ðí GEOM éáé ðáñññññéäð ðèðñíéðóáéð. Äβíáé íéá ðá÷-íééð èβóðá éáé óðæçðñíýíðáé ñññí áðóðçñÜ ðá÷-íééÜ èÝíáðá.

freebsd-gnome (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-gnome>)

GNOME

Óðæçððóáéð ó÷-áðééÝð ðá ðí ðáñéáÜèèññ **GNOME** äéá óðóððíáðóá FreeBSD. Äβíáé íéá ðá÷-íééð èβóðá éáé óðæçðñíýíðáé ñññí áðóðçñÜ ðá÷-íééÜ èÝíáðá.

frebsd-ipfw (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-ipfw>)

*IP Firewall*

Ἀδὲβ ς ἐβὸδᾶ ἄβιᾶέ ἄεᾶ ὠᾶ÷ιέέβ ὠδᾶςδὲβᾶέδ ὠῖ ὠῖνῖῖί ὠῖ ἄδᾶίᾶ ὠᾶ÷ᾶεᾶᾶᾶ ὠῖ ἔβᾶέᾶ IP firewall ὠῖ FreeBSD. Ἀβιᾶέ ἰεᾶ ὠᾶ÷ιέέβ ἐβὸδᾶ ἔᾶέ ὠδᾶςδὲβᾶέᾶ ἰῖῖ ἄδὸδᾶῖῖ ὠᾶ÷ιέέῖ ἔβᾶᾶ.

frebsd-ia64 (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-ia64>)

*ἰᾶᾶᾶῖῖ ὠῖ FreeBSD ὠδᾶί ἄῖᾶ-έᾶᾶᾶᾶᾶᾶ IA64*

Δῖῖᾶᾶᾶᾶ ἄεᾶ ἰεᾶ ὠᾶ÷ιέέβ ἐβὸδᾶ, ἄεᾶ ῖᾶᾶ ὠῖ ἄῖᾶᾶᾶᾶ ἄῖᾶᾶῖ ὠδᾶί ἰᾶᾶᾶῖῖ ὠῖ FreeBSD ὠδᾶί ὠεᾶᾶᾶᾶᾶᾶ IA-64 ὠςδ Intel, ἄεᾶ ἰᾶ ἄῖᾶᾶᾶ ὠῖ ὠῖᾶᾶᾶᾶᾶᾶᾶ ᾶ ἰᾶ ὠδᾶςδὲβᾶῖᾶ ἄῖᾶᾶᾶᾶᾶᾶᾶ ὠδᾶᾶᾶ. ῖᾶᾶ ὠῖ ἄῖᾶᾶᾶᾶᾶᾶ ἰᾶ ὠῖᾶᾶᾶᾶᾶᾶᾶᾶᾶᾶ ὠδᾶᾶᾶᾶᾶᾶ ὠδᾶᾶᾶᾶᾶᾶᾶ ἄᾶᾶᾶᾶᾶᾶᾶᾶ.

frebsd-isdn (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-isdn>)

*Ἀῖῖᾶᾶᾶ ὠῖ ISDN*

Ἀδὲβ ς ἐβὸδᾶ ἄβιᾶέ ἄεᾶ ῖᾶᾶ ὠῖ ὠδᾶςδὲβᾶῖ ὠδᾶ ἄῖῖᾶᾶᾶ ὠςδ ὠᾶῖᾶᾶᾶᾶᾶᾶᾶᾶ ISDN ὠῖ FreeBSD.

frebsd-java (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-java>)

*Ἀῖῖᾶᾶᾶ ὠςδ Java*

Ἀδὲβ ς ἐβὸδᾶ ἄβιᾶέ ἄεᾶ ῖᾶᾶ ὠῖ ὠδᾶςδὲβᾶῖ ὠδᾶ ἄῖῖᾶᾶᾶ ὠςδᾶᾶᾶᾶᾶᾶ ἄᾶᾶᾶᾶᾶᾶᾶ Java ἄεᾶ ὠῖ FreeBSD ἔᾶέ ὠδᾶᾶᾶᾶᾶᾶ ἔᾶέ ὠᾶᾶᾶᾶᾶᾶ ὠῖ JDKs.

frebsd-jobs (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-jobs>)

*ᾶᾶᾶᾶ ἔᾶέ ὠῖᾶᾶᾶᾶ ἄᾶᾶᾶᾶᾶ*

Ἀδὲβ ἄβιᾶέ ῖᾶᾶ ὠῖ ᾶᾶᾶ ἄεᾶ ἄῖᾶᾶᾶᾶᾶᾶ ἄῖᾶᾶᾶᾶᾶᾶ ἄεᾶ ὠῖᾶᾶᾶᾶᾶ ἔᾶέ ᾶᾶᾶᾶᾶᾶ ὠῖ ὠ÷ᾶᾶᾶᾶᾶ ἰᾶ ὠῖ FreeBSD, ἔᾶᾶᾶ ἔᾶέ ἄῖᾶᾶᾶᾶᾶᾶ ὠ÷ᾶᾶᾶᾶᾶ ἰᾶ ὠῖ FreeBSD. Ἀῖ ἄεᾶ ὠᾶᾶᾶᾶᾶᾶ ἄῖᾶᾶᾶᾶᾶ ὠ÷ᾶᾶᾶᾶᾶ ἰᾶ ὠῖ FreeBSD, ᾶ ὠῖᾶᾶᾶᾶ ἰεᾶ ἔβᾶ ἄᾶᾶᾶᾶᾶ ὠ÷ᾶᾶᾶᾶᾶ ἰᾶ ὠῖ FreeBSD, ἄδὲβ ἄβιᾶέ ὠῖ ὠᾶᾶᾶ ἰῖᾶᾶᾶ ἄεᾶ ἰᾶ ὠς ἄεᾶᾶᾶᾶᾶᾶ. ς ἐβὸδᾶ ἄδὲβ ἄᾶᾶ ἄβιᾶέ ἄεᾶ ἄᾶᾶᾶᾶ ἔβᾶᾶᾶᾶᾶᾶ, ἄεᾶ ὠᾶ ἰᾶᾶᾶ ὠᾶᾶᾶᾶᾶ ἄᾶᾶ ῖᾶᾶᾶ ἔβὸδᾶ ὠῖ Ἀεᾶᾶᾶᾶᾶᾶ.

Ἀδὲβ ς ἐβὸδᾶ, ῖᾶᾶ ἔᾶέ ἰε ὠᾶᾶᾶᾶᾶ ἔβὸδᾶ ὠῖ [FreeBSD.org](http://FreeBSD.org), ἄεᾶῖᾶᾶᾶᾶ ὠᾶᾶᾶᾶᾶᾶ. ὠᾶᾶ, ὠᾶᾶᾶ ἰᾶ ἄβὸδᾶ ὠᾶᾶᾶ ἄεᾶ ὠδᾶ ὠῖᾶᾶᾶᾶᾶ ἔᾶέ ὠδᾶ ἄῖᾶᾶᾶᾶᾶᾶ ὠςδ ἄῖᾶᾶᾶᾶᾶᾶ ᾶ ἄῖᾶᾶᾶᾶ ὠδᾶᾶ ἰᾶᾶᾶᾶᾶᾶ.

ὠῖ ἰᾶᾶᾶ ὠᾶ ἔᾶ ὠᾶᾶᾶᾶ ἰᾶ ᾶᾶᾶᾶᾶᾶᾶ ἰῖᾶ ἄῖᾶᾶᾶ ὠᾶᾶ ὠᾶᾶᾶᾶᾶ — ἔᾶᾶᾶ ὠᾶᾶᾶᾶᾶ ἄᾶᾶ ἔᾶᾶᾶᾶ, ἄῖ ἔᾶέ ἄᾶᾶᾶᾶᾶ ἰᾶᾶᾶᾶᾶ Portable Document Format (PDF), HTML, ἔᾶέ ἰᾶᾶᾶᾶ ῖᾶᾶ ἄβιᾶέ ἄᾶᾶᾶᾶᾶ ἄᾶᾶ ὠᾶᾶᾶᾶᾶ ᾶᾶᾶᾶᾶᾶᾶ. ἔᾶᾶᾶᾶᾶ ὠᾶᾶᾶᾶᾶ ὠῖ Microsoft Word (.doc) ἔᾶ ἄᾶᾶᾶᾶᾶᾶ ἄᾶᾶ ὠῖ ἄεᾶᾶᾶᾶᾶ ὠςδ ἐβὸδᾶ.

frebsd-kde (<http://frebsd.kde.org/mailman/listinfo/kde-freebsd>)

*KDE*

ὠδᾶςδὲβᾶᾶᾶ ὠῖ ὠῖᾶᾶᾶ ὠῖ **KDE** ὠᾶ ὠᾶᾶᾶᾶᾶᾶ FreeBSD. Ἀβιᾶέ ἰεᾶ ὠᾶ÷ιέέβ ἐβὸδᾶ ἔᾶέ ὠδᾶςδὲβᾶᾶᾶ ἰῖῖ ἄδὸδᾶῖῖ ὠᾶ÷ιέέῖ ἔβᾶᾶ.

frebsd-hackers (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-hackers>)

*ὠᾶ÷ιέέβ ὠδᾶςδὲβᾶᾶᾶ*

Ἀβιᾶέ ῖᾶᾶ ὠῖ ᾶᾶᾶ ἄεᾶ ὠᾶ÷ιέέβ ὠδᾶςδὲβᾶᾶᾶ ὠ÷ᾶᾶᾶᾶ ἰᾶ ὠῖ FreeBSD. Ἀδὲβ ἄβιᾶέ ς ἔβᾶᾶ ὠᾶ÷ιέέβ ἐβὸδᾶ. Ἀβιᾶέ ἄεᾶ ῖᾶᾶ ὠῖ ἄῖᾶᾶᾶᾶᾶᾶ ἄῖᾶᾶᾶ ὠῖ FreeBSD, ἄεᾶ ἰᾶ ἄῖᾶᾶᾶ ὠῖ ὠῖᾶᾶᾶᾶᾶᾶ ᾶ ὠδᾶςδὲβᾶῖᾶ

ΆίάέάέόέέΎδ έύόάέδ. ¶οηά δίο άίάέάΎηηόάέ ίά δάηάέιέιέοεΠόιόι όζι όά÷ίέεΠ όδæΠόζός άβίάέ άδñüóääέδά. Άβίάέ ίέά όά÷ίέεΠ έβόδά έάέ όδæζοιγίόάέ iüfi άδóδçñÛ όά÷ίέέÛ èÝιάδά.

frebsd-hardware (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-hardware>)

ΆάίέεΠ όδæΠόζός άέά δέέέü έέ άίάñδΠιάδά δδñüέόδóβι όοι FreeBSD

ΆάίέέΎδ όδæζοΠόάέδ άέά όýδίοδ όέέέιγύ δίο έάέόιöññáγί όοι FreeBSD, άέÛοηά δñüάέΠιάδά έάέ δñüóÛάέδ ό÷άδέέÛ ίά όι όέ ίά άáñÛóóáδ Π ίά άδñüóáδά.

frebsd-hubs (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-hubs>)

Mirror sites

ΆίάέίέίΠόάέδ έάέ όδæζοΠόάέδ άέά Ûοηά δίο όδíoçññγί mirror sites όίö FreeBSD.

frebsd-isp (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-isp>)

ÈÝιάδά άέά Δάνη÷άβδ Õδçñάόέβι Άέάüέέδýγίö

ΆδóΠ ç έβόδά άβίάέ άέά όδæΠόζός έàñÛδùí ό÷άδέέβι ίά Δάνη÷άβδ Õδçñάόέβι Άέάüέέδýγίö (ISPs) δίο ÷ñçóέíñδiέγί FreeBSD. Άβίάέ ίέά όά÷ίέεΠ έβόδά έάέ όδæζοιγίόάέ iüfi άδóδçñÛ όά÷ίέέÛ èÝιάδά.

frebsd-mono (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-mono>)

ΆδóñüÛΎδ Mono έάέ C# όοι FreeBSD

ΆδóΠ ç έβόδά άβίάέ άέά όδæΠόζός έàñÛδùí ό÷άδέέβι ίά όι όýóδçιά άíÛδóδiçδ άóáññáβι Mono όοι FreeBSD. Δñüέάέδάέ άέά ίέά όά÷ίέεΠ έβόδά. Δññññæάόάέ άέά iδiέíñΠδiδά άó÷íέάβδάέ άíáñáÛ ίά όζι άíÛδóδiç Π όç ίάόάóñÛ άóáññáβι Mono Π C# όοι FreeBSD. Ç όδæΠόζός άóñÛ όζι άδβέδóç δññáέçñÛδùí ç όçι άýñάόç άίάέάέδóέέβι έýóáñí. ¶οηά δίο άίάέάΎηηόάέ ίά δάηάέιέιέοεΠόιόι όζι όά÷ίέεΠ όδæΠόζός άβίάέ άδβόçδ άδñüóääέδά.

frebsd-openoffice (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-openoffice>)

OpenOffice.org

ΌδæζοΠόάέδ ό÷άδέέΎδ ίά όζι ίάόάóñÛ έάέ όδiδβñçός όiö **OpenOffice.org** έάέ όiö **StarOffice**.

frebsd-performance (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-performance>)

ΌδæζοΠόάέδ άέά όçí ñýèiέός έάέ όçí ááέδóδiδiβçός όiö FreeBSD

ΆδóΠ ç έβόδά όδÛñ÷άέ άέά ίά δάñÝ÷άέ Ýιά ίÝñüδ üδiδ iέ hackers, iέ άέά÷άέñέóδΎδ, έάέ üóíέ Ûέέiέ άíáέάóÝññiόάέ, ίά όδæζοιγί èÝιάδά ό÷άδέέÛ ίά όçι άδñüáiός όiö FreeBSD. ΆδññáέδÛ èÝιάδά άβίάέ iέ όδæζοΠόάέδ δiö άíάóÝññiόάέ óá ááέάόάóδÛóάέδ FreeBSD δiö δδñüέάέiόάέ óá ίááÛέí öüñδi, Ý÷iöi δññáέΠιάδά άδñüáiόςδ, Π öδÛññi όi FreeBSD óδά üñέá όiö. Ódíέóóγiñá άíáδέóýέάέδά ίά áñáóγiί óδç έβόδά üóíέ άíáέάóÝññiόάέ ίά ááέδóέβiόi όçí άδñüáiός όiö FreeBSD. Άβίάέ ίβá όά÷ίέεΠ έβόδά δiö άδáδéγíñáόάέ óá Ýiδáέññiöδ ÷ñΠόάδ όiö FreeBSD, hackers, Π άέά÷άέñέóδΎδ δiö άíáέάóÝññiόάέ ίά èÛññi όi FreeBSD áñΠáññi έάέ άíέüδέóδi. Άáí δññüέάέδάέ άέά ίέά έβόδά áñüδΠόáñí έάέ άδáíδΠόáñí δiö iδññáβ ίά άíδέέάδóδΠόáέ όçí ίáέÝδç όçδ óáέiçññüóçδ, áέέÛ Ýιά ίÝññü άέά ódíáέóññÛΎδ Π άέá άδáíδΠόáέδ óá άíáδÛiόçδά èÝιάδά ό÷άδέέÛ ίά όçí άδñüáiός.

frebsd-pf (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-pf>)

ΌδæζοΠόάέδ έάέ áññüδΠόáέδ άέá δi όýóδçιά packet filter firewall

ΌαζόΠόάέο ό÷άδέέΥδ ιά οι packet filter (pf) firewall system όοι FreeBSD. Όά÷ιέέΥδ όαζόΠόάέο έάέ άñùòΠόάέο ÷ñζόόβι άβιάέ άδññüóääêôâð. Ç έβόόά άβιάέ άδβόζο Ýία ιÝñìð áέα όαεΠόζόζ όìò ALTQ QoS framework.

freebsd-platforms (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-platforms>)

*ÌáóáöñÛ όìò FreeBSD óá ιç-Intel δέαóöüñìáð*

ΔññiêΠιáόά όìò FreeBSD δìò àìöáíβæííóáέ óá δañέóóüôâñâð áδü ìβá δέαóöüñìáð, έάεβò έάέ ááíέέΥδ όαζόΠόάέο έάέ δññìòÛóáέò áέα ìáóáöñÛ όìò FreeBSD óá ιç-Intel δέαóöüñìáð. Άβιάέ ιέα óá÷ιέέΠ έβόόά έάέ όαζόçìííóáέ ìññí áóóóçñÛ óá÷ιέέÛ èÝíáόά.

freebsd-policy (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-policy>)

*ÊáóáððèðìòΠñέáð áδñöÛóáέð (policy) όζò ìÛüááð Core όìò FreeBSD*

ΆóðΠ άβιάέ ìβá έβόόά ìá ιέέñΠ έβίζόζ, ìññí áέα άíÛáñúóζ, áέα όέò áδñöÛóáέð όζò Core ñÛüááð όìò FreeBSD ó÷áðééÛ ìá èÛðιέα èÝíáόά έáóáyèðìóζ όìò Project (policies).

freebsd-ports (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ports>)

*ΌαεΠόζόζ áέα óá “ports”*

ΌαζόΠόάέο ό÷áðééΥδ ìá όçí “ΌðëëíãΠ ðùí Ports” όìò FreeBSD (/usr/ports), όçí ððìáññΠ ðùí ports, έάέ ááíέέÛ όέð δññìóðÛέáéáð óóíðìíέóìññý ðùí ports. Άβιάέ ιέα óá÷ιέέΠ έβόόά έάέ όαζόçìííóáέ ìññí áóóóçñÛ óá÷ιέέÛ èÝíáόά.

freebsd-ports-bugs (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ports-bugs>)

*ΌαεΠόζόζ áέα óá óöÛèìáóá ðùí “ports”*

ΌαζόΠόάέο δìò ό÷áðβæííóáέ ìá όέð áíáóìñÝð δññíæçìÛðùí όçò “ΌðëëíãΠ ðùí Ports” (/usr/ports) όìò FreeBSD, δññìòÛóáέò áέα íÝá ports Π áέα áéëááÝð óá ððÛñ÷ííóá ports. Άβιάέ ιέα óá÷ιέέΠ έβόόά έάέ όαζόçìííóáέ ìññí áóóóçñÛ óá÷ιέέÛ èÝíáόά.

freebsd-proliant (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-proliant>)

*Όá÷ιέέΠ όαεΠόζόζ áέα όì FreeBSD óá äéáéñéóóÝð HP ProLiant*

ΆóðΠ ç έβόόά άβιάέ áέα óá÷ιέέΥδ όαζόΠόάέο ό÷áðééÛ ìá όçí ÷ñΠόζ όìò FreeBSD óá äéáéñéóóÝð HP ProLiant. Ç όαεΠόζόζ δañéëáíáÛíáé èÝíáόά δññíñáñìÛðùí ìãΠáçóζ áέα ProLiant, èñiáéóíééÛ áέα÷áβñέóζò, áñááéáβá ñèìβóáùí, έάέ áíáíãΠóáέò όìò BIOS. Ç έβόόά áóðΠ άβιάέ όì έáóáéçëüðáññí ìÝñìð áέα όαεΠόζόζ ό÷áðééÛ ìá óá áñèñβιáόά hpsamd, hpsmcli, έάέ hpacucli.

freebsd-python (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-python>)

*Ç Python όοι FreeBSD*

ΆóðΠ ç έβόόά άβιάέ áέα όαζόΠόάέο ό÷áðééΥδ ìá όçí ááéðéóóìðñβçóζ όçò ððìóðΠñέíçð όçò Python όοι FreeBSD. Άβιάέ ιέα óá÷ιέέΠ έβόόά. Δññññβæáóáέ áέα Ûðñá δìò áó÷ιέíýíóáέ ìá όçí ìáóáöñÛ όçò Python, ðùí áñèññìÛðùí όçò (modules) έάέ όìò **Zope** όοι FreeBSD. ¼óíé áíáéáóÝññíóáέ íá δañáéíèíðèΠóíóí όçí óá÷ιέέΠ όαεΠόζόζ, άβιάέ áðδññüóääêôíé.

freebsd-questions (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>)

*ΆññòΠόάέò ÷ñζόόβι*

Από το βιβλίο της Άννι-Ρόζα ο -από το 1980 και οι FreeBSD. Αλλά η Ήρα είναι ο Υπόλογο "how to" ο -από το 1980 βιβλίο της Άννι-Ρόζα ο -από το 1980 και οι FreeBSD.

freebsd-ruby (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ruby>)

*Ολοκληρωμένο ο -από το 1980 και οι Ruby στο FreeBSD*

Το βιβλίο της Άννι-Ρόζα ο -από το 1980 και οι FreeBSD. Η Άννι-Ρόζα ο -από το 1980 και οι FreeBSD. Η Άννι-Ρόζα ο -από το 1980 και οι FreeBSD.

Άννι-Ρόζα ο -από το 1980 και οι FreeBSD.

freebsd-scsi (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-scsi>)

*Οι οδηγίες SCSI*

Από το βιβλίο της Άννι-Ρόζα ο -από το 1980 και οι FreeBSD. Άννι-Ρόζα ο -από το 1980 και οι FreeBSD.

freebsd-security (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-security>)

*Εγχειρίδιο ασφαλείας*

Από το βιβλίο της Άννι-Ρόζα ο -από το 1980 και οι FreeBSD (DES, Kerberos, η Άννι-Ρόζα ο -από το 1980 και οι FreeBSD).

freebsd-security-notifications (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-security-notifications>)

*Αετιολογία ασφαλείας*

Άννι-Ρόζα ο -από το 1980 και οι FreeBSD. Άννι-Ρόζα ο -από το 1980 και οι FreeBSD.

freebsd-small (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-small>)

*× η ολοκληρωμένη ο -από το 1980 και οι FreeBSD*

Από το βιβλίο της Άννι-Ρόζα ο -από το 1980 και οι FreeBSD. Άννι-Ρόζα ο -από το 1980 και οι FreeBSD.

**Οι πληροφορίες:** Το βιβλίο της Άννι-Ρόζα ο -από το 1980 και οι FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-embedded>).

freebsd-stable (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-stable>)

*Ολοκληρωμένο ο -από το 1980 και οι FreeBSD-STABLE*

Από το βιβλίο της Άννι-Ρόζα ο -από το 1980 και οι FreeBSD-STABLE. Η Άννι-Ρόζα ο -από το 1980 και οι FreeBSD-STABLE.

-STABLE. Έά δñÝðáέ ίά áãñáóáβóá όά áðòÐ ός έβóóά, άί άείεϊòέáβóá όι “STABLE”. Άβίάέ ίέά όá÷-ίέέÐ έβóóά έάέ όðæçóιγίίόάέ ίüñí áðóçñŪ όá÷-ίέέŪ èÝíáðά.

frebsd-standards (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-standards>)

*Óðüññóòóç ίά όά δñüðóðά C99 & POSIX*

ΆðòÐ ç έβóóά άβίάέ áέά όá÷-ίέέÝò όðæçòÐóáέó ό÷-άóέέŪ ίά όçί όðüññóòóç όιò FreeBSD ίά όά δñüðóðά C99 έάέ POSIX.

frebsd-usb (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-usb>)

*ÓðæÐóçόç áέά όçί óðíóðÐñέίç όιò äέáyεϊò USB όóι FreeBSD*

ΆðòÐ ç έβóóά άβίάέ áέά όá÷-ίέέÝò όðæçòÐóáέó ό÷-άóέέŪ ίά όçί óðíóðÐñέίç όιò äέáyεϊò USB όóι FreeBSD.

frebsd-user-groups (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-user-groups>)

*ŪñāŪíúόç όüí óðεεüäüí ÷ñçóðñí*

ΆðòÐ ç έβóóά άβίάέ áέά όιòò όóíóñέέóðÝò όüí άðείÝñíòò όιðέέñí óðεεüäüí ÷ñçóðñí áέά όðæÐóçόç έäíŪóüí ίáóáίý όιòò έάέ ίá èŪðίέί ίÝεϊò όçò ñŪááó Core. ΆðòÐ ç έβóóά έά δñÝðáέ ίά άίáóÝñáέ ίüñí óέó όóίáíòÐóáέó έάέ όçί ŪñāŪíúόç projects ðíò άίáóÝñííóáέ όá ðñέóóóüóäñíòò áðü Ýíá óðεεüäüíò ÷ñçóðñí.

frebsd-vendors (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-vendors>)

*ΔüèçðÝò*

ŪñāŪíúόç όðæçòÐóáüí ίáóáίý όιò FreeBSD Project έάέ όüí ðüèçòñí έϊáέóíέέίý έάέ óεέέéý ό÷-άóέέéý ίá όι FreeBSD.

frebsd-virtualization (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-virtualization>)

*ÓðæÐóçόç äέŪóññüí όá÷-ίέέñí áέέñíέέéíðíβçόçò ðíò óðíóçñβáεííóáέ áðü όι FreeBSD.*

Ūέά έβóóά áέά όç όðæÐóçόç όüí äέŪóññüí όá÷-ίέέñí áέέñíέέéíðíβçόçò ðíò óðíóçñβáεííóáέ áðü όι FreeBSD. Άðü όç ίέá ίáñέŪ áóóέŪáέέ όóçí óéíðíβçόç όüí ááóέέñí έáέóíòñáεñí áέέŪ έάέ όçí ðñíóεÐεç ίÝüí áóíáíòÐóüí. Άðü όçí Ūέεç, ίέ ÷ñÐóóáð έá Ý÷-íòí ίέá ñŪáá όðæçòÐóáüí üðíò ίðñíýí ίá æçóιγίí äíÐεáέá όá ðññβðóóç ðñíáέçíŪóüí, Ð ίá όðæçóιγίί óέó áέέÝò όιòò ÷ñÐóáέó.

frebsd-wip-status (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-wip-status>)

*ΈáóŪóóáόç äñāáóέñí όá äíÝέέίç όóι FreeBSD*

Óçς έβóóά áðòÐ ίðññáβóá ίá άίáέίεíρóáóá όçí Ýíáññç έάέ όçí ðññíäí èŪðίέάó äñāáóβáð óáð ðíò ό÷-άóβáεáóέ ίá όι FreeBSD. Óá ίçίγίíáóá όá áðòÐ όç έβóóά äéÝá÷-ííóáέ. Óóíβóóáóáέ ίá óóáβéáóá όι ίÐííóíá óáð ίá ðáñáέÐðóç ίέá ðéí όιðέέÐ óáð έβóóά όιò FreeBSD, έάέ áðεñð ίá έίέñíðíεÐóáóá όι ίÐííóíá óáð όá áðòÐ όç έβóóά. Ūá όñí ðññüðí áðóü, ίðññáβóá äðβóçò ίá όðæçòÐóáóá áέá όçí äñāáóβá óáð óóçí όιðέέÐ έβóóá, έáεñð ç όðæÐóçόç όá áðòÐ όç έβóóá ääí áðέóñÝðáóáέ.

Άáβóá όá äñ÷-áβá όçò έβóóáó äέá ίá ðŪñáóá ίέá έáÝá όçò ññòÐò όüí ίçíòíŪóüí ðíò ίðññáβóá ίá óóáβéáóá.

Ūέá ðññβεççς όüí ðññέá÷-ñÝíüí όçò έβóóáó äñáÝ÷-áóáέ ίá äçííóέáyáóáέ έáóŪ óáέóŪ äέáóóÐíáóá óóç áέέóóáέÐ óíðíεáóβá όιò FreeBSD, ùò ίÝñíò όüí Áíáóñññí ΈáóŪóóáόçò (Status Reports) <sup>1</sup>. Óóçí βáέá όιðíεáóβá, ίðññáβóá äðβóçò ίá äñāáóá ðññέóóüóäñá ðáñáááβáíáóá έάέ ðññçäíýíáíáð άίáóññÝò.

frebsd-xen (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-xen>)

*ÓðæÐóçόç áέá όç ίáóáóññŪ όιò FreeBSD όóι Xen — óéíðíβçόç έάέ ÷ñÐόç*

Δñυιêéóáé áéá ιέα έβóðá ðιò áóóéÛæáé óççι ιáðáóιñÛ ðιò FreeBSD óðι Xen. Ç έβιççόç óá áððP ðç έβóðá áιáι Ýιáðáé ιá áβιáé ιέêñP, éáé Ýóóé èá ÷ñçóειιðιέçèáβ ðυιόι áéá ðá÷ιέéÝð óðæçðPóáéð ó÷:áðééÛ ιá ðι ð÷:ááéáóιυι éáé ðççι ðειðιβççóç, υιόι éáé ιá ðñιιáεPιáðá ááéáðÛóóáóçð éáé áéá÷:áβñéóçð.

### C.1.4 ÖéèðñÛñéóιá óðéò Έβóðáð ÇεáéðñιιέéιÝ Óá÷:ðáñιιáβιò

Ιέ έβóðáð çεáéðñιιέéιÝ ðá÷:ðáñιιáβιò ðιò FreeBSD óééðñÛñιιόáé ιá ðιέéáðειÝð ðñυðιòð áéá ιá áðιòγáιιðιá ðççι áéáññP spam, έπι, éáé Ûéευι áιáðééγιçðυι ιççιòιÛðυι. Õι óééðñÛñéóιá ðιò ðáñéáñÛóáóáé óá áððP ðççι áñυðççóá, áðιòáéáβ Ýιá ιυιι ιÝñιò ðυι óðñééεπι ιÝðñυι ðιò éáιáÛιιòιá áéá ðççι ðñιòóáóβá ðυι ééóðπι çεáéðñιιέéιÝ ðá÷:ðáñιιáβιò.

Óðéò έβóðáð áðéðñÛñιιόáé ιυιι óðáéáεñéιÝιé ðγðιé óóιçιιÝιυι áñ÷:áβυι. ¼éá óá óóιçιιÝιá áñ÷:áβá ιá ðγðι MIME ðιò ááι áñβóéáðáé óççι ðáñáéÛòυò έβóðá, áéááñÛóιιόáé ðñéι áéáιáιçèáβ ðι ιPιòιá óðéò έβóðáð.

- 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

**Óççιáβυòç:** ΙáñééÝð έβóðáð ιðιñáβ ιá áðéðñÛñιιόáé óóιçιιÝιá áñ÷:áβá éáé Ûéευι ðγðυι MIME, áééÛ ιé ðáñáðÛιυι ðγðιé éó÷:γιòι óðéò ðáñéóóυðáñáð έβóðáð.

ÁÛι ðι éáβιáñι áñυð ιççιγíáóιòð ðáñéÝ÷:áðáé ðυιόι óá ιιñðP HTML υιόι éáé áðειÝ éáéιÝñò, ðι ðιPιá HTML éá áóáéñáéáβ. ÁÛι Ýιá ιPιòιá ðáñéÝ÷:áé ιυιι HTML, éá ιáðáóñáðáβ óá áðευι éáβιáñι.

## C.2 Usenet Newsgroups

Áéðυð áðυι áγι newsgroups ðιò áó÷:ιéιγιόáé ιá ðι FreeBSD, ððÛñ÷:ιòι ðιέéÛ áéυιá óðá ιðιβá áβιáðáé óðæPðççóç áéá ðι FreeBSD P Ûééá èÝιáðá ðιò áιáá÷:ñÝñυð áιáéáðÝñιιόι ðιòð ÷ñPóðáð ðιò. Άéá éÛðιéá áðυι áððÛ óá newsgroups, ιðιñáβðá ιá éÛιáðá áιáæPðççóç ιá éÝιáéð-ééáéáéÛ óðéð ðáééÝð áçιιόéáγóáéð ([http://minnie.tuhs.org/BSD-info/bsdnews\\_search.html](http://minnie.tuhs.org/BSD-info/bsdnews_search.html)), ÷Ûñç óðççι ððççñáóβá ðιò ðñιιόóÝñáé ι Warren Toomey <wkt@cs.adfa.edu.au>.

### C.2.1 Newsgroups ὁδὸν 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) (Ὀδὸν Ἀντὶάτῆ)
- fr.comp.os.bsd (news:fr.comp.os.bsd) (Ὀδὸν Ἀεὶβέδω)
- it.comp.os.freebsd (news:it.comp.os.freebsd) (Ὀδὸν Ἐδὸν)
- tw.bbs.comp.386bsd (news:tw.bbs.comp.386bsd) (Ὀδὸν Δανάη οδὸν Ἐίτῆ)

### C.2.2 Ἐδὸν 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 Ὀδὸν 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 ΆέέηέόôÝò Éóôíóääßäüí

### C.3.1 Forums, Blogs, ééé ÊíéíúíééÜ Äßêôá

- Óá Forums óiò FreeBSD (<http://forums.freebsd.org/>) ááoßæííôáé óá áéáðáöÞ web éáé áβíáé éáôÜëëçá áéá ôâ÷íééÝò óðæçðÞóáéð éáé ânùðÞóáéð ðiò áóíñííí ôi FreeBSD.
- Ôi Planet FreeBSD (<http://planet.freebsdish.org/>) óôäéáíôñÞíáé óá Ýíá óçíáβi óéð ñiÝò áðü ääéÜäáð éóôíéüäéá íäêÞí óçð ñÜäáð áíÜððóíçð ðiò FreeBSD. ÐíëëÜ áðü óá íÝç, ÷ñçóéíðíéíýíí áððÞ óç äóíáóüüóçðá áéá íá áíüóóðíéÞóíóí óçíí áñááóβá ðiò éÜñiðí óç ääññÝíç óóéáñÞ, ôð÷üíí íÝáð áéíñêÞóáéð, éáêÞð éáé óá íäëííóééÜ ðiò ó÷Ýééá.
- Ôi éáíÜéé BSDConferences óóí Youtube (<http://www.youtube.com/bsdconferences>) ðáñÝ÷áé íéá óðëëíäÞ áβíóäü óççêÞð ðíéüóçðáð, áðü äéÜóíñá BSD óóíÝäñéá óá üëí ðíí èüóíí. Ðñüêééðáé áéá Ýíá éáðíÜóéí ðñüðí íá ðáñáéíéíðèÞóáðá óçíáíóééÜ íÝç óçð ñÜäáð áíÜððóíçð íá ðáñiðóéÜæíóí óç íÝá ðiòð äüðéäéÜ óóí FreeBSD.

### C.3.2 Άðßóçíá 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, Indonesia, Ireland, 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 2009/11/04 17:21:16 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/>
- <http://www2.at.FreeBSD.org/> (IPv6)

•

Belgium

- <http://freebsd.unixtech.be/>

•

Brazil

- <http://www.br.FreeBSD.org/>
- <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/>

•



Hungary

- <http://www.hu.FreeBSD.org/>
- <http://www2.hu.FreeBSD.org/>

•

Iceland

- <http://www.is.FreeBSD.org/>

•

Indonesia

- <http://www.id.FreeBSD.org/>

•

Ireland

- <http://www.ie.FreeBSD.org/>
- <http://www2.ie.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/>
  
- New Zealand
  - <http://www.nz.FreeBSD.org/>
  
- Norway
  - <http://www.no.FreeBSD.org/>
  
- Philippines
  - <http://www.FreeBSD.org.ph/>
  
- Poland
  - <http://www.pl.FreeBSD.org/>
  - <http://www2.pl.FreeBSD.org/> (IPv6)

•

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://www4.us.FreeBSD.org/> (IPv6)
- <http://www5.us.FreeBSD.org/> (IPv6)

## C.4 Άέάòèýíóáéò Çèâèñìíééìý Ôá ÷ òäñìñáβìò

Ïé áéüèüòèàð ãñðóáéò ÷ ñçóðñì δάνÝ ÷ ðìí óðá ìÝέç òìòð áέάòèýíóáéò çèâèñìíééìý ôá ÷ òäñìñáβìò ðìò ó ÷ áòβæìíóáé ìá òì FreeBSD. Ï áέá ÷ áéñéóòðò ðìò áíáò Ýñâáóáé δάνáéÛòù, áέάòçñáβ òì áέéáβììá ìá áíáéáèÝóáé òçì áέáyèðìóç, áì áβíáé éáòÛ ÷ ñçóç òçò ìá ðìíéíäβðìòä òñüðì.

Όνομα

ukug.uk.FreeBSD.org

Όνομα

Lee Johnston

Επώνυμο

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Αдрес

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## Όροι

1. <http://www.freebsd.org/news/status/>

# ḌáñŨñôçíá D. ÊëáéäéŨ PGP

Óõí ḌáñŨñôçíá áõõü, èá àñáßòá òá àçüóéá PGP êëáéäéŨ òüí officers éáé òüí ìáëþí òçò ñŨááò áíŨḌòõíçò òüõ FreeBSD. Ìḏñáßòá íá òá ÷ñçóéíüḏíéþòáòá áéá íá àéÝáñáòá ìéá øçòéáéþ òḏñáñáòþ P áéá íá óòáßèáòá êñòḏòñáñáòçíÝñí email òá éŨḏíéí ìÝéíð òçò ñŨááò. Ìḏñáßòá íá éáòááŨóáòá òçí ḏéþñç èßòóá áḏü êëáéäéŨ ÷ñçóòþí òüõ FreeBSD.org, áḏü òçí òíḏñèááòá <http://www.FreeBSD.org/doc/pgpkeyring.txt>.

## D.1 Officers

### D.1.1 ÌŨáá ÁóöŨëáéáò <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 ÆñáìíáòÝáò òçò ÌŨááò 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 ÆñáìíáòÝáò ÌŨááò Äéá ÷áßñéóçò òüí Ports

<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 ÌÝèç òçò ÌŨááò Core

### D.2.1 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.2.2 Brooks Davis <brooks@FreeBSD.org>

```
pub 1024D/F2381AD4 2001-02-10 Brooks Davis (The Aerospace Corporation) <brooks@aero.org>
   Key fingerprint = 655D 519C 26A7 82E7 2529 9BF0 5D8E 8BE9 F238 1AD4
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: 2008-01-24]
sub 1024g/42921194 2001-02-10 [expires: 2009-02-08]
```

## D.2.3 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>
sub 1024g/50FDBAD1 2001-09-21
```

## D.2.4 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.2.5 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.2.6 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.2.7 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 Ìÿèç ôçò ÌìÛááò ÁíÛðôõìçò****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 1024D/D069F2A0 2005-07-06
   Key fingerprint = 62EB 68F5 C1A4 8FCE 5A87 BE22 E469 BF8C D069 F2A0
uid                               Thomas Abthorpe (FreeBSD Committer) <tabthorpe@FreeBSD.org>
uid                               Thomas Abthorpe <thomas@goodking.ca>
uid                               Thomas Abthorpe <tabthorpe@gmail.com>
uid                               Thomas Abthorpe <thomasa@tbaytel.net>
uid                               Thomas Abthorpe <tabthorpe@FreeBSD.org>
uid                               Thomas Abthorpe <tabthorpe@goodking.ca>
uid                               Thomas Abthorpe <thomas@stthomasanglican.org>
uid                               Thomas Abthorpe <tabthorpe@stthomasanglican.org>
uid                               Thomas Abthorpe (FreeBSD Ports Committer) <tabthorpe@FreeBSD.org>
sub 2048g/16752D82 2005-07-06
sub 1024g/8CF958AB 2009-11-05
sub 1024R/985365A2 2009-11-05
```

### D.3.3 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.3.4 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>
sub 1024g/3B13C209 2003-04-09
```

### D.3.5 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.3.6 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.3.7 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.3.8 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.3.9 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.3.10 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.3.11 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.3.12 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.3.13 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.3.14 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.3.15 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.3.16 Nick Barkas <snb@FreeBSD.org>

```
pub 1024D/7E7582A4 2006-02-10
   Key fingerprint = 5DF1 3ABB 4F75 F76C E83F 322F C8B2 427A 7E75 82A4
uid      S. Nicholas Barkas <snb@freebsd.org>
uid      S. Nicholas Barkas <snb@moduli.net>
uid      [jpeg image of size 13220]
sub 2048g/AF72C3A3 2006-02-10
sub 1024D/3F6C2D91 2009-04-21 [expires: 2010-04-21]
```

### D.3.17 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.3.18 Doug Barton <DougB@FreeBSD.org>**

```
pub 1024D/D5B2F0FB 2003-01-16
Key fingerprint = 9DD1 E44C 8660 ADA6 580F 83B6 C886 A42B D5B2 F0FB
uid          Doug Barton <DougB@DougBarton.us>
uid          Doug Barton <DougB@DougBarton.net>
uid          Doug Barton <DougB@FreeBSD.org>
sub 4096g/2DBB3F89 2003-01-16
```

### **D.3.19 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.3.20 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.3.21 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.3.22 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.3.23 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.3.24 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.3.25 Roman Bogorodskiy <novel@FreeBSD.org>

```
pub 1024R/1DAACA46 2004-05-25 [expires: 2009-04-26]
   Key fingerprint = AC27 CF29 5E51 E53F 8C8D DB90 8074 5B38 1DAA CA46
uid          Roman Bogorodskiy <novel@FreeBSD.org>
uid          Roman Bogorodskiy <bogorodskiy@gmail.com>
uid          Roman Bogorodskiy <bogorodskiy@inbox.ru>
uid          Roman Bogorodskiy <novel@clublife.ru>
```

### D.3.26 Renato Botelho <garga@FreeBSD.org>

```
pub 1024D/2244EDA9 2003-12-16 [expires: 2011-12-31]
   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>
sub 1024g/7B295760 2003-12-16
```

### D.3.27 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.3.28 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.3.29 Oliver Braun <obraun@FreeBSD.org>

```
pub 1024D/EF25B1BA 2001-05-06 Oliver Braun <obraun@unsane.org>
   Key fingerprint = 6A3B 042A 732E 17E4 B6E7 3EAF C0B1 6B7D EF25 B1BA
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.3.30 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.3.31 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.3.32 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.3.33 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.3.34 Christian Brüffer <brueffer@FreeBSD.org>

```
pub 1024D/A0ED982D 2002-10-14 Christian Brueffer <chris@unixpages.org>
    Key fingerprint = A5C8 2099 19FF AACA 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.3.35 Markus Brüffer <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.3.36 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.3.37 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.3.38 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.3.39 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.3.40 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.3.41 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.3.42 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.3.43 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.3.44 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.3.45 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.3.46 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.3.47 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.3.48 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.3.49 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.3.50 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.3.51 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.3.52 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.3.53 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.3.54 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.3.55 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.3.56 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.3.57 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.3.58 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.3.59 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.3.60 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.3.61 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.3.62 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.3.63 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.3.64 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.3.65 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.3.66 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.3.67 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.3.68 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.3.69 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.3.70 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.3.71 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.3.72 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.3.73 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.3.74 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.3.75 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.3.76 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.3.77 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.3.78 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.3.79 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.3.80 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.3.81 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@icyb.net.ua>
sub 4096R/F9A4D312 2009-02-16
```

### D.3.82 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.3.83 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.3.84 Sebastien Gioria <gioria@FreeBSD.org>

```
pub 1024D/7C8DA4F4 2002-02-09 Sebastien Gioria <eagle@freebsd-fr.org>
   Key fingerprint = 41F4 4885 7C23 6ED3 CC24 97AA 6DDD B426 7C8D A4F4
uid      Sebastien Gioria <gioria@FreeBSD.ORG>
uid      Sebastien Gioria <gioria@Francenet.fr>
uid      Sebastien Gioria <gioria@fluxus.net>
sub 4096g/F147E4D3 2002-02-09
```

### D.3.85 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.3.86 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.3.87 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.3.88 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.3.89 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.3.90 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.3.91 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.3.92 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.3.93 Emanuel Haupt <ehaupt@FreeBSD.org>

```
pub 1024D/90215DB9 2007-02-06 [expires: 2008-02-06]
Key fingerprint = 741B C70F 100B F360 0B52 E92D 5F01 7A86 9021 5DB9
uid Emanuel Haupt <ehaupt@FreeBSD.org>
uid Emanuel Haupt <ehaupt@critical.ch>
sub 2048g/6DD0929C 2007-02-06 [expires: 2008-02-06]
```

### D.3.94 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.3.95 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.3.96 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.3.97 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.3.98 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.3.99 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.3.100 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.3.101 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.3.102 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.3.103 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.3.104 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.3.105 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.3.106 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.3.107 Chin-San Huang <chinsan@FreeBSD.org>

```
pub 1024D/350EECF A 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.3.108 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.3.109 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.3.110 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.3.111 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.3.112 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.3.113 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.3.114 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.3.115 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.3.116 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.3.117 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.3.118 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.3.119 Max Khon <fjoe@FreeBSD.org>

```
pub 1024D/414420F4 2003-04-29 Max Khon <fjoe@freebsd.org>
Key fingerprint = CE1F 29CA A6BF 2F26 13E8 1B61 62AE 6B8F 4144 20F4
uid Max Khon <fjoe@icclub.nsu.ru>
sub 1024g/6585039B 2003-04-29
```

### D.3.120 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.3.121 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.3.122 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.3.123 Johann Koiss <jkoiss@FreeBSD.org>

```
pub 1024D/DD61C2D8 2004-06-27 Johann Koiss <J.Koiss@web.de>
   Key fingerprint = 8B70 03DB 3C45 E71D 0ED4 4825 FEB0 EBEF DD61 C2D8
uid      Johann Koiss <jkoiss@freebsd.org>
sub 1024g/568307CB 2004-06-27
```

### D.3.124 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.3.125 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.3.126 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.3.127 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.3.128 Steven Kreuzer <skreuzer@FreeBSD.org>**

```
pub 1024D/E0D6F907 2009-03-16 [expires: 2011-03-16]
   Key fingerprint = 8D8F 14D6 ED9F 6BD0 7756 7A46 66BA B4B6 E0D6 F907
uid                               Steven Kreuzer <skreuzer@freebsd.org>
uid                               Steven Kreuzer <skreuzer@exit2shell.com>
sub 4096g/76940A06 2009-03-16 [expires: 2011-03-16]
```

### **D.3.129 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.3.130 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.3.131 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.3.132 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.3.133 René Ladan <rene@FreeBSD.org>**

```
pub 1024D/E5642BFC 2008-11-03
   Key fingerprint = ADBC ECCD EB5F A6B4 549F 600D 8C9E 647A E564 2BFC
uid                               René Ladan <rene@freebsd.org>
sub 2048g/C54EA560 2008-11-03
```

### **D.3.134 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.3.135 Max Laier <mllaier@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 <mllaier@freebsd.org>
uid                               Max Laier <max.laier@tm.uka.de>
sub 4096g/EDD08B9B 2005-06-28
```

### **D.3.136 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.3.137 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.3.138 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.3.139 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.3.140 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.3.141 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.3.142 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.3.143 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.3.144 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.3.145 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.3.146 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.3.147 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.3.148 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.3.149 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.3.150 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.3.151 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 <ulf.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.3.152 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.3.153 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.3.154 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.3.155 Tilman Linneweh <arved@FreeBSD.org>

```
pub 1024D/807AC53A 2002-06-03 [expires: 2009-06-15]
   Key fingerprint = A92F 344F 31A8 B8DE DDFA 7FB4 7C22 C39F 807A C53A
uid                               Tilman Linneweh <e0025974@student.tuwien.ac.at>
uid                               Tilman Linneweh <arved@arved.at>
uid                               Tilman Linneweh <arved@FreeBSD.org>
```

uid                   Tilman Linneweh <arved@inso.tuwien.ac.at>  
sub   1024g/FA351986 2002-06-03 [expires: 2009-06-15]

### **D.3.156 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.3.157 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.3.158 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.3.159 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.3.160 Remko Lodder <remko@FreeBSD.org>**

pub   1024D/8F494B77 2004-09-03 [expires: 2009-06-25]  
      Key fingerprint = 575D 8AD6 8646 E6D2 1226 0A8C D2A9 0DFF 8F49 4B77  
uid                   Remko Lodder (Remko Lodder) <remko@elvandar.org>  
uid                   Remko Lodder (my FreeBSD.org uid) <remko@FreeBSD.org>  
sub   2048g/6BF55109 2006-02-25 [expires: 2008-02-25]

### D.3.161 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.3.162 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.3.163 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.3.164 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.3.165 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.3.166 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.3.167 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.3.168 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.3.169 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.3.170 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.3.171 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.3.172 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.3.173 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.3.174 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.3.175 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.3.176 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.3.177 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.3.178 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.3.179 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.3.180 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.3.181 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.3.182 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.3.183 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.3.184 Akinori MUSHA <knu@FreeBSD.org>**

```
pub 1024D/9FD9E1EE 2000-03-21 Akinori MUSHA <knu@and.or.jp>
   Key fingerprint = 081D 099C 1705 861D 4B70 B04A 920B EFC7 9FD9 E1EE
uid          Akinori MUSHA <knu@FreeBSD.org>
uid          Akinori MUSHA <knu@idaemons.org>
uid          Akinori MUSHA <knu@ruby-lang.org>
sub 1024g/71BA9D45 2000-03-21
```

### **D.3.185 Thomas Möstl <tmm@FreeBSD.org>**

```
pub 1024D/419C776C 2000-11-28 Thomas Moestl <tmm@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.3.186 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.3.187 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.3.188 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.3.189 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.3.190 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.3.191 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.3.192 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.3.193 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.3.194 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.3.195 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.3.196 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.3.197 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.3.198 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.3.199 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.3.200 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 BAFB 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.3.201 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.3.202 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.3.203 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.3.204 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.3.205 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.3.206 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.3.207 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.3.208 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.3.209 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.3.210 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.3.211 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.3.212 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.3.213 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.3.214 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) <alejandror@varnet.biz>
sub 2048g/6890C6CA 2005-11-13
```

### **D.3.215 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.3.216 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.3.217 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.3.218 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.3.219 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.3.220 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.3.221 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.3.222 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.3.223 Beech Rintoul <beech@FreeBSD.org>

```
pub 1024D/790DB7C7 2009-01-23
   Key fingerprint = 3AFC 32D4 093B 63F1 28A8 1A18 B378 28D2 790D B7C7
uid          Beech Rintoul <beech@FreeBSD.org>
sub 2048g/9F3B61BF 2009-01-23
```

### D.3.224 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.3.225 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.3.226 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.3.227 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.3.228 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.3.229 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.3.230 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.3.231 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.3.232 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.3.233 Ed Schouten <ed@FreeBSD.org>**

```
pub 1024D/0D9E0B05 2006-03-21 [expires: 2011-03-20]
    Key fingerprint = 9476 D3D6 52BD F249 08A0 ACD5 E764 8318 0D9E 0B05
uid          Ed Schouten (FreeBSD) <ed@FreeBSD.org>
uid          Ed Schouten <ed@fxq.nl>
uid          Ed Schouten (Fontys Hogescholen Eindhoven) <e.schouten@student.fontys.nl>
uid          Ed Schouten (Dispuut Interlink) <ed@il.fontys.nl>
uid          Ed Schouten <ed@80386.nl>
sub 4096g/80043EEA 2006-03-21 [expires: 2011-03-20]
```

### **D.3.234 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.3.235 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.3.236 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.3.237 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.3.238 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.3.239 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.3.240 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.3.241 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.3.242 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.3.243 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.3.244 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.3.245 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.3.246 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.3.247 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.3.248 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.3.249 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.3.250 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.3.251 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.3.252 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.3.253 Dag-Erling C. Smørgrav <des@FreeBSD.org>**

```
pub 1024D/64EBE220 2006-11-11 [expires: 2011-01-23]
   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]
```

### **D.3.254 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.3.255 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.3.256 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.3.257 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.3.258 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.3.259 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 Spörlein (The FreeBSD Project) <uqs@FreeBSD.org>
uid      Ulrich Spörlein <ulrich.spoerlein@web.de>
sub 2048R/162E8BD2 2010-01-27 [expires: 2015-01-26]
```

### D.3.260 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.3.261 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.3.262 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.3.263 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.3.264 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.3.265 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.3.266 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.3.267 Gregory Sutter <gsutter@FreeBSD.org>**

```
pub 1024D/845DFEDD 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.3.268 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.3.269 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.3.270 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.3.271 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.3.272 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.3.273 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.3.274 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.3.275 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.3.276 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.3.277 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.3.278 David Thiel <lxf@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 <lxf@FreeBSD.org>  
sub 2048g/B9BD92C5 2006-11-30 [expires: 2011-11-29]

### D.3.279 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.3.280 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.3.281 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.3.282 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.3.283 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.3.284 Jilles Tjoelker <jilles@FreeBSD.org>

```
pub 1024D/A813D5EE 2001-02-18
   Key fingerprint = 0C82 44F5 0A1B 84E4 A9DD 7032 5102 275F A813 D5EE
uid      Jilles Tjoelker <jilles@stack.nl>
uid      Jilles Tjoelker <tjoelker@zonnet.nl>
uid      Jilles Tjoelker (FreeBSD) <jilles@FreeBSD.org>
sub 2048g/B94834AC 2001-02-18
```

### D.3.285 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.3.286 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.3.287 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.3.288 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.3.289 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.3.290 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.3.291 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.3.292 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.3.293 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.3.294 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.3.295 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.3.296 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.3.297 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.3.298 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.3.299 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.3.300 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.3.301 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.3.302 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.3.303 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.3.304 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.3.305 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.3.306 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.3.307 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
```



## ACPI Source Language

Ç æερõõά ðñιãñãñãóέõιιγ ιά ðçι ιðιβά ãñÕõãðáέ ç AML.

## Access Control List

Ìέα εβõõά áðü Õããέãð έáέ æέέάεβιαõά ðñιõðÝεάõçð, ç ιðιβά Ý÷ãέ õõιããεãβ ιã Ýιá áιõέέãβιãñι, üðüð ð.÷. Ýιá ãñ÷ãβι P ìέα æέέõðáέP õõõέãðP.

## Advanced Configuration and Power Interface

ιá ðñüõõðι ðι ιðιβι εάειñβæãέ ðιι ðñüðι áðέέιέιüιβãð ðιõ ðέέειγ ιã ðι εάέõιõñãέέü óγõõçιã. Ì õειðüð γðãñιçð ðιõ ACPI ãβιãέ ιá ιðιñãβ ðι ÈÕ ιá áðέέιέιüιPõãέ ιã ðι õέέéü áíüð õðιειãέõðP έáέ ιá ãειãõáέέãðõãβ üõι ðι ãõιãõüι έáέγõãñã áõõü ðι ðέέéü, áéüιç έέ áι ããι ιÝñãέ õá ðÕιõá ãé áõõü. Õι ACPI áðιõãεãβ ιãõãιÝέέιç ðüι APM, PNPBIOS έáέ áιõβõõιέ÷üι õã÷ñειãεβι, ðéð ιðιβãð έáέ áιõέέãέέõõÜ. Õι ACPI ðãñÝ÷ãέ ðç ãõιãõüõõçõá ιá ãéÝãñιõιã ðçι έáõãιÜεüõç έõ÷γιð, ðçι áιãõõιέP εάέõιõñãβãð ðιõ õõõõβιãõιð, ðçι áñãñãιðιβçõç έáέ áðãιãñãιðιέPõç õõõέãðβι, έέð.

## Application Programming Interface

ιá óγιñει áðü æéãñãããõβãð, ðñüõüειεã έáέ ãñããεããβã ðιõ εάειñβæιõι ðιι áιããññέõιÝι ðñüðι áðέέιέιüιβãð ιãõãñγ äγι P ðãñέõõüõãñüι õιçιÜõüι ειαέõιέέιγ. Õã áõõÜ ðãñέέãιãÜñιõáέ ðεçñιõιñβãð æéá ðι ðüð, ðüõã, έáέ æéãõβ õá õιβιãõá áõõÜ ειαέõιέέιγ έã õõιãñãÜæιõáέ, έáέ ðé ãβãιõð ãããñÝιá ιðιñγι ιá áιõáέεÜñιõι, ιá ñεñããõõιγι P ιá áðãιãñãããõõιγι.

## Advanced Power Management

ιá API ðι ιðιβι ðãñÝ÷ãέ õõι εάέõιõñãέέü óγõõçιã ðç ãõιãõüõõçõá ιá õõιãñãããõõãβ ιã ðι BIOS áðέõõã÷Üñιõáð έáέγõãñç æéã÷ãβñέõç ðçð έõ÷γιð ðιõ õõõõβιãõιð. Õι APM Ý÷ãέ áιõέέããõãõãéããβ áðü ðι ðñüõõðι ACPI, ðι ιðιβι ãβιãέ ðει ñειέεçñüιÝñι έáέ ðει áõÝέέέõι áðü ðι APM.

## Advanced Programmable Interrupt Controller

## Advanced Technology Attachment

## Asynchronous Transfer Mode

## Authenticated Post Office Protocol

## Automatic Mount Daemon

Το daemon αυτό είναι υπεύθυνο για την αυτόματη σύνδεση των συσκευών που είναι συνδεδεμένες με το σύστημα. Η λειτουργία του είναι να ελέγχει τα σημεία σύνδεσης και να πραγματοποιεί τις απαραίτητες ενέργειες για να διασφαλιστεί η ομαλή λειτουργία του συστήματος.

# B

## BAR

*Άλλα:* Base Address Register

## BIND

*Άλλα:* Berkeley Internet Name Domain

## BIOS

*Άλλα:* Basic Input/Output System

## BSD

*Άλλα:* Berkeley Software Distribution

## Base Address Register

Οι ελεγκτές που είναι συνδεδεμένοι στο σύστημα έχουν ένα συγκεκριμένο σημείο μνήμης που ονομάζεται Base Address Register (BAR). Το σημείο μνήμης αυτό είναι απαραίτητο για να λειτουργήσει ο ελεγκτής.

## Basic Input/Output System

Το BIOS είναι το βασικό σύστημα εισόδου/εξόδου που βρίσκεται στο ROM chip του μητρικού κυκλώματος. Είναι υπεύθυνο για την έναρξη του συστήματος και για την επικοινωνία με τον δίσκο και τα περιφερειακά. Το BIOS είναι το πρώτο λογισμικό που εκτελείται όταν το σύστημα ξεκινάει. Το BIOS είναι υπεύθυνο για την επικοινωνία με τον δίσκο και τα περιφερειακά. Το BIOS είναι το πρώτο λογισμικό που εκτελείται όταν το σύστημα ξεκινάει.

## Berkeley Internet Name Domain

Το DNS είναι το σύστημα ονομάτων που χρησιμοποιείται για να μετατρέψει τα ονόματα των υπολογιστών σε αριθμούς IP.







## Dynamic Host Configuration Protocol

Το πρωτόκολλο διαμόρφωσης δυναμικού υποστήριξης IP (DHCP) επιτρέπει στον υπολογιστή (host) να λαμβάνει αυτόματα τη διεύθυνση IP από τον δίαυτο DHCP. Το πρωτόκολλο DHCP ορίζει επίσης τη διάρκεια της "lease".

## E

### ECOFF

*Άλλα:* Extended COFF

### ELF

*Άλλα:* Executable and Linking Format

### ESP

*Άλλα:* Encapsulated Security Payload

### Encapsulated Security Payload

### Executable and Linking Format

### Extended COFF

## F

### FADT

*Άλλα:* Fixed ACPI Description Table

### FAT

*Άλλα:* File Allocation Table

### FAT16

*Άλλα:* File Allocation Table (16-bit)

### FTP

*Άλλα:* File Transfer Protocol



## HUP

Άλλα: HangUp

## HangUp

## HyperText Markup Language

Το πρόγραμμα διατύπωσης (markup language) είναι το HTML (web pages).

## I

### I/O

Άλλα: Input/Output

### IASL

Άλλα: Intel's ASL compiler

### IMAP

Άλλα: Internet Message Access Protocol

### IP

Άλλα: Internet Protocol

### IPFW

Άλλα: IP Firewall

### IPP

Άλλα: Internet Printing Protocol

### IPv4

Άλλα: IP Version 4

### IPv6

Άλλα: IP Version 6

### ISP

Άλλα: Internet Service Provider

### IP Firewall

## IP Version 4

The IP protocol version 4, which uses 32 bits for addressing. This version is still the most widely used, but it is slowly being replaced with IPv6.

Ἡ ἀποκρίση εἰς τὴν ερώτηση: IP Version 6.

## IP Version 6

The new IP protocol. Invented because the address space in IPv4 is running out. Uses 128 bits for addressing.

## Input/Output

### Intel's ASL compiler

Intel's compiler for converting ASL into AML.

### Internet Message Access Protocol

A protocol for accessing email messages on a mail server, characterised by the messages usually being kept on the server as opposed to being downloaded to the mail reader client.

Ἡ ἀποκρίση εἰς τὴν ερώτηση: Post Office Protocol Version 3.

### Internet Printing Protocol

### Internet Protocol

The packet transmitting protocol that is the basic protocol on the Internet. Originally developed at the U.S. Department of Defense and an extremely important part of the TCP/IP stack. Without the Internet Protocol, the Internet would not have become what it is today. For more information, see RFC 791 (<ftp://ftp.rfc-editor.org/in-notes/rfc791.txt>).

### Internet Service Provider

A company that provides access to the Internet.





**MFP4**

Άβδδ: Merge From Perforce

**MFS**

Άβδδ: Merge From Stable

**MIT**

Άβδδ: Massachusetts Institute of Technology

**MLS**

Άβδδ: Multi-Level Security

**MOTD**

Άβδδ: Message Of The Day

**MTA**

Άβδδ: Mail Transfer Agent

**MUA**

Άβδδ: Mail User Agent

**Mail Transfer Agent**

An application used to transfer email. An MTA has traditionally been part of the BSD base system. Today Sendmail is included in the base system, but there are many other MTAs, such as postfix, qmail and Exim.

**Mail User Agent**

Ιέα άδάνιττ άέα όç άέα÷άβηέός, άίÜáíúός ίçíοιÜòúí çέάέοñíέέτò áέέççεíτáάόβáð έάέ όçί άδίοόίετ άδáiòτράúί όά άδδÜ.

**Mandatory Access Control**

**Massachusetts Institute of Technology**

**Merge From Current**

Ç όδã÷τράόόç τ ίάδáiñÜ άíúð ÷άñάέδçñέόέέéý τ ίέάð áέúñέùόçð άδü όίí έέÜáí άίÜδδóίçð -CURRENT όά Ýία Üέεí έέÜáí (όóίττèð Ýία άδü όίòð έέÜáíòð -STABLE).

### Merge From Perforce

Ἡ διαδικασία τοῦ Merge From Perforce ἀπαιτεῖ τὴν ἐγκατάσταση τοῦ Perforce ὁποῖο εἶναι ἀπαιτούμενο γιὰ τὴν ἐκτέλεση τοῦ -CURRENT.

Ἐπιπλέον ἀπαιτεῖται τὸ Perforce.

### Merge From Stable

Ἡ διαδικασία τοῦ Merge From Stable τοῦ FreeBSD ἀπαιτεῖ τὴν ἐγκατάσταση τοῦ -CURRENT branch ἢ τοῦ -STABLE branch. Ἐπιπλέον ἀπαιτεῖται τὸ -STABLE ἢ τὸ -CURRENT.

Ἡ διαδικασία τοῦ Merge From Stable ἀπαιτεῖ τὴν ἐγκατάσταση τοῦ -STABLE branch ὅπου εἶναι ἀπαιτούμενο γιὰ τὴν ἐκτέλεση τοῦ -CURRENT.

Ἐπιπλέον ἀπαιτεῖται τὸ Merge From Current.

### Message Of The Day

A message, usually shown on login, often used to distribute information to users of the system.

### Multi-Level Security

### Multiple APIC Description Table

## N

### NAT

Ἐπιπλέον ἀπαιτεῖται τὸ Network Address Translation

### NDISulator

Ἐπιπλέον ἀπαιτεῖται τὸ Project Evil

### NFS

Ἐπιπλέον ἀπαιτεῖται τὸ Network File System

### NTFS

Ἐπιπλέον ἀπαιτεῖται τὸ New Technology File System

### NTP

Ἐπιπλέον ἀπαιτεῖται τὸ Network Time Protocol

## Network Address Translation

## Network File System

## New Technology File System

Το σύστημα αρχείων NTFS είναι ένα από τα πιο δημοφιλή συστήματα αρχείων της Microsoft και είναι υποστηρίξιμο από το “New Technology”, δηλαδή Windows 2000, Windows NT και Windows XP.

## Network Time Protocol

# O

## OBE

*Άβδα:* Overtaken By Events

## ODMR

*Άβδα:* On-Demand Mail Relay

## OS

*Άβδα:* Operating System

## On-Demand Mail Relay

## Operating System

Α set of programs, libraries and tools that provide access to the hardware resources of a computer. Operating systems range today from simplistic designs that support only one program running at a time, accessing only one device to fully multi-user, multi-tasking and multi-process systems that can serve thousands of users simultaneously, each of them running dozens of different applications.

## Overtaken By Events

× η κατάσταση είναι βλαβερή και τα δεδομένα είναι δύσκολο να αποθηκευτούν (υπό την ένδειξη της Αίτιας του Πιθανού Πιθανού είναι αδύνατο να ελεγχθεί η κατάσταση) και οι αρχεία είναι δύσκολο να ελεγχθούν και να αποθηκευτούν. Το FreeBSD, η κατάσταση είναι δύσκολο να ελεγχθεί, αλλά οι αρχεία είναι δύσκολο να ελεγχθούν και να αποθηκευτούν.

## **P**

### **p4**

*Äâβôâ*: Perforce

### **PAE**

*Äâβôâ*: Physical Address Extensions

### **PAM**

*Äâβôâ*: Pluggable Authentication Modules

### **PAP**

*Äâβôâ*: Password Authentication Protocol

### **PC**

*Äâβôâ*: Personal Computer

### **PCNSFD**

*Äâβôâ*: Personal Computer Network File System Daemon

### **PDF**

*Äâβôâ*: Portable Document Format

### **PID**

*Äâβôâ*: Process ID

### **POLA**

*Äâβôâ*: Principle Of Least Astonishment

### **POP**

*Äâβôâ*: Post Office Protocol

### **POP3**

*Äâβôâ*: Post Office Protocol Version 3

### **PPD**

*Äâβôâ*: PostScript Printer Description

### **PPP**

*Äâβôâ*: Point-to-Point Protocol

### **PPPoA**

*Äâβôâ*: PPP over ATM

### **PPPoE**

*Äâβôâ*: PPP over Ethernet

## **PPP over ATM**

## **PPP over Ethernet**

## **PR**

*Äâβôâ*: Problem Report

## **PXE**

*Äâβôâ*: Preboot eXecution Environment

## **Password Authentication Protocol**

## **Perforce**

A source code control product made by Perforce Software (<http://www.perforce.com/>) which is more advanced than CVS. Although not open source, its use is free of charge to open-source projects such as FreeBSD.

Some FreeBSD developers use a Perforce repository as a staging area for code that is considered too experimental for the -CURRENT branch.

## **Personal Computer**

## **Personal Computer Network File System Daemon**

## **Physical Address Extensions**

A method of enabling access to up to 64 GB of RAM on systems which only physically have a 32-bit wide address space (and would therefore be limited to 4 GB without PAE).

## **Pluggable Authentication Modules**

## **Point-to-Point Protocol**

## Pointy Hat

ιά ðεέεü ó÷άαüí έαδΎεí, ðιò ñεÜæάε ðεéý íà Ύία dunce cap, ðι íðιβí ÷άñβæάόάε όόά ìΎεç όçð ñÜááð áíÜððóίçð ðιò FreeBSD üðáí äçìεíòñáíýí ðñíáεΠιάόά ìά όç ìάόάεεβðóóέóç ðιò FreeBSD, üðáí εÜñιòí áεεάáΎð ðιò ááí ÷ñáεÜæíóáé, Π ááíέεÜ óá ìðιεάáΠðιόá ðáñβðóóòóç ðñíεάεíýí ðñíáεΠιάόά όóíí εβáέéá. ÁáíέεÜ, üéá óá ìΎεç όçð ñÜááð áíÜððóίçð ðιò εÜñιòí ðñááìáóέéÜ äìóεáéÜ ìáæáýíòí ó÷άóέéÜ óýíòíñá ìéá ìááÜεç óðεεíñΠ áðu áóðÜ óá έáðáεÜέéá. Ç ÷ñΠóç ðιò üñιò áβίáé (ó÷άáüí ðÜíóιðá) ÷εíòíñεóóέéΠ.

## Portable Document Format

## Post Office Protocol

### Post Office Protocol Version 3

A protocol for accessing email messages on a mail server, characterised by the messages usually being downloaded from the server to the client, as opposed to remaining on the server.

Άάβðá Άðβóçð: Internet Message Access Protocol.

## PostScript Printer Description

## Preboot eXecution Environment

## Principle Of Least Astonishment

Έάεβð áíáðóýóóáóáé ðι FreeBSD ìε áεεάáΎð ðιò áβίáé ìñáóΎð óóíí óáεέεü ÷ñΠóç ðñΎðáé ìá ðñíεάεíýí üóí ðι áðíáðüí ìεñüðáñáð έáé εéüðáñáð áεðεΠιάέð. Άέá ðáñÜááéáíá, ç Üóεíðç ìáðíñáóβá ìáóááεçðβí ðιò áðçñáÜæíòí όçí Ύίáñιç ðιò óðóðΠιάóíð óóíí áñ÷áβí /etc/defaults/rc.conf έáññáβóáé ðáñááβáóç ðιò POLA. Óá ìΎεç όçð ñÜááð áíÜððóίçð Ύ÷ιòí έáðÜ ñιò ðιò ðι POLA üðáí εÜñιòí áεεάáΎð óóíí óýóóçíá ìε ìðιβáð áðçñáÜæíòí ðιí óáεέεü ÷ñΠóç.

## Problem Report

A description of some kind of problem that has been found in either the FreeBSD source or documentation. See Writing FreeBSD Problem Reports ([http://www.FreeBSD.org/doc/el\\_GR.ISO8859-7/articles/problem-reports/index.html](http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/problem-reports/index.html)).



## Random Access Memory

### Received Data

An RS232C pin or wire that data is received on.

Ἄβδδᾶ Ἄδβόζδ: Transmitted Data.

### Recommended Standard 232C

A standard for communications between serial devices.

### Reduced Instruction Set Computer

An approach to processor design where the operations the hardware can perform are simplified but made as general purpose as possible. This can lead to lower power consumption, fewer transistors and in some cases, better performance and increased code density. Examples of RISC processors include the Alpha, Sparc, ARM and PowerPC.

### Redundant Array of Inexpensive Disks

### Remote Procedure Call

### repocopy

Ἄβδδᾶ: Repository Copy

### Repository Copy

A direct copying of files within the CVS repository.

Without a repocopy, if a file needed to be copied or moved to another place in the repository, the committer would run `cvsv add` to put the file in its new location, and then `cvsv rm` on the old file if the old copy was being removed.

The disadvantage of this method is that the history (i.e. the entries in the CVS logs) of the file would not be copied to the new location. As the FreeBSD Project considers this history very useful, a repository copy is often used instead. This is a process where one of the repository meisters will copy the files directly within the repository, rather than using the `cvsv(1)` program.

### Request For Comments

A set of documents defining Internet standards, protocols, and so forth. See [www.rfc-editor.org](http://www.rfc-editor.org) (<http://www.rfc-editor.org/>).

Also used as a general term when someone has a suggested change and wants feedback.

### **Request To Send**

An RS232C signal requesting that the remote system commences transmission of data.

Άβδδ: Clear To Send.

### **Router Advertisement**

## **S**

### **SCI**

Άβδδ: 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

### **SMTP Authentication**

## **Server Message Block**

## **Signal Ground**

An RS232 pin or wire that is the ground reference for the signal.

## **Simple Mail Transfer Protocol**

## **Secure Shell**

## **Small Computer System Interface**

## **Suspend To RAM**

## **Symmetric MultiProcessor**

## **System Control Interrupt**

# **T**

## **TCP**

*Äâβôâ*: Transmission Control Protocol

## **TCP/IP**

*Äâβôâ*: Transmission Control Protocol/Internet Protocol

## **TD**

*Äâβôâ*: Transmitted Data

## **TFTP**

*Äâβôâ*: Trivial FTP

## **TGT**

*Ἄλλο:* Ticket-Granting Ticket

## **TSC**

*Ἄλλο:* Time Stamp Counter

## **Ticket-Granting Ticket**

## **Time Stamp Counter**

A profiling counter internal to modern Pentium processors that counts core frequency clock ticks.

## **Transmission Control Protocol**

A protocol that sits on top of (e.g.) the IP protocol and guarantees that packets are delivered in a reliable, ordered, fashion.

## **Transmission Control Protocol/Internet Protocol**

The term for the combination of the TCP protocol running over the IP protocol. Much of the Internet runs over TCP/IP.

## **Transmitted Data**

An RS232C pin or wire that data is transmitted on.

*Ἄλλο Ἄλλο:* Received Data.

## **Trivial FTP**

# **U**

## **UDP**

*Ἄλλο:* User Datagram Protocol

## **UFS1**

*Ἄλλο:* Unix File System Version 1

## **UFS2**

*Ἄλλο:* Unix File System Version 2

## **UID**

*Äâβôâ*: User ID

## **URL**

*Äâβôâ*: Uniform Resource Locator

## **USB**

*Äâβôâ*: Universal Serial Bus

## **Uniform Resource Locator**

## **Unix File System Version 1**

## **Unix File System Version 2**

## **Universal Serial Bus**

## **User ID**

A unique number assigned to each user of a computer, by which the resources and permissions assigned to that user can be identified.

## **User Datagram Protocol**

## **V**

## **VPN**

*Äâβôâ*: Virtual Private Network

## **Virtual Private Network**

