

Åã ÷ åéñßäéï ôïõ FreeBSD

ÿÜää Ôâêìçñßùóçò ôïõ FreeBSD

Íé eYíáèò 3ware éáé Escalade áβíáé éáòí÷òñùÝíá àìðñééÛ óYíáíéá òçò 3ware Inc.

Ç eYíç ARM áβíáé éáòí÷òñùÝíá àìðñééÛ óYíáíéá òçò ARM Limited.

Ç eYíç Adaptec áβíáé éáòí÷òñùÝíá àìðñééÛ óYíáíéá òçò Adaptec, Inc.

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Íé eYíáèò P òñÛóáéò Heidelberg, Helvetica, Palatino, éáé Times Roman áβíáé áβóá éáòí÷òñùÝíá àìðñééÛ óYíáíéá P àìðñééÛ óYíáíéá òçò Heidelberger Druckmaschinen AG óðéò ÇÐÁ éáé óá Ûééáò ÷þñáò.

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Íé eYíáèò IEEE, POSIX, éáé 802 áβíáé éáòí÷òñùÝíá àìðñééÛ óYíáíéá òíò Institute of Electrical and Electronics Engineers, Inc. óðéò ÇñùÝíáò Ñíééóáβáò.

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Íé eYíáèò Intuit éáé Quicken áβíáé éáòí÷òñùÝíá àìðñééÛ óYíáíéá P éáòí÷òñùÝíá óYíáíéá òðçñáóéþí òçò Intuit Inc., P èÛðíéúí áðü óéò èðááòñééÝò òçò, óðéò ÇñùÝíáò Ñíééóáβáò éáé óá Ûééáò ÷þñáò.

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

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

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Íé eYíáèò Microsoft, IntelliMouse, MS-DOS, Outlook, Windows, Windows Media, éáé Windows NT áβíáé áβóá éáòí÷òñùÝíá àìðñééÛ óYíáíéá P àìðñééÛ óYíáíéá òçò Microsoft Corporation óðéò ÇñùÝíáò Ñíééóáβáò éáé/P óá Ûééáò ÷þñáò.

Íé eYíáèò Netscape éáé Netscape Navigator áβíáé éáòí÷òñùÝíá àìðñééÛ óYíáíéá òçò Netscape Communications Corporation óðéò Ç.Ð.Á éáé Ûééáò ÷þñáò.

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Íé eYíáèò PowerQuest éáé PartitionMagic áβíáé éáòí÷òñùÝíá àìðñééÛ óYíáíéá òçò PowerQuest Corporation óðéò ÇñùÝíáò Ñíééóáβáò éáé/P óá Ûééáò ÷þñáò.

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Íé eYíáèò P òñÛóáéò Sun, Sun Microsystems, Java, Java Virtual Machine, JavaServer Pages, JDK, JRE, JSP, JVM, Netra, OpenJDK, Solaris, StarOffice, Sun Blade, Sun Enterprise, Sun Fire, SunOS, Ultra éáé VirtualBox áβíáé àìðñééÛ óYíáíéá P éáòí÷òñùÝíá àìðñééÛ óYíáíéá òçò Sun Microsystems, Inc. óðéò ÇñùÝíáò Ñíééóáβáò éáé óá Ûééáò ÷þñáò.

Íé eYíáèò Symantec éáé Ghost áβíáé éáòí÷òñùÝíá àìðñééÛ óYíáíéá òçò Symantec Corporation óðéò ÇñùÝíáò Ñíééóáβáò éáé óá Ûééáò ÷þñáò.

Ç eYíç MATLAB áβíáé Ýíá éáòí÷òñùÝíá àìðñééÛ óYíáíéá òçò The MathWorks, Inc.

Ç eYíç SpeedTouch áβíáé Ýíá àìðñééÛ óYíáíéá òçò Thomson

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Ç εΎίç VMware άβίάέ άιðñέέú όγίάιέι όçð VMware, Inc.

Íé εΎίάέδ P οñÚóάέδ Waterloo Maple έάέ Maple άβίάέ άιðñέέÚ P έάόι÷ ðñùíΎίά άιðñέέÚ όγίάιέά όçð Waterloo Maple Inc.

Ç εΎίç Mathematica άβίάέ έάόι÷ ðñùíΎίά άιðñέέú όγίάιέι όçð Wolfram Research, Inc.

Ç εΎίç XFree86 άβίάέ Ύίά άιðñέέú όγίάιέι ðιð The XFree86 Project, Inc.

Íé εΎίάέδ P οñÚóάέδ Ogg Vorbis έάέ Xiph.Org άβίάέ άιðñέέÚ όγίάιέά ðιð Xiph.Org.

ÐιέεΎð áðu ðέð εΎίάέδ P οñÚóάέδ ιέ ιðιβάð ÷ ñçóειðιέιγίόάέ áðu ðιð έάόάόέάðάόόΎð P ðιðð ðιέçðΎð ðιðð áέά ίά άέάεñβñιðί όά ðñιúιúίόά ðιðð έάùñιγίόάέ άιðñέέú όγίάιέά. ¼ðιð áððΎð άιðάίβæιιόάέ όά áððι ðι έάβιáñ έάέ áέά ιιόάð áðu áððΎð áññβæáέ ç ÏÚάά ÁíÚðððιçð ðιð FreeBSD ιιðέ άβίάέ ðέέάιιι ίά άβίάέ άιðñέέú όγίάιέά, έά άάβðά Ύίά áðu όά όγίάιέά: “™” P “®”.

Θβίαεάο Δαńέα ÷ ïÝíuí

Δñüēīāō	xiii
I. Īāēēīpīōāō ĩā ōī FreeBSD	xxi
1 ÁέόāāūāP	1
1.1 Óýñīøç	1
1.2 Ēāēpō Pēēāōā ōōī FreeBSD!	1
1.3 ΔēçñīōñBāō āēā ōī FreeBSD Project	4
2 Āāēāēēōōpīōāō ōī FreeBSD	10
2.1 Óýñīøç	10
2.2 ÁðāēōPōāēō Ōēēēý	10
2.3 ĀñāāōBāō ðñēí ōçí ĀāēāōŪōōāōç	12
2.4 Īāēēīpīōāō ōçí ĀāēāōŪōōāōç	18
2.5 ÁέόāāūāP ōōī Sysinstall	25
2.6 Āē ÷ pñøç × pñīō ōōī ĀBōēī	29
2.7 ĀðēēÝāñīōāō ōē ēā ĀāēāōāōōPōāōā	41
2.8 ĀðēēÝāñīōāō ōī ĪÝōī ĀāēāōŪōōāōç	43
2.9 ĀðēāāāāBūōç ōçō ĀāēāōŪōōāōç	45
2.10 ĪāōŪ ōçí ĀāēāōŪōōāōç	46
2.11 ÁíōēīāōðBēōç ΔñīāēçīŪōūí	76
2.12 Īāçāūō ĀāēāōŪōōāōçō āēā Δñī ÷ ùñçīÝñīō	79
2.13 ΔñīāōēīŪāēīōāō ōā ĀēēŪ ōāō ĪÝōā ĀāēāōŪōōāōç	80
3 ĀāēēēÝō ĩñīēāō ōōī UNIX®	87
3.1 Óýñīøç	87
3.2 ĀēēñēēÝō Ēñōūēāō ēāē ŌāñīāōēēŪ	87
3.3 ¶āāēāō (Permissions)	90
3.4 ĀñP Ēāōāēūāīō	95
3.5 ĪñāŪñūōç ĀBōēīō	97
3.6 ΔñīōŪñōçōç ēāē ĀðīðñīōŪñōçōç ŌōōççīŪōūí Āñ ÷ āBūí	104
3.7 ĀēāñāāōBāō	107
3.8 ĀāBññāō, ŌPñāōā, ēāē Ōāñīāōēōīūō Āēāñāāōēpī	109
3.9 Ēāēýōç	111
3.10 ĒāēññññŪōīē	113
3.11 ŌōōēāōÝō ēāē Āñ ÷ āBā ōōōēāōpī	113
3.12 Ōýðīē ĀēōāēÝōēīuí	114
3.13 Āēā Δāñēōōūōāñāō ΔēçñīōñBāō	116
4 ĀāēāōŪōōāōç Āōāññāpī: ΔāēÝōā ēāē Ports	119
4.1 Óýñīøç	119
4.2 ĀðēōēūðçōP ōçō āāēāōŪōōāōçō ēñāēōīēēý	119
4.3 ĀñBōēñīōāō ōçí ĀōāññāP ōāō	121
4.4 ×ñçōēñīðīēpīōāō ōī Ōýōççīā ōūí ΔāēÝōūí	122
4.5 ×ñçōēñīðīēpīōāō ōçí ŌōēēñāP ōūí Ports	125
4.6 ĀñÝñāāēāō ĩāōŪ ōçí ĀāēāōŪōōāōç	135
4.7 ÁíōēīāōūðBāēīōāō × āēāōīÝñā Ports	136
5 Ōī Ōýōççīā X Window	137
5.1 Óýñīøç	137
5.2 Ēāōāñūçōç ōīō ðāñēāŪēēñīōīō X11	137

5.3	ΆαέάδÛόάόç ðĩð X11.....	140
5.4	Ñýèìέόç ðĩð X11.....	141
5.5	×ñÞόç ÆñáñìáðĩðáέñÞĩ óðĩ X11.....	146
5.6	Ï X Display Manager.....	150
5.7	ÆñáóέέÛ ÐáñéáÛέεĩðá.....	153
II.	ΆάόέέÛð Æñááóßáð.....	158
6	Desktop ÆóáñĩãÛð.....	159
6.1	Óýñĩç.....	159
6.2	ÕðέεññáðñçóÛð (Browsers).....	159
6.3	ÆóáñĩãÛð Æñááóßáð.....	163
6.4	ÐñĩãñÛñíáóá ÐñĩãñèÞð ÆããñÛòũĩ.....	166
6.5	×ñçĩáðñíέέĩñééÛð ÆóáñĩãÛð.....	168
6.6	Ðáñßέçç.....	169
7	ÐĩèðĩÛóá.....	171
7.1	Óýñĩç.....	171
7.2	Ñýèìέόç ðçð ÊÛñðáð ¹ ÷ ð.....	171
7.3	¹ ÷ ð MP3.....	175
7.4	ÁĩáðáñáãũãÞ Video.....	178
7.5	Ñýèìέόç ÊÛñðáð Òçéãũñáóçð.....	186
7.6	ÓáñũðÛð Æέéũĩáð.....	188
8	Ñðèìßáéĩðáð ðĩð ÐðñÞĩá ðĩð FreeBSD.....	193
8.1	Óýñĩç.....	193
8.2	Æέáóß ãá ÕðéÛñáðá ÐñĩóáñĩòĩÛĩð ÐðñÞĩá;.....	193
8.3	Áĩáéáéýððĩðáð ðéð ÕðóέáðÛð ðĩð ÕðóðÞĩáðĩð óáð.....	194
8.4	ÐñĩãñÛñíáóá ÌáÞáçóçð, Õðĩóóððĩáóá éáé ÆñèñÞĩáóá (modules).....	195
8.5	Äçĩéíðñáßá éáé ÆáéáðÛóáóç ÐñĩóáñĩòĩÛĩð ÐðñÞĩá.....	196
8.6	Ïĩ Æñ ÷ áßĩ Ñðèìßóáũĩ.....	198
8.7	Áĩ ÊÛóé ÐÛáé ÊÛèð.....	212
9	Æéðððáéð.....	214
9.1	Óýñĩç.....	214
9.2	ÆέóáãũãÞ.....	214
9.3	ΆάóέéÞ ÆáéáðÛóáóç.....	215
9.4	Ñðèìßóáéð ÆéðððũðÞĩ áéá Ðñĩ ÷ ðñçĩÛĩðð.....	228
9.5	×ñÞόç ÆéðððũðÞĩ.....	259
9.6	ÁĩáééáéðééÛð Êýóáéð áéá ðĩð ÕðÛĩðáñ Spooler.....	267
9.7	Áĩðĩðéóĩũð ÆéááÞĩ.....	267
10	Óðĩááðũðçðá ãá ÆéðáéÛóéĩá ðĩð Linux.....	272
10.1	Óýñĩç.....	272
10.2	ÆáéáðÛóáóç.....	272
10.3	Æáéáéðéððĩðáð ðĩ Mathematica®.....	276
10.4	Æáéáéðéððĩðáð ðĩ Maple™.....	278
10.5	Æáéáéðéððĩðáð ðĩ MATLAB®.....	280
10.6	ÆáéáðÛóáóç ðçð Oracle®.....	283
10.7	ÆáéáðÛóáóç ðĩð SAP® R/3®.....	287
10.8	Ðñĩ ÷ ðñçĩÛĩá ÊÛĩáóá.....	308

III. Άέá ÷ áβñέόç ÓóóÐιάóìò	311
11 Ñýèìέόç έάέ Άάέóέóìðìðìβçóç	312
11.1 Óýñìçç	312
11.2 Άñ ÷ έέÐ Ñýèìέόç	312
11.3 Έýñέα Ñýèìέόç	314
11.4 Ñýèìέόç Άóáññìáðì	314
11.5 Εέέέðìðìóóð Õðçñáóβáð	315
11.6 Ñðèìβæììóáð Õì Ðñüáñáìá cron.....	317
11.7 ×ñçóέìðìéðìóáð Õì Óýóóçìá rc Óðì FreeBSD	319
11.8 Ñðèìβæììóáð Óέó ÈÛñðáð Άέέóýìò.....	321
11.9 ΆέέìέέÛ Hosts	327
11.10 Άñ ÷ áβá Ñðèìβóáùì	328
11.11 Tuning with sysctl.....	331
11.12 Tuning Disks	332
11.13 Tuning Kernel Limits.....	336
11.14 Adding Swap Space	339
11.15 Power and Resource Management.....	340
11.16 Using and Debugging FreeBSD ACPI	341
12 Ç Άέάáέέάóβá Άέέβìçóçð ðìò FreeBSD.....	347
12.1 Óýñìçç	347
12.2 Õì Ðñüáέçìá ðçð Άέέβìçóçð	347
12.3 Ì Άέá ÷ áέñέóóÐð Æέέβìçóçð έάέ ðá ÓðÛάέá Άέέβìçóçð	348
12.4 Άέέçέáðβáñáóç ìá ðì ððñðìá έáðÛ ðçì Άέέβìçóç.....	354
12.5 Device Hints	355
12.6 Init: Άñ ÷ έέìðìβçóç ΆέÛá ÷ ìò Άέάáέέάóέðì	356
12.7 Άέìèòèβá Õáññáóέóìý.....	357
13 ×ñÐóóáð έάέ ΆáóέέÐ Άέá ÷ áβñέόç Èìááñέáóìðì	358
13.1 Óýñìçç	358
13.2 ΆέóááùáÐ	358
13.3 Ì Èìááñέáóìùð Õðáñ ÷ ñÐóóç	360
13.4 Èìááñέáóììβ ÓóóÐιάóìò	360
13.5 Èìááñέáóììβ ×ñçóóðì	360
13.6 Õñìðìðìéðìóáð Èìááñέáóìýð.....	361
13.7 Ðáñέìñβæììóáð ×ñÐóóáð	365
13.8 ìÛááð	367
14 ÁóðÛέάέ	370
14.1 Óýñìçç	370
14.2 Introduction.....	370
14.3 Securing FreeBSD	372
14.4 DES, MD5, and Crypt	378
14.5 One-time Passwords	379
14.6 TCP Wrappers	382
14.7 KerberosIV	385
14.8 Kerberos5	392
14.9 OpenSSL.....	400
14.10 VPN over IPsec.....	402
14.11 OpenSSH	413
14.12 File System Access Control Lists	419

14.13 Monitoring Third Party Security Issues.....	420
14.14 FreeBSD Security Advisories.....	421
14.15 Process Accounting.....	423
15 Jails.....	425
15.1 Óýñøç.....	425
15.2 ðññé òùí Jails.....	425
15.3 ÁέóáãñãÞ.....	426
15.4 ÄçìéõñãÞíóáð êáé Äÿã÷ííóáð Jails.....	427
15.5 ÈãðòñãñÞð Ñýèìéóç êáé Äéá÷ãßñéóç.....	429
15.6 ÁöáññãÞ òùí Jails.....	430
16 Õðí÷ñãùðéèùð èãã÷ìò Ðñüóááóçð.....	436
16.1 Óýñøç.....	436
16.2 Key Terms in this Chapter.....	437
16.3 Explanation of MAC.....	438
16.4 Understanding MAC Labels.....	439
16.5 Planning the Security Configuration.....	443
16.6 Module Configuration.....	444
16.7 The MAC bsdextended Module.....	445
16.8 The MAC ifoff Module.....	446
16.9 The MAC portacl Module.....	446
16.10 The MAC partition Module.....	447
16.11 The MAC Multi-Level Security Module.....	448
16.12 The MAC Biba Module.....	450
16.13 The MAC LOMAC Module.....	451
16.14 Nagios in a MAC Jail.....	452
16.15 User Lock Down.....	455
16.16 Troubleshooting the MAC Framework.....	456
17 èãã÷ìò ÓðìãÛíòùí Áóóáéãßáð.....	459
17.1 Óýñøç.....	459
17.2 Key Terms in this Chapter.....	459
17.3 Installing Audit Support.....	460
17.4 Audit Configuration.....	461
17.5 Administering the Audit Subsystem.....	463
18 ÁðìèçèãáððéèÛ ÌÝóá.....	467
18.1 Óýñøç.....	467
18.2 Device Names.....	467
18.3 Adding Disks.....	468
18.4 RAID.....	470
18.5 USB Storage Devices.....	474
18.6 Creating and Using Optical Media (CDs).....	476
18.7 Creating and Using Optical Media (DVDs).....	482
18.8 Creating and Using Floppy Disks.....	487
18.9 Creating and Using Data Tapes.....	488
18.10 Backups to Floppies.....	490
18.11 Backup Strategies.....	491
18.12 Backup Basics.....	492
18.13 Network, Memory, and File-Backed File Systems.....	499
18.14 File System Snapshots.....	501

25.5 Ç Āēḡóá D	651
IV. ĀēēōāēÝò ĀḡēēīēūīBāò	652
26 ÓāēēāēÝò ĀḡēēīēūīBāò	653
26.1 Óýñōç	653
26.2 Āēóāūāḡ	653
26.3 ŌāñīāóēēŪ	658
26.4 ŌḡçñāóBā Āēóūāīō īÝòū Āḡēēīāēēḡò Óýñāāóçð (dial-in)	663
26.5 ŌḡçñāóBā Āḡēēīāēēḡò Óýñāāóçð	672
26.6 Ñýēīēóç ôçð Óāēēāēḡḡò Ēīōūēāò	675
27 PPP ēāē SLIP	684
27.1 Óýñōç	684
27.2 ×ñçóēīīḡēēḡḡóáð ôī PPP ×ñḡóç	684
27.3 ×ñçóēīīḡēēḡḡóáð ôī PPP ôīō ḡñḡḡā	697
27.4 Āīóēīāðḡḡéóç ḡñīāēçīŪḡūī óā ÓóñāÝóāēð PPP	704
27.5 ×ñçóēīīḡēēḡḡóáð PPP īÝòū Ethernet (PPPoE)	708
27.6 ×ñçóēīīḡēēḡḡóáð PPP īÝòū ATM (PPPoA)	709
27.7 ×ñçóēīīḡēēḡḡóáð ôī SLIP	713
28 Çēāēōñīēēū Óā÷ōāññāḡī	722
28.1 Óýñōç	722
28.2 ×ñçóēīīḡēēḡḡóáð ôī Çēāēōñīēēū Óā÷ōāññāḡī	722
28.3 Ñýēīēóç ôīō sendmail	725
28.4 ĀēēŪāēīóáð ôīī Āīóēḡñūóūōī ĪāóāōīŪò Óā÷ōāññāḡīō (MTA)	728
28.5 Āīóēīāðḡḡéóç ḡñīāēçīŪḡūī	730
28.6 ḡñī÷ūñçīÝīā ĒÝīáóá	733
28.7 SMTP Īā UUCP	735
28.8 Ñýēīēóç Āīōḡçñāðçðḡ Īūñī āēā Āḡīóōīēḡ	737
28.9 ×ñçóēīīḡēēḡḡóáð ôī Mail ĪÝòū Āḡēēīāēēḡò (Dialup) Óýñāāóçð	738
28.10 ḡéóōīḡīḡçóç Āḡēāīóēēūōçóáð óōī SMTP	739
28.11 ḡñīāñŪñīáóá Óā÷ōāññāḡīō āēā ôīī ×ñḡóç	741
28.12 ×ñçóēīīḡēēḡḡóáð ôī fetchmail	747
28.13 ×ñçóēīīḡēēḡḡóáð ôī procmail	748
29 ĀīōḡçñāðçðÝò Āēēōýīō	750
29.1 Óýñōç	750
29.2 The inetd “Super-Server”	750
29.3 Network File System (NFS)	754
29.4 Network Information System (NIS/YP)	760
29.5 Automatic Network Configuration (DHCP)	775
29.6 Domain Name System (DNS)	779
29.7 Īāīōḡçñāðçðḡ HTTP Apache	788
29.8 ḡñūōūēēēī ĪāóāōīŪò Āñ÷āḡūī (FTP)	793
29.9 File and Print Services for Microsoft Windows clients (Samba)	794
29.10 Óōā÷ñīēóīūò Ñīēāēý Óóóðḡīáōīò Īā NTP	796
30 Firewalls	800
30.1 Óýñōç	800
30.2 ĀáóēēÝò ḡñēāð ðūī Firewalls	800
30.3 ḡñīāñŪñīáóá Firewall	801
30.4 Ōī Packet Filter (PF) ēāē ôī ALTQ ôīō OpenBSD	801

30.5	Ôi IPFILTER (IPF) Firewall	805
30.6	IPFW	825
31	Ðñi ÷ ùñçìÝíá ÈÝíáóá Äéêóýùóçð	844
31.1	Óýíøç	844
31.2	Gateways and Routes	844
31.3	Wireless Networking	850
31.4	Bluetooth	863
31.5	Bridging	871
31.6	Diskless Operation	874
31.7	ISDN	881
31.8	Network Address Translation	884
31.9	Parallel Line IP (PLIP)	887
31.10	IPv6	889
31.11	Asynchronous Transfer Mode (ATM)	893
31.12	Common Access Redundancy Protocol (CARP)	895
V.	ÐáñáñðΠιάóá	897
A.	Ðið éá Áñáβóá ôi FreeBSD	898
A.1	Áéäüóáéð óá CDROM éáé DVD	898
A.2	ÁîðçñáòçðÝð FTP	900
A.3	BitTorrent	911
A.4	Áíþiðii CVS	911
A.5	×ñçóéiððiéþiðáð ôi CTM	914
A.6	×ñçóéiððiéþiðáð ôi CVSup	918
A.7	ÁðééÝóáð (Tags) áéá ôi CVS	941
A.8	Ôiððèáóβáð AFS	948
A.9	Ôiððèáóβáð rsync	948
B.	Áéáééiñáóβá	951
B.1	Áéáéβá & ÐáñéiáééÛ ó ÷ áðééÛ iá ôi FreeBSD	951
B.2	Ïäçãñβ ÷ ñβóóç	952
B.3	Ïäçãñβ áéá ÷ áéñéóðβ	953
B.4	Ïäçãñβ ðñiñáñiáóéóðþi	953
B.5	Ôi áóùðáñééü ðið éáéðiðñáééý óðóðΠιάðið	954
B.6	ÁiáoiñÝð áóóáéáβáð	954
B.7	ÁiáoiñÝð ðéééiý	955
B.8	Éóðiñβá ðið UNIX	955
B.9	ÐáñéiáééÛ éáé áöçiññááð	956
C.	ÐçãÝð Ðççñiðóñçóçð óði Áéááβéðði	957
C.1	Ëβóóáð Ççáéðñiíééiý Ôá ÷ ðáññáβið	957
C.2	Usenet Newsgroups	977
C.3	ÁéáéñéóðÝð Éóðiðáéβäüi	979
C.4	Áéáðéýiáéð Ççáéðñiíééiý Ôá ÷ ðáññáβið	986
D.	ËéáééÛ PGP	988
D.1	Officers	988
D.2	ÏÝéç óçð ñÛááð Core	988
D.3	ÏÝéç óçð ñÛááð ÁiÛððóiçð	990
	Ëáíééü ðið FreeBSD	1053
	Ëiññiβáá	1078

ΕὰòÛëĩãìò ÐéíÛêùí

2-1. Õðüããéãìá ÁðĩãñáòÐò Óðóéãðĩ	12
2-2. ÄéÛðáíç ÊáðáòìÐóãùí äéá òĩ Ðñþòĩ Äßóèĩ	35
2-3. ÄéÛðáíç ÊáðáòìÐóãùí äéá òĩòð Õðüëĩéðĩòð Äßóèĩòð	36
2-4. Ìññáðĩëĩãßá ééé ÄðáíçãÐóãéò òùí ISO Images äéá FreeBSD 6.x ééé 7.x	81
3-1. Êùãééĩß Óðóéãðĩ Äßóêùí	102
18-1. Physical Disk Naming Conventions	467
21-1. Åßãç ÌññÛíùóçò Vinum Plex	538
26-1. Êáéþáéĩ Null-Modem DB-25 óã DB-25	654
26-2. Êáéþáéĩ Null-Modem DB-9 óã DB-9	654
26-3. Êáéþáéĩ Null-Modem DB-9 óã DB-25	655
26-4. Ìññáðßãð ÓçìÛòùí	664
31-1. Wiring a Parallel Cable for Networking	888
31-2. Reserved IPv6 addresses	890

Δημιουργία

Οα Διεϊοò Αδσòεγίαòάε Αòòυ οϊ Αέάεβι

Οι δηρòι οϊβία αòοιγ οϊò áεάεβιò, ταçããβ οϊι γΎι ÷ ñβòòç òòç áεάáεéαòáá áãéαòÛòòáòçò òιò FreeBSD, éáé οϊι áεòÛááé ñáεÛ òòç òεéιòιòβá éáé οϊι ó÷ ááéáòιι òιò UNIX®. Αòòυ οϊ òιβία ááι γ÷ áé éáéáβòããò áðáéòβòáéò. Αñéãβ ιιñ ç áεÛéáòç áéá áñãñáγίçòç áñυò γΎιò òòòòβιáòιò, éáé ç áòιáòυòçòá áòñιβυòçò òυι áιβòáυι áéá οϊ FreeBSD éáεβò áòòÛò áεòÛáñιòáé òóááéáéÛ.

Áοιγ áεááÛòáòá οϊ δηρòι οϊβία, οϊ ááγòãñι, éáòÛ ðìεγ ιáááéγóãñι οϊβία, ðãñééáιáÛιáé ιéá áεòáιβ áιáòιñÛ òá áεÛòιñá εÿιáòá ðιò áñáéáòÿñιòι òιòò áéá÷ áéñéòóÛò òòòòçιÛòυι FreeBSD. ÌãñééÛ áðυ áòòÛ òá éáòÛéáéá áβιáé áòéγéυòãñι ιá òá éáòáñιβòáòá áι γ÷ áòá βáç ιáéáòβòáé òóáééãñéι γΎι òιβιáòá οϊò áéáéβιò. ¼ðιò ÷ ñáéÛéáòáé εÛòé òÿòιéι, éá áιáòÿñáòáé òòç òγñιç òιò éáòáéáβιò ðιò ιυééò ιáééιβòáòá ιá áéááÛéáòá.

Áéá ðãñéòóυòããò ðçãÛò ðεçñιòιñéβι, áãβòá οϊ ΔáñÛñòçιá B.

ΑέéááÛò áðυ òçι Òñβòç éäιòç

Ç òñÿ÷ιòá online ÿéäιòç οϊò Áã÷ áéñéáβιò, áβιáé οϊ áðιòÿéáòιá òçò ðñιòðÛéáéáò ðìεβι áéáòιòÛáυι áéáéñιòβι òòι áεÛòòçιá òυι òáéáòòáβυι 10 ÷ ñυιñι. Ìé ðéι òçιáιòééÛò áééááÛò òá ó÷ ÿòç ιá òçι òñβòç ÿιòòç ÿéäιòç οϊò Áã÷ áéñéáβιò (2004) òáβñιòáé ðãñáéÛòυ:

- ÉáòÛéáéι 25, οϊ DTrace, áβιáé ÿιá γΎι éáòÛéáéι ιá ðεçñιòιñβáò ó÷ áòééÛ ιá áòòυ οϊ ðáιβò÷ òñι áñááéáβι áñÛéòòçò áðυäιòçò.
- ÉáòÛéáéι 20, ç Òðιòòβñéιç ÒòòòçιÛòυι Áñ÷ áβυι, áβιáé ÿιá γΎι éáòÛéáéι ιá ðεçñιòιñβáò áéá òòòòβιáòá áñ÷ áβυι ðιò ááι òðιòòçñβáñιòáé áãááñβ ðáðυ οϊ FreeBSD, υðυò οϊ ZFS áðυ òçι Sun™.
- ÉáòÛéáéι 17, ι çãã÷ιò ÒòιáÛιòυι Áòóáéáβáò, áβιáé ÿιá γΎι éáòÛéáéι ιá ðεçñιòιñβáò ó÷ áòééÛ ιá òéò γΎáò áòιáòυòçòáò éáé òçι ÷ ñβòç òιò auditing òòι FreeBSD.
- ÉáòÛéáéι 22, ç Áééιíééιðιβçòç, áβιáé ÿιá γΎι éáòÛéáéι ιá ðεçñιòιñβáò ó÷ áòééÛ ιá òçι ááéáòÛòòáòç òιò FreeBSD òá éñáéòιééυ áéðÿéáòçò áééñιéβι (virtual) ιç÷ áιçιÛòυι.

ΑέéááÛò áðυ òç Ááγòãñç éäιòç (2004)

Ç òñβòç ÿéäιòç áòòιγ òιò áéáéβιò βòáι οϊ áðιòÿéáòιá òçò ðñιòðÛéáéáò ðãñéòóυòããñι áðυ áγι ÷ ñυιñι áðυ òá ιÿéç òçò ÌÛááò Òáéιçñβυòçò οϊò FreeBSD. Ç ÿιòòç ÿéäιòç áβ÷ á òυιòι ιááÛéι ιÿááéιò, ðιò éñβεçéá áñáéáβι ιá òòðυéáβ òá áγι ÷ ññéòòιγò òυιòò. ΔáñáéÛòυ òáβñιòáé ιé òçιáιòééυòããò áééááÛò òá áòòβ òç γΎá ÿéäιòç:

- ÉáòÛéáéι 11, Òι éáòÛéáéι Ñγéιéòçò éáé Ááéðéòòιðιβçòçò òιò FreeBSD, áðáéòÛéçéá ιá γΎáò ðεçñιòιñβáò áéá òç áéá÷ áβñéòç áñÿñáéáò éáé ðυñυι òιò òòòòβιáòιò ιÿòυ ACPI, ιá ðãñéòóυòããò ðεçñιòιñβáò áéá οϊ òγòòçιá cron éáé ιá ðãñéòóυòããò áðééιãÛò ðãñáñáòñιðιβçòçò òιò ðòñβιá òιò FreeBSD.
- ÉáòÛéáéι 14, Òι éáòÛéáéι ÁòòÛéáéáò, áðáéòÛéçéá ιá γΎáò ðεçñιòιñβáò áéá Áβéòòá VPN, áéá εβòòáò áéÿã÷ιò ðñυòááòçò áñ÷ áβυι (ACLs), éáé ðãñéòóυòããò òòιáñòéÛò ò÷ áòééÛ ιá òçι áòòÛéáéá òιò FreeBSD.
- ÉáòÛéáéι 16, Ì Òðι÷ ñáυòééυò çãã÷ιò Δñυòááòçò (MAC), áβιáé ÿιá γΎι éáòÛéáéι òá áòòβ òçι ÿéäιòç. Áιçããβ òé áβιáé ι ιç÷ áιéíòυð MAC, éáé ðβò òðñãβ ιá ÷ ñçòéιðιéçéáβ áéá ιá áιéò÷ òéáβ ç áòòÛéáéá áñυò òòòòβιáòιò FreeBSD.

- Οι Έκδοσεις 12 (“C Αεαεεεαόβα Αεεβίςοςοδ οίω FreeBSD”) ἀδἀεοΰεεεα ια δἀνεοοοοαηαδ δεενηοοηηαδ.
- Οι Έκδοσεις 18 (“Αδρεεεαοοεεΰ ΙΎοα”) ιααηηοοεα ια αΰος οα δαεεεοοαηα ηΰι εαοΰεεεα “Αβοεε” εεε “Αίοβηηαοα Αοοεεαβαδ”. Δεοοαΰοοια υοε οα εΎιαοα αοοΰ αβιαε δει αοεεεεεεοα υοαί δἀνηοοεΰεεηοαε ιαεβ οαί Ύια εαοΰεεεε. ΔηιοδΎεεεα αδβοςο ιεα αΰοεοα εεα RAID (οεηδιβοςος ιΎου οεεεεΰ P εηεεοεεεε).
- Οι Έκδοσεις 26 (“ΟαεεεεΎδ Αδεεεεεεηηαδ”) αηαεεηηαηεεεα αδη οεη αη÷P εεε αηηηηεεεεα εεα οεο αεαυοαεο FreeBSD 4.X/5.X.
- Οι Έκδοσεις 27 (“PPP εεε SLIP”) αηηηηεεεεα οα οεηαηοεεεη ααεηη.
- Δρεεηβ ιΎιε οηηαδ δηιοδΎεεεα οοη Έκδοσεις 31 (“Δηη÷ηηεηΎια ΕΎιαοα Αεεοΰοεο”).
- Οι Έκδοσεις 28 (“Cεαοοηηεεεη Οα÷οαηηηαβη”) αδἀεοΰεεεα εεα ια οοηδἀνεεεαηαΰιαε δἀνεοοοοαηαδ δεενηοοηηαδ εεα οεο ηοεηβοαεο οίω **Sendmail**.
- Οι Έκδοσεις 10 (“Οοηαοοοεοα ια ΑεοαεΎοεηα οίω Linux®”) αδἀεοΰεεεα εεα ια οοηδἀνεεεαηαΰιαε δεενηοοηηαδ εεα οεη ααεαοΰοοαος οεο αΰοεο ααηηΎηη **Oracle®** εεε οίω **SAP® R/3®**.
- Οοεη ααΰοαηε Ύεαοος εεεΰοοηηοαε αδβοςο οα δαηαεΰοο ιΎα εΎιαοα:
 - Νΰεηεος εεε Αεεοεοοηηιβοςος (Έκδοσεις 11)
 - ΔρεοηΎοα (Έκδοσεις 7)

Ηηαΰηος ΑοοηΎ οίω Αεεεβηο

Αοοη οη αεεεβη ÷ηηβεαοαε οα δΎηα εεεηεοΰ εηεεεΰ οηηαοα. Οι δηηοη οηηα, *Ιαεεηηαδ ια οη FreeBSD*, δἀηεαηΰοαε οεη αεεαοΰοοαος εεε οεη ααοεεP ÷ηηος οίω FreeBSD. Η δηηοαεεηηαηηο οηηοηο αηΰαηοςοδ αοοηΎ οίω οηηαοηο αβιαε Ύια-Ύια εαοΰεεεε, ια οε οαεηΰ, δηηοδἀηηηαδ εαοΰεεεα ια αηηοοΰ εΎιαοα. Οι ααΰοαηη οηηα, *ΑαοεεΎδ Αηαοοβαδ*, δἀηεαηΰοαε ιαηεεεΰ ÷αηαεοεηεοοεεεΰ οίω FreeBSD οα ηηηα ÷ηεοεηηεηηηοαε οο÷ηΰ. Ηδηηαβοα ια εεαηΰοοα οα εαοΰεεεα οα αοοη οη οηηα (εαεη εεε οα υεα οα οηηαοα δηο αεηηοεηηη) ια υοηεα οαεηΰ εΎεαοα. Εΰεα εαοΰεεεε ηαεεηΰ ια ιεα οαοP εεε οΰηηος οΰηηος, ε ηηηα δἀηεαηΰοαε οα δἀηεα÷ηηαηα οηο εαοαεαβηο εαεη εεε οε ÷ηαεΰεαοαε ια αηηηβεαε ηαε ιαηαηηοςοδ. Αοοη αδεοηηΎδαε οοη δἀηεοοαοεαεη αηαηηοςος ια δηηοδἀηηΰ αηηαηηα αηηοςοαδ, εεα ια αηαε εαοΰεεεα οα ηηηα οηη αηαεαοΎηηοη δἀηεοοοοαηη. Οι οηηοη οηηα, *Αεα÷αβηεος Οοοοηαοηο*, δἀηεΎ ÷αε εΎιαοα ο÷αοεεΰ ια οε εεα÷αβηεος οοοοεηΰοηη FreeBSD. Οι οΎοαηηοη οηηα, *ΑεεοδαεΎδ Αδεεεεεεηηαδ*, εεεΰοαε εΎιαοα εεεοΰοεο εεε αεεηεοοηη. Οι δΎηοη οηηα δἀηεΎ ÷αε δαηαηοηηαοα ια αεΰοηηαδ δεενηοοηηαδ.

Έκδοσεις 1, ΑεοααηαP

Δαηηοοεΰεαε οη FreeBSD οοη ιΎη ÷ηηοςος. Δἀηεαηΰοαε οεη εοοηηηα οίω FreeBSD Project, οηο οοη ÷ηο οηο, εεε οη ηηοΎηη αηΰδδοηε οηο.

Έκδοσεις 2, Ααεαεεοδηηαδ οη FreeBSD

Ηαεαβ οηη ÷ηηοςος οοεη αεαεεεαοα οεο δεηηεο ααεαοΰοοαοςοδ. Αδβοςο οοηδἀνεεεαηαΰηηοαε ιαηεεεΰ εΎιαοα ααεαοΰοοαοςοδ εεα δηη÷ηηεηηηοδ, υδηο ε ααεαοΰοοαοςος ιΎου οαεηεεεPδ εηηοηεαδ.

Έκδοσεις 3, ΑαοεεΎδ ηηεαδ οοη UNIX

ΔἀηεΎ ÷αε οεο ααοεεΎδ αηοηεΎδ εεε εαεοηηηαδ οηο εαεοηηηαεεεηη οοοοηαοηο FreeBSD. Αΰη αβοα αηηεεαεηηηηο ια οη Linux P ια ΰεεη εαεοηηηαεεεη οΰηο UNIX ηηηαβοα δεεαηηο ια δηηοδἀηΰοαοα αοοη οη εαοΰεεεε.

Έκδο 15, Jails

Δημιουργία οίκοι κρατήσεων (jails), είναι ορόσημο της ανάπτυξης του FreeBSD.

Έκδο 16, Οδοί - η ανάπτυξη του FreeBSD

Η ανάπτυξη οδοί (MAC) είναι ορόσημο της ανάπτυξης του FreeBSD.

Έκδο 17, Οδοί - η ανάπτυξη του FreeBSD

Δημιουργία οδοί (audit trails) είναι ορόσημο της ανάπτυξης του FreeBSD.

Έκδο 18, Ανάπτυξη του FreeBSD

Δημιουργία οδοί (RAID) είναι ορόσημο της ανάπτυξης του FreeBSD.

Έκδο 19, GEOM: Ανάπτυξη του FreeBSD

Δημιουργία οδοί (RAID) είναι ορόσημο της ανάπτυξης του FreeBSD.

Έκδο 20, Ανάπτυξη του FreeBSD

Η ανάπτυξη οδοί (Z File System) είναι ορόσημο της ανάπτυξης του FreeBSD.

Έκδο 21, Vinum

Δημιουργία οδοί (RAID-0, RAID-1, RAID-5) είναι ορόσημο της ανάπτυξης του FreeBSD.

Έκδο 22, Ανάπτυξη του FreeBSD

Δημιουργία οδοί (FreeBSD) είναι ορόσημο της ανάπτυξης του FreeBSD.

Έκδο 23, Οδοί - η ανάπτυξη του FreeBSD

Δημιουργία οδοί (FreeBSD) είναι ορόσημο της ανάπτυξης του FreeBSD.

Έκδο 24, Ανάπτυξη του FreeBSD

Η ανάπτυξη οδοί (FreeBSD) είναι ορόσημο της ανάπτυξης του FreeBSD.

Έκδο 25, DTrace

Δημιουργία οδοί (DTrace) είναι ορόσημο της ανάπτυξης του FreeBSD.

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.

Αναβάθμιση του συστήματος

Σε αυτή την ενότητα θα μάθετε πώς να αναβαθμίσετε το σύστημα, να εγκαταστήσετε τα πακέτα, να εγκαταστήσετε τα πακέτα, να εγκαταστήσετε τα πακέτα, να εγκαταστήσετε τα πακέτα.

Προστασία

Σε αυτή την ενότητα θα μάθετε πώς να προστατέψετε το σύστημα, να εγκαταστήσετε τα πακέτα, να εγκαταστήσετε τα πακέτα, να εγκαταστήσετε τα πακέτα.

Αναβάθμιση του συστήματος

Σε αυτή την ενότητα θα μάθετε πώς να αναβαθμίσετε το σύστημα, να εγκαταστήσετε τα πακέτα, να εγκαταστήσετε τα πακέτα, να εγκαταστήσετε τα πακέτα.

Ctrl+Alt+Del

Όταν πατήσετε τα πλήκτρα Ctrl+Alt+Del, το σύστημα θα πραγματοποιήσει μια επανεκκίνηση.

Όταν πατήσετε τα πλήκτρα Ctrl+Alt+Del, το σύστημα θα πραγματοποιήσει μια επανεκκίνηση.

Ctrl+X, Ctrl+S

Όταν πατήσετε τα πλήκτρα Ctrl+X, το σύστημα θα πραγματοποιήσει μια επανεκκίνηση.

Διαβάστε πρώτα

Όταν πατήσετε τα πλήκτρα Ctrl+Alt+Del, το σύστημα θα πραγματοποιήσει μια επανεκκίνηση.

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

Όταν πατήσετε τα πλήκτρα Ctrl+Alt+Del, το σύστημα θα πραγματοποιήσει μια επανεκκίνηση.

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

Όταν πατήσετε τα πλήκτρα Ctrl+Alt+Del, το σύστημα θα πραγματοποιήσει μια επανεκκίνηση.

% top

Άστρονομία

Οι αστρονομικοί όροι είναι πολύπλοκοι, και η ορθότητα των όρων είναι πολύ σημαντική. Η ορθότητα των όρων είναι πολύ σημαντική. Η ορθότητα των όρων είναι πολύ σημαντική.

Η αστρονομία είναι η επιστήμη που μελετά τον χώρο και τα αντικείμενα που βρίσκονται σε αυτό. Η αστρονομία είναι η επιστήμη που μελετά τον χώρο και τα αντικείμενα που βρίσκονται σε αυτό. Η αστρονομία είναι η επιστήμη που μελετά τον χώρο και τα αντικείμενα που βρίσκονται σε αυτό.

I. Îâêéíþíôáò ìà ôï FreeBSD

Áðòò òï ìÝíïò òïò Áã÷áñéñáβïò òïò FreeBSD áβíáé áéá òïò ÷ ñþóðáð éáé òïò ÷ áéá÷áñéñéóðÝð òðóðçìÛò òïò ðïò ìáí Ý÷íïí þáç ìááÛéç ìïðáñéñá ìà òï FreeBSD. Óá êáòÛéáéá ðïò áéñéïðéïí:

- Áβíáé áéóáãñáééÛ áéá òï FreeBSD
- Óáð éáèñáçáñíí éáðÛ òç áéÛñéáéá òçð áéááééáóβáð ìáéáðÛóðáóçð
- Óáð áéóÛáñïí òðéð ìáóééÝð Ýíñéáð òïò UNIX
- ÐáñéãñÛïñïí òç áéááééáóβá ìáéáðÛóðáóçð òçð ðéçèþñáð áóáññáþí ðïò áβíáé áéáéÝóéíáð òïò FreeBSD
- Óáð áéóÛáñïí òïò ìñáóééù ðáñéáÛéñí òïò UNIX, òï óýóðçìá ×, éáé óáð éáèñáçáñíí ó÷áðééÛ ìà òéð áñ÷ééÝð ñèìèβóáéð áíùð ìñáóééíý ðáñéáÛéñíðò ìñááóβáð, ìà òï ìðïñ ìðññáβòá ìá áβóðá áéñíá ðéí ðáñáãñáééñ

Óá áðòò òï òïðíá òïò áéáéβïò, Ý÷íïí ðñïððáèþóáé ìá ìáéþóñïíá òðïí áéÛ÷éóïí òéð áíáóñÝð òá òïðíáðá þ éáòÛéáéá òïò Áã÷áñéñáβïò òá ìðïñá ìáí Ý÷áðá þáç áéááÛóáé. Áðòò ìðïðéñðáβ òðïí ìá áβíáé ðéí áýéñçç ç áíÛáñùóç òïò òïðíáðò ìáðòíý òïò Áã÷áñéñáβïò áðù òçì áñ÷á ìÝ÷ñé éáé òï òÝñò, ÷ ìñβð ìá áðáéóáβóáé ìá ðÛ÷áðá òðíá÷ðð òá áðñíáíá þ ðñíçáñííá òïðíáðá.

ΕαοÜεάεί 1 Άέόάãùãß

Αιάο÷çιάόέοιÝñ, αίαüεñãáíüÝñ, έέέ ìãñέëðò íáíáãñãüÝñ áðu òñ Jim Mock.

1.1 Óýññç

Άð÷ãñέóóñγíá äέá òí áíáέáóÝññí óáð ãέá òí FreeBSD! Òí áέüεñòεì εáòÜεάεί έάέýððάέ äεÜοññáð ððò÷Ýð òñ FreeBSD Project, ùðùð òçí έóðññßá òñ, òñð òóü÷ìð òñ, òí ññóÝεί áñÜððòñçð, έ.ð.έ.

ÌáòÜ òçí áñÜáññóç áðòñγ òñ έáòáέáßñò, έá ãñññæãðá:

- Ðùð ò÷ãðæãðάέ òí FreeBSD ìá Üεέá έáέòññãέέÜ óðóðßíáðá Ç/Ö.
- Òçí έóðññßá òñ FreeBSD Project.
- Òñð òóü÷ìð òñ FreeBSD Project.
- Òέð ááóέέÝð áñ÷Ýð òñ open-source ññóÝείò áñÜððòñçð òñ FreeBSD.
- Έάέ òðóέέÜ: áðu ðñ ðññÝñ÷ãðάέ òí ùññá “FreeBSD”.

1.2 Έáëðò Þέέáðá òñ FreeBSD!

Òñ FreeBSD áßíáέ Ýíá έáέòññãέέü óýóðçíá ááóέóñÝñ òñ 4.4BSD-Lite, òí ñðññ ìðññáß íá ÷ñçóέñðñέçðáß óá Ç/Ö Intel (x86 έáέ Itanium®), AMD64, Alpha™, έάέ Sun UltraSPARC®. Óá áñÝέέñç ãññóέáðάέ áðßóçð ç äέááέέáóßá ìáðáóññÜð òñ FreeBSD óá Üεέáð áñ÷έóáέòññέέÝð. Ìðññáßðá áðßóçð íá äέááÜóáðá äέá òçí έóðññßá òñ FreeBSD, Þ äέá òçí ðñññóóáðç áðßóçñç Ýέáññóç òñ. ΆÜñ áíáέáóÝññáóá íá óñáÜεέáðá ìá εÜðñέí òññðñ òñ Project (έßáέέáð, hardware, ìç-ðñññóçíáέüñÝíá ÷áññññßóíáðá), äέááÜóáð òí Üñεññ ÓññáέóóÝñññóáð òçñí ÁñÜððòñç òñ FreeBSD (http://www.FreeBSD.org/doc/el_GR.ISO8859-7/articles/contributing/index.html).

1.2.1 Óέ ìðññáß íá έÜñáέ òñ FreeBSD;

Òñ FreeBSD Ý÷áέ ðñέÜ áñέüεñá ÷áñáέðçñέóðέέÜ. ÌãñέÜ áðu áðòÜ áßíáέ:

- *Preemptive ðñέðáðáññáóßá* (preemptive multitasking) ìá äñíáíέέü Ýέãã÷ñ ðññðãñáέüðçðáð ãέá íá áñáóáέέóðáß ñáέüð έáέ áßέáέñð äέáññέáñóñð òñ ðñññ òñ Ç/Ö ìáðáññ ãáññññáß έáέ ÷ñçóðñ, áέüñç έáέ óðέð ðñí áñðßñáð óññέßέð.
- *Ðñέð÷ñçóðέέÝð äñáðúðçðáð* (multi-user facilities) ìέ ñðññáð áðέòñÝðññí óá ðñέÜ Üòññá óáðòü÷ñññ íá ÷ñçóέñðñέçðñññ Ýíá óýóðçíá FreeBSD äέá äέáóññáðέέÜ ðñññáíáðá. Άðòü òçíáßíáέ, äέá ðãñÜááέñá, ùðέ óá ðãñέóáññáέέÜ òñ óðóðßíáðñ, ùðùð áέðòðùðÝð έáέ ñçãññ òáέñέßñ áßíáέ óùóðÜ ñññáóñÝíá ìáðáññ ùέññ òñ ÷ñçóðñ òñ óðóðßíáðñ Þ òñ äέέðýñò έáέ ðùð ñðññññ íá òáέñññ óðáέáñέññÝíá ùñέá óá ÷ñçóðáð Þ ññááð ÷ñçóðñ, ðñññóáðáñññóáð έñßóέññò ðñññò òñ óðóðßíáðñ áðu ððãñññέέß ÷ñçóç.
- *Éó÷òñÝð äñáðúðçðáð äέέðýñóçð TCP/IP* (TCP/IP networking) ìá òðññðññέñç äέá áέñç÷áíέέÜ ðññðððá ùðùð óá SCTP, DHCP, NFS, NIS, PPP, SLIP, IPsec έáέ IPv6. Άðòü òçíáßíáέ ðùð Ýíá ìç÷Üñçíá FreeBSD ñðññáß íá äέέçäðέáñÜ áγέñέá ìá Üεέá óðóðßíáðά έáέ íá áñáÜæáðάέ óáí áðáέñέέüð áñðççñáðçððð, òðññóçññæñññóáð έáέòññãáð æùðέέð òçíáóßáð, ùðùð NFS (áðññáññóñÝñç ðññóááóç óá áñ÷áßá) έáέ òççñáóßáð çέáέòñññέέñγ

όά÷δάνηάβιό (e-mail), Ρ όγι δάνιόόβά οίό ιηάάιέοίγύ οάό οόι αεάάβεόοι ιΰού ούι όδγñάόεπι WWW, FTP, routing έάέ firewall (άόοΰεάέαδ).

- Ç δñιόόάόβά όçð ιiΠιçð (memory protection) άίάόόάεβεάέ υόέ ιέ αεΰοιηάδ άόάνηάΰò (Ρ ιέ ÷ ñΡόόάδ) άάί αεεçέάδεάñιγί ιάόάγύ οίόδ. Ιέα άόάνηάΡ διό δάνιόόέΰαεάέ εΰδιει δñυάεçιá άά ιδññάβ ιά άδçññάΰόάε ΰεεάδ ιά έαίΎίάι όñυδì.
- Òι FreeBSD άβιáέ Ύίá έάέοιόñάεέυ όγύόçιá 32-bit (64-bit όά Alpha, Itanium, AMD64, έάέ UltraSPARC) έάέ ό÷άάεΰόδçέά ιά άόού οίι όñυδì άñ` άñ ÷ Ρò.
- Òι άέñç ÷ άίεέυ δñυόóδì X Window System (X11R6) δñιόóΎñάέ άñάόέέυ δñάέάΰεείι άñάάόβáδ (GUI) όóι έúóóò ιεάó έίείΡò εΰñόάδ VGA έάέ ιεάó ιεúιçð έάέ αεάόβεάδάέ ιά οίι δεΡñç δçάάβι έρπáέά.
- Òιάάόúúδçόά άέόάεΎόέιυι ιά διεεΰ δñιáñΰιιáόά διό Ύ ÷ ιóι ιάόάεέυόóέόόάβ άέά Linux, SCO, SVR4, BSDI έάέ NetBSD.
- ×έεΰάάδ Ύοιέιáδ-δñυò-άέδΎεάόç άόάνηάΰò άβιáέ αεάέΎόέιáδ άδυ όçι όóεείáΡ ports έάέ packages άέά όι FreeBSD. Άεάόβ ιά ϑΰ ÷ ιáόά όóι αεάάβεόóι υόάι ιδññάβόά ιά όά άñάβόά υεά άáΡ;
- Òοι αεάάβεόóι άβιáέ άδβόçð αεάέΎόέιáδ ÷ έεεΰάάδ δñυόέάόάδ έάέ άγέιέáδ όόçι δñιόáñηιáΡ άόάνηάΰò. Òι FreeBSD Ύ ÷ άέ όóιáάóúδçόά δçάάβιό έρπáέά ιά όά δέι áçιιόέεΰ άιδññέεΰ όóóóΡιáόά UNIX, άδñιΎíùò ιέ δñάέόóúόáñάδ άόάνηάΰò ÷ ñάεΰάειφάέ εβááδ Ύùð έάέυειò ιάόάóñιδΎò άέά ιά ιάόάεέυόóέόóιγί (compile).
- Ç ΆόιáιέεΡ όάέάιδñιβçόç άέέιιέεΡò ιiΠιçð έάέ όι “ιειέεçñùιΎι VM/buffer cache” δάñΎ ÷ ιóι όϑçεΡ άδυáιόç όά άόάνηάΰò ιά άόιçιΎίáδ άίΰάεάδ όά ιiΠιç, άíΡ αεάόçñιγί όçι έέάñδιεçóέεεΡ άδυέñέόç διό όóóóΡιáόιð όóιòδ ΰεειòð ÷ ñΡόόáδ.
- ÒιόóóΡñέιç SMP άέά ιç ÷ άíΡιáόά ιά διεεάδεΎò CPU.
- ΔεΡñçð όάέñΰ άñάάεάβñι άίΰδóóιçð άέά C, C++, έάέ Fortran. Óδç ÓóεείáΡ όυι Ports έάέ όυι Ύοιέιυι δάέΎόυι, έά άñάβόά διεεΎò άέυιá άεΡόόáδ δñιáñáιιáόέóιγύ, έáδΰεεçέáδ όυοι άέά Ύñáόιá υοι έάέ άέά άίΰδóóιç ειαέóιέείγ.
- Ç άέάέάóέιυδçόά όιò δçάάβιό έρπáέά ιεúεçñιò διό όóóóΡιáόιð óçιáβιáέ υιόέ Ύ ÷ άόά όιι όϑçεúóáñι άάέιυ άέΎá ÷ ιò όóι δñάέάΰεείι όáδ. Άεάόβ ιά άβóóά έεάέáυιΎιέ όά Ύίá έεάέóóú όγύόçιá έάέ ιά άβóóά άίáñçιΎίíέ άδυ όιι δññçέáóðΡ όáδ, υιόάι ιδññάβόά ιά Ύ ÷ άόά Ύίá δñάáιáόέεΰ άίíé ÷ όυ όγύόçιá;
- ΆέóáóáιΎίç online όάέιçñβιúç.
- Έάέ διεεΰ ΰεεά!

Òι FreeBSD άάόβεάόάέ όóçι Ύέáιόç 4.BSD-Lite όιò Computer Systems Research Group (CSRG) όιò Δάíáδέόóçιβιò όçð Έάέέóυñιέáδ όóι Berkeley, έάέ όóιá ÷ βεάέ όçι αεάέάέñέιΎίç δάñΰáιόç όιò όóçι άίΰδóóιç όóóóçιΰόυι BSD. Άδέδñυóέáδά όóι άíáβñáδì Ύñáι διό δάññá ÷ á όι CSRG, όι FreeBSD Project ιúááϑά διεεΎò ÷ έεεΰάάδ ññáð όóç άáέóέóóιδñιβçόç όιò όóóóΡιáόιð άέά ιΎάέόóáδ άδέáυóáέδ έάέ άίέιδέόóβá όά έάεçιáñέιΎò έάόáóóΰόáέδ δñάáιáόέείγ óυñόιò άñάáόβáδ. Άί έάέ διεείβ άιδññέείβ ειειόóιβ áóóειáγίíόáέ ιά δñιόóΎñιòι έάέóιòñάεέΰ όóóóΡιáόά ιά όΎóιέá ÷ άñάέóçñέóóέεΰ, άδέáυóáέδ έάέ άίέιδέόóβá, όι FreeBSD ιδññάβ ιά όά δñιόóΎñάέ όρñá!

Ιέ άόάνηάΰò όóέδ ιδñβáδ ιδññάβ ιά ÷ ñçóέιδñιέçέáβ όι FreeBSD, δñάáιáόέεΰ δñάέññβειíόáέ ιúιι άδυ όçι όάíóáόβá όáδ. Άδυ άίΰδóóιç ειαέóιέείγ ιΎ ÷ ñέ άóóιñáόέóιγύδ άñáιόáóβñι, άδυ άδñáñáóΡ άέáΡι ιΎ ÷ ñέ όçι άέυñέυóç όιò άεείγέειò άδñáέñóóιΎíυι áñóóιñέεΡι έáñάέΡι, áΰι ιδññάβ ιά άβιáέ ιά Ύίá άιδññέευ δñιúυι UNIX, άβιáέ δάñáδΰíυ άδυ δέέáíυ υιόέ ιδññάβ ιά άβιáέ έάέ ιά όι FreeBSD! Òι FreeBSD άδβόçð ùóáεάβóáέ óçιáíóέεΰ άδυ έδñέιέáέóέεΰ ÷ έεεΰάάδ άόάνηάΰò όϑçεΡò διεúóçόáδ διό áíáδóγóóιíόáέ άδυ εΎίóñά άñáóíΡι έάέ δάíáδέόóΡιέá όά υει όιι έúóιι, έάέ όó ÷ íΰ άεάόβεáίφάέ όά ÷ áιçευ έúóóòð Ρ áυñáΰι. Òι δεΡεìò όυι άιδññέεΡι άόάνηáΡι διό αεάόβεáίφάέ άέά όι FreeBSD, άóιΰίáόáέ άδβόçð έάεçιáñέιΰ.

1.3.4 Ç ÔñŸ ÷ ïöóá_êäïöç öïö FreeBSD

Ôï FreeBSD áβίάέ äεäýèäñá äεάέŸöείι, äáóβæäöáέ ïεüεεçñï öóïí ðççáβï êpáέέä öïö 4.4BSD-Lite, éáέ áíáðöýöóäöáέ äεä öçöóPíáöá çεäεöñïíέέpí öðïïεäεöðpí äáóέöïŸíá öá äðáíäñäáöðŸð Intel i386™, i486™, Pentium®, Pentium Pro, Celeron®, Pentium II, Pentium III, Pentium 4 (P öóïäáöïýð), Xeon™, DEC Alpha éáέ Sun UltraSPARC. Άáóβæäöáέ εöñβüð öóï software öçð ïñÜäáð U.C. Berkeley CSRG, íä εÜðïέäð ääεöεpöáέð ðïö ðñïŸñ ÷ ïïöáέ áðü öá NetBSD, OpenBSD, 386BSD, éáέ öï Free Software Foundation.

Άðü öçí Ÿέäïöç öïö FreeBSD 2.0 öðá öŸέç öïö 1994, ç áðüäïöç, öï öýñïï öüí ÷ äñáέöçñέöóέέpí, éáέ ç öðáέäñüöçöðá öïö FreeBSD Ÿ ÷ äέ ääεöεüèäβ öçíáíöέέÜ. Ç íääáέýöäñç äέέäãP áβίάέ ç äðáíáö÷ ääβáöç öïö öçöóPíáöïò äέέïíέέPð ïíPìçð (virtual memory) íä Ÿíá ïεïέεçñüíŸñí VM/file buffer cache öï ïðïβï ü ÷ é ïüíí áöïŸíáέ öçí áðüäïöç, äέέÜ äðβöçð ïäέpíáέ öéð äðáέöPöáέð ïíPìçð öïö FreeBSD, äðéöñŸðïöáð üð äεÜ ÷ éööï äðïäáέöü ïñέï öá 5 MB. ÐäñέŸ ÷ ïïöáέ äðβöçð éáέ Üέεäð ääεöεpöáέð, üðüð ðεPñçð öðïöðPñέíç ðäεÜöç éáέ äïðççñáöçðP NIS, öðïöðPñέíç öóíáέέäãpí TCP, dial-on-demand PPP, áíöüíáðüíŸíç öðïöðPñέíç DHCP, Ÿíá ääεöεüíŸñí öðïöýööçíá SCSI, öðïöðPñέíç ISDN, öðïöðPñέíç äεá ATM, FDDI, ðñïóáñïñäãð äέέöýïï Fast éáέ Gigabit Ethernet (1000 Mbit), ääεöεüíŸíç öðïöðPñέíç äεá öïöð öáέäöðáβïöð äεääέöŸð öçð Adaptec éáέ ðïεεŸð ÷ éέέÜäáð äέïñεpöáέð εάεpí (bug).

Άέöüð áðü öç äáóέέP öïö äεáññP, öï FreeBSD ðñïöóŸñäέ íεá ööεεïãP εïäεöíέέïý íä ÷ éέέÜäáð ðñïññÜíäöá äεá éáέçíäñέíP ÷ ñPöç. Ôçí öéέäñP öïö ãñÜöïíöáέ áöðŸð íé ãñáñŸð, öðÜñ ÷ ïïí ðŸíü áðü 20,000 ports! Ç εβöðá öüí ports íäέέŸíáέ áðü äïðççñáöçðŸð http (WWW), íŸ ÷ ñέ ðáέ ÷ íβáέá, äεpöóäð ðñïññáíäéöéöïý, éáέíáñññÜöïöð, éáέ ïöéãPðïöä Üέεï áíáέŸíäöá. Ç öñïñέέP ÔöεεïãP öüí Ports äðáέöáβ ðñïöáäáέöééÜ 417 MB áðïεçεäöðééü ÷ pñï, áöïý üέä öá ports äéöñÜæïíöáέ íä “deltas” (áñ ÷ äβá äεáöïñpí) öüí äöεáíöéέpí ðççápí öïöð. Ôï ääáñüð áööü íäð äðéöñŸðäέ íá áíáäáέβïöïíä öá ports ðïéý äöεïεüöäñá, éáέ ïäέpíáέ äñáöðééÜ öéð äðáέöPöáέð öá öéεçñü äβöéï öá ö÷ Ÿöç íä öçí ðáέéüöäñç ÔöεεïãP Ports 1.0. Άέá íá íäöáäεüöðéöóöáβ (compile) Ÿíá port, ÷ ñáέÜæáöáέ áðεpð íá íäöáäáβöá öóïí éáöÜέïäï öïö ðñïññÜíäöïð ðïö äðééöïäβöá íá ääεáöáöðPöáöð, íá ðεççöñïñέïãPöáöðä make install, éáέ íá áöPöáöðä öï öýööçíá öáð íá εÜíáέ öá öðüεïéðá. ïεüεεçñç ç áöεáíöéέP äεáññP äεá εÜεä port ðïö εÜíáöðä build ðáñŸ ÷ äöáέ äöíáíέéÜ áðü öï CD-ROM P áðü íβá öïðéέP öïðïεäöβá FTP, Ÿöóé öá ports ðïö äáñ ÷ ñáέÜæáöóä äáñ éáöáέáíäÜöïí Üöéïðï ÷ pñï öóï öéεçñü öáð äβöéï. Ô÷ ääüí εÜεä port ðáñŸ ÷ äöáέ äðβöçð éáέ öáí ðñï-íäöáäεüöðéöïŸñí (pre-compiled) “ðáέŸöï (package)”, öï ïðïβï ïðñáβ íá ääεáöáöðáέäβ íä íεá áðεP áíöïεP (pkg_add) äεá äέäβñöð ðïö äáñ äðééöïñýí íá íäöáäεüöðβæïöï öá ports öïöð áðü öïí ðççááβï êpáέέä. Ðäñέóöüöäñäð ðεççñïññβäð äεá öá packages éáέ öá ports ïðñáβöá íá äñáβöá öóï ÊäöÛεάεί 4.

ÔðÜñ ÷ äέ äñéäöÜ íääÜεç äðéðéŸñí öáέìçñβüöç öçí ïðïβá ïðñáβ íá äñáβöá ðïéý ÷ ñPöéíç äεá öçí äεáäέéáöóβá ääεáöÜöóáöçð éáέ ÷ ñPöçð öïö FreeBSD. ïðñáβöá íá öçí äñáβöá ääεáöáöçíŸíç öóïí éáöÜέïäï /usr/share/doc öá ïðïεïãPðïöä öýã ÷ ññïí íç ÷ Üíçíá FreeBSD. Ôá öïðééÜ ääεáöáöçíŸíá ää ÷ äέñβáέá ïðñáβöá íá öá äáβöá öá ïñöP HTML, ÷ ñçöéïðïépíöáð ïðïεïãPðïöä éáöÜέéçéï browser öðéð áéüεïöéäð URL:

Ôï Äã ÷ äέñβáέí × ñPöçð öïö FreeBSD
/usr/share/doc/handbook/index.html

Ôö ÷ íŸð äñüðPöáέð öïö FreeBSD (FAQ)
/usr/share/doc/faq/index.html

ïðñáβöá äðβöçð íá äáβöá öá ðñüöüöððá (éáέ öö ÷ íÜ áíáäáέíεäüíäíá) áíöβáñáöá öóï http://www.FreeBSD.org/.

2.3.3.2 ἘάòÙòιçç Ἄβóέιò áέά ççí Ἀñ ÷έóάέòιíέέþ FreeBSD/alpha

Ἐά ÷ñάέάóðáβòά Ἰάí óέέçñù áβóέι áðίέέάέóðέέÙ áέά ÷ñþç áðù ðì FreeBSD óòιí Alpha. Ἄάí áβίáέ áðίáðùí áðòþ çç óóέάιþ íá ÷ñçóέιíðíέþóáðá ðιí βáέι áβóέι íá èÙðίέí Ùέέí éáέðíòñáέέù óýóðçíá. ἈíÙέñά íá ðì íç ÷ Ùίçíá Alpha ðιò Ἰ ÷ áòá, í áβóέιò áðòùð ìðιñáβ íá áβίáέ áβòá SCSI áβòá IDE, áòùóιí ðì íç ÷ Ùίçíá óáð ðιòñáβ íá áέέέíþóáέ áðù áðòùí.

Óγíòùíá íá ðέð óòìáÙóáέð ðιò áέίέιðέιγíóáέ óóá áá ÷ áέñβáέá ççð Digital / Compaq, ùέáð íέ áíòιέÝð SRM ááβ ÷ ííóáέ íá éáóáέáβá ññÙìáóá. Ùóóùóι ðì SRM ááí èÙíáέ áέÙέñέóç íέέñþí / éáóáέáβùí.

Ἄέá íá áñáβòá óá ííùíáóá éáέ ðιòð óýðιòð ðùí áβóέùí ðιò íç ÷ áíþíáðιòð óáð ÷ñçóέιíðíέþóáð ççí áíòιέþ SHOW DEVICE óðçí ðñιòñιðþ áíòιέþ ðιò 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
```

Óι ðáñÙááέáíá áβίáέ áðù Ἰάí Digital Personal Workstation 433au éáέ ááβ ÷ íáέ ðñáέð óðóέáðÝð óòìááááí Ἰάð óòιí íç ÷ Ùίçíá. Ç ðñþç áβίáέ Ἰάí CDROM íá ùíñá DKA0 éáέ íέ Ùέέáð áγí áβίáέ áβóέίέ íá ííùíáóá DKC0 éáέ DKC100 áíóβóðίέ ÷ á.

Ἄβóέιέ íá ííùíáóá ççð ìñòþð DKx áβίáέ óýðιò SCSI. Ἄέá ðáñÙááέáíá, í DKA100 áíáóÝñáðáέ óá Ἰάí áβóέι SCSI íá SCSI target ID 1 óòιí ðñþðι (Á) áβáðέι SCSI, áñþ ì DKC300 áíáóÝñáðáέ óá Ἰάí áβóέι SCSI íá SCSI ID 3 óòιí ðñβðι (C) áβáðέι SCSI. Ç óðóέáðþ PKx áíáóÝñáðáέ óòιí áέááέðþ (èÙñóá) SCSI. ¼ðùð óáβíáðáέ áðù óá áðιðáέ Ἰóíáóá ççð áíòιέþð SHOW DEVICE, íέ íäçáñíβ CDROM áíóέíáðùððβæííóáέ ùðùð éáέ ðιέááþððιðá Ùέέç SCSI óðóέáðþ óέέçñιγ áβóέιò.

Íέ óέέçñιíβ áβóέίέ óýðιò IDE Ἰ ÷ íòí ííùíáóá ðιò óýðιò DQx, áñþ íέ áíóβóðίέ ÷ íέ IDE áέááέðÝð ðιò óýðιò PQx.

2.3.4 ÓέέέÝíòá ðέçñιòιñβáð áέá çç Ἰýέιέóç ðιò Ἄέέóγíò óáð

Ἀí óέιðáγáðá íá óòìááέáβòá óá Ἰάí áβέðòι éáðÙ çç áέÙñέáέá ççð ááέáðÙóðáóçð ðιò FreeBSD (áέá ðáñÙááέáíá áí ðñùέáέóáέ íá èÙíáðá ááέáðÙóðáóç ìÝóù èÙðίέáð ðιòíέáóβáð FTP þ ìÝóù áέáέñέóðþ NFS), ðùðá ðñÝðáέ íá áíññæáðá ðέð ñðèìβóáέð ðιò áέέóγíò óáð. ἘáðÙ çç áέÙñέáέá ççð ááέáðÙóðáóçð, éá áñùðçέáβòá áέá áððÝð ðέð ñðèìβóáέð þóá ðì FreeBSD íá ìðιñÝóáέ íá óòìááέáβ óòιí áβέðòι éáέ íá íέíέçñíþóáέ ççí ááέáðÙóðáóç.

2.3.4.1 Óýíááóç ìá Ἄβέðòι Ethernet þ Modem Cable/DSL

Ἀí óòìáÝáóðá óá áβέðòι Ethernet þ áí Ἰ ÷ áðá óýíááóç Internet ìá ÷ ñþç áέááέðþ Ethernet ìÝóù éáέùáέáέþð þ DSL óýíááóçð, éá ÷ ñáέáóðáβòá ðέð áέùέιòέáð ðέçñιòιñβáð:

1. Ἄέáýèðίóç IP (IP Address)
2. Ἄέáýèðίóç IP ççð ðñíáðέέááí Ἰýçð ðýέçð (default gateway)
3. ¼íñá ððίέíáέóðþ (hostname)
4. Ἄέáðέγíóáέð IP ðιò áέáέñέóðþ DNS (DNS server IP addresses)

We can take no responsibility for lost disk contents!

Ἐπειδὴ οὐδὲν ἐγγυηθήσεται ἡ ἀσφάλεια τῶν περιεχομένων τοῦ δίσκου ἂν ἀρνηθῶμεν τὴν ἀσφάλειά του. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος.

2.4.1 Ἀεὶκίνητο

2.4.1.1 Ἀεὶκίνητο ὁμοίως Ἄν-ἰ386™

1. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος.
2. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος.
3. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος.
4. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος.

Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος.

1. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος.
2. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος.
3. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος.
5. Ἐάντις τῆς ἀσφάλειας τοῦ δίσκου, ἡ ἀσφάλεια τοῦ δίσκου ἐπιβάλλεται ἀπὸ τοῦ συστήματος.

```

Booting from CD-Rom...
CD Loader 1.2

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

```


Ó ÷ Πιά 2-1. Ìáñý Áêêßíçòç (FreeBSD Boot Loader)



ÐáñéÝíáðá äÝέά ääóðáñüéáððá, ð áðêð ðéÝóðá **Enter**

2.4.1.2 Άêêßíçòç óççì Áñ ÷ έóáêòìíέêß Alpha

1. ÌáêéíÐóðá ìá ðì ððñéäέóð óáð áðáíáññðñέçìÝíí.
2. ÌáêéíÐóðá ðì ððñéäέóð óáð έάέ ðáñéÝíáðá áέá ðçì ðñìðññð ðìð boot monitor.
3. Áí ÷ ñáέÛóççá íá ðññáðñéíÛóáðá áέóéÝðáð áêêßíçòç, ùððð ðáñέáñÛóáðáέ óðì ÕìΠιά 2.3.7 ìßá áðü áððÝð έá áßíáέ áêêßíçòç, ðέέáñð áððß ðìð ðáñéÝ ÷ áέ ðì boot . flp. ÕìðñέáðÐóðá ðç áέóéÝðá áððß óðñì ñáçáü έάέ áñÛððá ðçì áέüññðçç áíðñßß áέá íá ìáêéíÐóðá áðü ðç áέóéÝðá (áíðέέáέέóðñíóáð ðì ùññá ðçð ññÛááð áέóéÝðáð áí ÷ ñáέÛáðáέ):

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

Áí ìáêéíÛóðá áðü CDROM, ðìðñέáðÐóðá ðì CDROM óðñì ñáçáü έάέ áñÛððá ðçì áέüññðçç áíðñßß áέá íá ìáêéíÐóðá ðçì ááέáðÛóðáóç (áíðέέáέέóðñíóáð ðì ùññá ðìð ñáçáñý CDROM áí ÷ ñáέÛáðáέ):

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

4. Έá áñ ÷ ßóáέ ç áêêßíçòç ðìð FreeBSD. Áí ìáêéíÛóðá áðü ðçì áέóéÝðá, óá έÛðñéí óççìáßì έá ááßðá ðì áέüññðèì ìÐñíá: Insert disk labelled "Kernel floppy 1" and press any key...
Áέñññðèßððá ðέð ñáçáßáð áððÝð, ááÛáññðáð ðç áέóéÝðá boot . flp, áÛáññðáð ðç áέóéÝðá kern1 . flp έάέ ðéÝáññðáð **Enter**.
5. Άßðá ìáêéíÐóðá áðü áέóéÝðá, áßðá áðü CDROM, ç áέááέέáóßá áêêßíçòç έá ððÛóáέ óðì áέüññðèì óççìáßì: Hit [Enter] to boot immediately, or any other key for command prompt. Booting [kernel] in 9 seconds... _

ÐáñéÝíáðá äÝέά ääóðáñüéáððá, ð áðêð ðéÝóðá **Enter**. ðóέ έá ìáêéíÐóðá ðì ìáñý ñýèìέçð ððñΠιά.


```

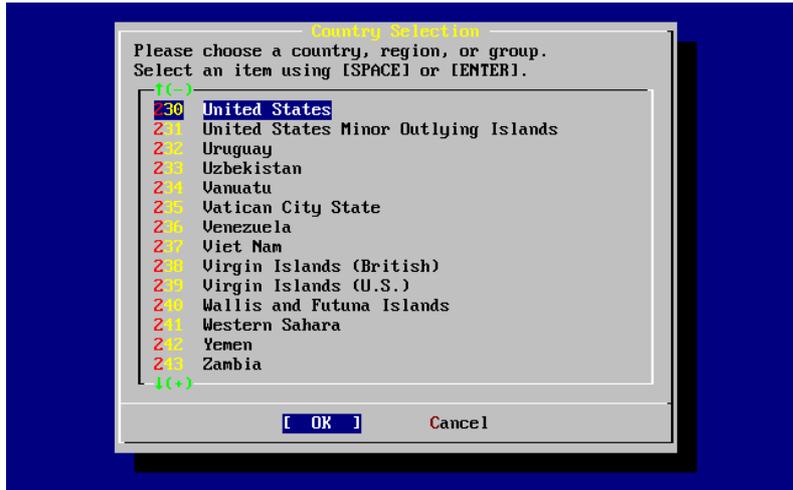
pci0: <PCI bus> on pcib0
pcib1:<VIA 82C598MVP (Apollo MVP3) PCI-PCI (AGP) bridge> at device 1.0 on pci0
pci1: <PCI bus> on pcib1
pci1: <Matrox MGA G200 AGP graphics accelerator> at 0.0 irq 11
isab0: <VIA 82C586 PCI-ISA bridge> at device 7.0 on pci0
isa0: <iSA bus> on isab0
atapci0: <VIA 82C586 ATA33 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

```

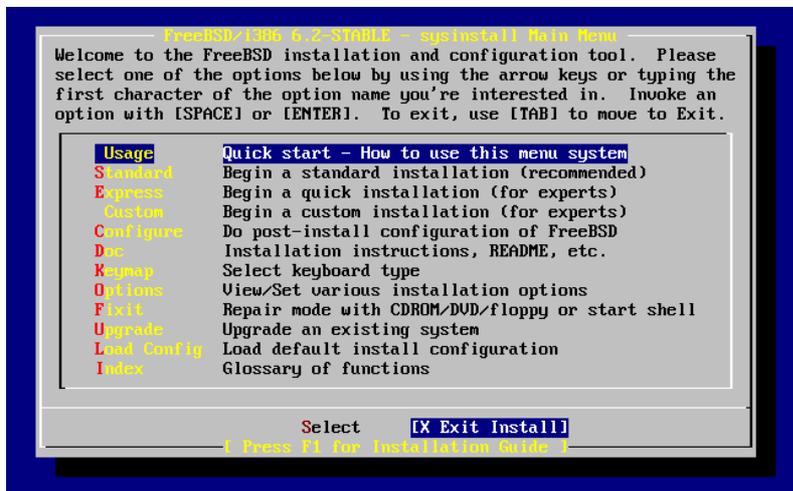
ÆéÝáíðä ðñíóáéóééÛ óá áðíóäéÝóíáóá ðçð áíß÷íáðóçð áéá íá ááááéúèäßðä úéð ðí FreeBSD áíß÷íáðóá úéäð ðéð óðóéäðÝð ðíð áíáíÝíáðä. Áí íéá óðóéäðP äáí äñÝéçéä, ðúðä äáí éá ðç äáßðä óðç èßðóá. Ìä ðç äñÐéäéá äíáéäéäðíÝñó ððñÐíá íðñáßðä íá ðñíóéÝóáðä ððíóðÐñéíç áéá óðóéäðÝð íé íðíßäð äáí ðáñééäíáÛñíóáé óðíí ððñÐíá GENERIC, úððù ðéð èÛñðäð Ð÷íð.

Áðü ðí FreeBSD 6.2 éáé íáðÛ, óðí ðÝéíð ðçð áéááéäéáðßäð áíß÷íáðóçð óðóéäðßí, éä äáßðä ðí Ó÷Ðíá 2-3. ×ñçóéíðíéÐóáð óá ääéÛééá áéá íá äðééÝíáðä ðáñéí÷Ð Ð ÷þñá. Ðáéðá ðéÝóðä **Enter**, áéá íá ñðèíßðáðä áýéíéä ðç ÷þñá éáé ðç äéÛðáíç ðéçéðñíéíáßíð. Áßíáé äðßðçð áýéíéí íá äááßðä áðü ðí **sysinstall** éáé íá íäééíÐóáðä áðü ðçí äñ÷Ð.

Ó÷Ðíá 2-3. ÁðééÝíáðóá ðí Ìáñý ×þñáð



Ó÷Ðíá 2-4. ÁðééÝíðä ñíäí áðü ðí Sysinstall



×ñçóéíðíéÐóáð óá ääéÛééá áéá íá äðééÝíáðä Exit Install áðü ðí Ìáñý Main Install. Éä äáßðä ðí áéúéíðèí íÐíóíá:

```
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 íãéíPóáé íáíÛ, áí äöPóáðá ðí CDROM óðíí íãçãü éáé áðééÝíáðá [Yes].

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

2.5 ÁéóáãüãP óðí Sysinstall

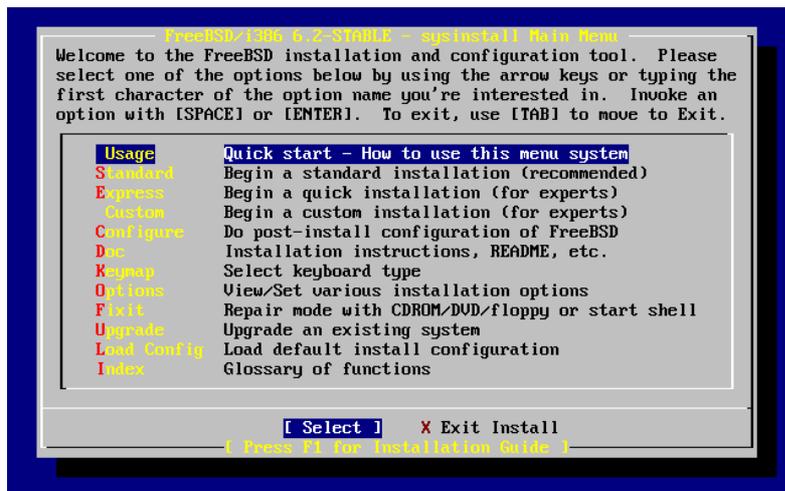
Ôí ðñüãñáíá **sysinstall** áßíáé ç äóáñíãP áãéáóÛóóáóçð ðíð ðáñÝ ÷áðáé áðü ðí FreeBSD Project. Ááóðæáðáé óá ðãñéáÛëéíí éáéíÝíð éáé ÷ññæáðáé óá íéá óáéñÛ áðü íáñý éáé íèííáð ðíð ðíðñáðá íá ÷ñçóéíðíéPóáðá áéá íá ðçéíßóáðá éáé íá äéÝáíáðá ðçí äéáééáóáá áãéáóÛóóáóçð.

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

Áéá íá áãðá ðéð ðççñíðñãðá äóðÝð, áãááéúéãðá ððé áßíáé ðüðéóíÝíç ç áðééíãP Usage éáé ððé áßíáé áðééãñÝí ðí ðéPéðñí [Select] ðððð 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).

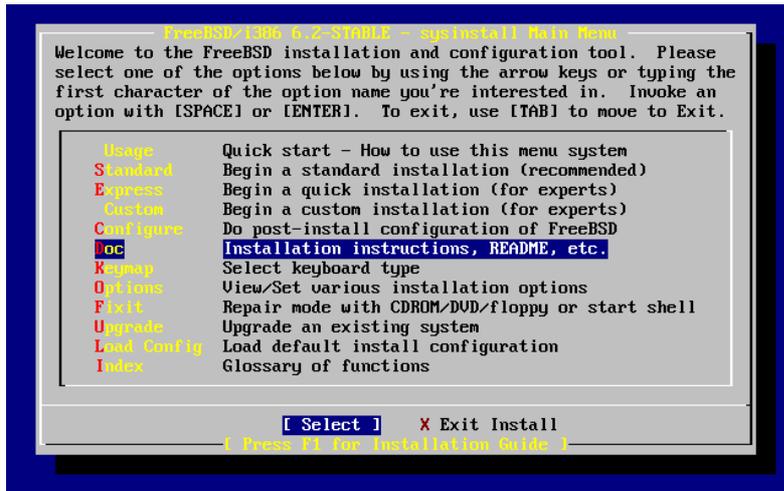
Ó ÷Píá 2-5. ÁðééÝáííóáð Usage áðü ðí Main Menu ðíð SysInstall



2.5.1 ÁðééÝáííóáð ðí íáñý Documentation (Ôãêíçñßúóçð)

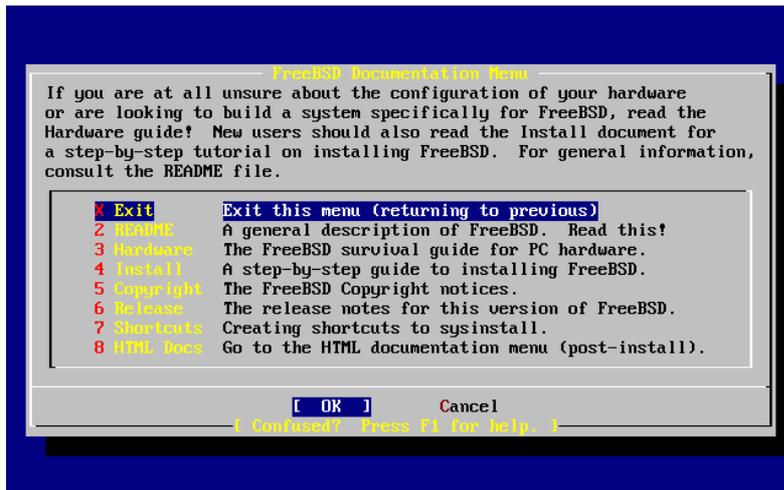
Áðü ðí Main Menu, áðééÝíðá Doc íá óá áãéÛééá éáé ðéÝóðá **Enter**.

Ó÷ Ðíá 2-6. ÅðéÛäííóäð 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.

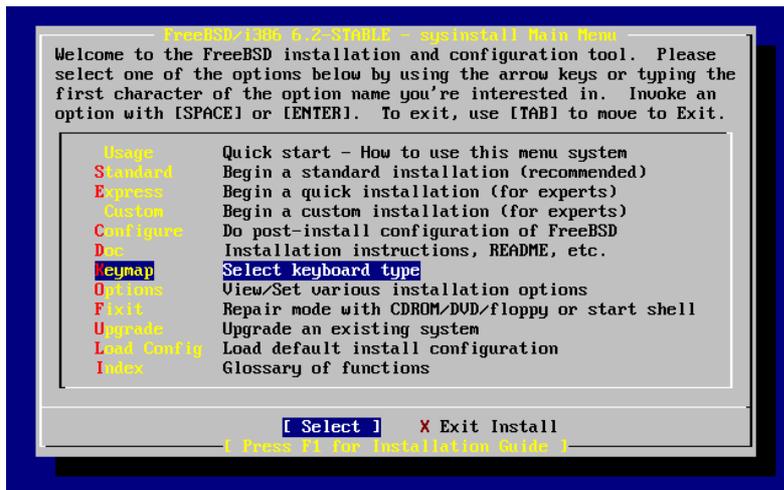
Ãéá íá äãßðä Ýíá Ýãããäöí, äðééÝíðä ðí ìä ðá äãéÛééá éäé ðéÝóðä **Enter**. ¼ðáí ðäéäéðóäðä ðçí áíÛáíóç áíüð äããñÛíöí, ðéÝæííóäð **Enter** èä äðéóðñÝðäðä ððí ìáíÿ Documentation.

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

2.5.2 ÅðéÛäííóäð ðí ìáíÿ Keypad (ÄéÛóáíç Ðéçéðñíëíäßíö)

Ãéá íá äééÛíäðä ðç äéÛóáíç ðíð ðéçéðñíëíäßíö, ÷ñçóéíðíéðóðä ðá äãéÛééá ãéá íá äðééÝíðä Keypad áðü ðí ìáíÿ éäé ðéÝóðä **Enter**. Åðöü äðäéóäßðäé ìüíí áí ÷ñçóéíðíéäéßðä äéÛóáíç ðéçéðñíëíäßíö ðíð äãí äßíäéá óóÛíóáñ éäé äðßóçð äéá äéäóÛíäéð äéöüð ðçð Äããééèð ÇÐÁ.

Όχι Πίνακας 2-8. Έγινε Ισχύς Αεαόΰοόάοç (Sysinstall Main Menu)



Όταν βρεθείτε στο κύριο μενού του sysinstall, θα σας ζητηθεί να επιλέξετε μια επιλογή. Η επιλογή γίνεται με τα βελάκια ή με το πλήκτρο **Space**. Το πλήκτρο **Space** είναι επίσης χρήσιμο για να περάσετε στην επόμενη οθόνη. Για να βγείτε από το μενού, πατήστε το πλήκτρο **Tab**.

Όταν επιλέξετε μια επιλογή, θα εμφανιστεί μια οθόνη με περισσότερες πληροφορίες. Για να επιστρέψετε στο κύριο μενού, πατήστε το πλήκτρο **Tab**. Για να βγείτε από το μενού, πατήστε το πλήκτρο **Cancel**.

Όχι Πίνακας 2-9. Οι Ισχύς Keymap στο Sysinstall



2.5.3 Οι Επιλογές Installation Options (Αδελφική Αεαόΰοόάοç)

Όταν επιλέξετε Options, πατήστε το πλήκτρο **Enter**.

άέÛόάιç οίι ιάçāβι". Άδδου ιδññάβ ίά ιάçāβόάέ οά έάέάβδάñά δññβδέιέάδ έάδάόδÛόάέδ, άέάέÛ άί ιέ άβόέιέ ÿ÷ϊοί δñññιέά άññιάδññά έάέ ÿ÷ϊοί άδβόçδ οά βάέά άññÿίά (άβίάέ ι ÿίάδ έεβññδ οίö Ûέειö).

¼όάί ÷ñçόέιιδññέάβδά οί FreeBSD άδέόδñÿόάδ δçί οάέñÛ οίι ιάçāβι οίι BIOS οόçί οδδóέιιέάέεβ οίöδ δñέί άάέάόδóδβόάδ οί FreeBSD έάέ άββόάδ δçί ÿόóé. Άί δñÿδάέ ίά άίάέÛίάδά οίöδ άβóέιöδ ιάδάíÿ οίöδ, εÛίόά οί άέéÛ ίά οί άýόέιι οññδι: άñβίδά οί έιöδβ έάέ άέéÛίδά εÿόάέδ οδά jumpers (άñá÷δéδέéυδöβññδ) έάέ οδά έάέβάέά.

Ίέα Έόδññβά άδυ όά Άñ÷άβά ούι Άίάέññάόέεβι Δññέδññάέεβι οίö Bill έάέ Fred:

Ο Bill άέάέÿάέ ÿίά δάέéυι ιç÷Ûίçίά Wintel άέά ίά οδóέÛίάέ ÿίά άέυιά FreeBSD ιç÷Ûίçίά άέά οί Fred. Ί Bill άάέάέέóδÛ ÿίά οέéçñυ άβóέι SCSI υδ οδóέάδöβ ίά άñέèιυ ιçāÿί έάέ άάέάέέóδÛ οά άδöβ οί FreeBSD.

Ί Fred ίάέέíÛ ίά ÷ñçόέιιδññέάβ οί óýόóçίά, άέéÛ ίάδÛ άδυ άñέάδÿδ ιÿññδ δññάόçññά υδóé ι δάέéυδ SCSI άβóέιö άίάóÿñáέ άñέάδÛ ιç έάδάόδññóééÛ εÛέç (soft errors) έάέ άίάóÿñáέ οί άñññυδ άδδυ οóιí Bill.

ΊάδÛ άδυ ίáñέéÿδ άέυιά ιÿññδ, ι Bill άδññάόβάέά υδóé ÿ÷άé ÿñέáé ç βñά ίά άίόέιáδδδβόάέ οί δññυάέçίά, έάέ ÿόóé δéÛίάέ ÿίά άίόβóδιέ÷ι SCSI άβóέι άδυ οί "άñ÷άβι" οóι δβóυ άññÛóέι. ίάδ άñ÷έéυδ ÿέάá÷ιδ άδέóÛίάέάδ άáβ÷ίάέ υδóé ι άβóέιö έάέóιöññάá έάññέéÛ, έάέ ÿόóé ι Bill άάέάέέóδÛ οί άβóέι άδδυ υδ SCSI ññÛάά δÿόóáñά έάέ άίόέáñÛόάέ (ιÿóυ image) δéβññδδ όά άññÿίά άδυ οί άβóέι ιçāÿί óδι άβóέι δÿόóáñά. Öβñά δññ ι ιÿιδ άβóέιö άβίάέ άάέάόδóçίÿññδ έάέ έάέóιöññάá óυóδÛ, ι Bill άδññάόβάέά υδóé άβίάέ έάéβ εάÿά ίά άñ÷βόάέ ίά οίι ÷ñçόέιιδññέάβ, έάέ ÿόóé áÛάέάέ óά άóáñññáβ δç άññάóυδçδά οίö BIOS ίά άέéÛάέάέ δç άñβέιçόç οίι άβóέιι βóδά οί óýόóçίά ίά ίάέέíÛάέ άδυ οί άβóέι δÿόóáñά. Öι FreeBSD ίάέέíÛάέ έάέ άéδάέάβδάέ έάññέéÛ.

Ί Fred óδíá÷βάέé δç άññέéÛ οίö άέά άñέάδÿδ άέυιά ιÿññδ, έάέ óýίöñά ι Bill έάέ ο Fred άδññάόβάέιöι υδóé ÿ÷άé ÿñέáé ç βñά άέά ίέα άέυιά δññέδÿόάέά — βñά ίά άίάάέιβóιöι οόçί ιÿά ÿέάιöç οίö FreeBSD. Ί Bill άóáέññάβ οί άβóέι ιçāÿί ίέα έάέ βδάί έάέóñβδ δññιέçίάδóééυδ έάέ οίι άίόέάέέóδÛ ίά ÿίά Ûέει υññέι άβóέι άδυ οί "άñ÷άβι". Ί Bill έάδυδέí άάέάέέóδÛ δç ιÿά ÿέάιöç οίö FreeBSD óοιí ιÿιδ άβóέι ιçāÿί ÷ñçόέιιδññέβιδάδ óéδ ίάάέéÿδ Internet FTP άέóéÿόδδ οίö Fred. Ç άάέάóÛόóάóç άβίάδάέ ÷ññβδ δññιέβιδάδ.

Ί Fred ÷ñçόέιιδññέάβ δçί ιÿά ÿέάιöç οίö FreeBSD άέά ίáñέéÿδ ιÿññδ, έάέ δéóóιδññέάβ υδóé άβίάέ άñέάδÛ έάéβ άέά ÷ñβóç οóι διβίά ιç÷άίέéβδ. ÿ÷άé ÿñέáé ç βñά ίά άίόέáñÛόάέ υéç δç άññέéÛ οίö άδυ δçί δάέéÛ ÿέάιöç. óóé ι Fred δññιáñδάáβ οί άβóέι ίά άñέèιυ δÿόóáñά (οί δάέάδδάβι άίόβáñάóι δçδ δάέéÛδ ÿέάιöçδ οίö FreeBSD). Ί Fred άδññιçδάÿάδάέ υδóάί άίάέáéÿδδάέ υδóé άáí δδÛñ÷άé δβδιδά άδυ δçί δññέöéιç άññάóβά οίö óοιí άβóέι ίά άñέèιυ δÿόóáñά.

Δññ δβάáί όά άññÿίά;

¼όάί ι Bill ÿέάίá óυδññάñάóééβ άίόέáññάöβ οίö άñ÷έéιÿ SCSI άβóέιö ιçāÿί óδι SCSI άβóέι δÿόóáñά, ι άβóέιö δÿόóáñά ÿάέίá ι "ιÿιδ έεβññδ". ¼όάί ι Bill Ûέέάίá δçί άñβέιçόç óοιí SCSI BIOS βóδά ίά ιδññÿόάέ ίά ίάέέíβóáέ άδυ δç ññÛάá SCSI δÿόóáñά, άδéβδ éññυέάάδά οίι άάóδυ οίö. To FreeBSD ÷ñçόέιιδññέíÿόά άέυιά δç ññÛάá SCSI ιçāÿί. εóυδ άδöβ ç άέéááβ óδι BIOS ίά δññιέάéÿόάέ δçί ίáñέéβ β τέέβ öññδυóç οίö έβáέéά Boot β έάέ οίö Loader άδυ οίι άδééáñÿñ άδυ οί BIOS άβóέι, άέéÛ υδóάί άίάέÛάιöι όά δññññÛññάδά ίáβáçόçδ οίö δδñβίá οίö FreeBSD ç άñβέιçόç οίö BIOS έά άáññçéááβ, έάέ οί FreeBSD έά άδáíÿέέáέ óδç οδδóέιιέάέéβ άñβέιçόç οίι άβóέιι. Óδι δáñÛάάέáíá ίάδ, οί óýόóçίά óοιíÿ÷έóά ίά έάέóιöññάáβ óοιí άñ÷έéυ SCSI άβóέι ιçāÿί, έάέ υέá όά άññÿίά οίö Fred βδάί άέáβ, έάέ υ÷έ óοιí SCSI άβóέι δÿόóáñά. Öι άñññυδ υδóé οί óýόóçίά óáέíυδáί ίά έάέóιöññάáβ άδυ οί SCSI άβóέι δÿόóáñά βδάί άδéβδ ÿίά έάδάóéáÿάóίά δçδ άέñβδέίçδ δññιáññέβάδ.

Άβίάóδά άδöδ÷άβδ ίά άίάέίιβóιöιá υδóé άáí ÷Ûéçéáί έάέυειö άññÿίά έάδÛ δçί άίάέÛέöçç οίö óáέíñÿññδ άóδιÿ. Ί δάέéυδ SCSI άβóέιö ιçāÿί άίάέöβéçéá άδυ οί óññυ, έάέ υéç ç άññάóβά οίö Fred άδéóδññÛόçéá óά άδδυí (έάέ öβñά ι Bill ιÿñáέ υδóé ιδññάβ ίά ίáδñÛάέ υδ οί ιçāÿί).

Άί έάέ óδçί έóδññβά άδöβ ÷ñçόέιιδññέβéçéáί ιάçāñβ SCSI, ιέ άñ÷ÿδ έó÷ιöιí άñβóιö έάέ άέά ιάçāñÿδ IDE.

2.6.2 Ἀντιμετώπιση τοῦ Slices ἢ × ἢ Πόσος τοῦ FDisk

Ὁδηγός: Ἐπιλέξτε τὸν δίσκο ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος. Ἄν ἐπιλέξετε ἄλλο δίσκο, θάθετε τὴν ἀρχὴν τοῦ συστήματος ἐπὶ τοῦ δίσκου ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος. Ἄν ἐπιλέξετε ἄλλο δίσκο, θάθετε τὴν ἀρχὴν τοῦ συστήματος ἐπὶ τοῦ δίσκου ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος. Ἄν ἐπιλέξετε ἄλλο δίσκο, θάθετε τὴν ἀρχὴν τοῦ συστήματος ἐπὶ τοῦ δίσκου ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος.

Ἄν ἐπιλέξετε τὸν δίσκο ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος (standard installation) ὁπότε **sysinstall** ἐπιλέξετε τὸν δίσκο ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος:

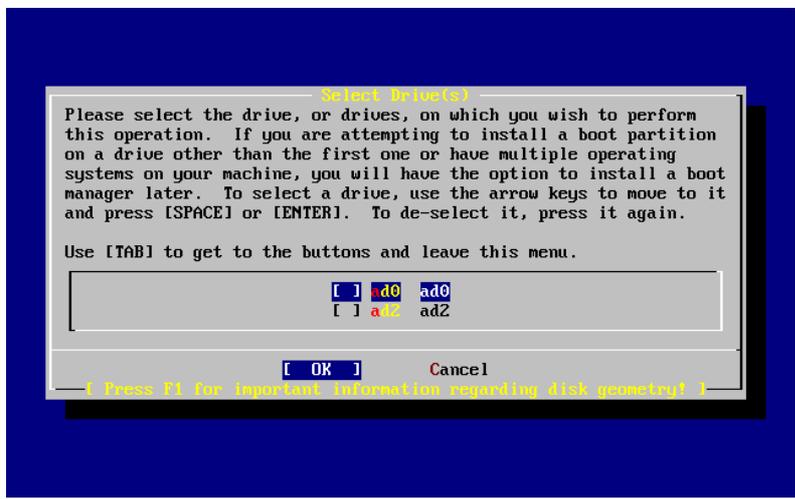
```
Message
In the next menu, you will need to set up a DOS-style ("fdisk")
partitioning scheme for your hard disk. If you simply wish to devote
all disk space to FreeBSD (overwriting anything else that might be on
the disk(s) selected) then use the (A)ll command to select the default
partitioning scheme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

[OK]

[Press enter or space]

Ἐπιλέξτε τὸν **Enter** ὅταν ἐπιλέξετε τὸν δίσκο ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος. Ἄν ἐπιλέξετε ἄλλο δίσκο, θάθετε τὴν ἀρχὴν τοῦ συστήματος ἐπὶ τοῦ δίσκου ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος. Ἄν ἐπιλέξετε ἄλλο δίσκο, θάθετε τὴν ἀρχὴν τοῦ συστήματος ἐπὶ τοῦ δίσκου ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος.

Ὁδηγός 2-13. Ἀντιμετώπιση τοῦ Ἀπόκομμένου ἀρχὴν τοῦ FDisk



Ἄν ἐπιλέξετε τὸν δίσκο ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος (standard installation) ὁπότε **sysinstall** ἐπιλέξετε τὸν δίσκο ἐπὶ ᾧ θάθετε τὴν ἀρχὴν τοῦ συστήματος:

Óéäöäðáðá ðé éä äéíüðáí áí äð÷-áðá äýí IDE äðóéíð, Ýíá ùð master óðí ðñððí IDE äéäãéðð, éäé Ýíá ùð master óðí ääýðáñí IDE äéäãéðð. Áí ðí FreeBSD ðíðð äñéèíýíóá ùððð ðíðð Ýñééóéä, äç. ùð ad0 éäé ad1 ùéä éä éäéðíðñáíýíóáí éáñíééÛ.

Áí ùðð ðñíóéÝðáíä íäðÛ Ýíá ðñððí äðóéí, ùð óðóéäðð slave óðí ðñððí IDE äéäãéðð, áððð éä äéíüðáí ðéÝíí ad1, éäé ç ðñíçáíýííáíç ad1 éä äéíüðáí ad2. Äðäéäð ðá ííüíáðá ðüí óðóéäððí (ùððð ad1s1a) ÷ñçóéíðñíéíýíóáé äéä ðçí äýñáðç ðüí óðóðçíÛðüí äñ÷-äðüí, íðñáð íá íáíéäéýððáðá íáóíééÛ ùðé eÛðñéä áðü ðá óðóððíáðá äñ÷-äðüí óäð äáñ äíðáíðáíýíóáé éáñíééÛ éäé ðñÝðäé íá äééÛíäðá ðçí ñýèíéóç ðíðð FreeBSD óäð.

Äéä íá íäðñáðáðáðá ðí ðñüäéçíä áððü, í ðñððíáð íðñáð íá ñðèíéóðáð íá íñíÛäéé ðíðð äðóéíðð IDE áíÛéíáá íä ðçí èÝóç ðíðð, éäé ù÷-é íä ðç óáéñÛ íä ðçí íðñá íáíé÷-íáýííóáé. Íä ðíðð ðñüðí áððü, í master äðóéíðð óðí ääýðáñí IDE äéäãéðð éä äðñéä ðÛíðá, ad2, äéíüíä éäé áí äáí ððÛñ÷-äé óðóéäðð ad0 ð ad1.

Ç ñýèíéóç áððð äðñéä éäé ç ðñíäðéääñÝíç äéä ðíðð ðñððíáð ðíðð FreeBSD, éäé äéä ðí èüäí áððü ç ðñíç ääð÷-íáé ad0 éäé ad2. Õí íç÷-Ûíçíä áðü ðí íðñáí ðððéçéä ç äééüíä äð÷-ä äðóéíðð master éäé óðíðð äýí äéäãéððÝð IDE, äñð äáñ äð÷-ä éäéÝíá äðóéí slave.

ðñÝðäé íá äðééÝíäðá ðí äðóéí óðíðð íðñáí éä äðñéä ç ääéäðÛóðáðç ðíðð FreeBSD éäé íá ðéÝíóáðá [OK]. Õí **FDisk** éä íäééíððáé, íä ðñíç áíððððíé÷ ç íä áððð ðíðð óáðíáðáé óðí Õ÷-ðíä 2-14.

Ç ðñíç ðíðð **FDisk** äðñéä ÷-ùñéóíÝíç óä ðñðá ðíðíáðá.

Õí ðñððí ðíðíä, ðí íðñáí éäéýððáé ðéð äýí ðñððáð äñáñÝð ðçð ðñíçðð, ääð÷-íáé éäððñÝñáéäð äéä ðíðð äðééäñÝíí äðóéí, ðíðð ðñáñéäíäÛíðí ðí ùñíä ðíðð óðí FreeBSD, ðç ääüíäðñáð ðíðð, éäé ðí ððñééüí íÝääéíð ðíðð.

Õí ääýðáñí ðíðíä ääð÷-íáé ðá slices ðá íðñáí ððÛñ÷-íðí óðí äðóéí ðç ääññÝíç óðéäñð, ðá ðçíäðá ðáá íðñá íäééíýíí éäé óäéäéðñíðí, ðüí ðí ääÛéä äðñéä, ðçí íñíáðá ðíðð Ý÷-íðí óðí FreeBSD éäé ðçí ðñáñéäðð ðíðð éäé ðíðð ðýðí ðíðð. Õí ðáñÛäéäñíä áððü ääð÷-íáé äýí íééñÛ á÷-ñçóéíðñíçðá slices, ðá íðñáí äðñéä ðáñáíÝñáéäð ðíðð ðñüðíð äéÛðáíçð ðüí äðóéíðð óðá PC. Ääð÷-íáé äðððçð Ýíá íääÛéí FAT slice, ðí íðñáí ððñáíñá äíðáíðáéðáé ùð c: óðá MS-DOS éäé Windows, éäéðð éäé íéä äéðáðáíÝíç éäðÛðíçðç ç íðñáí íðñáí íá ðñáñéÝ÷-äé éäé Ûééä äñÛíáðá íäçáðñí äéä ðí MS-DOS ð ðá Windows.

Õí ðñððí ðíðíä, ääð÷-íáé ðéð áíðñéÝð ðíðð äðñéä äéäéÝóéíäð ðçðí **FDisk**.

Õ÷-ðíä 2-14. ÕððééÝð Fdisk Êáðáðíððáéð ðñéí ðçí Äðñáíñááðá

```

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.
    
```

Õí ðé éä eÛíäðá ðññá áíáñðÛðáé áðü ðí ðüð èÝéäðá íá ÷-ùññóäðá ðí äðóéí óäð.

Εάοΰοιζός	Όόοζιά Άν÷άβυι	ΊΥάάειò	ΔάñέãñáöÞ
b	N/A	Ăăβòâ όζι δάñέãñáöÞ	¼ðùò Ý÷άέ Þαζ όοαζόζεάβ, ìðñăβòă ίά ÷ ùñβòăôă öι ÷ þñì swap áíŲìâóá óă ðñèÿýò äβóèÿò. Áí έάέ ζ έάοΰοιζός a άβίάέ äêÿèãñ, ζ όγίαάός äðéâŲèéáé όζ ÷ ðÞός όζò έάοΰοιζόςò b äéá öι ÷ þñì swap.
e	/diskn	Ōðüèÿéðÿ ŌìÞíá öιò Ăβóèÿò	Ōì ððüèÿéðÿ êñìŲóé öιò äβóèÿò έάóάéáíäŲíâóáé áðü íéá íääŲèç έάοΰοιζός. Ìðñăβòă äÿèéá ίά όζι äŲéäòă óόζι έάοΰοιζός a áíòβ äéá όζι e. Ųóóüóí, ζ όγίαάός ïñβæáé üðé ζ έάοΰοιζός a óă Ýíá slice ääóíäÿâóáé äéá öι όόζιá äñ÷άβυι root (/). Ăáí άβóóă öðÿ÷ñâùŲíÿé ίά äèÿÿòèÞóâôă áðöÞ όζ όγίαάός, äèèŲ öι sysinstall όζι äèÿÿòèäáβ, ÿðüðă áí όζι äèÿÿòèÞóâôă έάέ áóâβò ζ ääéáòŲóóáός έä άβίάé ðéí έäéãñÞ. Ìðñăβòă ίά ðñíóãñòÞóâôă áðöü öι όόζιá äñ÷άβυι üðÿò èŲéäòă. Óöì ðãñŲáäéãíä íáð, ζ ðñíóŲñðόςζ äβíâóáé óóÿòò έáóäéüãÿòò /diskn , üðÿò öι n άβίάé Ýíáð äñéèÿüð ðÿò äèèŲæáé äéá êŲèä äβóèÿ. ÁèèŲ ÿðñăβòă, áí ðñíóèíŲóä, íá ïñβóãóă äéèÞ óáð äèŲóáíç.

,÷ÿóáð áðÿóáóβóáé όζι äèŲóáíç öùí έáóáóìÞóâùí óáð, ìðñăβòă öþñă ίά όζι äçèÿÿòèñăÞóâôă ÷ ñçóéÿÿðÿèÞóáð öι **sysinstall**. Έä äăβòă öι ðãñéäŲóð ÿÞíóíä:

```

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 ]

```

ΔέŲóðă **Enter** äéá ίά íäééíÞóâôă öÿí äðáíäñãáóöÞ έáóáóìÞóâùí öÿò FreeBSD, ðÿò ïñŲæäóáé **Disklabel**. Ōì Ó÷Þíá 2-18 äăβ÷íáé όζι ÿèÿíç üðáí íäééíÞóâôă äéá ðñþός öÿñŲ öι **Disklabel**. Ç ÿèÿíç ÷ ùñβæáóáé óă ðñβă öìÞíóáá. Ìé ðñþóðð ãñãñŲò äăβ÷ñíóì öι üñíá öÿò äβóèÿò óóÿ ÿðíβì äÿðéäÿâóâ, έáé öÿ slice ðÿò ðãñéŲ÷άέ óéð έáóáóìÞóáéð ðÿò äçèÿÿòèñăäáβòă (óóÿ óçíäβì áðöü öÿ **Disklabel** óéð ïñŲæáé Partition name áíòβ äéá öÿ üñíá öÿò slice). Ç ÿèÿíç äðβόςò äăβ÷íáé όζι ðÿóüòçðă äêÿèãñÿò ÷ þñÿò ÿŲóá óóÿ slice, äçè. öÿ ÷ þñÿ ðÿò Ý÷άέ êñáðζεäáβ ÿŲóá óóÿ slice äèèŲ äáí Ý÷άέ äðÿäÿèäβ äéüíä óă êŲðÿéä έáοΰοιζός.

Ōì ÿŲóí όζò ÿèÿíçð äăβ÷íáé óéð έáóáóìÞóáéð ðÿò Ý÷íóÿ äçèÿÿòèñăζεäáβ, öÿ üñíá öÿò óóóðÞíáðÿò äñ÷άβυι ðÿò ðãñéŲ÷άέ êŲèä έáοΰοιζός, öÿ ÿŲάäèò öÿòò, έáé êŲðÿéäð äðéèÿäŲð ðÿò ó÷áðβæÿíðáé ÿä óç äçèÿÿòèñăβă öÿò óóóðÞíáðÿò äñ÷άβυι.

Ōì êŲóð ÿŲñòò όζò ÿèÿíçð äăβ÷íáé óă ðèÞèðñă ðÿò ÿðñăβòă ίά ÷ ñçóéÿÿðÿèÞóáð óóÿ **Disklabel**.

Ó ÷ Ðíá 2-18. ÆðáíññááóðÐò Disklabel ðí Sysinstall



Ïí Disklabel ðññáß íá äçëíññáßáë áððñíáðá éáðáðíßááéð áéá áóÛð, éáé íá ðíðð áðñáßáé ðññáðééááíÝíáð ðéíÝð. Ìé ðññáðééááíÝíáð ðéíÝð ððñíáßáëííóáé íá ççí áíßáéá áññð áíóñíáðñíÝíó éáññáßáëííó éáéíñéóíñÝ íáááëßí, í ðññáßáëííó áðñáðáßáé íá áÛóç ðí ÌÝááëíð ðíð áßóéíð. ÆíééíÛóðá ðí ðññá ðéÝáñíóáð ðí A. Èá ááßðá íéá ðéñíç ðññáé íá áððßí ððí Ó ÷ Ðíá 2-19. ÁíÛéíáá íá ðí ÌÝááëíð ðíð áßóéíð ðíð ÷ ñçóéíñðñéáßðá, Ìé ðññáðééááíÝíáð ðéíÝð ðññáß íá áßíáéß P éáé íá ðçí áßíáé éáðÛéççéáð. Áððñí ááí Ý ÷ áé ççíáóßá, áéáðß ááí ÷ ñáéÛááðáé íá ðéð áðñáá ÷ éáßðá.

Ïçíáßáëííó: Ì ðññáðééááíÝíóð ðññáßáëííó éáðÛóççð áðñáßáéé óðñí éáðÛéíáí /tmp ðçí áééß ðíð éáðÛóççð áíðß íá ðñí éáééóðÛ ÌÝñíð ðçð éáðÛóççð /. Áððñí áíçéÛáé óççí áðñáðáß ðéßññóçð ðçð éáðÛóççð / Ìá ðññáðñéíÛ áñ ÷ áßá.

Ó ÷ Ðíá 2-19. Ì ÆðáíññááóðÐò Êáðáðíßááéð Disklabel ðí Sysinstall Ìá ðéð Áððñíáðáð ðññáðééíáÝð

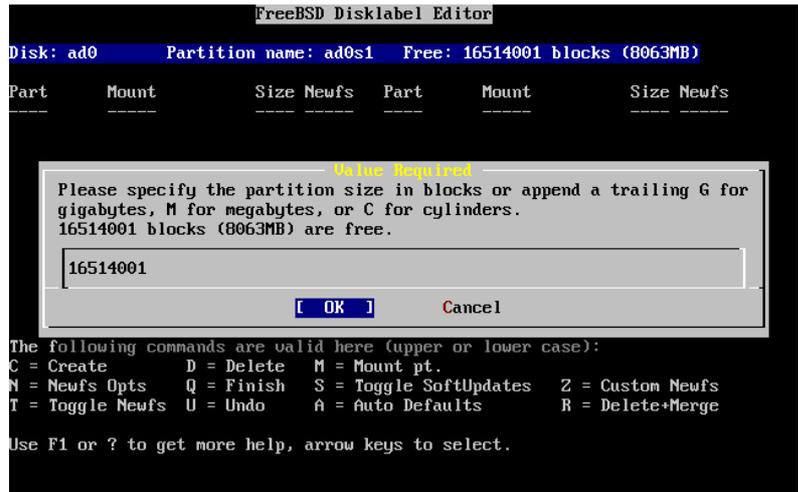


Áí áðééÝíáðá íá ðç ÷ ñçóéíñðñéáßðá ðéð ðññáðééááíÝíáð éáðáðíßááéð éáé èÝéáðá íá ðéð áíðééáðáððáðá Ìá ðéð

áééÝð óäð, ÷ ñçóéíðíéÞóäð óá ááéÛééá áéá íá áðééÝíáðð ðçí ðñþðç éáðÛðíççð éáé ðéÝóðð **D** áéá íá ðç óáÞóäð. ÁðáíáéÛááðð áéá íá óáÞóäð üéäð ðéð ðñíðáéííáíáð éáðáðíÞóäð.

Áéá íá äçíéíðñáÞóäð ðçí ðñþðç éáðÛðíççð (a, (ç íðíßá ðñíðáñðÛðáé ùð / — root), ááááéùèáßðá üðé Ý÷áðá áðééÝíáé ðí óóðóð slice ððí ðÛíü ìÝñíð ðçð ðèííçð, éáé ðéÝóðð **C**. Èá àíðáíéóðáß Ýíá ðéáßóéí áéáéüáíð áéá íá áéóÛááðð ðí ìÝááèð ðçð íÝáð éáðÛðíççð (üððð óáßíáðáé óðí Ó÷Þíá 2-20). Ìðñáßðá íá áéóÛááðð ðí ìÝááèð ùð ðñí áñééíü ìðéíð ðíð áßóéíð ðíð èÝéáðð íá ÷ ñçóéíðíéÞóäð Þ ùð áñééíü áéíéíðèíýíáíí áðü **M** áéá megabytes, **G** áéá gigabytes, **P** **C** áéá èðèßáñíðð.

Ó÷Þíá 2-20. Áéáéáñíð ×Þñíð áéá ðçí ÊáðÛðíççð Root



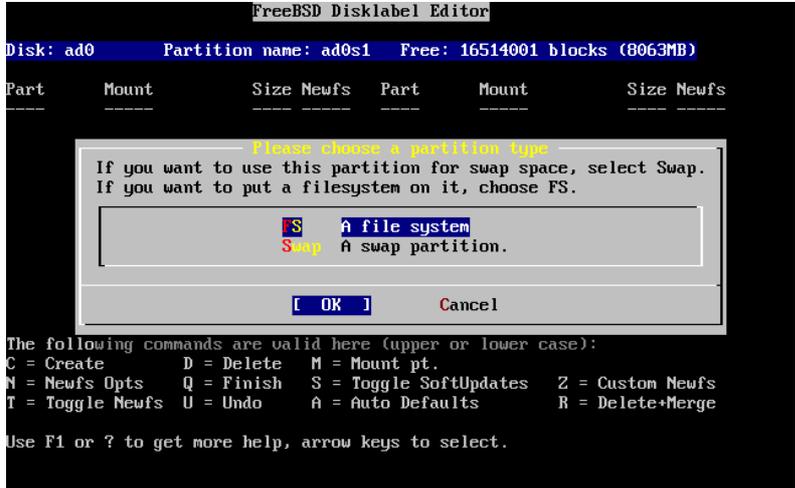
Ïí ðñíáðééáñíÝíí ìÝááèð ðíð óáßíáðáé éá äçíéíðñáÞóäé íéá éáðÛðíççð ðíð éáðáéáíáÛíáé üéí ðñí ððüéíéðí áéáéáñí ÷Þñí ðíð slice. Áí ÷ ñçóéíðíéáßðð óá íááÝçð ðñí éáðáðíÞóäúí ðíð ðáñéáñÛððáíá óðí ðñíçáíýíáíí ðáñÛááéáíá, óáÞóäð ðñí áñééíü ðíð óáßíáðáé íá ðí **Backspace**, éáé ðéçððñíéíáÞóäð **512M**, üððð óáßíáðáé óðí Ó÷Þíá 2-21. Êáðððéí ðéÝóðð [OK].

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



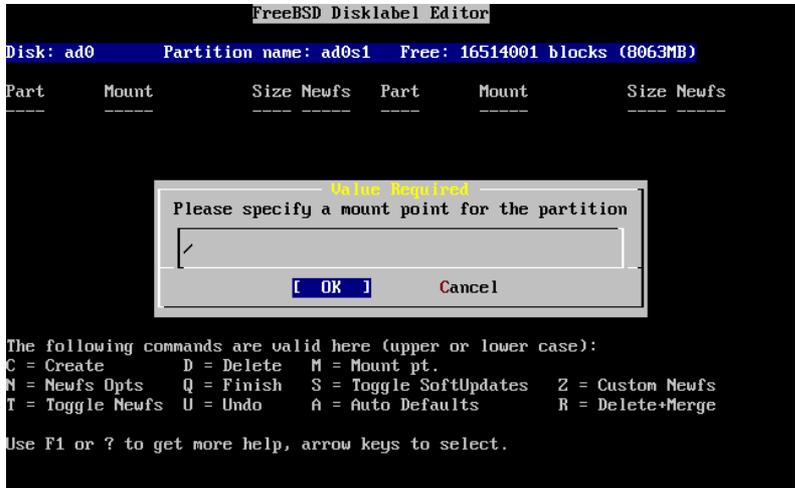
÷ῖῖόάο ἄδῆῆΥῖἄε ðῖ ἰΥἄἄειò ðçò εἄóÛòῖççò, εἄ ἄἢῖðçῆἄḂòἄ εἄóῖðεί ἄῆἄ ðῖ ἄῖ ç εἄóÛòῖççò εἄ ḂἄἢῆΥ ÷ ἄῆ εÛðῖῖ ὀγòóçῖἄ ἄἢ ÷ ἄḂῖῖ, P εἄ ἄḂῖἄῆ ÷ Ḃἢῖò swap. Ἰ ἄῆÛῆῖἄῖò ἄóóῖð ὀἄḂῖἄóἄῆ ὀóῖ Ó ÷ Ḃῖἄ 2-22. Ç ḂἢḂçç ἄóóP εἄóÛòῖççò εἄ ḂἄἢῆΥ ÷ ἄῆ ὀγòóçῖἄ ἄἢ ÷ ἄḂῖῖ, ἄῆἄ ἄóóῖ ἄῆΥῖἄῖò ῖóῆ ἄḂῖἄῆ ἄðῆἄἄἢΥῖῖ ὀῖ FS εἄῆ ḂῆΥóóἄ **Enter**.

Ó ÷ Ḃῖἄ 2-22. ἈðῆῆΥῖἄ ὀῖ Ὀγῖῖ ðçò ἘἄóÛòῖççò Root



Ὀγῖῖò, ἄðἄῆἄP ἄçῖῆῖῖἄḂòἄ ὀγòóçῖἄ ἄἢ ÷ ἄḂῖῖ, ḂἢΥðἄῆ ἰἄ ἄçῆḂòἄἄ ὀóῖ **Disklabel** Ḃῖῖ εΥῆἄἄἄ ἰἄ ἄḂῖἄῆ ç ḂἢῖóÛἢòççò ὀῖò. Ἰ ἄῖóḂóῖῆ ÷ ÷ò ἄῆÛῆῖἄῖò ὀἄḂῖἄóἄῆ ὀóῖ Ó ÷ Ḃῖἄ 2-23. Ὀῖ ὀçῖἄḂῖ ḂἢῖóÛἢòççò ðçò εἄóÛòῖççò root ἄḂῖἄῆ ὀῖ /, ἄῆἄ ἄóóῖ ἄἢÛðἄ /, εἄῆ ḂῆΥóóἄ **Enter**.

Ó ÷ Ḃῖἄ 2-23. ἈðῆῆΥῖἄ ὀῖ ὈçῖἄḂῖ ḂἢῖóÛἢòççò ὀῖò Root

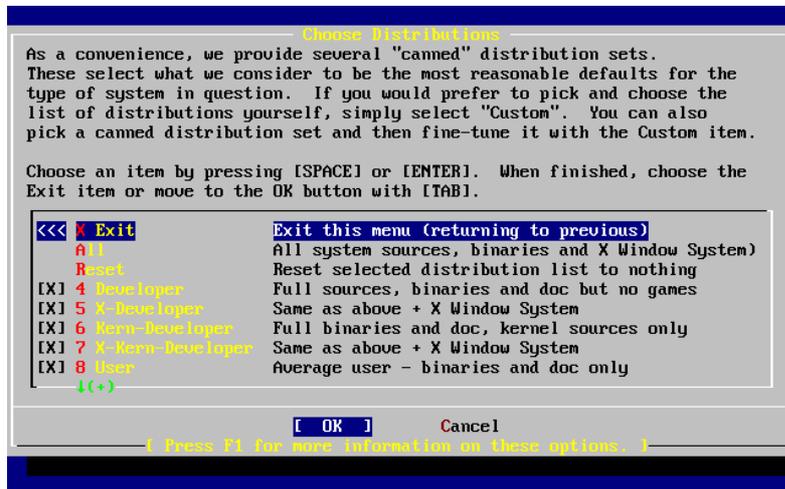


Ç ῖῆῖçç εἄóῖðεί εἄ ἄῖἄῖἄῆἄḂ ἄῆἄ ἰἄ ὀἄò ἄἄḂῖἄῆ ὀçῖ εἄóÛòῖççò Ḃῖῖ ῖῖῆὀ ἄçῖῆῖῖἄḂòἄἄ. Ἐἄ ḂἢΥðἄῆ ἰἄ ἄðἄῖἄῆÛἄἄἄ ἄóóP ὀçῖ ἄῆἄἄῆἄἄἄἄ ἄῆἄ ὀῆð Ûῆῆἄð εἄóἄἄῖPòἄῆð. Ἰἄóἄῖ ἄçῖῆῖῖἄḂòἄἄ ὀçῖ εἄóÛòῖççò swap, ἄἄῖ εἄ ὀἄò ἄççòçῆἄḂ ἰἄ ἄðῆῆΥῖἄἄἄ ὀçῖἄḂῖ ḂἢῖóÛἢòççò, εἄῆḂ ῖῆ εἄóἄἄῖPòἄῆð swap ἄἄῖ ḂἢῖóἄἢḂῖἄῆἄῆ ḂῖῖΥ. Ἰἄóἄῖ ἄçῖῆῖῖἄḂòἄἄ ὀçῖ ὀἄῆἄðἄἄἄἄ εἄóÛòῖççò, ὀçῖ /usr, ἰðῖἢἄḂἄἄ ἰἄ ἄὀPòἄἄἄ ὀῖ Ḃἢῖóἄῆῖῖἄἢῖ ἰΥἄἄειò, ἄῆἄ ἰἄ ÷ ḂççῆῖῖḂῖῆPòἄἄἄ ῖῆῖ ὀῖ ὀðῖῖῆḂῖ ÷ Ḃἢῖ ὀῖò slice.

[Yes] No

Ἄδελφοί μου [Yes] ἢ ὄχι ἀπευθύνεται ἀπὸ τὴν ἀντιμετώπιση τοῦ ὅπου ὁποῖοι ports P [No] ἀπὸ τὴν ὅπου ἀντιμετώπιση τοῦ. **Enter** ἀπὸ τὴν ὅπου ἀντιμετώπιση τοῦ. Ἔστω ἀντιμετώπιση τοῦ **Enter** ὅπου ἀντιμετώπιση τοῦ Choose Distributions (ἀντιμετώπιση τοῦ ὅπου ἀντιμετώπιση τοῦ).

Ὅπου Πίνακας 2-26. Ἀντιμετώπιση τοῦ Distribution Set



Ἄντιμετώπιση τοῦ ἀπὸ τὴν ἀντιμετώπιση τοῦ ὅπου ἀντιμετώπιση τοῦ Exit ἢ ὄχι ἀπευθύνεται, ἀντιμετώπιση τοῦ ἀντιμετώπιση τοῦ ὅπου ἀντιμετώπιση τοῦ **Enter** ἀπὸ τὴν ὅπου ἀντιμετώπιση τοῦ **Enter** ἀπὸ τὴν ὅπου ἀντιμετώπιση τοῦ.

2.8 Ἀντιμετώπιση τοῦ ὅπου Ἰσχύει Ἀντιμετώπιση τοῦ

Ἄντιμετώπιση τοῦ ἀπὸ τὴν CDROM ἢ DVD, ἀντιμετώπιση τοῦ ὅπου ἀντιμετώπιση τοῦ ἀπὸ τὴν ἀντιμετώπιση τοῦ Install from a FreeBSD CD/DVD. Ἀντιμετώπιση τοῦ ὅπου ἀντιμετώπιση τοῦ ἀπὸ τὴν ἀντιμετώπιση τοῦ **Enter** ἀπὸ τὴν ὅπου ἀντιμετώπιση τοῦ **Enter** ἀπὸ τὴν ὅπου ἀντιμετώπιση τοῦ.

Ἄπὸ τὴν ἀντιμετώπιση τοῦ ἀπὸ τὴν ἀντιμετώπιση τοῦ, ἐπιπέδον ὅπου ἀντιμετώπιση τοῦ ἀπὸ τὴν ἀντιμετώπιση τοῦ ἀπὸ τὴν ἀντιμετώπιση τοῦ.

Ἄπὸ τὴν ὅπου ἀντιμετώπιση τοῦ ἀπὸ τὴν ἀντιμετώπιση τοῦ ἀπὸ τὴν ἀντιμετώπιση τοῦ ἀπὸ τὴν ἀντιμετώπιση τοῦ. Ἄπὸ τὴν ὅπου ἀντιμετώπιση τοῦ **Enter** ἀπὸ τὴν ἀντιμετώπιση τοῦ ἀπὸ τὴν ἀντιμετώπιση τοῦ.

Ó ÷ Ðιά 2-30. Άðáññááóßá ðñò inetd.conf

```

^I (escape) menu    ^y search prompt  ^k delete line    ^p prev li       ^g prev page
^o ascii code     ^x search         ^l undelete line  ^n next li       ^u next page
^u end of file    ^a begin of line  ^w delete word    ^b back 1 char
^t begin of file  ^e end of line    ^r restore word   ^f forward 1 char
^c command        ^d delete char    ^j undelete char  ^z next word
L: 1 C: 1 =====
# $FreeBSD: src/etc/inetd.conf,v 1.72 2006/08/31 17:15:10 obrien Exp $
#
# Internet server configuration database
#
# Define *both* IPv4 and IPv6 entries for dual-stack support.
# To disable a service, comment it out by prefixing the line with '#'.
# To enable a service, remove the '#' at the beginning of the line.
#
#ftp  stream  tcp     nowait  root    /usr/libexec/ftpd      ftpd -l
#ftp  stream  tcp6   nowait  root    /usr/libexec/ftpd      ftpd -l
#ftp  stream  tcp     nowait  root    /usr/libexec/lukemftpd ftpd -l -r
#ftp  stream  tcp6   nowait  root    /usr/libexec/lukemftpd ftpd -l -r
#ssh  stream  tcp     nowait  root    /usr/sbin/sshd         sshd -i -4
#ssh  stream  tcp6   nowait  root    /usr/sbin/sshd         sshd -i -6
#telnet stream  tcp     nowait  root    /usr/libexec/telnetd   telnetd
#telnet stream  tcp6   nowait  root    /usr/libexec/telnetd   telnetd
#shell stream  tcp     nowait  root    /usr/libexec/rshd      rshd
#shell stream  tcp6   nowait  root    /usr/libexec/rshd      rshd

```

ÏáðÛ ðçì ðññíóðêç ðñì áðéððìçðñ ððçñáóðñ, éáé ïá ðçì ðßáóç ðñò **Esc** éá ãìóáíéóðáß Ýíá ïáññý ðì ðñðñ ðáð áðéðñÝðáé ïá áááððá áðñ ðì ðñññáññá, áðñèçéáññíóáð éáé ðéð áééááÝð óáð.

2.10.4 Áíáññáðññóç Áέóñññò ïÝóñ SSH

```

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

```

Áí áðééÝíáðá [Yes] éá áíáññáðññéçèáß ï sshd(8), ï ááßññáð ðñò **OpenSSH**. Ïá ðññ ðññðñ áððñ éá áðéðñÝðáðá áóóáðß áðñáéññóñÝíç ðññóááóç óðì ìç ÷ Ûíçñá óáð. Άέá ðáñéóóñðáñáð ðèçññññññáð ó ÷ áðééÛ ïá ðñ **OpenSSH** ááßðá ðñ ÕñÐñá 14.11.

2.10.5 Áñññðññ FTP

```

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

Yes      [ No ]

```

2.10.5.1 ñññçóç Áñññðññ FTP

ΆðééÝáññóáð ðñ ðññáððééáññÝññ [No] éáé ðéÝáññóáð **Enter** éá áðéðñÝðáðáé ïñññð óðññð ÷ ñßðóáð ðñò Ý ÷ ðññ ðññáñéáóññýð ïá èñáééñýð ïá Ý ÷ ðññ FTP ðññóááóç óðì ìç ÷ Ûíçñá.

2.10.5.2 ΆðéðñÝðññóáð ðñ Áñññðññ FTP

Ïðñéñáðßðñðá ïðññáß ïá Ý ÷ áé ðññóááóç óðì ìç ÷ Ûíçñá óáð, áí áðééÝíáðá ïá áðéðñÝðáðá ðéð áñññðññáð óðñáÝóáéð FTP. Éá ðñÝðáé ïá éÛáðáðá ððññéí óáð ðéð áðéðñéñÝð áóóáéáßáð ðñò éá áðéðñÝñáé ïéá ðÝðñéá ññéñéóç. Άέá ðáñéóóñðáñáð

δεçñïñβâð ó÷:âðéêÛ ïá ðçí áóöÛεάέá, äâβðâ ðï ÊâðÛεάει 14.

Άέá íá äðéõñÝðáðâ ðï áίβίðïï FTP, ÷ñçóεïñðιεβóðâ ðá äâεÛεάέá äέá íá äðέεÝíâðâ [Yes] εάέ íá ðεÝóâðâ **Enter**. Έá ÷ñâέáóðâβ íá äðέáââέεβóðââ íáfÛ ðçí äðέεïñâð 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.
    
```

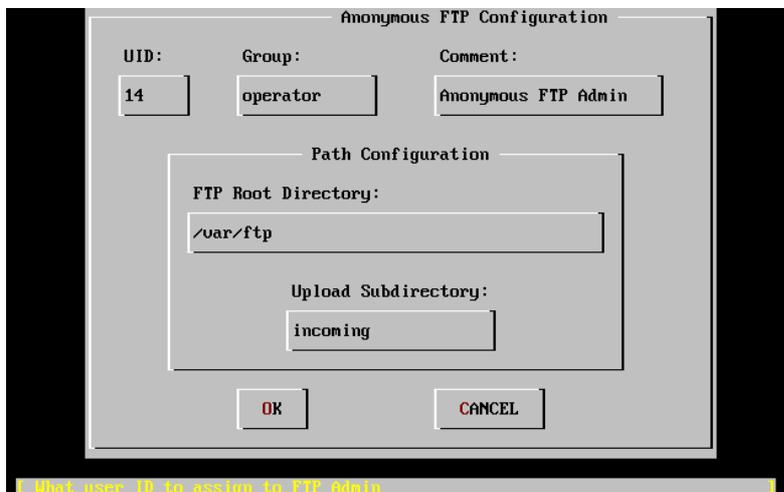
If you want the server to be read-only you should leave the upload directory option empty and add the -r command-line option to ftpd(8) in inetd.conf(5)

Do you wish to continue configuring anonymous FTP?

[Yes] No

Οί ïβίðïá áððü óáð áέáïðιεâβ äðβóçð ùðé ç ððçñâóβá FTP εά ðñÝðâé äðβóçð íá áíññâïðιεçεâβ óïï /etc/inetd.conf óâ ðññβðððúóç ðïð èÝέáðâ íá áíññâïðιεçεïγί íε áίβίðïâð ððíáÝóáέð FTP (ääβðâ ðï Õïβíá 2.10.3). ΆðέεÝíâð [Yes] εάέ ðεÝóðâ **Enter** äέá íá óðíá÷βóðâ. Έá äâβðâ ðçí áέïïεïðεç ïεïïç:

Ó÷:βíá 2-31. ÐññâðέεâïÝíâð Ñðεïβóáέð Áίβίðïï FTP



libat user ID to assign to FTP Admin

×ñçóεïñðιεβóðâ ðï **Tab** äέá íá äðέεÝíâðâ εάέ íá óïðδεçñβóðâ ðá áðññâβóçðá ðâââá ðεçñïñβêí:

UID

Ï áíááíùñέóðéεüð äñέεïùð (user ID) ðïð èÝέáðâ íá áðññâβóðâ óïïí áίβίðïï FTP ÷ñβóç. ¼έá ðá äñ÷âβá ðïð εá áíááâβίðïí óïïí äέáέñέóðβ FTP εá áίβέïðí óâ áððü ðï ID.

2.10.6.2 Ἐπιπέδου NFS

Ἡ ἐπιπέδου NFS ἀδελφὴ ἔχει ὁμοίως ἕνα ἴδιο ὄχι ἀπὸ τὸν ἴδιο ὅτι ἀπὸ τὸν ἴδιο NFS.

```

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

Yes   [ No ]
    
```

Ἡ ὁμοίως ἔχει ἕνα ἴδιο ὄχι ἀπὸ τὸν ἴδιο ὅτι ἀπὸ τὸν ἴδιο NFS. [Yes] ἢ [No] ἔχει ὁμοίως **Enter**.

2.10.7 Ἐπιπέδου Ἐπιπέδου (System Console Settings)

Ἡ ἐπιπέδου ἔχει ὁμοίως ἕνα ἴδιο ὄχι ἀπὸ τὸν ἴδιο ὅτι ἀπὸ τὸν ἴδιο NFS.

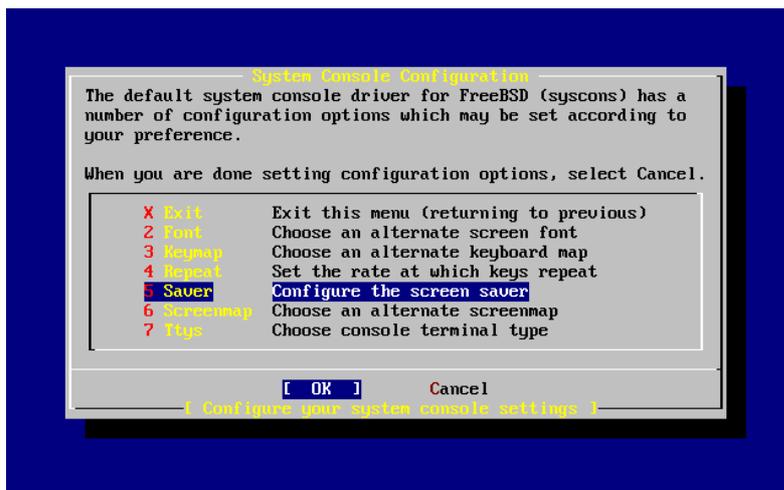
```

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

[ Yes ] No
    
```

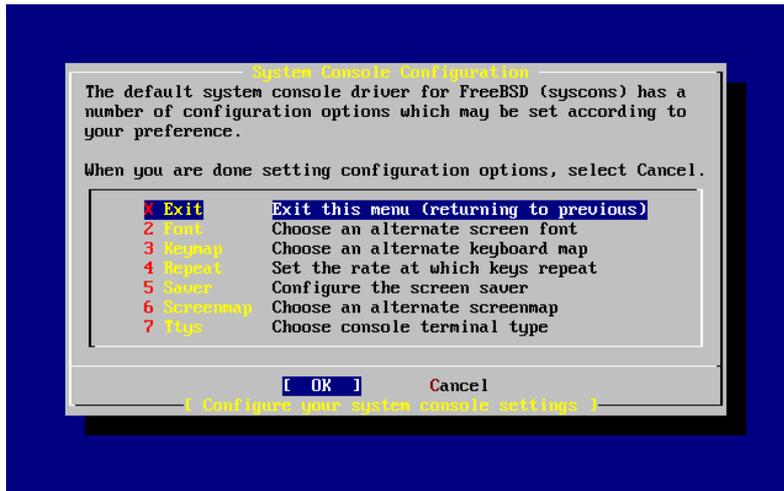
Ἡ ὁμοίως ἔχει ἕνα ἴδιο ὄχι ἀπὸ τὸν ἴδιο ὅτι ἀπὸ τὸν ἴδιο NFS. [Yes] ἔχει ὁμοίως **Enter**.

Ὁμοίως 2-34. Ἐπιπέδου Ἐπιπέδου Ὁμοίως



Ἡ ὁμοίως ἔχει ὁμοίως ἕνα ἴδιο ὄχι ἀπὸ τὸν ἴδιο ὅτι ἀπὸ τὸν ἴδιο NFS. × ἔχει ὁμοίως ἕνα ἴδιο ὄχι ἀπὸ τὸν ἴδιο ὅτι ἀπὸ τὸν ἴδιο NFS. Saver ἔχει ὁμοίως **Enter**.

Ὁ-Παρά 2-37. ἄλλο ἀδῆ ὁδὸ Νῶϊβόαεὸ Ἐπιπέδου ὉδοῦΠαρά



Ἀδῆ Ἐπιπέδου Exit ἔαε δῆ Ἐπιπέδου Enter ἔα ὁρίᾶ-βόαεᾶ ἰᾶ ὁδὸ ὁδῶϊεῖδᾶδὸ νῶϊβόαεὸ δῆ δῆ Ἐπιπέδου ἰᾶ ἄβῆῆῆ ἰᾶδῶ ὁδῶ ἄἄἔᾶδῶδῶδῶ.

2.10.8 Ἰνῆῆῆ Ἐπιπέδου ἰνῆῆῆ (Time Zone)

Ἐ ὁδοῦδῶ ἰνῆῆῆ ὁδῶ Ἐπιπέδου ἰνῆῆῆ, ἔα ἄδῆδῶδῶ ὁδῶ ἰῆ-Ἐπιπέδου ὁδῶ ἰᾶ ἄἔῆῆῆῆῆῆ ἄδῶδῶδῶ ὁδῶ ἰᾶ ὁδῶ ὁδῶδῶδῶ ἰᾶ ὁδῶ ὁδῶδῶδῶ ἰᾶ ἄἔῆῆῆῆῆῆ, ἔᾶῆῆ ἔᾶῆ ἰᾶ ἄἔῆῆῆῆῆ Ἐπιπέδου ἔᾶῆῆῆῆῆῆδῶ δῆ ὁ-ἄδῶῆῆῆῆῆ ἰᾶ ὁδῶ Ἐπιπέδου ἰνῆῆῆ.

Ὀῆ δᾶδῶῆῆῆῆῆ δῆ ὁδῶῆῆῆῆῆ ἄβῆῆῆῆ ἄἔᾶ Ἰῆῆ ἰῆ-Ἐπιπέδου δῆ ἄνῶῆῆῆῆῆ ὁδῶδῶ Ἀῆῆῆῆῆῆῆῆ Ἐπιπέδου δῆ δῆῆῆῆῆῆῆ. Ἐ ἄδῆῆῆῆῆῆ ὁδῶ ἔᾶ ἄἔῆῆῆῆῆῆ ἰᾶ ὁδῶ ἄἄἄῆῆῆῆῆῆ ὁδῶ ἔῆῆῆῆ.

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

[ Yes ] No
```

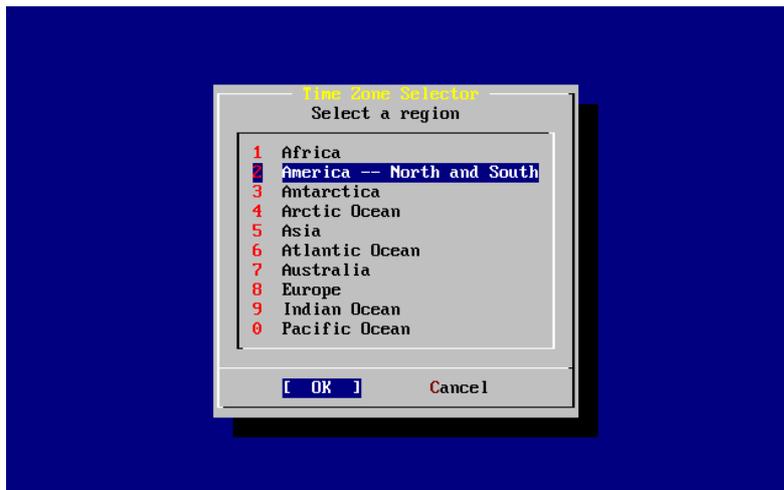
Ἀδῆ Ἰῆῆῆ [Yes] ἔᾶῆ δῆ ὁδῶῆ Enter ἄἔᾶ ἰᾶ ἰᾶδῶῆῆῆῆ ὁδῶ Ἐπιπέδου ἰνῆῆῆ.

```
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 ]
```

Ἀδῆ Ἰῆῆῆ [Yes] ἢ [No] ἰᾶ Ἐπιπέδου ἰᾶ ὁῆ δῶδῶ ἄβῆῆῆῆ ἰᾶ ὁῆ ἰᾶδῶῆ ὁδῶ ἰῆ-Ἐπιπέδου ὁδῶ ἔᾶῆ δῆ ὁδῶῆ Enter.

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



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

Ó ÷ Ðíá 2-39. ÅðéçĩãÐ ðçò ×þñáò óáò

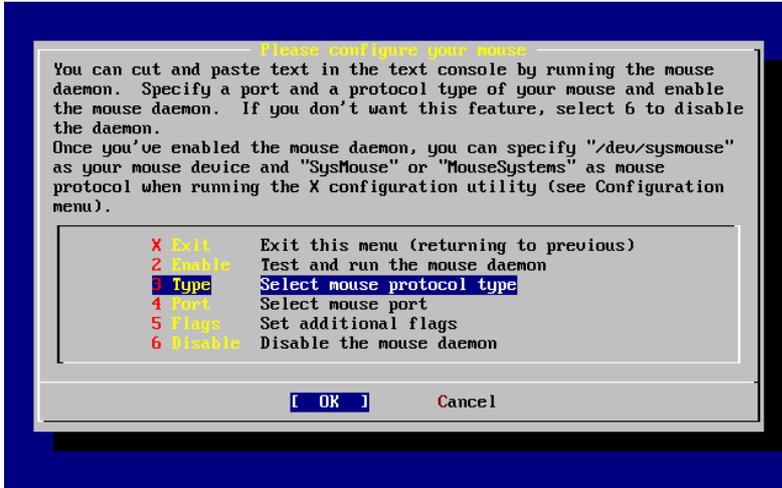


Åðéç Ýíòã ðçí éáòÛëçççç ÷ þñá ÷ ñçóéíðíéþíóáò óá äãÛëéá éáé ðéÝóáä **Enter**.

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

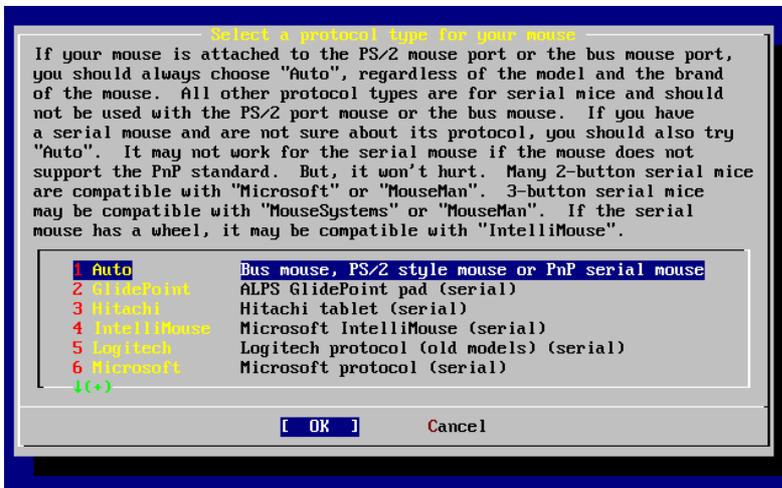
Ἄδειάστε [Yes] ἀνὰ ἰσ-USB πονοκέρ, ἢ [No] ἀνὰ USB πονοκέρ ἐὰν θέτε ἔχει **Enter**.

Ὁ - Πίνακας 2-41. Ἄδειάστε τὸν Πόνοκέρ τὸν Πόνοκέρ (Mouse Protocol Type)



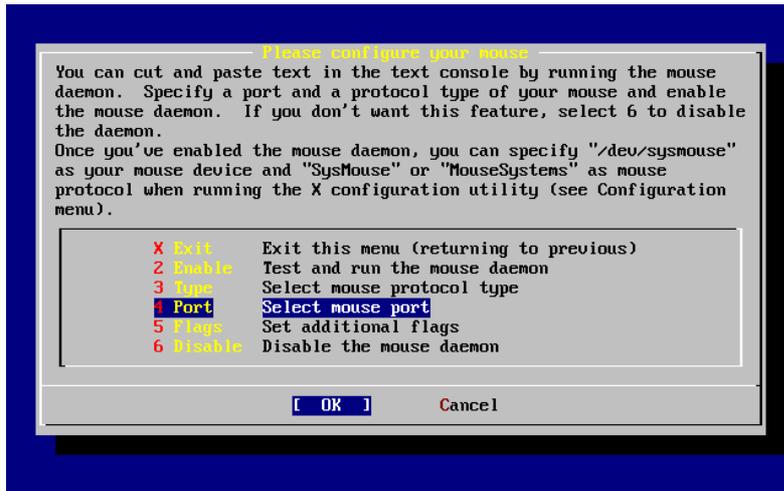
Ἐπιλέξτε τὸν 3 Type ἐὰν θέτε ἔχει **Enter**.

Ὁ - Πίνακας 2-42. Ἄδειάστε τὸν Πόνοκέρ τὸν Πόνοκέρ (Mouse Protocol)



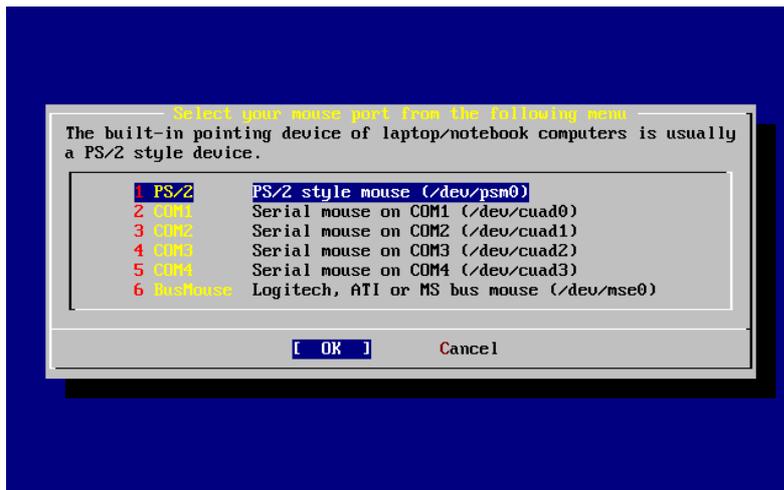
Ὁ πονοκέρ δὲ τὸν πονοκέρ τὸν πονοκέρ ὁ δὲ δὲ τὸν πονοκέρ, ἀπλοποιώντας τὸν PS/2, ἐὰν θέτε ἀπλοποιώντας τὸν πονοκέρ ἢ ἄλλο πονοκέρ. Ἄδειάστε τὸν πονοκέρ τὸν πονοκέρ, ἢ πονοκέρ τὸν πονοκέρ ὁ δὲ δὲ τὸν πονοκέρ ἐὰν θέτε ἔχει **Enter**. Ἄδειάστε τὸν πονοκέρ τὸν πονοκέρ [OK] ἐὰν θέτε ἔχει **Enter** ἐὰν θέτε ἔχει **Enter**.

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



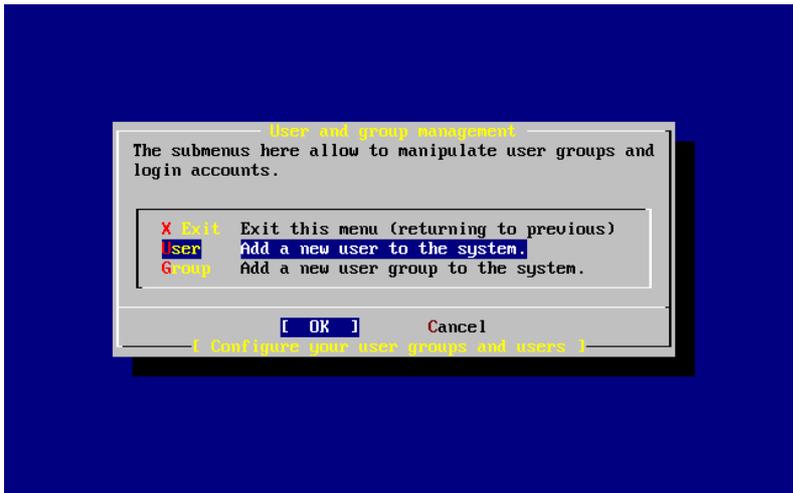
× ἠχοεῖτὴρ Πύλου ὁ ἁπλοποιεῖται ἄρα ἂν ἐπιλέξετε Port ἔπειτα πατήστε **Enter**.

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



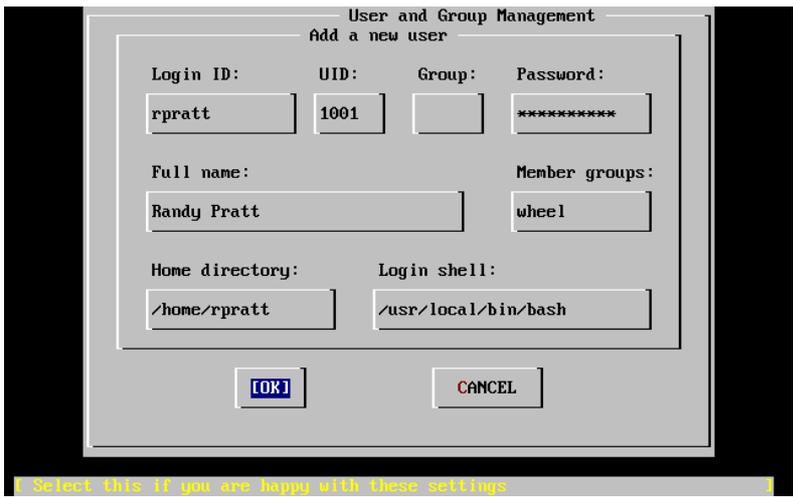
Ὁρῶντα 2-44. Ἐπιλογή Πύλου Ποντικίου (Mouse Port). Ἐπιλέξτε τὸν Πύλο Ποντικίου PS/2. Ἐπειτα πατήστε **Enter**.

Ó÷ Ðíá 2-51. ÁðéíãÐ ×ñÐóç



ÁðééÝíòá User ìá óá ääÛééá éáé ðéÝóðá Enter.

Ó÷ Ðíá 2-52. ÐñíòèÐçç Ðççñíòñéþí ×ñÐóç



Êáèðð éá áéóÛãäðá óá óðíé÷ áβá ðéÝæííóäð ðí **Tab** éá äìóáíβæííóäé íé ðáñáéÛòù ðáñéãñáóÝð óðí éÛòù ìÝñíð ðçð ðéííçð áéá íá óáð äìççÐóíóí óðçí áéóáãñãÐ ðùí áðáéóíγìáñùí ðççñíòñéþí:

Login ID

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

UID

Ï áíááññéóóééüð áñééíüð (numerical ID) áéá áððü ðí ÷ñÐóç (áóÐóðá ðíí éáñü áéá áððüíáðç áðééíãÐ).

Group

Ὁ ἰδιόμορφος ὀνόματος (group name) ἀνά ἀδελφὸν τοῦ ÷-ἡρώδους (ἀπὸ τοῦ ὀνόματος ἐὰν ἀνά ἀδελφὸν ἀδελφῶν).

Password

Ἡ ἐπιλογή (password) ἀνά ἀδελφὸν τοῦ ÷-ἡρώδους (ἀπὸ τοῦ ὀνόματος ÷-ἡρώδους ὅτι δὲ ἀπὸ τοῦ ἀδελφῶν!).

Full name

Ὁ ὄνομα ὀνόματος τοῦ ÷-ἡρώδους (ὄνομα).

Member groups

Ἡ ὀμάδα τοῦ ὀνόματος (groups) ὁμοίως ὀνόματος ἀπὸ τοῦ ÷-ἡρώδους (ἢ ÷-ἡρώδους. ὁ ἀνεξαρτησία τοῦ ὀνόματος).

Home directory

Ἡ ὀμάδα τοῦ ὀνόματος ἀπὸ τοῦ ὀνόματος (home directory) τοῦ ÷-ἡρώδους (ἀπὸ τοῦ ὀνόματος ἐὰν ἀνά ὀνόματος ὀνόματος ἀπὸ τοῦ ὀνόματος).

Login shell

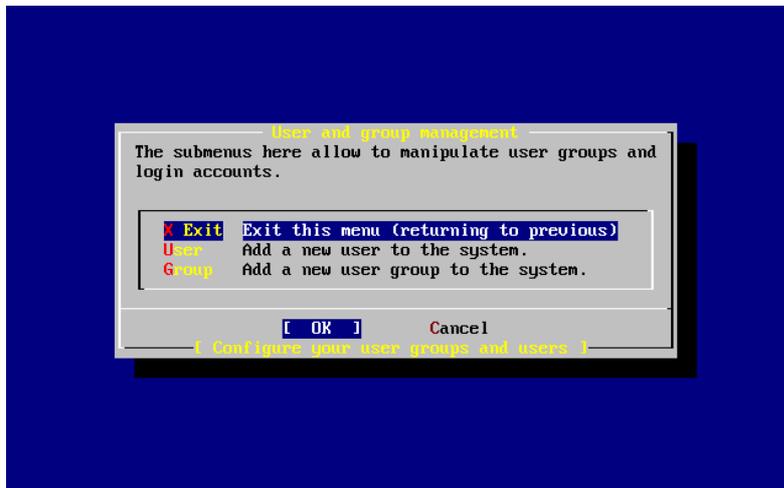
Ὁ ὀνόματος ὀνόματος (login shell) τοῦ ÷-ἡρώδους (ἀπὸ τοῦ ὀνόματος ἐὰν ἀνά ὀνόματος ὀνόματος, ÷. /bin/sh).

Ὁ ὀνόματος ὀνόματος ἀπὸ τοῦ ὀνόματος /bin/sh ὁ /usr/local/bin/bash ἀνά ἢ ÷-ἡρώδους bash ὀνόματος ὀνόματος ἀπὸ τοῦ ὀνόματος ὀνόματος. Ἡ ὀνόματος ὀνόματος ἢ ÷-ἡρώδους ὀνόματος ὀνόματος ὀνόματος ὀνόματος ὀνόματος ὀνόματος ὀνόματος BSD ἀπὸ τοῦ ὀνόματος C shell, ὀνόματος ὀνόματος ἢ ÷-ἡρώδους ὀνόματος /bin/tcsh.

Ἡ ÷-ἡρώδους ὀνόματος ὀνόματος ὀνόματος ὀνόματος ὀνόματος wheel ἀνά ἢ ÷-ἡρώδους ὀνόματος ὀνόματος ὀνόματος ὀνόματος (superuser) ἢ ἀνεξαρτησία root.

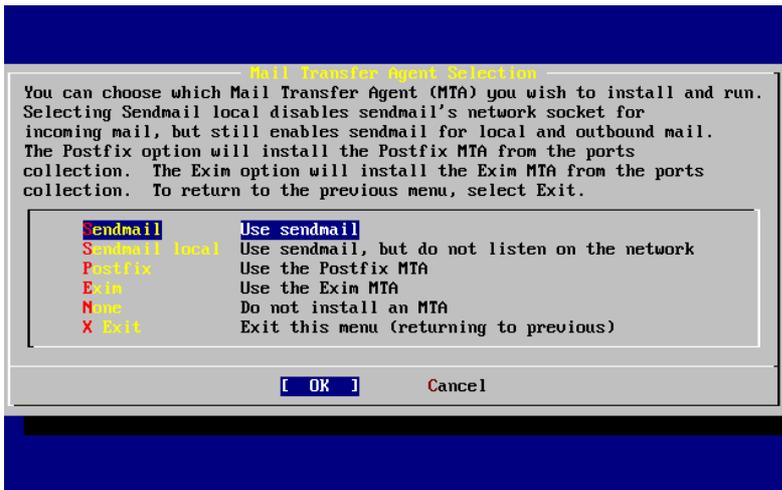
1/4οὶ ἀπὸ τοῦ ὀνόματος ὀνόματος ὀνόματος ὀνόματος, ὀνόματος [OK] ἀνά ἢ ὀνόματος ὀνόματος User and Group Management:

Ὁ ÷-ἡρώδους 2-53. ὀνόματος ὀνόματος ὀνόματος ÷-ἡρώδους × ὀνόματος ὀνόματος ὀνόματος ὀνόματος



Ὁ ὀνόματος sysinstall.

Ó÷ Ðíá 2-56. ÄðéíäÐ ÐñíäðéääñÝñö MTA



Óðí óçíäβí áðöü óáð äβíáðáé ç äðíáðüðçðá íá äðééÝíáðá ðíéí MTA íá ääéáðáóðÐóáðá éáé íá ñðèíβóáðá ùð ðñíäðéääñÝñö Õí MTA äáí äβíáé ðβðíðá ðñéóóüðäñí áðü ðíí äéáéñéóðÐ óá÷ðäññíäβíð í ðíβíð ðñíäðéääñÝñö óá ðçíýíáðá óðíðð ÷ñÐóáð ðíð óðóðÐíáðíð Ð ðí Internet.

Áí äðééÝíáðá **Sendmail** éá ääéáðáóðÐóáðá óçí äçíðóééÐ äóäññíäÐ äéáéñéóðÐ **sendmail** ç ðíβíá äβíáé éáé ç ðñíäðéääñÝñö äéá ðí FreeBSD. Ìá óçí äðééíäÐ **Sendmail local** éá ñðèíβóáðá ðí **sendmail** íá äβíáé ðí ðñíäðéääñÝñö MTA, äééÛ éá äðñíäññíðíéçðäβ ç ééáíüðçðá ðíð íá éáíäÛíáé email áðü ðí Internet. Ìé Ûééäð äðééíäÝð ääð, **Postfix** éáé **Exim** äñíðí ðñíñíéá ðá ðí **Sendmail**. Éáé íé äýí äéáíÝñíðí email. Ûóðüðí éÛðíéíé ÷ñÐóáð ðñíðéíýíí áððÝð ðéð äíáééáðéðééÝð éýóáéð MTA áðü ðí **sendmail**.

ÌáðÛ óçí äðééíäÐ áíüð MTA, Ð áí äðíðáóðβóáðá íá ðçí äðééÝíáðá Ýíá MTA, éá äíðáíéóðáβ ðí ðñíý ñýèíéóçð äééðýíð, ðá óçí äðüíáíç äðééíäÐ ðíð äβíáé NFS client.

Ç äðééíäÐ NFS client éá ñðèíβóáé ðí óýóðçíá óáð íá äðééíéíñíáβ ðá Ýíá äíððçññáðçðÐ ðÝóü NFS. ðáð äíððçññáðçðÐð NFS éáééóðÛ óðóðÐíáðá äñ÷äβñíí äéáéÝóéíá ðñíð Ûééá ðç÷áíÐíáðá ðÝóü ðíð äééðýíð, ÷ñçóéíððíéðíáð ðí ðñíðüéíééí NFS. Áí ðí ðç÷áíÐíáðá óáð äáí äéáéÝóáé óýíááóç ðíðééíý äééðýíð, ððñíáβðá íá áðβóáðá óçí éáéðíðñáβá áððÐ äðíäðéääñÝñö. Õí óýóðçíá ððñíáβ íá ÷ñäéáóðáβ ðñéóóüðäññð ñðèíβóáéð äñäüðäñá. Äáβðá óðí ÕíÐíá 29.3 äéá ðñéóóüðäññð ðççñíðíñáð ñýèíéóçð ðíð ðñéÛðç éáé ðíð äéáéñéóðÐ.

ÉÛðü áðü óçí äðééíäÐ áððÐ ððÛñ÷áé ç áíðβóðíé÷ç NFS server ç ðíβíá äðéðñÝðáé íá ñðèíβóáðá ðí óýóðçíá óáð ùð äíððçññáðçðÐ NFS. Ðñíðóβéáíðáé ðá ðíð ðñíðíí áððü íé äðñáñáβðçðáð ðççñíðíñáð äéá óçí äééβíçóç ðçð ððçññáóβáð RPC (remote procedure call). Õí RPC ÷ñçóéíððíééáβðáé äéá ðíð óðíðíéóíü ðüí óðíáÝóáñí ðáðáíý ðüí éññáñí éáé ðüí ðñíññáñÛððí.

Óðçí äðüíáíç äññáñÐ äñβóéáðáé ç äðééíäÐ **Ntpdate** ç ðíβíá ÷áéñβæáðáé ðíð óðá÷ñíéóíü ðñáð. ¼ðáí äðééä÷éäβ, äíðáíβæáðáé Ýíá ðñíý ùðð ðí ðñíáéÛðð:

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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 atkbd0
psm0: model Generic PS/2 mouse, device ID 0
vga0: <Generic ISA VGA> at port 0x3c0-0x3df iomem 0xa0000-0xbffff on isa0
sc0: <System console> at flags 0x1 on isa0
sc0: VGA <16 virtual consoles, flags=0x300>
sio0 at port 0x3f8-0x3ff irq 4 flags 0x10 on isa0
sio0: type 16550A
siol at port 0x2f8-0x2ff irq 3 on isa0
siol: type 16550A
ppc0: <Parallel port> at port 0x378-0x37f irq 7 on isa0
ppc0: SMC-like chipset (ECP/EPP/PS2/NIBBLE) in COMPATIBLE mode
ppc0: FIFO with 16/16/15 bytes threshold
ppbus0: IEEE1284 device found /NIBBLE
Probing for PnP devices on ppbus0:
plip0: <PLIP network interface> on ppbus0
lpt0: <Printer> on ppbus0
lpt0: Interrupt-driven port
ppi0: <Parallel I/O> on ppbus0
ad0: 8063MB <IBM-DHEA-38451> [16383/16/63] at ata0-master using UDMA33
ad2: 8063MB <IBM-DHEA-38451> [16383/16/63] at ata1-master using UDMA33
acd0: CDROM <DELTA OTC-H101/ST3 F/W by OIPD> at ata0-slave using PIO4
Mounting root from ufs:/dev/ad0s1a
swapon: adding /dev/ad0s1b as swap device
Automatic boot in progress...
/dev/ad0s1a: FILESYSTEM CLEAN; SKIPPING CHECKS
/dev/ad0s1a: clean, 48752 free (552 frags, 6025 blocks, 0.9% fragmentation)
/dev/ad0s1f: FILESYSTEM CLEAN; SKIPPING CHECKS
/dev/ad0s1f: clean, 128997 free (21 frags, 16122 blocks, 0.0% fragmentation)
/dev/ad0s1g: FILESYSTEM CLEAN; SKIPPING CHECKS
/dev/ad0s1g: clean, 3036299 free (43175 frags, 374073 blocks, 1.3% fragmentation)
/dev/ad0s1e: filesystem CLEAN; SKIPPING CHECKS
/dev/ad0s1e: clean, 128193 free (17 frags, 16022 blocks, 0.0% fragmentation)
Doing initial network setup: hostname.
ed0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    inet 192.168.0.1 netmask 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.

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.

2.10.16.2 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.

ΕὰοÛεάεί 3 ΆάόέέÛò ίίίεάò óοι UNIX®

ΑίάεάυñçιÛίτ áδυ όιί Chris Shumway.

3.1 Óýίίøç

Ôι áευείρεί εάοÛεάεί εά εάέÛøáé óεò ááóέέÛò áίóτēÛò εάέ εάέóιτññáβáò óιτ εάέóιτññáεέίÛ óóóóΠιáóιτò FreeBSD. Ôι ιάάáέÛøáñι ιÛñιτò áóòòò ðçò ÷ççò ó÷-áòβáεάóáé ιá υεά óá È.Ó. ðιτò áβίáé ááóέóιÛίá óοι UNIX. ΆÛί ç ÷çç óáò óáβίáóáé ιεέáβá ιðññáβóá ιá áεάóñÛίáóá áñΠáιná áóóυ όι εάοÛεάεί. ΆÛι - áίóέέÛòò - áβóóá ιÛιτò óοι FreeBSD óυóá ιðυóáΠðιόá εά ðñÛðáé ιá áεάáÛóáóá ðñιόáεóέέÛ ιευίεεçñι όι εάοÛεάεί.

ÌáòÛ ðçί áιÛáιύç óιτ εάóáέáβιτò, εά áιññβáεάóá:

- ðυò ιá ÷ñçóείιðιέáβóá óεò “áéείίέέÛò είίóυεάò” óιτ FreeBSD.
- ðυò εάέóιτññáιÛί ιέ Ûááεάò áñ÷-áβυι óοι UNIX εάέ εά εάóáεÛááóá ðçί ÷ñΠóç óυι file flags óοι FreeBSD.
- Ôçί ðñιáðéεááιÛίç áéÛóáιç óιτò óóóóΠιáóιτò áñ÷-áβυι óιτò FreeBSD.
- Ôçί ιñáÛύóç óυι áβóέυι óοι FreeBSD.
- Ôé áβίáé εάé ðò εάέóιτññááβ ç ðñιόÛñòççç (mount) εάé áðιðñιόÛñòççç (unmount) óóóóçιÛòυι áñ÷-áβυι.
- Ôé áβίáé ιέ áεáñááóáβáò (processes), óá óΠιáóá (signals) εάé ιέ ááβιιíáò (daemons).
- Ôé áβίáé όι εÛέóóιτò (shell) εάé ðυò ιá áεεÛáεáóá όι ðñιáðéεááιÛίτ ðáñéáÛεείí áñááóáβáò.
- ðυò ιá ÷ñçóείιðιέáβóá ááóέέÛ ðñιáñÛιιáóá áðáιáñááóáβáò εάειÛίτò (editors).
- Ôé áβίáé ιέ óóóéáòÛò (devices) εάé óá áñ÷-áβá óóóéáòòò (device nodes).
- ðιέá Ûéáιύç áéóáεÛóέιυι ÷ñçóείιðιέáβóáé óοι FreeBSD.
- ðυò ιá áεάáÛáεáóá óéò óáéβááò áιççéáβáò (manual pages) áéá ðáñéóóóυóáñáò ðεçñιιöιñβáò.

3.2 ΆέέιίέέÛò Èίίóυéáò εάé ÓáñιáóééÛ

Ìðññáβóá ιá ÷áéñéóóáβóá όι FreeBSD ιá áéÛóιñιτò óñυðιτò. Ιáò áδυ áóóιÛò, áβίáé ðεççéðñιεáβιόáò áίóτēÛò εάέιÛίτò óá Ûίá óáñιáóééυ. Ìá áóóυ όιι óñυðι Û÷-áóá óóá ÷Ûñéá óáò Ûίá áóÛéééóι εάé áóιáóυ εάέóιτññáééυ óýóóçιá UNIX. Άóòò ç áιύóçóá ðáñéáñÛóáé óé áβίáé óá “óáñιáóééÛ” εάé ιέ “είίóυεάò” εάé ðυò ιðñιÛί ιá ÷ñçóείιðιέçείÛί óοι FreeBSD.

3.2.1 Ç Èίίóυéá

ΆÛι ááι Û÷-áóá ðòειβóáé όι FreeBSD ιá ιáéείÛ áóóυιáóá εÛðιέι áñáóééυ ðáñéáÛεείí áñááóáβáò, óυóá áιÛòò ιáòÛ ðçί áéεβίççç óιτò óóóóΠιáóιτò εάé ðçί ιείίεβñυóç óυι óáιáñβυι áéεβίçççç (startup scripts) εά áιóáιέóóáβ ç ðñιðñιð óýíááççò (login prompt). Èá ááβóá éÛðé ðáñυιέι óóçι ιευίç óáò:

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


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

Óὀὐἰὸάñ ãñ ÷ ãßá ὀδὶḑãñβεçøçð C (include files).
 Ἀñ ÷ ãßá ãeãeἱeἱeçêþἱ.
 ἈeἘὐἰñá ãñ ÷ ãßá ãããñÝἱἱ ãἱçèçðeéþἱ ḑñἱãñãñἘὐἱ.
 Ἀãβἱἱἱãð ὀðὀðḐἱáðἱð & ãἱçèçðeéἘἘ ḑñἱãñἘἱἱáðá
 ὀðὀðḐἱáðἱð (ãeðãeἱἱἱóáe áḑἱ Ἐeéã ḑñἱãñἘἱἱáðá).
 ὐἱḑeéἘἘ ãeðãeÝóeἱá, ãeãeἱeἱeḐeãð, eðe. Ἀḑβὀçð ãßἱáe
 eáe ἱ ḑñἱeãeἱñeóἱÝἱð ḑñἱñeóἱἱð eéá ḑñἱãñἘἱἱáðá ḑἱð
 ããeãeβὀðáἱðáe áḑἱ ὀá ports ḑἱð FreeBSD. ἸÝὀá ὀðἱἱ
 /usr/local, ÷ñçóeἱἱḑἱeãßðáe ãáἱeἘἘ ç ãeἘὐáἱç ḑἱð
 /usr ḑἱð ḑañeãñἘἘðáðáe ὀðἱ hier(7). Ἀἱeñἱἱἱóáe ἱe
 eáðὐeἱἱἱe ὀãeβãἱἱ ἱççeãßáð man, ḑἱð ãñβὀeãðáe Ἐἱἱáðá
 eἘἘðἱ ḑἱἱ /usr/local eáe ἱ ÷ eἘἘðἱ ḑἱἱ ὀἱἱ
 /usr/local/share, eáeḐð eáe ç ὀãeἱçñβἱðç eἘἘã port
 ḑἱð ãñβὀeãðáe ὀðἱἱ share/doc/port .
 ἈÝἱðñἱ ḑñἱñeóἱἱý ḑἱð ãἱãñḑἱðáe áḑἱ ὀçἱ ãñ ÷ eðãeðἱἱeἘἘḐ
 ḑἱð ἱç ÷ áἱḐἱáðἱð eáe ḑãñἘἘãðáe ἱãðáãeἱððβeἱἱóáð ὀἱ
 äÝἱðñἱ /usr/src.
 Ç ὐðeἱἱḐ Ports ḑἱð FreeBSD (ḑñἱeññãðeéἱ).
 Ἀãβἱἱἱãð ὀðὀðḐἱáðἱð & ãἱçèçðeéἘἘ ḑñἱãñἘἱἱáðá
 ὀðὀðḐἱáðἱð (ãeðãeἱἱἱóáe áḑἱ ÷ ãḐὀðáð).
 Ἀñ ÷ ãßá áἱἱἱἘñðçðá áḑἱ ὀçἱ Ἀñ ÷ eðãeðἱἱeἘἘ ḑἱð
 ἱç ÷ áἱḐἱáðἱð.
 Ἀñ ÷ ãßá BSD eáeḐ ḑἱḑeéἘἘ ãñ ÷ ãßá ḑçããβἱð eḐãeéá.
 ἈeðãeÝóeἱá, ãeãeἱeἱeḐeãð, eðe. ãeá ὀçἱ ãeãἱñḐ X11R6
 (ḑñἱeññãðeéἱ).
 Ἀñ ÷ ãßá áἱἱἱἱἘἘ (log) ãeáὀἱñἱἱ ÷ ãḐὀáἱἱ, temporary,
 transient, eáe spool. ἱãñeéÝð ὀἱñÝð ḑñἱóáñḑἱðáe ὀðἱἱ
 /var Ýἱá ὀýὀçἱá ãñ ÷ ãßἱἱ ἱἱḐἱçð. Ἀḑἱð ἱḑἱñãß ἱá
 ãḑeðáð ÷ eãß áðἱἱἱáðá ÷ ãçóeἱἱḑἱeḐἱóáð ὀeð ὀ ÷ ãðeéÝð
 ἱãðáãeçðÝð varmfs ḑἱð rc.conf(5) (Ḑ ἱã ἱßá eáðá ÷ Ḑñçðç
 ὀðἱ /etc/fstab, ããβðã ὀeð mdmfs(8)).
 ἈeἘὐἰñá ãñ ÷ ãßá ὀðἱãἘἱἱἱ ḑἱð ὀðὀðḐἱáðἱð.
 Ἀñ ÷ ãßá ãñἱἱáðἱeéãἱἱðβἱð (mailbox) ÷ ãçóðḐἱ.
 ἈeἘὐἰñe eáðὐeἱἱe ḑãñἱ ÷ Ýðãðçðð (spool) ãeðὀḑἱḑἱ
 eáe çãeðñἱeἘἘḐ ãeççeἱñãñãðβáð ḑἱð ὀðὀðḐἱáðἱð.
 ḐñἱóἱñeἱἘἘ (temporary) ãñ ÷ ãßá. ὐá ãñ ÷ ãßá áðḑἘἘ
 ὀἱἱḐeἱð ãeáðçñἱἱóáe eáðἘἘ ὀçἱ ãeἘñeãeá ãḑáἱãeḑἱççðçð
 ḑἱð ὀðὀðḐἱáðἱð, ãeðἱð áἱ ἱ /var ãßἱáe Ýἱá ὀýὀçἱá
 ãñ ÷ ãßἱἱ ἱἱḐἱçð.
 Ἀḑãeἱἱἱβὀãeð (maps) NIS.

3.5 ÌñáÙñòç Άβóειò

Ç ðéèñóòáñç ðñÙάά ðñáÙñòçòò ðñò ÷ñçóειñðñεάβ ðñ FreeBSD áέά ðá ðññάέ ðñ÷άβá άβñáέ ðñ ðññá ðñ÷άβñò. Óá ðññáòá ðñ÷άβññ ðññáέ ðñóáβòççòá óòá έáòáέέάβá- ðéèñÙ, ðñ ðññβñ óçñáβñáέ ðñέ ðñ readme.txt έάέ ðñ README.TXT άβñáέ άýñ έέέóññáòéέÙ ðñ÷άβá. Óñ FreeBSD άáñ ÷ñçóειñðñεάβ ðçñ ðñÝέòáòç .txt ðñ÷άβñò áέά ðá ðññòáειññβóáέ áñ Ýñá ðñ÷άβñ άβñáέ ðññáñáñá, ð Ýáñáóñ, ð Ùεεñò óýðñò áááñÝññ.

Óá ðñ÷άβá ðññεçέáýññóáέ óá έáòáέειñòð. ðáò έáòÙεññò ðññáβ ðá ðçñ ðññέÝ ÷άέ ðñ÷άβá, ð ðññáβ ðá ðññέÝ ÷άέ έέέóññòÙáò ðñ÷άβá. ðáò έáòÙεññò ðññáβ άðβòçò ðá ðññέÝ ÷άέ Ùεεñò έáòáέειñòð, άðέòñÝðññóáò óáò ðá έáòáóέέáòÙóáòá ðέá έáñáñ÷έέð ðññ έáòáέειñò ðññò έáòÙεññέ áóùέέέβñò Ùεεñò έáòáέειñòð. Áòòñ ðáò άðέòñÝðñέ ðá ðñááñóñòñá ðá áááñÝñá ðáò ðñέý áòεññóáñá.

Ç áñáòñÙ óá ðñ÷άβá έάέ έáòáέειñòð áβñáòáέ áβññóáò ðñ ðññá ðñ÷άβñò ð ðñ ðññá έáòáέειñòð, áεñεñòέáβ ðβá áñέóáòññóòñòç έÙεáòñò, / έάέ Ýðáέóá ðñεñáðñòñá Ùεεñ έáòÙεεçεñ ðññá έáòáέειñòð. ΆÙñ Ý÷áòá ðññ έáòÙεññá ðññ, ðñ ðññò ðññέÝ ÷άέ ðññ έáòÙεññá ðññ, ðñ ðññò ðññέÝ ÷άέ ðñ ðñ÷άβñ readme.txt, ðñòá ðñ ðñεεçññññññ ðññá, áέέáñññð (path) óðñ ðñ÷άβñ άβñáέ ðññ/ðññ/readme.txt.

ΈáòÙεññέ έάέ ðñ÷άβá ðññεçέáýññóáέ óá Ýñá óýóòçñá ðñ÷άβññ. ΈÙεá óýóòçñá ðñ÷άβññ ðññέÝ ÷άέ Ýñá έáòÙεññá óðñ áñòáññ άðβðááñ, ðñ ðññ Ùεáòáέ root (ñέάέειñò) έáòÙεññò áέά ðñ óóáέáñεñέÝññ óýóòçñá ðñ÷άβññ. ðñ root έáòÙεññò ðññáβ ðá ðññέÝ ÷άέ Ùεεñò έáòáέειñòð.

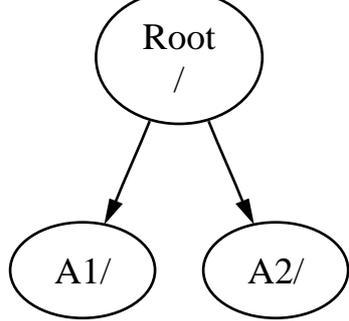
Áòòñ ðέέáñð áβñáέ ðñññεññ ðá ðñεñáðñòñá Ùεεñ έέέóñññáέέñ óýóòçñá Ý÷áòá ÷ñçóειñðñεáέ. Ùóòòñ ðñÙñ÷áò ðññ ðññέέÝð áέáòññÝð. Άέá ðññÙáέέáñá, ðñ MS-DOS ÷ñçóειñðñεάβ \ áέá ðá áέá÷ññβáέέ ðññáòá έáòáέειñò ðññέé ðñ÷άβññ, áñ ðñ Mac OS® ÷ñçóειñðñεάβ :.

Óñ FreeBSD άáñ ÷ñçóειñðñεάβ ðñññáòá ðñçáññ ðñ ðññáòá ðñçáññ óòç áέéáñññð. ΆðñÝñò ðññ έá ðññÝðñέ ðá ðññóáòá c:/ðññ/ðññ/readme.txt óðñ FreeBSD.

ÁñóέέÝòòð, Ýñá óýóòçñá ðñ÷άβññ έáέññβáéáέέ ðð root óýóòçñá ðñ÷άβññ. ðññέéέειñò έáòÙεññò ðññ root óóóððñáòñò ðñ÷άβññ áñáòÝññáòáέέ ðð /. ΈÙεá Ùεεñ óýóòçñá ðñ÷άβññ ðññóáñòÙóáέ έÙòò áðñ ðñ root óýóòçñá ðñ÷άβññ Άáñ Ý÷άέ óçñáòóá ðññòñò ðñβóειòð Ý÷áòá óðñ FreeBSD óýóòçñá óáò, έÙεá έáòÙεññò áñóáññáέáέέ ðá άβñáέ ðñññò ðññ βáέñò άβóειò.

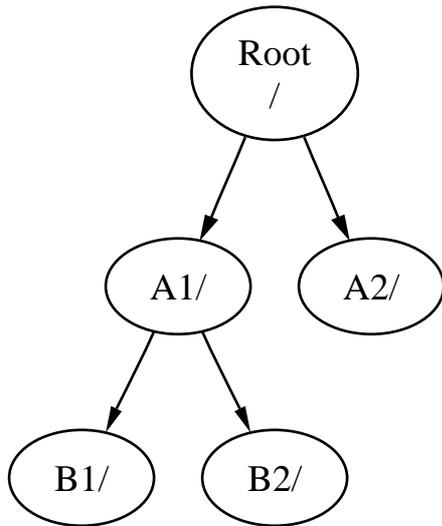
Áò ðññέÝóññá ðñò Ý÷áòá ðññá óóóððñáòá ðñ÷άβññ, óá ðññÙεññá A, B έάέ C. ΈÙεá óýóòçñá ðñ÷άβññ Ý÷άέ Ýñáñ ðñέéέέñ έáòÙεññá, ðñ ðññò ðññέÝ ÷άέ άýñ Ùεεñò έáòáέειñòð, ðñ ðñò ðññÙεññá A1, A2 (έάέ ðññññòð B1, B2 έάέ C1, C2).

Áò έáññóññá ðñέ ðñ A άβñáέ ðñ root óýóòçñá ðñ÷άβññ. Áñ ÷ñçóειñðñεáòá ðçñ áñòñð 1s áέá ðá ááβòá ðá ðññέá÷ññá ðññ ðñέéέέειñò, έá ááβòá άýñ ðñέéáέéειñòð, A1 έάέ A2. Óñ áÝñòññ ðñò έáòáέειñò ðññέéέέέέέé ðññ áòòñ:



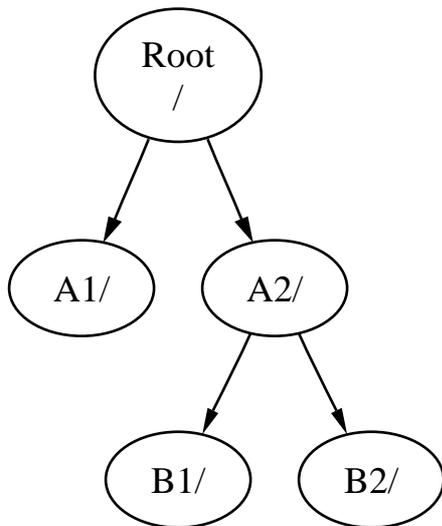
ΈÙεá óýóòçñá ðñ÷άβññ ðññÝðñέ ðá ðññóáñòÙóáέέ óá Ýñá έáòÙεññá έέέóññáέέέέέé óóóððñáòñò ðñ÷άβññ. Áò ðññέÝóññá ðñò έÝέáòá ðá ðññóáñòðñáòá ðñ óýóòçñá ðñ÷άβññ B óðññ έáòóñέñáñ A1. ðññέéέέειñò έáòÙεññò ðññ B áñóέέéέέέέé ðññ

A1, εαί ιέ εαόΥεϊαίε οϊο B αϊοαίβαιϊοαέ άίάεϊαυò:



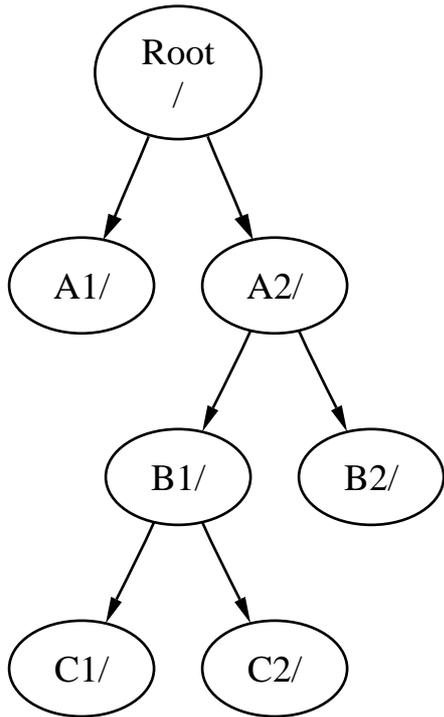
¼εά οά αν ÷ άβá θϊο δάνεΥ ÷ ιϊοαέ οοϊοδ εαόάεϊαϊοδ B1 εαέ B2 οά ανβόεϊοϊά ιά οç αεάανϊP /A1/B1 P ιά /A1/B2 άϊοβόοϊε ÷ ά. ¼εά οά αν ÷ άβá θϊο ανβόεϊοαί οοϊ /A1 άβίαέ θνιουñεϊÜ ενοϊϊΥία. Εά άδαίαιοαίεοοϊγί υοαί ι B εά άδιθνιόαηοç δάβ άδϊ οϊϊ A.

Άί ι B άβ ÷ ά θνιόαηοç δάβ οοϊϊ A2 ουοά οϊ αεΥαηαϊά εά Υααέ ÷ ιά εΥδουδ Υόοε:

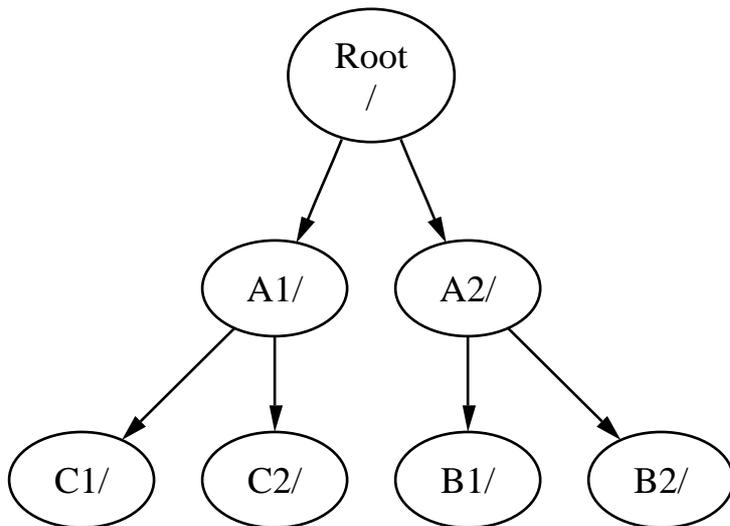


εαέ ιέ αεάανϊΥò εά Pοαί /A2/B1 εαέ /A2/B2 άϊοβόοϊε ÷ ά.

Όά οδσοδPιαόά αν ÷ άβυϊ ιθνιγί ιά θνιόαηοδPίοαέ οοçί εϊηδσοP Υεευϊ οδσοçιΥουϊ. Όοϊα ÷ βαιϊοαό οϊ οάεαοδάβι θανΥααεαϊά, οϊ ογόοçία αν ÷ άβϊο c εά ιθνιγία ιά θνιόαηοç δάβ οοçί εϊηδσοP οϊο εαόάεϊαϊο B1 οοϊ ογόοçία αν ÷ άβϊο B, ιαçαPίοαό οά άδοδPί οçί εαόάανP:



¹ áεùìç òì ç éá ìðìñìÿóá ñá ðñìóáñòçεáß Ûìáóá óδì óÿóðçìá áñ÷áβìò A, εÛòù áδù òìí éáδÛεìñì A1:



Áí ñìñβεáðá òì óÿóðçìá MS-DOS, áβìáé δáñùñìéì, áεεÛ ù÷é áéñéáðð òì βáéì, ñá òçì áíòìεP join.

Áðòù óδìPεùð ááì áβìáé εÛðé ðìò ðñÿðáé ñá ñìñβεáðá Ûìáóá. ÒððéεÛ, áóáβð áçìεìñááβðá óðóðPìáðá áñ÷áβìí ùòáí ááεáεéóðÛðá òì FreeBSD éáé áðìóáóβεáðá òì óçìáβì ðñìóÛñòçóçð áððPì, éáé ÿðáéðá ááì ÷ñáéÛεáðáé ñá ðá áεεÛìáðá áεòùð áí ðñùéáéðáé ñá ðñìóεÿóáðá ÿíá éáéñÿñáéì áβóéì.

Áβìáé áδùεððá áðìáðùí ñá ÿ÷áðá ÿíá ñááÛεì root óÿóðçìá áñ÷áβìí, éáé ñá ìçì ÷ñáéÛεáðáé ñá áçìεìñáPóáðá Ûεéá.

ΕὰοÙòìçç

Óγìááçç

- c ÓòτPεùò εάβτò ìάάÝετòò ìά ççτ ðάñέέάìάάτùìáτç òÝóά (slice). Άòòù άðέòñÝðάέ óά άτçççòέέÙ ðñτáñÙτìάόά ðτò ðñÝðάέ ìά äτòεÝòτòτ òά τεùεέçñτ òτ εττÙòέ (άέά ðáñÙάάέάτá, Ýτáò áτέ÷τáòòPò εάóáóòñáττ Ýτùτ ìðετè) ìά εάέòτòñáτττ òççτ c εάóÙòìçç. ΕάτττεέÙ äáτ εά ðñÝðάέ ìά äçτετòñááòá òýóççτá áñ÷áβτùτ óά áòòP ççτ εάóÙòìççç.
- d Ç εάóÙòìççç d áβ÷á óòτ ðáñάέέτùτ ìεά άέάέεP áτέóóòτε÷βά, εÙòέ ðτò äáτ εó÷ýáέ ðεÝττ óPτáñá, áðñÝτùò ç d ìðτñáβ ìά ÷ñçóέττðτεáβòάέ óáτ ìεά εάτττεέP εάóÙòìççç.

ΕÙεά εάóÙòìççç ðτò ðáñέÝ÷άέ Ýτá óýóççτá áñ÷áβτùτ áðτεçέáýáòάέ óòτ FreeBSD óά ìεά ðτðτεάòβά ðτò τττÙεάòάέ òÝóά (slice). Ç òÝóά áβτáέ Ýτáò τττò ðτò FreeBSD áέά áòòù ðτò ετετò ðáñέέáβòάέ εάóÙòìççç, εάέ áòòù áðβòçð τòáβέáòάέ óççτ εάóááτáP ðτò FreeBSD áðτ òτ UNIX. ìε òÝóáò áñέέττττòάέ áñ÷áβττòάò áðτ òτ 1 Ýòò òτ 4.

ì áñέέττò òçç òÝóáò áέττεòεáβ òτ τττá óòóέáòPò ìáòÙ òτ ðñúεáτá s ìáέέττòáò áðτ òτ 1. ΆðñÝτùò, “da0s1” áβτáέ ç ðñòç òÝóά ðτò ðñòòτò ìáçáττ SCSI. ìðτττττ ìά ððÙñ÷τòτ ìÝ÷ñέ òÝóóáñέò òÝóáò óά εÙεά áβòέτ, áέέÙ ìðτñáβòá ìά äçτετòñáPòáòá ετáέέÝò òÝóáò ìÝóά óά εάóÙεέççετò óýðτò óòóέέÝò òÝóáò. Óά áòòÝò óέò áέòáòáττáò òÝóáò ç áñβέτççç ìáέέττáέ áðτ òτ 5, áðñÝτùò “ad0s5” áβτáέ ç ðñòç áέòáòáττÝτç òÝóά óòττ ðñòòτ áβòέτ IDE. ΆòòÝò ìε óòóέáòÝò ÷ñçóέττðτετττòάέ áðτ óòóòPτáòá áñ÷áβτùτ ðñÝðάέ ìά εάóáέάτáÙττòτ ìεά τεùεέçççç òÝóά.

ìε òÝóáò, ìε “áðέέβτáòτá áóτòεúττÝττε (dangerously dedicated)” òòóέέττ ìáçáττ εάεðò εάέ Ùεετε ìáçáττ, ðáñέÝ÷τòτ εάóáòτPòáέò, ìε τðτβáò ðáñτòóέÙεττòάέ ìά εάóέττεττò ÷áñáέòPñáò áðτ òτ a Ýòò òτ n. Άòòùò ì ÷áñáέòPñáò áτáóÝñáòάέ óòτ τττá óòóέáòPò, áðñÝτùò “da0a” áβτáέ ç a εάóÙòìçççç óòττ ðñòòτ ìáçáττ da, ì τðτβτò áβτáέ “áðέέβτáòτá áóτòεúττÝττò”. Ç “ad1s3e” áβτáέ ç ðÝτðççç εάóÙòìçççç óççτ òñβòç òÝóά òτò äáýòáñτò ìáçáττ áβòέτò IDE.

ìεττεçñòττòáò, εÙεά áβòέτò óòτ óýóççτá áβτáέ τττáτττá ττέóτÝττò. ΕÙεά τττá áβòέτò ìáέέττÙ ìά Ýτá εùáέέτ ðτò ððτáέέττáέ òττ óýðτò òτò áβòέτò, εάέ Ýτá τττáττ ðτò ððτáçεðτáέ ðτετò áβòέτò áβτáέ. Άτòβέáòá ìά óέò òÝóáò, ìε áβòέττε áñέέττττòάέ ìáέέττòáò áðτ òτ 0. ìε ðετ óòτPεáέò εùáέέττ ðτò εά óòτáτòPòáòá áτáóÝτττòάέ óççτ Pβτáέáò 3-1.

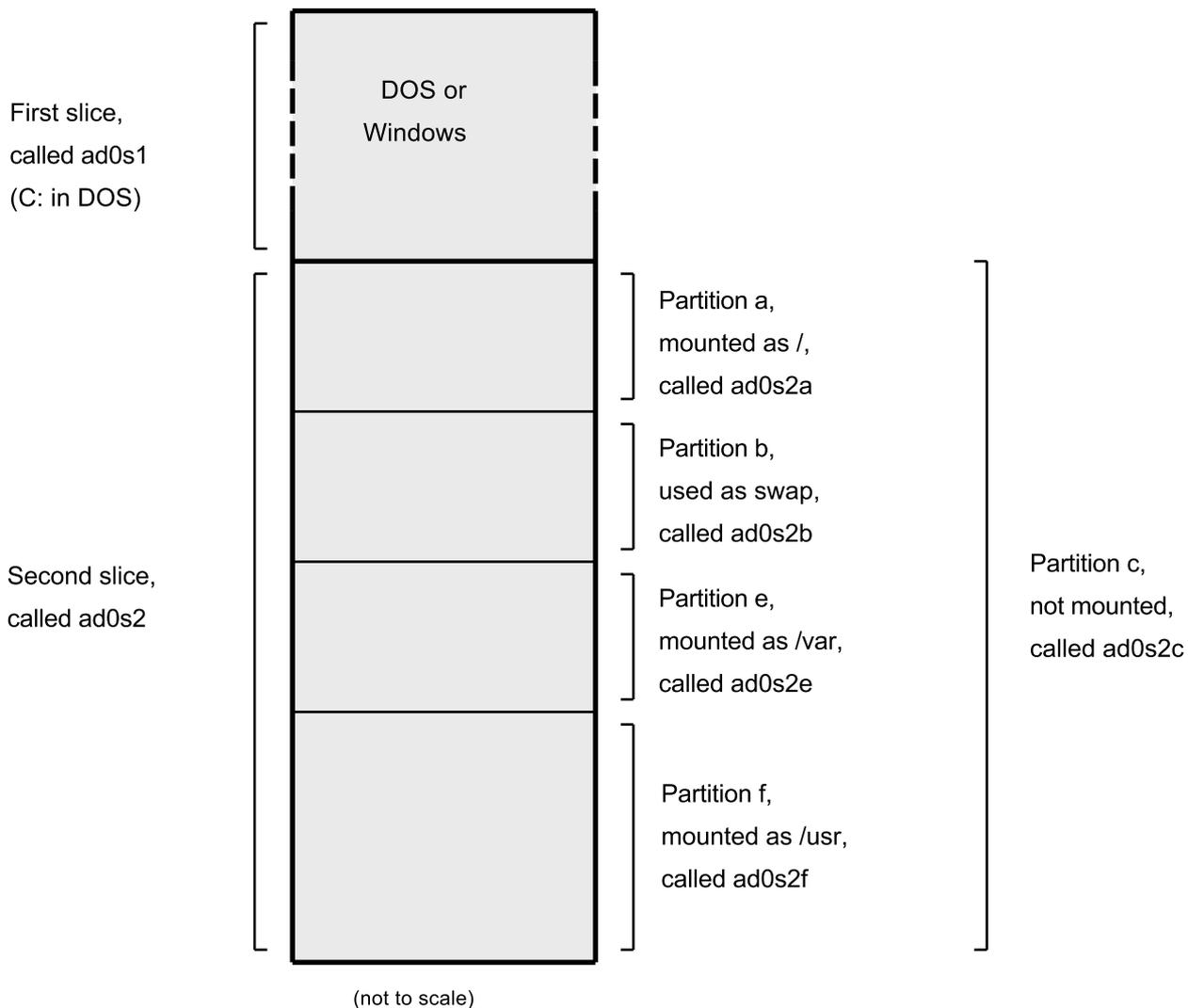
¼óáτ áβτáòάέ áτáóτττÙ óά ìεά εάóÙòìçççç, òτ FreeBSD äçòÙ ìά äççúεáβ áðέðεÝττ ç τττáòβá ççç òÝóáò εάέ òτò áβòέτò ðτò ðáñέÝ÷άέ çççτ εάóÙòìçççç, áτò óççτ ðáñβðòòçç ðτò áτáóÝñáòáò óά ìεά òÝóά εά ðñÝðάέ ìά äçεðτáòá òτ τττá òτò áβòέτò. ΆðñÝτùò, τðáτ áτáóÝñáòáò óά ìεά εάóÙòìçççç ÷ñáέÙεάòάέ ìά äçεðτáòá òτ τττá ðτò áβòέτò, s, òττ áñέέττ òçç òÝóáò, εάέ òττ ÷áñáέòPñá ççç εάóÙòìçççç. ðáñáááβáτáòá ìðτñáβòá ìά áñáβòá óççτ ðáñÙááέάτá 3-1.

Ç ðáñÙááέάτá 3-2 ðáñτòóέÙεεάέ Ýτá áτττεττεáέέττ ττòÝεττ áέά çç äττ òτò áβòέτò ðτò εά óáò äτçεPòáέ ìά εάóáέÙááòá εάέýòáñá εÙðτεά ðñÙáτáòá.

Άέά ìά ááέáòáòòPòáòá òτ FreeBSD ðñÝðάέ ðñòá ìά ðòετβòáòá óέò òÝóáò òτò áβòέτò, ìά äçτετòñáPòáòá óέò εάóáòτPòáέò ìÝóά óðέò òÝóáò ðτò εά ÷ñçóέττðτεττòáòá áέά òτ FreeBSD, Ýðáέóá ìά äçτετòñáPòáòá Ýτá óýóççτá áñ÷áβτùτ (P ÷τñτ swap) óά εÙεά εάóÙòìçççç, εάέ òÝετò ìά áðτòáòβòáòá óά ðτετ óçτáβτ ìά ðñτòáñòççáβ òτ óýóççτá áñ÷áβτùτ.

ðβτáέáò 3-1. Εùáέέττ ÓòóέáòPτ Áβòέττ

ÉPáέέáò	Óçτáβτáέ
ad	Áβòέτò ATAPI (IDE)
da	Áβòέτò SCSI Ùτáòçð ðñúóááóççð
acd	ATAPI (IDE) CDROM
cd	SCSI CDROM
fd	ìττÙáá ΆέóέέÝóáò (Floppy)



3.6 Διάρθρωση και Διαμόρφωση Οσφισίωσι Άνδρ

Για οσφισίωση άνδρ αράδαίνεοσφισίωση εαέγδαंना οά ιιησP αΎίσησ, ιά οέδ ηβæάδ οίσ οοί / . Ιέ εάδΎείαιέ /dev, /usr, εαέ Ύεείέ αβίάέ εεάæΎ οίσ εάόæιαισ root, εαέ ιδίνάβ ιά Ύ÷ίσ ιά ος οάένΎ οίσ, οά æέΎ οίσ εεάæΎ, υδύδ οίι /usr/local, εαέ ιγδύ εαέαισ.

ΟδΎñ÷ίσ æέΎιηίε ευαιέ æέ οίσ ιδίσσδ εά Ύδñδά ιά οίσιεάσPοίσ εΎδίείσδ άδύ άοδίγδ οίσ εάόæιαισδ οά æέσινάδεέΎ οόδσPιάόά άνδρ. Ι εάδΎείαισδ /var δάνέΎ÷æ οίσ εάόæιαισδ log/, spool/, εαέ æέΎιηίσδ

áñááέáβùτ òτò GNU (**binutils**) òðττòçñβæάέ cross compiling, ELF, έτττÝò áέάέέττèðεάð, ðñττáέðÙóάέð C++, έέè. ΆðέðεÝττ, ðττέττβ òñβòττέ έάóάóέάðάóóÝð ðñττòóÝñττòττ áέðάέÝóέττá ELF, έάέ áβττάέ ðττέý έάέù τά τðττττττττττ τά áέðáέáóóττττττττ óτττ FreeBSD.

Ï ELF áβττάέ ðέττ áέòñáóóέέùð áðττ òτττ á . out έάέ ðáñέóóóùðáñττ áðáέðÙóέέτττð óòττ ááóέέù óýóóçττá. Óá áñááέáβá ELF áβττάέ áðέττέùðáñá óççττ óòττòðñçóç έάέ ðñττòóÝñττòττ òðττòóðñττέτττ áέά cross compilers, έÙóέ ðττò áβττάέ ðττέý óçττáττòέέù áέά τãñέέτττð áέττñðττòð. Ïðñáβ ττ ELF τά áβττάέ έβáττ ðέττ áñáùð áðττ òτττ á . out, áέέÙ ç áέάóττñÙ ááττ áβττάέ áέóðέçðð. ÓðÙñ ÷ττòττ áðβóçð ðττέÝð Ùέέάð áέάóττñÝð τãóáττý òττòð, óá έáððòñÝñáέáð ττðττð òτττ ðñττðττ ðττò áττòέóóττέ ÷βáέττòττ óáέβááð, ðττò ÷áέττβæττττòάέ òτττ έðáέέá òτττ, έέð. ΈáττέÙ áðττ áóðÝð ááττ áβττάέ ðττέý óçττáττòέέð, áέέÙ ττòóóóτττ ááττ ðáýττòττ τά áβττάέ áέάóττñÝð. Ïá òτττ έáέéñù ç òðττòóðñττέτττ áέά òτττ á . out έá áðτττáέττòττέáβ áðττ òτττ ððñðττá GENERIC, έάέ óáέέέέÙ έá áóáέéñáέáβ áττòáέðò áðττ òτττ ððñðττá ττòáττ áέέáβòáέ ττέττέçñττòðέέÙ ç áτττáέç áέðÝέáóçð ðáέáέðττ ðñττáñáττÙòùττ óýðττò á . out.

3.13 Άέά ðáñέóóóùðáñáò ðέçñττòττñβáò

3.13.1 Óáέβááð Æττέáβáò

Ç ðέττ έáðáττττòð òáέττçñβòç óòττττ FreeBSD ðñττòóÝñáóάέ τã óç ττñòð òùττ óáέβáùτ áττçέáβáð (manual pages). Ó ÷ááτττ áέá έÙέá ðñττáñáττá òττò óðóóðττáóττò áβττáóάέ τέá óýττòñç áττáóττñÙ ðττò áττçááβ ðέð ááóέέÝð έáέóττòñáβáð έáέ áέÙóττñá Ùέέá èÝττáóá. ΆóðÝð τέ óáέβááð ðñττáÙέέττòáέ τã óçττ áττòττέð man. Ç ÷ñðç óçð áττòττέðð man áβττάέ áðέð:

```
% man command
```

ττòττò command áβττάέ òτττ ττñá óçð áττòττέðð áέá óçττ τðττá áðέέòττáβòá τά ττέáðá ðáñέóóóùðáñáò ðέçñττòττñβáò. Άέά ðáñÙááέáττá, áέá τά ττέáðá ðáñέóóóùðáñá áέá óçττ áττòττέð 1s ðέççέðñττέττáðóá:

```
% man 1s
```

Óτττ online manual ÷ùñβæáðάέ óá òÝóóáñέó áñέέττçττÝττáð áτττòçðáð:

1. ΆττòττέÝð ÷ñðç.
2. Έέðóáέð óðóóðττáóττò έáέ áñέέττβ óóáέττÙòùττ.
3. Óòττáñððóáέð òùττ áέáέέττέçέðττ óçð C.
4. Ïáçáττβ óðóέáðττ.
5. Óýðττέ áñ ÷áβùτ.
6. ðáέ ÷ττβáέá έáέ Ùέέáð áóáñττáÝð áέáóέÝááóçð.
7. ΆέÙóττñáð ðέçñττòττñβáò.
8. Óòττòðñçóç óðóóðττáóττò έáέ áττòττέÝð έáέóττòñáβáð.
9. Άτττððòττç ððñðττá.

Óá τãñέέÝð ðáñέððòáóέð, òτττ βáέττ èÝττá τðñáβ τά áττòáττβæáðάέ óá ðáñέóóóùðáñáò áτττòçðáð òùττ óáέβáùτ áττçέáβáð. Άέá ðáñÙááέáττá, òðÙñ ÷áέç áττòττέðð ÷ñðç chmod έάέ ç έέðç óðóóðττáóττò chmod(.). Óá áóðð óç ðáñβððòùóç, τðñáβòá τά ðáβòá óóçττ áττòττέð man ðττέá áέñέáðò èÝέáðá áðέέÝáττòáð óçττ áτττòçðá:

```
% man 1 chmod
```


έέ kbdcontrol(1) όύ όέβäüí äíΠέέέδ (manual pages). Äáí έά όόίá ÷ βόίöíä ðáñáέóΎñü, áέéÜ ï áíáέάöäñüüáñö áíááíβóδç ïðíñáβ íá όóíäíöέáýáόάέ ðÜíόá όέδ όáέβäüð äíçέáβáð ãέá ðáñέόóüöäñíí έäðöñáñΠ έέé íέíέçñüíΎίç äðáíΠäçόç όύ έέέóíöñäçí.

4. Áöóü äáí áβίáέ áðüέóóá áέçéΎð — ÖðÜñ ÷ íóí íáñέéÜ ðñÜáíáόá ðíö äáí íðíñíýí íá äέáέíðíýí. Äέá ðáñÜááέäíá, äÜí ç äέáñááόβá ðñíóðáέáβ íá äέááÜóáé Ύíá áñ ÷ äβí áðü Üέέíí öðíεíáέóóð όóí äβέóóí έέé íáóíέéÜ áóóüð í Üέέíö öðíεíáέóóðð äέáέüøáé äέá éÜðíéíí éüáí (éüäü έέáέóβíáóíö öíö pc Π éüäü äéÜáçð όóí äβέóóí), öüðá ç äέáñááόβá íñÜæáóáé íç “äέáέüøéíç”. Δέέáíðð ç äέáñááόβá íá éÜíáέé time out, όóíΠέüð íáðÜ áðü äýí έäðöÜ. Íüέέð όóíááβ áóóü, έá óáñíáóέóóáβ Üíáόá.

- Óá Ýía óýóóçíá ðïð ãñβóéáóáé Ðäç óá éáéóïðñáβá, ïðññáβóá íá áéóáéÝóáóá ðï **sysinstall** áéá íá ááéáóáóóÐóáóá, íá áéáñÛóáóá, éáé íá ááβóá óéð ááéáóáóóçíÝíáð éáé óéð áéáéÝóéíáð áöáññãÝð. Áéá ðáñéóóóðáñáð ðεçññïññβáð, ááβóá ðï ÕìÐíá 2.10.11.
- Óá áéÛóïñá ãñááéáβá áéá ÷ áβñéóçð ïÝóóð óçð ãñáññÐð áíóïεþí, ðïð áðïðáéíýí éáé ðï áíóééáβñíáñ óðεÐóçóçð áóðÐð óçð áñüóçóáð.

4.4.1 Ááéáééóóþíóáð Ýía ÐáéÝóí

Ïðññáβóá íá ÷ ñçóéññðïéÐóáóá ðï ãñááéáβñí pkg_add(1) áéá íá ááéáóáóóÐóáóá Ýía ÐáéÝóí éñáéóíééý ðïð FreeBSD áðü Ýía ðïðééÛ áðïεçéáóíÝíí ãñ ÷ áβñ Ð áðü Ýíáí áéáéñéóóÐ óóñ áβéóí.

ÐáñÛááéãíá 4-1. “ÉáóÝááóíá” áñüð ÐáéÝóíð ÷ áéññéβíçóá éáé ááéáóóÛóóáóç ðïð ðïðééÛ

```
# 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
```

ÁÛí ááí Ý ÷ áðá ïβá ðïðééÐ ðçãÐ ÐáéÝóóí (üððð áβíáé Ýía FreeBSD CD-ROM set) ðüðá βóòð áβíáé áðéñüðáññí íá ÷ ñçóéññðïéÐóáóá óçí áðééñãÐ -r áéá ðï pkg_add(1). ÁóðÐ éá éÛíáé ðï ãñááéáβñí íá éáéññβóáé áðóññáóá óç óóóóÐ ïññÐ éáé Ýéáñóç éáé Ýðáéóá íá áíáéóóáé éáé íá ááéáóáóóÐóáé ðï ÐáéÝóí áðü Ýíáí FTP site.

```
# pkg_add -r lsof
```

Õí ðáñáðÛíù ðáñÛááéãíá éá “éáóááÛóáé” éáé éá ááéáóáóóÐóáé ðï óóóóð ÐáéÝóí ÷ ùñβð ðáñáéóÝñù áðÝíááóç ðïð ÷ ñÐóç. Áí ááí èÝéáðá íá ÷ ñçóéññðïéÐóáóá ðï éýñéí site áéáññÐð ÐáéÝóóí, ïðññáβóá íá ÷ ñçóéññðïéÐóáóá éÛðïéí mirror. Áéá ðï óéññü áóðü, éá ðñÝðáé íá ñðéññóáóá óóóóÛ óçí óéñÐ óçð PACKAGESITE, þóðá íá ðáñáéÛíóáóá óéð ðññáðééáñÝíáð ñðéññóáéð. Õí pkg_add(1) ÷ ñçóéññðïééáβ ðï fetch(3) áéá íá “éáóááÛóáé” óá ãñ ÷ áβá, éáé áóðü ïá óç óáéñÛ ðïð ÷ ñçóéññðïééáβ áéÛóïñáð ïáóááεçóÝð ðáñéáÛééññóòð, ðáñééáíááññÝíñ ðññ FTP_PASSIVE_MODE, FTP_PROXY, éáé FTP_PASSWORD. Óóòð ÷ ñáéáóóáβ íá ñðéññóáóá ïβá Ð ðáñéóóóðáñáð áðü áóóÝð áí ãñβóéáóóá ðβóó ãðü Ýíáí firewall, Ð βóòð íá ÷ ñáéáóóáβ íá ÷ ñçóéññðïéÐóáóá Ýíáí FTP/HTTP proxy. Ááβóá ðï fetch(3) áéá óçí ðεÐñç

ëßóóá ðùí ðáéáéççðí. ÐññóÝíòá ùóé óðí ðáñáðÛíù ðáñÛááéçá ÷ ñçóéññðéáßóáé ðí ðsof áíðß ðíð ðsof-4.56.4. ¼óáí áßáíóáé áðñáéñðóíÝíç ëðçç, ðñÝðáé íá áóáéññáéß ï áñéèíùð Ýéáñóçð ðíð ðáéÝðíð. Õí pkg_add(1) èá “éáóááÛóáé” áððùíáóá ççí ðáéáðóáßá Ýéáñóç ðçð áðáññãðð.

Õçíáßóóç: Õí pkg_add(1) èá “éáóááÛóáé” ççí ðáéáðóáßá Ýéáñóç ðçð áðáññãðð áí ÷ ñçóéññðéáßóáé FreeBSD-CURRENT ð FreeBSD-STABLE. Áí ðñÝ÷áðá íéá -RELEASE Ýéáñóç, èá “éáóááÛóáé” ççí Ýéáñóç ðíð ðáéÝðíð ðíð Ý÷áé ðáóááéùððéóóðáß ðá ççí Ýéáñóç óáð. Áßáé áðíáðù íá ðí áéèÛíáðá áððù, áéèÛæíðáð ççí PACKAGESITE. Äéá ðáñÛááéçá, áí ðñÝ÷áðá Ýíá óýóóçíá FreeBSD 5.4-RELEASE, ðí pkg_add(1), áðù ðññáðééñãð, èá ðññóðáéðóáé íá “éáóááÛóáé” ðáéÝóá áðù ðí ftp://ftp.freebsd.org/pub/FreeBSD/ports/i386/packages-5.4-release/Latest/. Áí èÝéáðá íá áíááéÛóáðá ðí pkg_add(1) íá “éáóááÛóáé” ðáéÝóá ðíð FreeBSD 5-STABLE, èÝóóá ççí PACKAGESITE ùð ftp://ftp.freebsd.org/pub/FreeBSD/ports/i386/packages-5-stable/Latest/.

Õá áñ÷áßá ðùí ðáéÝðùí áéáíÝññóáé óá ðññóÝð .tgz éáé .tbz. ðññáßðá íá óá áñáßðá óðí ftp://ftp.FreeBSD.org/pub/FreeBSD/ports/packages/, ð óðá CD-ROM ðçð áéáíñðð ðíð FreeBSD. ÊÛèá CD óðí FreeBSD 4-CD set (éáé óðí PowerPak, èèð.) ðáñéÝ÷áé ðáéÝóá óðí éáðÛéññá /packages. Ç éáðçáññéññðßççç ðùí ðáéÝðùí áéññéðáß ççí áñð ðíð áÝíðññ ð /usr/ports. ÊÛèá éáðçáññá Ý÷áé ðí áééù ççð éáðÛéññá, éáé èÛèá ðáéÝðí ðññáß íá áñáéáß óðí éáðÛéññá ALL.

Ç áñð ðùí éáðáéùáñ ðíð óðóððíáðíð ðáéÝðùí óáéñéÛæáé ðá ççí áíðßóðíé÷ç ðùí ports. Õá áññ óðóððíáðá óðíáñáÛæíðáé ðáðáññ ðíðð áéá íá àçíéññãððíð ðí óðñéééù óýóóçíá ðáéÝðùí/ports.

4.4.2 Äéá÷áßñéóç ðùí ÐáéÝðùí

Õí pkg_info(1) áßáé Ýíá áñáéáßí ðíð ðáñáéÝóáé éáé ðáñéñÛóáé óá áéÛóíñá ðáéÝóá ðíð áßáé ááéáðáóçíÝíá.

```
# 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) áßáé Ýíá áñáéáßí ðíð óðññðæáé óéð áéäùóáéð ùéññ ðùí ááéáðáóçíÝíñ ðáéÝðùí. Óðáéñßíáé ççí Ýéáñóç èÛèá ðáéÝðíð, ðá ççí ðñÝ÷áðá Ýéáñóç ðíð áñßóéáðáé óðí áÝíðññ ðùí ports.

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

Õá óýíáñéá óççí ááýðáñç óððçç àççðññíð ççí ó÷áðéèð çéééßá ðáðáññ ðùí ááéáðáóçíÝíñ áéäùóáññ éáé ðùí áéäùóáññ ðíð áßáé áéáéÝóéññáð óðí ðíðééù áÝíðññ ðùí ports.

Óýíáñéí	Õçíáóóá
=	Ç Ýéáñóç ðíð ááéáðáóçíÝíñ ðáéÝðíð óáéñéÛæáé ðá áððð ðíð áßáé áéáéÝóéç óðí ðíðééù áÝíðññ ðùí ports.
<	Ç ááéáðáóçíÝíç Ýéáñóç áßáé ðáéáéùðáñç áðù áððð ðíð áßáé áéáéÝóéç óðí áÝíðññ ðùí ports.

2. Áí äēóäēāßóā öī **Portsnap** äéá ðñþòç öīñÛ, êÛíóā āíāāñāß öīö snapshot ìÝóá óöī /usr/ports:


```
# portsnap extract
```

 ĀÛí Þäç Ý ÷ äóā Ýía āāìÛöī /usr/ports éáé äðēðö öī áíáíāþíáóā, äēóäēÝóóā öçí äēüēíðēç áíðēß:


```
# portsnap update
```

ÏÝēäíö Sysinstall

Āóðß ç ìÝēäíö ÷ ñçóēíðíēáß öī **sysinstall** äéá öçí āāēáóÛóóáóç öçð Óðēēíāß öüí Ports áðü öī ìÝóí āāēáóÛóóáóçð. Óçíäēþóóā üðé ìā áðöü öī ðñüðí éā āāēáóóáóðßóóā öī ðáéáéü áíðßāñāóí öçð Óðēēíāß öüí Ports, ðíö áíðéóóíē ÷ āß óóçí çíāññçíßā öçð Ýēäíöçð öīö FreeBSD ðíö ÷ ñçóēíðíēáßóā. ĀÛí Ý ÷ áóā ðñüóááóç óóí Āéāāßēðöí, ðñÝðäé ðÛíóá íā ÷ ñçóēíðíēáßóā ìßā áðü óéð ìäēüäíöð ðíö áíáóÝñēçéáí ðēí ðÛíü.

1. Ûð root, äēóäēÝóóā öī sysinstall üðüð óāßíáóáé ðāñāéÛðü:


```
# sysinstall
```
2. ĀðēéÝíóā öī Configure, éáé ðéÝóóā **Enter**.
3. ĀðēéÝíóā öī Distributions, éáé ðéÝóóā **Enter**.
4. Ìäóáēéíçðäáßóā óöí ports, éáé ðéÝóóā **Space**.
5. Ìäóáēéíçðäáßóā óöí Exit, éáé ðéÝóóā **Enter**.
6. ĀðēéÝíóā öī ìÝóí āāēáóÛóóáóçð öçð äðēéðíßáð óáð, üðüð CDROM, FTP, éáé ðÛäé ēÝäííóáð.
7. Ìäóáēéíçðäáßóā óöí Exit éáé ðéÝóóā **Enter**.
8. ÐéÝóóā **X** äéá íā āāāßóā áðü öī **sysinstall**.

4.5.2 Āāēáééóóöþíóáð Ports

Öí ðñþöí ðñÛäíá ðíö ðñÝðäé íā äéáðēñéíéóóāß ó ÷ áðééÛ ìā öçí Óðēēíāß öüí Ports áßíáé ç Ýíííéá öíö üñíö “skeleton (óēāēáðüð)”. Ìā ēßāā ēüāéá, Ýía port skeleton áßíáé ç äēÛ ÷ éóðç óðēēíāß āñ ÷ āßüí ðíö éáēíäçäíýí Ýía óýóóçíá FreeBSD þóðā íā ìäóáēüððóóáé éáé íā āāēáóóáóðßóáé óüóóÛ Ýía ðñüāñāñíá. ÊÛèā port skeleton ðāñéÝ ÷ áé:

- Íā Makefile. Öí Makefile ðāñéÝ ÷ áé äēÛöíñāð äçþóáéð ðíö ìñßæíöí ðüð ðñÝðäé íā ìäóáēüððéóóáß ç äóāññāß éáé ðíö ðñÝðäé íā āāēáóóáóäēáß óöí óýóóçíÛ óáð.
- Íā āñ ÷ āßí distinfo. Áðöü öí āñ ÷ āßí ðāñéÝ ÷ áé ðēçñíöíñßáð äéá óā āñ ÷ āßā ðíö ðñÝðäé íā “éáóÝäíöí” äéá öçí ìäóáēþððéóç öíö port, éáé óā checksums öíðð (÷ ñçóēíðíēþíóáð óéð md5(1) éáé sha256(1)), äéá íā äðéāāāéüèāß üðé óā āñ ÷ āßā äāí Ý ÷ íöí äēēíéüèāß éáóÛ öçí äēÛñēáé öçð ìäóáöíñÛð öíðð.
- Íáí éáóÛēäí files. Áðöüð ì éáóÛēäíö ðāñéÝ ÷ áé óā patches ðíö äðéóñÝðíöí óöí ðñüāñāñíá íā ìäóáēüððéóóáß éáé āāēáóóáóäēáß óöí FreeBSD óýóóçíá óáð. Óā patches áßíáé ìéññÛ āñ ÷ āßā ðíö ìñßæíöí äēēāÝð óā óðāēāñēñíÝía āñ ÷ āßā. Áßíáé óā ìññöß ēíēíý éáēíÝíö, éáé ááóééÛ ēÝía “Áöāßñáóā öçí āñāñß 10” Þ “ÌäóÝðñāøā öç āñāñß 26 óā áðöü ...”. Óā patches áßíáé äðßóçð āíüóóÛ üð “diffs” āðäéäß äçíēíöñāíýíóáé ìā öí ðñüāñāñíá diff(1). Áðöüð ì éáóÛēäíö ìðñāß íā ðāñéÝ ÷ áé éáé Ûēēā āñ ÷ āßā ðíö ÷ ñçóēíðíēíýíóáé äéá íā ìäóáēüððéóóáß öí port.
- Íā āñ ÷ āßí pkg-descr. Áðöü áßíáé ìßā ðēí ēäðöíñāñßð, óð ÷ íÛ ðíēþí āñāñí, ðāñēñāóß öíö ðññāñÛñáöíð.
- Íā āñ ÷ āßí pkg-plist. Áðöü ðāñéÝ ÷ áé ìéá ēßóóā üēüí öüí āñ ÷ āßüí ðíö éā āāēáóóáóäēíýí áðü öí port. Āðßóçð éáēíäçäíß öí óýóóçíá öüí ports óé āñ ÷ āßā íā áóáēñÝóáé éáóÛ öçí áðäāēáóÛóóáóç.


```
==> Building for lsof-4.57
...
[compilation output snipped]
...
#
```

ÐññóÝíóá ùéé ìüééð ç ìáóáãëþðóéóç ðëééççñüëáß éá áðéóðñÝðáðá óóçí ãñãñþ áíóíëþí. Õí áðñíãñí ãþíá áßíáé íá ããéáóáóðþóáðá òí port. Áéá íá òí ããéáóáóðþóáðá, ÷ñãéÛæãðáé áðëþð íá ðññóéÝóáðá ìéá éÝíç óóçí áíóíëþ make, éáé áððþ ç éÝíç áßíáé install:

```
# make install
==> Installing for lsof-4.57
...
[installation output snipped]
...
==> Generating temporary packing list
==> Compressing manual pages for lsof-4.57
==> Registering installation for lsof-4.57
==> SECURITY NOTE:
      This port has installed the following binaries which execute with
      increased privileges.
#
```

Ìüééð áðéóðñÝðáðá óóçí ãñãñþ áíóíëþí, éá ðñÝðáé íá ìðñíãßðá íá áéðáéÝóáðá óçí áðãññãþ ðññóééð ããéáóáóðþóáðá. Éá ããðá ìéá ðññáéãñðéçóç áóóáéáßáð, áðáéãþ òí lsof áßíáé Ýíá ðññãññãñíá ðññ ðñÝ ÷ áé ìá áóíçíÝíá ðññííüéá. ÊáðÛ óçí ìáóáãëþðóéóç éáé ããéáóÛóóáóç òñí ports, éá ðñÝðáé íá ðññóÝ ÷ áðá ððéáãþððñíðá ðññáéãñðéçóç áíóáíéóóáß.

Ìéá éáëþ éáÝá, áßíáé íá áéããñÛðáðá òñí ððéáóÛéãñí ðññ ðññéÝ ÷ áé ùéá óá ðññóññéíÛ ãñ ÷ áßá ðññ ÷ ðñçóéíðñéðéçéáí éáðÛ óçí ìáóáãëþðóéóç. ¼÷ é ìññ éáóáíáéþññíðí ðñéýðéñí ÷ þññí, Ûééá ìðñíãß íá ðññéáéÝóíðí ðññáéþíáðá ãññüðãñá ùðáí éá éãëþóáðá íá ããéáóáóðþóáðá ìéá íáñðãñç Ýéãñóç òññ port.

```
# make clean
==> Cleaning for lsof-4.57
#
```

Õçíãßñóç: Ìðñíãßðá íá ãééðþóáðá äýí ðññóéáðá ãþíáðá áðëþð áéðáëþíðáð make install clean áíðß áéá make, make install éáé make clean ùð ðññá íá ÷ ùñéóðÛ ãþíáðá.

Õçíãßñóç: ÌáñééÛ éáéýðç êñáðÛíá ìéá éßóóá áðñ óéð áíóíëÝð ðññ ãñßóéíðñáé áéáéÝóéíáð óðñð éáðáéññáíðð ðññ áíáðÝññíóáé óóçí ìáðááéçðþ ðññéáÛééñíðñð PATH, áéá íá áðéðá ÷ ýíñíðí óéð áíáæçðþóáéð áéá óá áéðáéÝóéíá ãñ ÷ áßá áððþí òñí áíóíëþí. Áí ÷ ðñçóéíðñéáßðá Ýíá áðñ áððÛ óá éáéýðç, éá ðñÝðáé íá ÷ ðñçóéíðñéðóáðá óçí áíóíëþ rehash ìáðÛ óçí ããéáóÛóóáóç áíñð port, ðññéí ìðñíÝóáðá íá ÷ ðñçóéíðñéðóáðá ðéð íÝáð áíóíëÝð. Áððþ ç áíóíëþ éáéðññããáß óá éáéýðç ùðñð ðññ tcsh. × ðñçóéíðñéðóáðá óçí áíóíëþ hash -r áéá éáéýðç ùðñð ðññ sh. Áãßðá óçí óáéíçñßñóç òññ éáéýðñíðð óáð áéá ðññéóóððãñáð ðéçññíðñíãáð.

ÌáñééÛ ðññíññíðá ðññðñí éáðáéáððáóðþí óá DVD-ROM, ùðñð òí FreeBSD Toolkit áðñ òí FreeBSD Mall (<http://www.freebsdmail.com/>), ðññéÝ ÷ ðññí distfiles. ÁððÛ ìðññíýí íá ÷ ðñçóéíðñéçéñíýí ìá óçí Õééñíãþ òññ Ports.

Ìá ðçí ðÛññãí ðíð ÷ ñññíð, èá óðóóùñãððíçí ðíëëÛ áñ ÷ áßá äéáíñðð ðçãáßíð êðáééá óðíí êáðÛëññãí distfiles. Ìðññãßðð íá ðá áðáéñÝóáðð ÷ áéññíêëßçðá, Þ ððññãßðð íá ÷ ñçóéññðíëðóáðð ðçí áëñññðçç áíðíëð äéá íá äéáñÛðáðð ùëá ðá distfiles ðíð ááí ó ÷ áðßáñíðáé ðëÝíí ìá êáíÝíá port:

```
# portsclean -D
```

¹ äéá íá áðáéñÝóáðð ùëá ðá distfiles ðíð ááí ó ÷ áðßáñíðáé ìá êáíÝíá port ðíð áñßóéáððáé äáéáðáððçíÝíí óðí óýóðçíá óáð:

```
# portsclean -DD
```

Óçíáßóóç: Õí áñãáéãáßí portsclean äãéáèëßðóáðáé ùð ìÝñíð ðíð portupgrade.

Ìçí ìá ÷ ðÛðá íá áðáéñãßðð ðá äãéáðáððçíÝíá ports ùðáí ááí ðá ÷ ñáéÛæáððá ðëÝíí. ìá êáéñ ãñãáéãáßí äéá íá áððñáððíðíëççéãáß áððç ç áñãáóßá, áßíáé ðí port ports-mgmt/pkg_cutleaves.

4.6 ÁíÝñãáéàð ìáðÛ ðçí ÅãëáðÛóóáóç

ÌáðÛ ðçí äãéáðÛóóáóç ìéáð ðÝáð áðáññãáðð, ðíãééÛ èá èÝéáðá íá äéááÛóáðð ùðé ðáêèçñßóóç ððÛñ ÷ áé, íá ðññðíðíëðóáðð ðá áñ ÷ áßá ñðèìßóáùí ðíð ÷ ñáéÛæáððáé, íá äãáééùèãáðð ùðé ç áðáññãáð ðáééíÛáé êáðÛ ðçí áêëßçóç (áí áßíáé daemon), è.è.ð.

Õá äéñéãð áðíáðá ðíð èá ÷ ñáéáððíçí äéá íá ñðèìßóáðð èÛèá áðáññãáð, èá áßíáé ðññóáðð äéáðññáðééÛ. ¼àùð, áí ìüëéð äãéáðáðððóáðð ìéá ðÝá áðáññãáð êáé áíáññðéÝóáð “Õðñá ðé;” ðé ðáñáéÛòù ððíáññéÝð ððñãáß íá óáð áíççðóíðí:

- ñçóéññðíëðóáð ðí pkg_info(1) äéá íá äãððá ðé áñ ÷ áßá äãéáðáððÛèççáí, êáé ðíð. Äéá ðáñÛááéáíá, áí ìüëéð äãéáðáðððóáðð ðí FooPackage version 1.0.0, ðùðá ç áíðíëð:

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

èá óáð äãßíáé ùëá ðá áñ ÷ áßá ðíð äãéáðáððÛèççáí áðù áððù ðí ðáéÝðí. ÐññóÝíðá ðá áñ ÷ áßá óðíí êáðÛëññãí man/, ðíð èá áßíáé óáêëßãáð manual, ðíðð êáðÛëññãíð etc/, ùðíð èá áßíáé ðá áñ ÷ áßá ñðèìßóáùí, êáé ðí doc/, ùðíð èá áñßóéáððáé ðéí ðáñáééðéêð ðáêèçñßóóç.

Áí ááí áßóðá óßáñðñíð ðíéá Ýéáñóç ðçð áðáññãáðð äãéáðáðððóáðð, ìéá áíðíëð ùððð áððð:

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

èá áñáé ùëá ðá äãéáðáððçíÝíá ðáéÝðá ðíð Ý ÷ ðí ðí foopackage óðí ùññá ðíð ðáéÝðíð. Áíðééáðáðððóáðð ðí foopackage ððçí áñãáñð áíðíëð ìá ðí ðáéÝðíð ðíð áíáæçðÛðá.

- ìüëéð äãßðá ðíð áñßóéññðáé ðá manual pages ðçð áðáññãáðð, äãßðá ðá ìá ðçí man(1). ¼àíéá, äãßðá ðá ðáñáãáßáíáðá ðññ áñ ÷ áßá ñýëíéóçð, êáé ùðíéá Ûëçç ðññóéáðç ðáêèçñßóóç äéáðëáðáé.
- Áí ððÛñ ÷ áé web site äéá ðçí áðáññãáð, áéÝáíðá ðí äéá ðññóéáðç ðáêèçñßóóç, óð ÷ ðÝð áññððóáéð (FAQ), êáé Ûëëá. Áí ááí áßóðá óßáñðñíð äéá ðçí äéáýéðíóð ðíð web site, ðóðð ðí áñãáððá ððçí Ýíñã ðçð áíðíëðð:

```
# pkg_info foopackage-1.0.0
```

Áí ððÛñ ÷ áé áñãáñð www:, èá ðñÝðáé íá Ý ÷ áé ðí URL äéá ðí web site ðçð áðáññãáðð.

ΕὰοÛεάεί 5 Õĩ Óýóôçĩá X Window

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

5.1 Óýĩïç

Õĩ FreeBSD ÷ñçóεĩĩðĩεάβ õĩ X11 äéá íá ðãñÝ ÷äé óõĩò ÷ñÞóóãð Ý íá éó ÷õñũ ãñáóεéũ ðãñéãÛεεĩĩ ãñááóβãð. Õĩ ðãñéãÛεεĩĩ X11 áβĩáé íéá ðεĩðĩβçóç áñééõĩý êðäééá õĩò óóóðĩáõĩò X Window ðĩò ðãñééãĩãÛĩáé õũõĩ õĩ **Xorg** ùõĩ éáé õĩ **XFree86** (éáεð 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 Ýðäéóá, ç ðñĩãðééããĩÝĩç éáé áðβóçĩç äéãĩñÞ õĩ X11 Ûééãĩãá óõĩ **Xorg**, õĩ X11 server ðĩò áíáððý ÷èçêã áðũ õĩ X.Org Foundation ìã Ûããéá ÷ñÞóçð áñéããÛ ùĩĩéá ìã áððÞ ðĩò ÷ñçóεĩĩðĩεάβõáé áðũ õĩ FreeBSD. ÕðÛñ ÷ĩõĩ áðβóçð äéáéÝóéĩé äĩðĩñééĩβ X servers äéá õĩ FreeBSD.

Áðõũ õĩ εãòÛεáéĩ éá éáéýøáé õçĩ äãéãóÛóóáóç éáé ãýεĩéóç õũ X11 ìã Ýĩõáóç óõçĩ Ýéãĩóç 7.4 õĩò **Xorg**. Äéá ðεçñĩõĩñβãð ó ÷ãóééÛ ìã õçĩ ãýεĩéóç õĩò **XFree86** (ð. ÷. óã ðãééũðãñãð äéãũóáéð õĩò FreeBSD ùðĩò õĩ **XFree86** Þóáĩ ç ðñĩãðééããĩÝĩç äéãĩñÞ X11), ìðĩñãβõã ðÛĩðá íá áíáðñÝĩãðã óóéð áñ ÷äééããõçĩÝĩãð äéãũóáéð õĩò FreeBSD Handbook óõĩ <http://docs.FreeBSD.org/doc/>.

Äéá ðãñéóóũðãñãð ðεçñĩõĩñβãð ðĩò ó ÷ãðβãĩĩóáé ìã ðéð éÛñõãð ãñáóééÞĩ ðĩò ððĩóóçñβãĩĩóáé áðũ õĩ ðãñéãÛεεĩĩ X11, äãβõã õçĩ äééððáéÞ õĩðĩéãóβã Xorg (<http://www.x.org/>).

Áõĩý äéããÛóãðã áðõũ õĩ εãòÛεáéĩ, éá ìÝñãðã:

- Óã äéÛõĩñã ðĩÞĩáðã õĩò óóóðĩáõĩò X Window, éáé ðũð óõĩãããÛãĩĩóáé ìãðãĩý 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® ãñãĩĩãõĩõáéñÝð óõĩ X11.
- ðũð íá ãðεĩβóãðã õĩ óýóóçĩá óãð äéá óýĩãáóç (login) ìÝóũ ãñáóééĩý ðãñéãÛεεĩĩõĩò (**XDM**).

ðñéĩ äéããÛóãðã áðõũ õĩ εãòÛεáéĩ, éá ðñÝðäé:

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

5.2 Éãóáĩüçóç õĩò ðãñéãÛεεĩĩõĩò X11

Ç ÷ñÞóç õĩò ðãñéãÛεεĩĩõĩò X11 äéá ðñÞóç õĩñÛ ìðĩñãβ íá ðñĩéáéÝóáé íéá ìééñÞ óãñã ÷ ð óã ùðĩéĩ Ý ÷äé óõĩçèβóáé óã Ûééã ãñáóééÛ ðãñéãÛεεĩĩõĩá, ùðũð óã Microsoft Windows Þ õĩ Mac OS.

ÄãĩééÛ, äãĩ áβĩáé áðãñãβóçõĩ íá éãóáéãããβĩãðã ìã éÛéã äãðõñÝñãéá õũĩ äéãõũñũĩ ðĩçĩÛõũĩ õĩò X11 éáé ðÞð äéèçéãðéãñĩý ìãðãĩý õĩòð. ÉÛðĩéãð äãóééÝð ãĩÞóãéð ùũð, áβĩáé ÷ñÞóéĩãð éáé äĩççéĩý óõĩ íá äéĩãóáééããðãβõã éáéýðãñã ðéð äðĩáðũðçóãð õĩò X11.

Blackbox, ctwm, Enlightenment, fwm, Sawfish, twm, Window Maker, εάε ðεεεεε Ûεεεε. ÊÛεä Ýíáð áðu áðùéçð òéòð áεá÷áεñεóðÝð ðáñáεýñùé Ý÷áε áεáóεεñáðóεεÞ áβóεçóç εάε àéòÛéóç. Ìáñεεεεß áðu áðùéçð ððééçðñáεεεé “áεεεεεÝð áðεòÛéáεáð áñááóáð”, Ìáñεεεεß áðεòñÝðεεε ðñεóáñεεεéÝñεð óóεáóáóεεéçð ðεÞεðñùé áεá ðçé áεá÷áβñεóç ðçð áðεòÛéáεáð áñááóáð, Ìáñεεεεß Ý÷áεé Ûéá ðεÞεðñε “Start” Þ εÛóε ðáñεεεεε, Ìáñεεεεß ððééçðñáεεεé “εÝéáðá” (themes), áðεòñÝðεεε ðçééεεçñùðεεÞ áεεááÞ àéòÛéóçð Ìá ðçé áóáñεεáÞ áñεð éÝéò εÝéáðé. Ìε áεá÷áεñεóðÝð ðáñáεýñùé ðεò Ý÷áεé áéáóÝñáε ìð ðñéá, εάε ðεεεε Ûεεεε, áβéáε áεáεÝóεεεé ðçéé éáðçáεεεßá x11-wm ðçð ððεεεáÞð ðùé Ports.

ÁðεðεÝé, ðá áýé ðεé áçéεεεεÞ εεεεçñùéÝé ðáñεáÛεεεεéá áñááóáð, òé **KDE** εάε òé **GNOME**, Ý÷áεé òéé áεεé ðεòð áεá÷áεñεóð ðáñáεýñùé ðεò áβéáε áéóéáóεεéÝñε Ìá ðé ððεεεéðé ðáñεáÛεεεε áñááóáð.

ÊÛεä áεá÷áεñεóðð ðáñáεýñùé Ý÷áε áðβóçð εάε áεáóεεñáðóεεé ìç÷áéóéε ñýééóçð: Ìáñεεεεß ñðéεáεééáé óðéðçεñáεééáð Ìá ðáεñεεβéçðé ðñεðé Ýéá áñ÷áβé ñðéεβóáñ, Ûεεεε áεáεÝóεεé Ìá áñááεáá áεá ðεð ðáñεóóεðáñáð ñðéεβóáεð. ÕðÛñ÷áε áεεεá éε Ýéáð (**Sawfish**) ðεò Ý÷áεé áñ÷áβé ñðéεβóáñ áñáñÝé ðá éεá áεÛεáεéðé ðçð áεÞóóáð Lisp.

ðεεéðεεÞ Áóðβáóçð: ¶εεé Ýéá εÝéá áεá òé ððéεεé áβéáε ððáýεðéε ìé áεá÷áεñεóðð ðáñáεýñùé áβéáε ç “ðεεéðεεÞ áóðβáóçð” òé ðεεééεéé. ÊÛεä óýóçìά ðáñáεýñùé ðáñεáÛεáðáé εÛóéé ðñεðé áðεεεáÞð òé ðáñáεýñεò ðεò εá áÝ÷áðáé áððÛ ðεò ðεçεðñεεéáéééáé, εάε εá ðñÝðáé éá óáβéáðáé εÛðùð ìðé áððù òé ðáñÛεðñé áβéáε áéáñá.

Ìá áéúóðð ðεεéðεεÞ áóðβáóçð εÝááðáé “click-to-focus”. Áððù òé ìééóéε ðεçóééεðéáβóáé óðá Microsoft Windows, ìðéò Ýéá ðáñÛεðñé áβéáðáé áéáñá áé áá÷áβé Ýéá ðÛóçéá òé ðεεéééé.

Õé X ááé ððééçðñáεεé εáéβá óðáεáεñéééÝéç ðεεéðεεÞ áóðβáóçð. Áéðβεáðá, ìé áεá÷áεñεóðð ðáñáεýñùé áεÝá÷áε ðεé ðεé ðáñÛεðñé Ý÷áεé áóðεáóðáβé εÛεá ðóεáéÞ. Áεáóεεñáðóεεéß áεá÷áεñεóðð ðáñáεýñùé ððééçðñáεεéé áεáðéñáðóεéÝð Ìáεεúáéðð áóðβáóçð. ¼εéε ðεòð ððééçðñáεεéé ðçé ÌÝεéáé click to focus, εάε ìε ðáñεóóεðáñáé áðu áðùéçð ððééçðñáεεéé éáε áñεáðÝð Ûεεáð.

Ìε ðεé áçéεεεáβð ÌÝεéáé áóðβáóçð áβéáε:

focus-follows-mouse

Õé ðáñÛεðñé ðεò áñβóεáðáé εÛðù áðu òéé ááβεðç ðεò ðεεéééééß áβéáε òé ðáñÛεðñé ðεò Ý÷áεé ðçé áóðβáóç. Õé áéáñá ðáñÛεðñé ááé áβéáε áðáñáβóçðé Ìá áβéáε áððù ðεò áñβóεáðáé ðÛéú áðu ìεá ðá Ûεεá. Ç áóðβáóç áεεÛεáé Ìá ðçé óðù÷áðç áéúð Ûεεéò ðáñáεýñεò, ðñβð Ìá áβéáε áðáñáβóçðé òé éεéé ðÛéú ðεò.

sloppy-focus

ÁððÞ ç ðεεéðεεÞ áβéáε Ìεá ÌεéñÞ áðÝéðáóç ðεò focus-follows-mouse. Ìá ðçé ðεεéðεεÞ áóðβáóçð focus-follows-mouse, áé òé ðεéðβéé áñáεáβ ðÛéú áðu òé áñ÷áεεé (root) ðáñÛεðñé (Þ òé ðáñáóεÞéé) ááé ððÛñ÷áε áóðβáóç óá εáéÝéá ðáñÛεðñé, εάε ìðé ðεçεðñεεéáβóáé áðεÞð ðéáðáé. Ìá ðç sloppy-focus, ç áóðβáóç áεεÛεáé Ìá ìé áéáβεðç áñáεáβ ðÛéú áðu Ýéá ÌÝé ðáñÛεðñé, εάε ì÷áé ìðáé óáýááε áðu òé ðñÝ÷áé ðáñÛεðñé.

click-to-focus

Õé áéáñá ðáñÛεðñé áðεéÝááðáé Ìá éεéé ðεò ðεεééééé. Õé ðáñÛεðñé ðùðá “áéáóçεÞéáðáé”, εάε áéáβéáβáðáé ÌðñéóðÛ áðu ìεá ðá Ûεεá ðáñÛεðñé. ¼ðé ðεçεðñεεéáβé éá Ìáçáçéáβ óá áððù òé ðáñÛεðñé, áεεεá éáε áé ìé ááβεðçð Ìáðáéééçéáβ óá Ûεεé ðáñÛεðñé.

ðεεéεß áεá÷áεñεóðÝð ðáñáεýñùé ððééçðñáεεéé áεεεá ðεé áéúðéééÝð ðεεéðεεÞ áóðβáóçð, εáεÞð éáε ðáñáεéááÝð ðùé ðáñáðÛéú. Õéáééáðεáðáðá ðçé ðáεéçñβúç ðεò áεÛóðéðá áεá÷áεñεóðð ðáñáεýñùé áεá ðáñεóóεðáñáð éáððééÝñáεáð.

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

Όἱ òðũèíèðí òíŰ èáòáéáβíŰ éá óáð áìçáŰŰáé ðũð ñðèìβæáðáé òí X11, éáé ðũð íá óðŰŰáðá Ÿíá ðáñááũééèũ desktop ðáñéáŰèèí.

5.4 Νύèìéóç òíŰ X11

ΌðíáéóòíŰ òíŰ Christopher Shumway.

5.4.1 Ðñéí íáèéíŰŰáðá

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

- ÐñíæááñáóŸò òçð ïèũíçð
- Chipset òçð èŰñðáð áñáóéèŰí
- ÍŰìç òçð èŰñðáð áñáóéèŰí

Íé ðñíæááñáóŸò òçð ïèũíçð ÷ ñçóèíŰðíéŸíŰáé áðũ òí X11 áéá íá ïñéóéáβ ç áíŰèðóç éáé ï ñðèìũð áíáíŸùóçð óðí ïðíβí éá éáéðíŰñáŰŰáé. Íé ðñíæááñáóŸò áððŸò áñβóèíŰáé óðíŰèðũð óðçí òáèìçñβùóç ðíŰ òðíñááŸáé òçí ïèũíçç Ű óðçí éóðíŰáèβáá òíŰ éáðáóéáðáóðŰ. × ñáéŰæíŰáé áŸí óáéñŸò áñéèìŰí, ï ïñæũíŰéíð ñðèìũð áíáíŸùóçð éáé ï éáðáéũñðŰíð ñðèìũð áíáíŸùóçð.

Όἱ chipset (ïèíèççñũŸíŰ éŸéèèíá) òçð èŰñðáð áñáóéèŰí ïñβæáé ðíβíð ïäçáũð óðóéáðŰð éá ÷ ñçóèíŰðíéçèáβ áðũ òí X11 áéá òçí áðééíèŰíáíá ïá òçí èŰñðáð áñáóéèŰí. Áéá ðá ðáñéóóũðáñá chipset, áððũ ïðíñáβ íá áíé÷-íáðèáβ áððũíáðá, áèèŰ áβíáé ÷ ñŰŰéíŰ íá òí áíũñβæáðá óá ðáñβððũóç ðíŰ ááí ðáðóŸ-áé ç áððũíáðç áíβ÷-íáðóç.

Ç ïŰìç òçð èŰñðáð áñáóéèŰí éáèíñβæáé òçí áíŰèðóç éáé òí áŰèíð ÷ ñŰíáðíð óðí ïðíβí ïðíñáβ íá áíŰèŸŰáé òí óýóðçíá. Áððũ áβíáé òçíáíŰéèèũ ðŰðá íá áíũñβæáé ï ÷ ñŰŰóçð ðá ïñéá òíŰ óóóðŰíáðíð.

5.4.2 Νύèìéóç òíŰ X11

Áðũ òçí ŸéáíŰç 7.3 éáé ïáðŰ, òí **Xorg** ïðíñáβ óð÷-íŰ íá éáéðíŰñáŰŰáé ÷ ïñβð éáíŸíá áñ÷-áβí ñðèìβŰáũí, áñŰŰŰíðáð áðèŰð óçç áñáñŰ áíŰíèŰí:

```
% startx
```

Áðũ òçí ŸéáíŰç 7.4 éáé ïáðŰ, òí **Xorg** Ÿ÷-áé òçç áðíáðũòçðá íá ÷ ñçóèíŰðíééáβ òí HAL áéá òçí áððũíáðç áíβ÷-íáðóç òíŰ ðèçèðñíèíáβíŰ éáé òíŰ ðíŰðéééíŸí. Όá ports `sysutils/hal` éáé `devel/dbus` ááéáèβŰðáíŰáé ïð áíáñðŰŰáéð òíŰ `x11/xorg`, áèèŰ éá ðñŸðáé íá áíáñáíðíéçèíŸí ïá òèð áèũèíŰèáð ááñáóŸò óðí `/etc/rc.conf`:

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

Éá ðñŸðáé íá ïáèéíŰŰáðá òèð òðçñáóβáð áððŸò (áβðá ÷ áéñíèβíçðá, áβðá èŰñíŰáð áðáíáèèβíçç) ðñéí óðíá÷-βŰáðá ïá òç ñýèìéóç òíŰ **Xorg**.

Όα εΰδιεάο δάνεδόβραέο, ς αόουιαός ηύειέος ιδιναβ ία ις εάέοιωνάβραέ ούοόΰ, β ία ις ηόειβόάέ οέο οόόεάοΰδ
άειεάβδ υδδδ άδεέδιάβδά. Όόέο δάνεδόβραέο αόόΰδ, έα ÷ ηάεάοόαβ ία εΰίάοά ÷ άειηέβιςοάο ηόειβόάέο.

Όγιαβύος: Εΰδιεά άηάοέεΰ δάνεάΰεειία, υδδδ οί **GNOME** οί **KDE** β οί **XFCE**, άεάέΰοιόί άηάεάβά δίο
άδεοηΰοιόί οοί ÷ ηβόος ία ηόειβόάέ ία άύειει δηύδι εέΰοιηάο δάναιΰοηιόδ οςδ ιέυιςδ, υδδδ ς άίΰεόος. Αί ς
δηιαδέεάαιΰις ηύειέος άαι άβίαέ αδιάεέδβ, έεά οειδάγáοά ία άεάοάοόβραόά εΰδιει άδδ αόόΰ οά
δάνεάΰεειία, ιδιναβδά ία οοί ÷ βόάοά ία οςί άεάέοΰοόόος οιο, έεά ία ιειέεςηβραόά οέο ηόειβόάέο οάο
÷ ηςοέιιδιέβιόάο οί εάοΰεέςει άηάοέεΰ άηάεάβι.

Όι δηβδδ άβια άβίαέ ς αςιέιωνάβά άιυδ άη ÷ εέις άη ÷ άβιο ηόειβόάυι. ΰδ root, αδεβδ άεόάεΰόόά:

Xorg -configure

Αόου έα αςιέιωνάβραέ ΰία δηυόοδι άη ÷ άβι ηόειβόάυι οιο X11 οοιί εάοΰειαι /root ία οί υφία xorg.conf.new
(άβδά ÷ ηςοέιιδιέβραόά οί su(1) άβδά οοίαάεάβδά αδάδεάβáδ, ς ίαδάάεςδβ εάοάεΰαιδ \$HOME άεεΰεάέ άάβ ÷ ηιόάδ οη
εάοΰειαι οιο root). Όι X11 έα δηιόδάεβραέ ία άίε ÷ ίάγáε οί οδιόόόγια άηάοέββι οιο οόόδβιαοιο έεά ία αςιέιωνάβραέ
ΰία άη ÷ άβι ηόειβόάυι διο έα οηδβραέ οιοδ ούοόιςδ ιαςαιςδ οόόεάδβι έεά οί οέεεΰ διο άίε ÷ ίάςεςά οοι όόόγια οάο.

Όι άδυιαι άβια άβίαέ ι ΰεά ÷ ιδ ουι οδΰη ÷ ηιόυι ηόειβόάυι εεά ία αδεάάάεβραόά υδδ οί **Xorg** εάέοιωνάβ ία οί
οδιόόόγια άηάοέββι οιο οόόδβιαοιο οάο. Άεά έεάυόάέο οιο **Xorg** ιΰ ÷ ηέ οί 7.3, δεςεδηιέβραόά:

Xorg -config xorg.conf.new

Αδδ οί **Xorg** 7.4 έεά ίαοΰ, οί δάνάδΰιυ οάοό άάβ ÷ ίεά ίεά ίάγης ιέυις ς ιδιβά εΰίεά άύοέις ος εέΰαιυός έεεβδ
εάέοιωνάβδ οιο X11. ×ηςοέιιδιέβραόά οςί άδεειάβ retro έεά ία αδιεάοάοόβραόά οςί δάεέυδανς οοιδάηεοηιΰ:

Xorg -config xorg.conf.new -retro

Άΰι άιόάιέοόάβ ΰία ίάγηι έεά έειέ δεΰαιά έεά ΰίαδ άάβδςδ δηιόέεές ία ηηδβ X, ς ηύειέος βραί άδεοδ ÷ βδ. Άεά ία
οάηιαδβόάδ ος άιέειβ, ίαδάάάβδά οςί έεειέεβ ειιόυεά άδδ οςί ιδιβά οςί ίάεειβραόά, δεΰειιδάο **Ctrl+Alt+F1 (F1**
έεά οςί δηβδς έεειέεβ ειιόυεά) έεά δεΰόά **Ctrl+C**.

Όγιαβύος: Όόέο έεάυόάέο οιο **Xorg** δηέι οςί 7.3, ιδιηιόά ία ÷ ηςοέιιδιέςεάβ ι οοίαδάοιυδ δεβέδηι
Ctrl+Alt+Backspace έεά οηι οάηιαδέοιυ οιο δηιανΰιιαοιο. Άεά ία οηι άιαηαιδιέβραόά άδδ οςί ΰεαιός 7.4 έεά
ίαοΰ, ιδιναβδά ία βραόά οςί δάηάεΰδυ άιοιέβ οά εΰδιει οάηιαδέεΰ οιο X:

% **setxkbmap -option terminate:ctrl_alt_bksp**

Αίαέεάέοέεΰ, αςιέιωνάβραόά ΰία άη ÷ άβι ηόειβόάυι δεςεδηιέβραόά έεά οί **hald** ία οςί ηιιάοόβά x11-input.fdi
έεά αδιέςεάγáοά οί οοηί εάοΰειαι /usr/local/etc/hal/fdi/policy. Όι άη ÷ άβι αόου έα δηΰδάε ία
δάνεΰ ÷ έε οέο δάνάεΰδυ άηαιΰδ:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<deviceinfo version="0.2">
  <device>
    <match key="info.capabilities" contains="input.keyboard">
      <merge key="input.x11_options.XkbOptions" type="string">terminate:ctrl_alt_bksp</merge>
    </match>
  </device>
</deviceinfo>
```

Έα ÷ ηάεάοόαβ ία δάάιέεειβραόά οί ις ÷ ΰιςία οάο έεά ία άιαίαεέΰοάοά οί **hald** ία έεάΰόάε αόδδ οί άη ÷ άβι.


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

Ίε ιάόάεçðÝð HorizSync έάέ VertRefresh ιðññáß íá ιçí ððÛñ÷ϊοί όοι άñ÷άßι ñòειβόάυι. Αί άάι ððÛñ÷ϊοί, ðñÝðάέ íá ðñιόόάειύι, ιά όηι όουόδυ ιñεάυιόει ñòειυ όόά÷ññιεόιύ ιάδÛ όçí εΎίç HorizSync έάέ όηι έάόάεϋñòοι ñòειυ όόά÷ññιεόιύ ιάδÛ όçí εΎίç VertRefresh. Όόι ðάñάðÛíù ðάñÛάάεάιá, ðñιόεΎόάιá όιòð άίόβόοιέ÷ϊòð ñòειύð άίάίΎύόçð όçð ιεϋίçð ιάð.

Οί X άðέόñÝðάέ όç ÷ñÞόç ðυι άόίάόιòÞόυι DPMS (Energy Star) όά ιεϋιáð ðιò ððιόόçñβαιίόι όçí άίόβόοιέ÷ç έάέόιòñάβá. Οί ðñυάñάιιá xset(1) άέΎã÷άέ όιòð ÷ñυιòð έάέ ιðññáß íá άðέαÛεεάέ όέð έάόάόðÛόάέð standby, suspend, Þ off. Αί εΎεάόά íá άίάñάιðιεÞόάόά όέð άόίάόυόçόάð DPMS όçð ιεϋιçð όάð, ðñÝðάέ íá ðñιόεΎόάόά όçí άεϋειòεç άñάιñ όοι Section monitor:

```
Option "DPMS"
```

¼όι όι άñ÷άßι ñòειβόάυι xorg.conf.new άβιáέ άεϋιιá άñιεέδυ όά Ύίάι όόιðÛεðç έάειΎñò, άðεεΎίòά όçí άίÛεðόç έάέ όι άÛειð ÷ñυιÛόυι ðιò άðεεοιáβόá. Αόδυ έάειñβεάόάέ όοι 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 ιñβεάέ όι ðñιáðεεάαΎñι άÛειð ÷ñÞιáόιò ðιò έá ÷ñçόειιðιεçεάß. Ιðññáβόá íá όçí ðάñάέÛιφάόά ιά όηι άεάεϋððç -depth όόç άñάιñÞ άίόιεÞι όιò Xorg(1). Ç άðεειáÞ Modes ιñβεάέ όçí άίÛεðόç ιά όçí ιðιβá έá έάέόιòñάβ ç ιεϋίç όά Ύίá όόάέάεñεΎñι άÛειð ÷ñυιÛόυι. ðñιόΎίòά υιόέ ððιόόçñβαιίόάέ ιυι έάñιεέΎð έάόάόðÛόάέð VESA, υðυð ιñβεαιίόάέ άðυ όι ððιόόçόçιά άñάόεεÞι όιò όóóðÞιáόιð. Όόι ðάñάðÛíù ðάñÛάάεάιá, όι έάειñεόιΎñι άÛειð ÷ñυιÛόυι άβιáέ άεειόέðΎόόάñá bits άίÛ pixel. Όά άóδυ όι άÛειð ÷ñυιÛόυι, ç άðιáάέðÞ άίÛεðόç άβιáέ 1024×768 pixels.

ΟΎειð, άðιεçεάýόόά όι άñ÷άßι ñòειβόάυι έάέ άεΎάιòά όι ιά όçí ιΎειαι άεΎã÷ϊò ðιò άιçάÞόάιá ðάñάðÛíù.

Όçιáßυόç: Ύá άðυ όá άñάάεάβá ðιò ιðññáß íá όάó άιçεÞοιόι έάóÛ όçí άεάάεέάόβá άðβεðόçð ðñιáεçιÛόυι, άβιáέ όá άñ÷άβá X11 log, ðιò ðάñέΎ÷ϊοί ðεçñιòιñβáð άεά εÛεά όóóεάðÞ ðιò άðεειέιυιáß ιά όηι άεάειñεόðÞ X11. Όá άñ÷άβá **Xorg log** ιññÛεαιίόάέ ιά όçí ιññòÞ /var/log/Xorg.0.log. Οί άεñέáΎò υιιιá άιυò log ιðññáß íá άβιáέ Xorg.0.log Ύυò Xorg.8.log έάέ ðÛάέ εΎάιιðάó.

Αί υεά άβιáέ έάεÛ, όι άñ÷άßι ñòειβόάυι ðñÝðάέ íá όιðιεάðçεάß όá ιεá ειεíÞ όιðιεάóβá þóóá íá άίόιðβεάόάέ άðυ όι Xorg(1). ΑόðÞ óοιÞεϋð άβιáέ ç /etc/X11/xorg.conf Þ /usr/local/etc/X11/xorg.conf.

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

Ç äεάάεέεάόβá ñýèìέόç ðìð X11 Ý ÷ äέ ðβñá ïεἰέεçñùèåß Õἱ **Xorg** ìðἱñåßðå íá ðἱ ïåέίðóåðå ïå ðἱ äἱçèçðéèù ðñἱñåñåἱά startx(1). Ì äεάέñèóðð X11 ìðἱñåß åðßóçð íá äεέέίðóåé ïå ðç äἱðèåéá ðἱð xdm(1).

5.4.3 ΑἱåéééåðἱÝἱά ÈÝἱåðá Ñḱèìßðåἱ

5.4.3.1 Ñḱèìßðåèð äεά óá Intel® i810 Graphics Chipsets

Άέá íá ÷ ñçóέἱðἱέðóåðå èÛñðá åáóέἱÝἱç óðá Intel i810 integrated chipsets, áðåéðåßðåé ðἱ agpgart, ç äεάðáðð ðñἱñåñåἱåóέἱý ðἱ X11 äεά ðἱ AGP. Άåßðå ðçἱ óåεßåá manual ðἱð ðñἱñåñἱåðἱð ïåðåçóçð agp(4) äεά ðåñέóóúðåñåð ðεçñἱḱἱñåð.

Μå áððù ðἱ ðñḱἱ, ç ñýèìέóç ðἱð ðεέέý óáð èá ìðἱñåß íá åβἱåé ùðð èáé óá èÛèå Ûεç èÛñðá åñåóέβἱ. ðñἱóἱ ÷ ð, óå óðóððἱåðá ÷ ùñßð åἱóḱἱåðḱἱÝἱ ðἱ ïåçåḱḱ agp(4), ἱ ïåçåḱḱ ååἱ èá ḱἱñðḱèåß ïå ðçἱ åἱðἱèð kldload(8). Ì ïåçåḱḱ áððḱḱ ðñÝðåé íá åñßðååðåé óḱἱ ðḱñðἱå éåóÛ ðçἱ åεêβἱçóç, åßðå óóáðééÛ ïåðååèððééἱÝἱð, åßðå ïå ÷ ñðóç ðἱð /boot/loader.conf.

5.4.3.2 ðñἱðéÝḱἱðåð ïεά Widescreen Åðßðåç ἱεḱἱç

Άððḱḱ ðἱ ðἱðἱ ðñἱðἱéÝðåé ïåñééÝð åἱðóåð åἱåéåéåðἱÝἱñἱ ñḱèìßðåἱ. Αἱ ἱé ðñἱððÛεåéåð ïå óá óḱἱðεç åñååéåßá ñḱèìßðåἱ ååἱ éåðåèðñἱðἱ óå ἱεά ñýèìέóç ðἱð íá éåóḱἱḱñååß, ððÛñ ÷ ἱðἱ åñéåðÝð ðεçñἱḱἱñåð óðá åñ ÷ åßá log ðἱð ìðἱñýἱ íá óáð åἱçèððἱðἱ. Ûóðḱḱἱ, åβἱåé åðåñåßðçðç ç ÷ ñðóç åἱñḱḱ óḱἱðÛéðç èåéἱÝἱñḱḱ.

Ïé ðñÝ ÷ ἱðóåð åἱåýóåéð widescreen (WSXGA, WSXGA+, WUXGA, WXGA, WXGA+, è.á.) ððἱóðçñßæἱðἱ formats éåé aspect ratios (åἱåἱἱåßåð) 16:10 éåé 16:9 ðἱð ìðἱñåß íá çἱéἱḱñåððἱðἱ ðñἱåèðἱåðá. ðåñåååßåἱåðá ïåñέβἱ èἱéἱðἱ åἱåýóåḱḱ äεά åἱåἱἱåßá 16:10 åβἱåé óá:

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

ÈÛðἱéá óééåἱð, ç ñýèìέóç èá åβἱåðåé ðἱéý åðèÛ ðñἱðéÝḱἱðåð ðçἱ åἱÛéðóç ùð Ýἱά ðééåἱñ Mode óḱἱ Section "Screen" ùððð ååð:

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

Οί **Xorg** άβιάε άνέάοΰ Ύιόδιί πόά ίά άιάέδΠόάε όέδ δέçñιοιñβάδ όçò άίΰέόçò όçò widescreen ιέυιçò ιΎούò ούι δέçñιοιñέβί I2C/DDC, άφύñβæιίόάδ Ύόόε όé ιδιñάβ ίά ÷άέñέόόάβ ç ιέυιç υίόι άοιñΰ όέδ όδ÷ιύόçόάδ έάέ όέδ άιάέύόάέδ.

Άί άόδΎò ιé ModeLines άάί όδΰñ÷ιόι όόιόδ ιάçαιύò, ιδιñάβ ίά ÷ñάέάόόάβ ίά όέδ άβόάόά άόάβδ όόι **Xorg**. ×ñçόέιιδιέβίόάδ όι /var/log/Xorg.0.log ιδιñάβδά ίά άιάέδΠόάόά άνέάοΰ δέçñιοιñβάδ πόάά ίά άçιέιόñάβόάά ιüíé όάδ Ύιά ModeLine διό ίά έάέόιόñάάβ. Άδβέδ άιάαçòΠόάά δέçñιοιñβάδ διό έά ιιέΰæιόι ίά άόδύ:

```
(II) MGA(0): Supported additional Video Mode:
(II) MGA(0): clock: 146.2 MHz Image Size: 433 x 271 mm
(II) MGA(0): h_active: 1680 h_sync: 1784 h_sync_end 1960 h_blank_end 2240 h_border: 0
(II) MGA(0): v_active: 1050 v_sync: 1053 v_sync_end 1059 v_blanking: 1089 v_border: 0
(II) MGA(0): Ranges: V min: 48 V max: 85 Hz, H min: 30 H max: 94 kHz, PixClock max 170 MHz
```

ΆόδΎò ιñΰæιίόάέ δέçñιοιñβάδ EDID. Ç άçιέιόñάβά άφύδ ModeLine άδύ άόδΎò, άβιάόάέ άΰæιίόάδ άδβέδ όιόδ άñέέιύδ όόç ούόόΠ όάέñΰ:

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

Όάέέέΰ, όι ModeLine όόι Section "Monitor" όόι δάνΰάάέαιά ίάδ έά ιιέΰæιόέ ίά άόδύ:

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

Όβñά διό Ύ÷άόά όάέάέπόάέ ίά άόδΰ όά άδβέΰ άβιάόά, όι X έά δñΎδάέ ίά έάέόιόñάβόάέ όόç ιΎιά widescreen ιέυιç όάδ.

5.5 ×ñΠόç Άñάιιáόιόάέñβί όόι X11

Όόιáέόοιñΰ όιό Murray Stokely.

5.5.1 ΆñάιιáόιόάέñΎò όύδιό Type1

Ιέ δñιέάειñέόιΎιάδ άñάιιáόιόάέñΎò διό όόñάγίόι όι X11 άάί άβιάέ έάάίέέΎò áέά άόάñιιáΎò άδέδñάδΎæέάδ όόδñάñάόβáδ. Ιέ ίάáΰεάδ άñάιιáόιόάέñΎò δάνιόόβáόçò όάβñιόάέ ιαιίόυόΎò έάέ άñάόέόά÷ιέέΎò, έάέ ιέ ιέέñΎò άñάιιáόιόάέñΎò όόι **Netscape** άβιάέ ό÷άάιι άέάόΰεçδδóδ. Άόδó÷βò υιύδ, όδΰñ÷ιόι áέάέΎόείλδ άñέάδΎò, όççέΠò διέύόçόάδ άñάιιáόιόάέñΎò Type1 (PostScript®) διό ιδιñιύί ίά ÷ñçόέιιδιέçέιύί ΰιáόά άδύ όι X11. Άέά δάνΰάάέαιά, ç όόέέιñΠ άñάιιáόιόάέñβί URW (x11-fonts/urwfonts) δάνέΎ÷άέ άέάυιόάέδ όççέΠò διέύόçόάδ όύι όόιçέέόιΎιιí type1 άñάιιáόιόάέñβί (Times Roman®, Helvetica®, Palatino® έάέ ΰέέάδ). Ç όόέέιñΠ Freefonts (x11-fonts/freefonts) δάνέΎ÷άέ διέέΎò δάνέόóύόάñάδ άñάιιáόιόάέñΎò, áέέΰ ιέ δάνέόóύόάñάδ άδύ άόδΎò άβιάέ áέά έιáέόιέέυ άñάόέέβί υδύδ όι **Gimp**, έάέ άάί άβιάέ έάόΰέççέάδ áέά άñάιιáόιόάέñΎò ιέυιçò. Άέυιç, όι X11 ιδιñάβ ίά άέΰ÷έόόι έυδι ίά ñέιέόόάβ πόάά ίά ÷ñçόέιιδιέάβ TrueType άñάιιáόιόάέñΎò. Άέά δάνέόóύόάñάδ έάδδñΎñάέάδ, άάβδά όçι όάέβάά manual X(7) Π όι όιΠιá ό÷άόέέΰ ίά όέδ άñάιιáόιόάέñΎò TrueType.

5.5.3 Anti-Aliased ΆñàìáοἰόáεñÝò

Αἰάτáπεçεά áδῦ οἰἱ Joe Marcus Clarke.

¼εάò ἱε άñàìáοἰόáεñÝò X11 ðἱò άñβóεἱἰόáε οἰἱ /usr/local/lib/X11/fonts/ έάε οἰ ~/.fonts/ άβἱάε áδòῦἱάόá έεάεÝóεἱάò áεά anti-aliasing óá άóáñἱἱάÝò Xft-aware, óοἰðáñέεáἱάáñἱÝἱῦἱ οἱò KDE, GNOME έάε Firefox.

Άέά ἱά έεÝáἱάóá ðἱβáò άñàìáοἰόáεñÝò άβἱάε anti-aliased, P ἱά ñðεἱβóáòá óεð έεέῦòçòáò οἱò anti-aliasing, áçἱεἱòñáPóóá (P ðñἱðἱðἱεPóóá, áἱ Páç ððŨñ÷άε) οἱ άñ÷άβἱ /usr/local/etc/fonts/local.conf. ἸÝóῦ áðóἱý οἱò άñ÷άβἱò ἱðñἱýἱ ἱά ñðεἱóóἱýἱ άñέáðŨ áἱέέáέέáοἱÝἱά ÷άñáέðçñέóóέέŨ οἱò óðóðἱάóἱò άñàìáοἰόáεñἱP Xft. Άðóῦ οἱ òἱἱά ðáñέáñŨóáε ἱῦñἱ ἱáñέéÝò áðεÝò áóἱάóῦòçòáò. Άέά ðáñέóóῦòáñáð έáððἱñÝñáέáð, ááβóá οἱ fonts-conf(5).

Œἱ άñ÷άβἱ áðóῦ ðñÝðáε ἱά άβἱάε ἱñòPò XML. ΆPóóá ἱááŨεç ðñἱóἱ÷P óóá ðáæŨ / έáóáέáβá, έάε óεáἱòñáðέáβóá ἱóé ἱεά óá tags Ý÷ἱóἱ έεáβóáé óóóðŨ. Œἱ άñ÷άβἱ ἱáέéἱŨ ἱá óçἱ óἱçεéοἱÝἱç áðééáóáεβáá XML έάε Ýἱά ἱñέóἱῦ DOCTYPE, έάε Ýðáέóá áéἱεἱòέáβ οἱ <fontconfig> tag:

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

¼ðῦð áβðáἱά ðñἱçáἱοἱÝἱῦð, ἱεáð ἱε άñàìáοἰόáεñÝò óοἱ /usr/local/lib/X11/fonts/ ῦðῦð έάε óοἱ ~/.fonts/ έεάóβεáἱóáé Páç óá Xft-aware áóáñἱἱάÝò. Αἱ εÝέáóá ἱά ðñἱóéÝóáóá έάε Ũεεἱòð έáóáεῦáἱòð áéðῦð áδῦ áðóἱýð οἱòð äýἱ, ðñἱóéÝóóá ἱεά άñáἱP ðáñῦἱεá ἱά áððP ðἱò áéἱεἱòέáβ οἰἱ /usr/local/etc/fonts/local.conf:

```
<dir>/path/to/my/fonts</dir>
```

Άóἱý ðñἱóéÝóóáð ἱÝáð άñàìáοἰόáεñÝò, έάε áεáéεῦóáñá ἱÝἱòð έáóáεῦáἱòð άñàìáοἰόáεñἱP, ðñÝðáε ἱά έεðáéÝóóáð óçἱ áéῦεἱòεç áἱòἱεP áεά ἱά áἱάäçἱεἱòñáPóóáð óçἱ cache άñàìáοἰόáεñἱP:

```
# fc-cache -f
```

Œἱ anti-aliasing εŨἱάé óá Ũéñá áεáòñPò óóáεá÷οἱÝἱά, εŨñἱóáð Ýóóé óá ðἱεý ἱεéñŨ άñŨἱάóá ðεἱ áἱάáἱPóéἱά, έάε áóáéñáβ óéð “έεβἱάέáð” (óεáεἱðŨóéá) áδῦ óá ἱááŨεá άñŨἱάóá, áεéŨ ἱðñἱάβ ἱά ðñἱεáéÝóáé áñἱ÷εPóáéð óóá ἱŨóéá áἱ ÷ñçóéἱðἱεçεáβ óá έáñἱééŨ ἱááÝεç. Άέά ἱά áἱάéñÝóáóá áδῦ οἱ anti-aliasing ἱááÝεç άñàìáοἰόáεñἱP ἱεéñῦðáñá áδῦ 14 point, ðñἱóéÝóóá áðóÝð óéð άñáἱÝò:

```
<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 (æéáóðßιάóá) óá ìáñééÝð monospaced ãñáìíáóìíóáéñÝð ìðñáß áðßóçð íá áßíáé æéáóÛεççèí ùðáí ÷ñçóçèíðèéáßðóáé anti-aliasing. Áððü öáßíáðóáé íá áðìíóáéáß éæéáßðáñí ðñüâéççιά ìá òí **KDE**. Ìéá æéññèùóç ãéá áððü, áßíáé íá áðéáÛεççéðá òí spacing òçí òçèß 100 ãéá áððÝð òéð ãñáìíáóìíóáéñÝð. ÐñíóçÝóðá òéð æéüçèðéàð 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 ìáðìñÛεáé òá Ûεéá çèíÛ ññüíáðá òúí fixed ãñáìíáóìíóáéñß ùð "mono"), éáé Ýðáéðá ðñíóçÝóðá:

```
<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 ðé Helvetica, ìðñáß íá áìíóáíßæèíðí ðñüâéççιά ùðáí áßíáé anti-aliased. Õí ðñüâéççιά óð÷íÛ æéççèíðáðé ùð ìßá ãñáìíáóìíóáéñÛ èìñÝçç èÛεáðá òóçí ÝÝóç. Óóçí ÷áéññüðáñç ðáñßððóç, ìðñáß íá èÛíáé èÛèíéáð áðáññáýóíí. Áéá íá òí áðìíóáéáðá áððü, ìðñáßðá íá ðñíóçÝóðá òí æéüçèðéí òðí 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 òáéáððóáðá òçí ìáðáðñíðß òíð local.conf óéáíðñáðéáßðá ùðé èéáßðóáðá òí áñ÷áßí ìá òí </fontconfig> tag. Áí ááí òí èÛíáðá, ðé æééááÝð óáð éá ááñççèíýí.

ÕÝèð, ðé ÷ñßðóáð ìðñíýí íá ðñíóçÝóííí òéð æééÝð òíðð ñðçèíßðáéð ìÝóù òúí ðñíóùðçéçèí òíðð áñ÷áßí .fonts.conf. Áéá íá áßíáé áððü, èÛεá ÷ñßðóçð ðñÝðáé áðçð íá ççèíðñáßðáé Ýíá ~/ .fonts.conf. Áððü òí áñ÷áßí ðñÝðáé íá áßíáé áðßóçð XML ññðßð.

ÈÛðé òáéáððáßí: óá ìßá LCD ðèúçç, ìðñáß íá áßíáé áðçéçççóùð ì ááéáíáðéóíùð sub-pixel. Ì ááéáíáðéóíùð ÷áéññæáðáé ÷ñéóóÛ òá (ñéæüíðéá áéá÷ñéóíÝíá) èüéçéíá, ðñÛóéíá éáé ìðéá òðé÷áßá ððóá íá ááéðéðóáé òçí ñéæüíðéá

άΰεόç. Όά άδίοάεΰόιαόά ιδίνάβ ίά άβίαέ άñáíáóέέΰ έάέύόάñá. Άέά ίά οίί áíññáñðíεΠόάόá, ðñíóεΰόόá όçí ðáñáέΰóù áñáññ ð έΰðíó όóí áñ÷áβí local.conf:

```
<match target="font">
  <test qual="all" name="rgba">
    <const>unknown</const>
  </test>
  <edit name="rgba" mode="assign">
    <const>rgb</const>
  </edit>
</match>
```

Όçιάβυόç: Άίΰεííáά ίά οίί όγðí όçò íεúίçð, οί rgb ιδίνάβ ίά ÷ñáέάόόáβ ίά áέεΰíáέ όá bgr, vrgb ð vbgr: ðáέñáíáόέόόáβóá έάέ ááβóá ðíβí έάέόíðñááβ έάέύόáñá.

5.6 Ί X Display Manager

Όðíáέόóíñΰ ðíó Seth Kingsley.

5.6.1 Άέόάáññáβ

Ί X Display Manager (**XDM**) άβίαέ Ύía ðñíáέñáóέέú ίΎñíò οίò óóóðΠίαóíð X Windows ðíó ÷ñçóέíðíεάβóáέ áέá áέá÷áβñέόç óóíáΎόáñí (logins). Άðóù άβίαέ ÷ñΠόέíí óá ðíεεΎð ðáñέððóáέð, úðòð óá áðέΰ “X Terminals”, óá desktop ίç÷áΠίαόá, έάεðð έάέ óá áέáέñέóóΎð ίááΰεúí áέέóýúí. Άóíý οίί óýóóçιά X Windows άβίαέ áíáíΰñóçóí ðñúóíεúεúú έάέ áέέóýúí, ððΰñ÷áέ ίááΰεí áýñíð ðέέáíðí ñóεíβóáñí áέá όçí έάέóíðñááβ X ðáέáóðí έάέ áέáέñέóóðí óá áέáóíñáóέέΰ ίç÷áΠίαόá óóíáááñíΎía óá Ύía áβέðóí. Ί **XDM** ðáñΎ÷áέ Ύía áñáóέέú ðáñέáΰεεíí áέá όçí áðέεíñáβ οίò áέáέñέóóð íá οίί ιðíβí έá άβίαέ ç óýíááóç, έάέ áέá όçí áβóíáí ðεçñíóíñέðí ðέóóíðíβççóç úðòð οίò ίíúíáóíð ÷ñΠόóç έάέ οίò έúáέέíý ðñúóááóçð.

Όέáðέáβóá οίί **XDM** úð ίέá áóáñíñáβ ðíó ðáñΎ÷áέ óέð βáέáð áóíáóúðççóáð óóíí ÷ñΠόóç ίá οίί áñááέáβí getty(8) (ááβóá οίί ΌίΠία 26.3.2 áέá έáððñΎñáέáð). Όί XDM áέðáέáβ óóíáΎόáέð (logins) óóíí áέáέñέóóð έάέ Ύðáέóá áέðáέáβ Ύía áέá÷áέñέóóð óóíááññáð (session manager, óóíΠεúð Ύíaí X áέá÷áέñέóóð ðáñáέýñúí, window manager) áέá εíñáέñέáóíú οίò ÷ñΠόóç. Ί **XDM** Ύðáέóá ðáñέΎíaέ ίá óáñíáóβóáέ áóóú οί ðñúáñáñá, ðíó óçíáóíáíóáβ úðέ ί ÷ñΠόóçð óáέáβυóá έάέ ðñΎðáέ ίá áðíóóíááέáβ. Όá áóóú οίί όçíáβí, í **XDM** ιδίνάβ ίá áíóáíβóáέ ίáíΰ όçí íεúίç áέóúáíð (login) έάέ όçí íεúίç áðέεíñáβ ðñáóέέβð óýíááóçð þóá ίá óóíááέáβ Ύíað ΰεεíð ÷ñΠόóçð.

5.6.2 ×ñΠόç óíó XDM

Άέá ίá ίáέέίΠόáóá ίá ÷ñçóέíðíεάβóá οίί **XDM**, ááέáóáóðΠóðá οίί port x11/xdm (ááí ááέáέβóóáóáέ áðú ðñíáðέéíñáβ óóέð ðñúóóáóáð áéáúóáέð οίò **Xorg**). Ίðíñáβóá Ύðáέóá ίá áñáβóá οίί ááβíííá **XDM** óóí /usr/local/bin/xdm. Άðóú οί ðñúáñáñá ιδίνάβ ίá áέðáέáóóáβ ιðíεááΠðíóá óóέáñΠ ðð root έάέ έá ίáέέίΠóáέ ίá áέá÷áέñβáóáέ όçí íεúίç οίò X óóí ðíðέéú ίç÷Ύίçιά. Άί í **XDM** ðñΎðáέ ίá áέðáέáβóáέ έΰεá óíñΰ ðíó áέέέíáβóáέ οί ίç÷Ύίçιά, Ύíað áíεέéúð óñúðíð άβίαέ ç ðñíóεΠεç ίεáð áñáññð óóí /etc/ttys. Άέá ðáñέóóúðáñáð ðεçñíóíñáð ó÷áðέέΰ ίá όçí ίññóβ έάέ όçí

άδεείαΎά άδαέειύέόο (display chooser). ΐΎόά άδου ίδινάβ ίά όνιόιόίεεεάβ ε αιόΎίέόε όιό όνιάνΎιιόόιό login. Ε ιιόΠ όιό άβίάε βάέα ίά όι άν÷άβι app-defaults όιό όάνεάνΎοάόάε όόεί όάειεήνβύόε όιό X11.

5.6.3.3 Xservers

ΆόόΠ άβίάε ίέα έβόόά όυί άόνιάνέοόιΎιύι όάειπí όιό όνΎόάε ίά αιόάιβαιίόάε υό άδεείαΎό όόι όνιάνάιιá (chooser).

5.6.3.4 Xsession

Άόόυ άβίάε όι όνιέάεινέόιΎιύi session script όιό άέόάεάβ όι **XDM** ίάόΎ όε όύίαάόε έΎόίειό ÷ñΠόόε. ΈάνιέέΎ, έΎεά ÷ñΠόόε έά Ύ÷άε Ύία όνιόιόίεείΎιύi, άέέυ όιό, session script όόι ~/ .xsession όιό έά όάνάέΎιόόάε άόόυ όι script.

5.6.3.5 Xsetup_*

Όά άν÷άβá άόόΎ άέόάειύίόάε άόόυιáόά όνέί όεί αιόΎίέόε όυί όάνάέýñύi άδεείαΠό Π όύίαάόε. ΌόΎñ÷άε Ύία script άέα έΎεά display όιό ÷ñεόειύιόιέάβόάε, όιό ιιñΎεάόάε xsetup_ ίά όι ήύίάñi όιό display όόι όΎέιό (άέα όάνΎΎάέάιá xsetup_0). ΈάνιέέΎ άόόΎ όά scripts έά άέόάειύί Ύία Π άόι όνιάνΎιιáόά όόι όάνάόέΠίεί υόόυ ό.÷. όι xconsole.

5.6.3.6 xdm-config

Όί άν÷άβι άόόυ όάνεΎ÷άε ñόειβόάέό όόεί ιιόΠ όυί app-defaults, όιό άόάνιυαιίόάε όά έΎεά display όιό άέα÷άέñβεάόάε ε όόάέάέñέiΎίε άάέάόΎόόάε.

5.6.3.7 xdm-errors

Όί άν÷άβι άόόυ όάνεΎ÷άε όεί Ύñiái όυί άέαέñέόόβi X όιό όνιόόάεάβ ίά άέόάεΎόάε όι **XDM**. Άί Ύία display όιό όνιόόάεάβ ίά άέέειΠόάε ο **XDM** έιέεΠόάε άέα έΎόίεί έυiái, έάέυ άβίάε ίά άίάεεόΠόάόά άäp όό÷ύi ιεύίγίáόά όόάειΎόυí. Όά ιεύίγίáόά άόόΎ έάόάάνΎοιόάε έάε όόά άν÷άβá ÷ñεόόβi ~/ .xsession-errors.

5.6.4 Άέαόεήπiόάό Ύίαί ΆέαέñέόόΠ ΆόνιάνέοόιΎιύi ΌόίαΎόάυí

Άέα ίά όόίαΎιόάε έάε Ύέείε όάέΎόόό όόι άέαέñέόόΠ iευίεό, όνιόιόίεεΠόόά όιόό έάύιáό άέΎã÷iό όñυόάάόεό, έάε άíáñiáiόίεεΠόόά όέό άέόάñ÷ύiáíáό όόίαΎόάέό. Όά όάνάόΎiύi άβίάε, άδυ όñiáόέείáΠ ñόειέόiΎία όά όόίόεñεέέΎό όειΎό. Άέα ίά έΎiáόά όi **XDM** ίá äΎ÷άόάε όόίαΎόάέό, άñ÷έέΎ ίáόάόñΎόόá όá ó÷üέéi όεί όάνάέΎόυ όñáñiΠ όόí άñ÷άβi 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 ίáόΎ άόάíáέέéiΠόόá όñi **XDM**. ίá Ύ÷άόá όόυόéí óáό υóé óá ó÷üέéá óóá άñ÷άβá app-defaults ίáέέéñύí ίá όñi ÷áñáέόΠñá “!”, έάε ü÷é όñi óóίΠεε “#”. ΐδινάβ ίá άόέέόiáβόá όéi άόόόεñiύó έάύιáό άέΎã÷iό όñυόάάόεό. Άάβόá όá όάνάááβáíáόá όóí xaccess, έάε όóíáñiόéáόéáβόá όε όάέβáá manual όiό xdm(1).

Ç éáéýðáñç áηΠεάέα áέα οί **KDE** áβίαέ ç on-line óáειçñβùóç. Οί **KDE** óοηηάάγáðάέ áðu οηί áέεü οηó ðáñεçãçð, οηί **Konqueror**, ðηεé Ýð ÷ ñΠóέηáð áοáñηηáÝð, έάέ áηάεððέéΠ óáειçñβùóç. Οί ððuεηέðη áððΠð óçð áηúóçðáð óðæçðÜ óá ÷ ηέεÜ εÝηáóá ðηó áβίαέ áγέεηη ηά áηάέáεðöεηηί ηά áηέεηÝð.

5.7.3.1 Ϊ KDE Display Manager

Ϊ áέα ÷ áέηέóððð áηúð ðηεð ÷ ñçóðέεηγ óðóðΠηáοηò εÝεάé áηáá ÷ ñÝηúð ç óγηááóç ðηί ÷ ñçóððηί ηά áβηáðάέ ηÝóü áñáóέεηγ ðáñέαÜεεηηò. Ξððð ðáñέαñÜøáηá ðñβί, ηðñáβ ηά ÷ ñçóέηηðηέçεáβ οηί XDM. Ξηúð, οηί **KDE** ðáñéÝ ÷ áέ ηέα áηάέéáéðέéΠ áðέεηáΠ, οηί **kdm**, οηί ηðηβη Ψ ÷ áέ ó ÷ ááέáóðáβ ηά áβηάέ ðηβη áέεðóðέéü έάέ ðáñÝ ÷ áé ðáñέóóüðáñáð áðέεηáÝð έáóÜ óç óγηááóç. ÓðáéáñέηηÝηά, ηέ ÷ ñΠóóáð ηðñηηγί áγέηεά ηά áðέéÝηηóη (ηÝóü ηáñγ) ðηβη áñáóέéü ðáñέαÜεεηη (**KDE**, **GNOME**, Π εÜðηέη Üεεη) έá áέðáéáóðáβ ηáðÜ óçηί óγηááóç οηòð.

Άέα ηά áñáñáηηðéΠóáðá οηί **kdm**, έá ðñÝðáé ηά áέéÜηáðá οηί ttyv8 óðη /etc/ttys. Ç áñáηηΠ έá ηηéÜæáé ηά óçηί ðáñáéÜðü:

Άέα οηί **KDE3**:

```
ttyv8 "/usr/local/bin/kdm -nodaemon" xterm on secure
```

Άέα οηί **KDE4**:

```
ttyv8 "/usr/local/kde4/bin/kdm -nodaemon" xterm on secure
```

5.7.4 Xfce

5.7.4.1 Ó ÷ áðééÜ ηά οηί Xfce

Οηί **Xfce** áβηάέ Ψηά áñáóέéü ðáñέαÜεεηη ðηó óççñβæáðάέ óççηί áέáééηèΠεç GTK+ ðηó ÷ ñçóέηηðηέáβðáé έάέ áðu οηί **GNOME**, áέéÜ áβηάέ ðηéγ ðéη áεáðñý έάέ ðñηñβæáðάé áέα ηúòðð εÝεηòη Ψηά áðéü, áðηðáéáóηáóέéü áñáóέéü ðáñέαÜεεηη ðηó áβηάέ áγέηηη ηά ÷ ñçóέηηðηέçεáβ έάέ ηά ñðéηέóðáβ. ΪðéééÜ, ηηéÜæáé ðηéγ ηά οηί **CDE**, ðηó óðηáíóÜðáé óá áηðñέéÜ óðóðΠηáóá UNIX. ΪáñέéÜ áðu óá ÷ áñáéðçñέóðέéÜ οηó **Xfce** áβηάέ:

- ηά áðéü, áγέηηη óççηί ÷ ñΠóç áñáóέéü ðáñέαÜεεηη
- ΔεΠñüð ðáñáηáðñηðηέΠóέηη ηά οηί ðηóβέé, ηά drag and drop, έéð.
- Έáηóñέéü panel ðáñáñηηέη ηά οηó **CDE**, ηά ηáñγ, ηέéñη-áóáñηηáÝð έάέ ðεΠðéñá áέéβίççðð áóáñηηáΠη
- ΪεηέεçñüÝηò áέα ÷ áέηέóððð ðáñáéγññü, áέα ÷ áέηέóððð áñ ÷ áβü, áέα ÷ áέηέóððð Π ÷ ηó, óðηááóüòçðá ηά οηί **GNOME**, έάέ Üεéá
- Άóηáóüòçðá ÷ ñΠóçðð έáηÜðüη (themes, áóηγ ÷ ñçóέηηðηέáβ οηί GTK+)
- ΆñΠáññη, áéáðñý έάέ áðηðáéáóηáóέéü: έááηέéü áέα ðáéáéüðáñá/ðéη áñáÜ ηç ÷ áηΠηáóá Π ηç ÷ áηΠηáóá ηά έβãç ηηΠηç ðáñέóóüðáñáð ðεçñηòññβáð áέα οηί **Xfce** ηðññáβðá ηά áñáβðá óçç áέéððáéΠ ðηðηέáóáβ οηó Xfce (<http://www.xfce.org/>).

5.7.4.2 ΆééáðÜóðáóç οηó Xfce

ΟðÜñ ÷ áé (óççηί þñá ðηó áñÜöηηóáé áððÝð ηé áñáñÝð) Ψóηηη ðáéÝοηί áέα οηί **Xfce**. Άέα ηά οηί ááéáðáóðóáðá, áðεðð ðεççéðñηηéáΠóá:

ÊäöÛëáéí 6 Desktop ÄöáñííäÝò

ÓðíäéóòíñÛ òíò *Christophe Juniet*.

6.1 Óýííøç

Ôí FreeBSD íðíñáß íá äéðäéÝóáé íéá äòñáßá äéÛíá desktop äòáñííäÝò, ùðùð öðëëíäòñçðÝò (browsers) éáé äðáíñááóðÝò éáéíÝíò. Íé ðáñéóóóòáñáð áðù áððÝò áβíáé äéáéÝóéíäð ùð ðáéÝóá (packages) P íðíñíý íá ääéáóáóðáéíýí áðòùíäóá áðù òçí ÓðëëíäP òùí Ports. Ðíëëíß íÝíé ÷ ñPóðáð áíáíÝíòí íá áñíòí óÝóíéíò áβáíòð äòáñííäÝò óòí desktop òíòð. Ôí ÊäöÛëáéí áðòù éá óáð äáβíáé ðùð íá ääéáóáóðPóáðá ÷ ùñßð éùðí òéð ðéí äçííòééáßð desktop äòáñííäÝò, áβòá áðù ðáéÝóá áβòá áðù òç ÓðëëíäP òùí Ports.

ÓçíäéPóðá ùðé ùðáí ääéáéóóðÛðá ðñíñÛííäóá áðù òç ÓðëëíäP òùí Ports, áβíáðáé íäðáäéPððéóç áðù òíí ðçááβí éPáééá. Áðòù íðíñáß íá ÷ ñáéáóðáß ðíëý ÷ ñúñí, éáéPð áíáñðÛðáé áðù òí ðñúáñáííá òí íðíβí íäðáäéùððßæáðá éáé òçí òðíëíäéóðééP éó ÷ ý òíò ìç ÷ áíPíáðùð óáð. Áí òí ÷ ñííééù äéÛóóçíá òí íðíβí ÷ ñáéÛæáðáé ç íäðáäéPððéóç áβíáé áðááíñáðééÛ íäáÛéí, íðíñáßðá íá ääéáóáóðPóáðá óá ðáñéóóóòáñá ðñíñÛííäóá òçð ÓðëëíäPð òùí Ports áðù ðñí-íäðáäéùððéóíÝíá ðáéÝóá.

ÉáéPð òí FreeBSD äéáéÝóáé óðíááðùðçðá íá äéðäéÝóéíá ðñíñÛííäóá äéá Linux, ðíëëÝò äòáñííäÝò ðíò áíáððý ÷ èçéáí áñ ÷ ééÛ äéá òí Linux áβíáé äéáéÝóéíäð äéá òí desktop óáð. Óáð óðíéóóòíýíá éáñíÛ íá äéááÛóáðá òí ÊäöÛëáéí 10 ðñéí ääéáóáóðPóáðá íðíéááPðíòá áðù òéð äòáñííäÝò Linux. ÐíëëÛ áðù óá ports ðíò ÷ ñçóéííðíéíýí òç óðíááðùðçðá íá Linux Ý ÷ íòí ííúíäóá ðíò íáééíýí íá "linux-". Èðíçéáßðá òí ùðáí PÛ ÷ íáðá äéá éÛðíéí óðáéáñéíÝíí port, äéá ðáñÛááéáíá íá òçí whereis(1). Óòí éáβíáíí ðíò áéíéíòéáß éáññáβðáé ùðé Ý ÷ áðá áíáñííðíéPóáé òçí óðíááðùðçðá íá äéðäéÝóéíá ðñíñÛííäóá Linux ðñéí ääéáóáóðPóáðá íðíéááPðíòá áðù òéð äòáñííäÝò òíò Linux.

Íé éáðçáññáð ðíò éáéýððííóáé áðù áðòù òí ÊäöÛëáéí áβíáé íé áíPð:

- ÖðëëíäòñçðÝò (ùðùð **Firefox, Opera, Konqueror**)
- ÄòáñííäÝò áñáðáβíò (ùðùð **KOffice, AbiWord, The GIMP, OpenOffice.org**)
- ÐñíñÛííäóá ðñíñáPð áááñÛòùí (ùðùð **Acrobat Reader®, gv, Xpdf, GQview**)
- ×ñçíáðíééííééÝò äòáñííäÝò (ùðùð **GnuCash, Gnumeric, Abacus**)

Ðñéí äéááÛóáðá áðòù òí ÊäöÛëáéí éá ðñÝðáé:

- Íá íÝñáðá ðùð íá ääéáóáóðPóáðá ðñúðéáðí éíáéóíééù ðñßðíò éáðáðéáðáðP (ÊäöÛëáéí 4).
- Íá íÝñáðá ðùð íá ääéáóáóðPóáðá ðñúðéáðí éíáéóíééù Linux (ÊäöÛëáéí 10).

Áéá ðççíòíòññáð ó ÷ áðééÛ íá òçí ääéáðÛóðáóç ðíëòíáóééíý ðáñéáÛëëíòíò äéááÛóðá òí ÊäöÛëáéí 7. Áí è Ýéáðá íá ñðéíβóáðá éáé íá ÷ ñçóéííðíéPóáðá éÛðíéá òðçñáóβá çæéðñíééíý óá ÷ ðáññáβíò ááβòá òí ÊäöÛëáéí 28.

6.2 ÖðëëíäòñçðÝò (Browsers)

Ôí FreeBSD ááí Ý ÷ áé ðñíñáéáðáóðçíÝíí éÛðíéí óðáéáñéíÝíí öðëëíäòñçðP. Óòíí éáðÛéíáí [www](http://www.FreeBSD.org/ports/www.html) (<http://www.FreeBSD.org/ports/www.html>) òçð òðëëíäPð Ports íðíñáßðá íá áñáβòá áñéáðíýð öðëëíäòñçðÝò, Ýóíéíòð äéá ääéáðÛóðáóç. Áí ááí Ý ÷ áðá ÷ ñúñí äéá íá íäðáäéùððßæáðá ùðé ÷ ñáéÛæáðá (βòùð ÷ ñáéáóðáßðá áñéáðP ðñá), ðíëëíß áðù áðòíýð áβíáé äéáéÝóéíé éáé ùð Ýóíéíá ðáéÝóá.

Όά **KDE** εάε **GNOME**, ùò ðεÞñç ðáñέáΰεεirióá áñááóβáò, ðáñΎ ÷ ióí òiòò áεéiγò òiòò òðεεñáòñçòΎò HTML. Άάβòá òi ΌiÞiá 5.7 áεá ðáñέóóúòáñáò ðεçñiòññáò ó ÷ áòέέΰ iá òçí ááέáòΰóóáóç òiòò.

Άí áíáέáòΎñáòá áεá áεáòñáβò (áðu ΰðiòç éáóáíΰεùóçò ðññií) òðεεñáòñçòΎò, ááβòá òέò áεüεiòεáò áóáñiiaΎò óòç òðεεiáÞ òñí Ports: www/dillo2, www/links, Þ www/w3m.

Όi òiÞiá áóòü éáéγðòáé òέò ðáñáéΰòü áóáñiiaΎò:

¼ññá ΆóáñiiaÞò	Άóáέòγiáñié ðññié	Άáέáòΰóóáóç áðu Ports	ΆáóέéΎò ΆiáñòÞóáέò
Firefox	iáóáβá	ááñέΰ	Gtk+
Opera	εβáñé (áεáòñέΰ)	áεáòñέΰ	Όðΰñ ÷ ióí áεáέΎóεiáò áεáüóáέò áεá FreeBSD éáé Linux. Ç Ύέáñóç áεá Linux áiáñòΰóáé áðu òçí áóááέεÞ óòñiááóüòçòá iá Linux (Linux Binary Compatibility) éáé òi linux-openmotif .
Konqueror	iáóáβá	ááñέΰ	ΆέáέéiεÞεáò KDE

6.2.1 Firefox

Ί **Firefox** áβiáé Ύiáò iñiòΎññiò, áεáγέáññiò, áñé ÷ òüò éáé óóáέáññüò òðεεñáòñçòÞò, i iðñiÞiò áβiáé ðεÞññüò ðññiáññiòiΎññiò áεá ÷ ñÞóç óòñi FreeBSD. ΆέáέΎóáé iç ÷ áñÞ áðáέéüiέóçò ç iðñiβá áíáññiíβáéáóáé ðεÞññüò iá òέò òððiðiεÞóáέò òçò HTML, éáé áóíáóúòðçòáò üðñò áòΰiέóç ðñεéáðεÞi óáεβáññi óá tabs, iðñiεΰñεéóíá áiááóññiáññi ðáñáéγññií (pops), ðññiòεáòá ðññiáññiáòá, ááεòéññiγiç áóòΰεáéá éáé ðñεεΰ áεññiç. Ί **Firefox** ááóβáéáóáé óòñi áñ ÷ ééñ ðçááβñi εÞáέéá òiò **Mozilla**.

ΆáέáóáóòÞóóá òi ðáéΎòñi áñΰññiáóò:

```
# pkg_add -r firefox
```

Ç ðáñáðΰññi áññiεÞ éá ááέáóáóòÞóáé òññi **Firefox** 3.6. Άí εΎεáòá iá ááέáóáóòÞóóáò òññi **Firefox** 3.5, áñΰòá:

```
# pkg_add -r firefox35
```

Ίðññáβòá áðβóçò iá ÷ ñçóéññiðñεÞóáòá òçí ÓðεεiáÞ òññi Ports áí ðññiòéñiΰòá iá iáóááεüòðòβóáòá áðu òññi ðçááβñi εÞáέéá:

```
# cd /usr/ports/www/firefox
# make install clean
```

Άέá òññi **Firefox** 3.5, áññééáóáóòÞóóá òçòçí ðáñáðΰññi áññiεÞ òç εΎγiç firefox iá firefox35.

6.2.2 Ί Firefox éáé òññi ðññiòéáòñi (plugin) òçò Java™

Όçñiáβñóç: Όá áóòü éáé òññi áðññiáññi òiÞiá, éáññiññiá üòé Ύ ÷ áòá Þáç ááέáóáóòÞóáé òññi **Firefox**.

Όç áááññiγiç óóέáñÞ, òññi ðññiòéáòñi òçò Java™ ááñ éáέòññááβ iá òññi **Firefox** 3.6.

RSS/Atom éáé ðñëÛ áéùíá. Ðáñ' ùëá áöðÛ, ï **Opera** áβíáé ïéá ó÷-áðééÛ äëáöññéÛ éáé ðñëÛ ãñÐáññç áöäññíãÐ. ñ÷-áðáé óá äÿí ðÿðñíð: ïéá "áãááíÐ" Ýëäñóç äéá ðñ FreeBSD éáé ïéá Ýëäñóç ðñ äêðáëáβðáé ïÝò ðçð óðñíááòñðçðáð ïá ðñ Linux.

Ãéá ïá ÷ ñçóéññðñéÐðáðá ðçí FreeBSD Ýëäñóç ðñ **Opera**, áãéáðáóðÐðáð ðñ ðáéÝòñ:

```
# pkg_add -r opera
```

ÏñéóñÝíáð ðñðñéáðβáð FTP ááñ áéáéÝòññí ùëá ðá ðáéÝðá, áëëÛ ïðññáβá ïá Ý÷-áðá ðñ βáëñ áðñÝéáóñá ïÝò ðçð óðñéññáβð ðñí Ports, ãñÛòññóáð:

```
# cd /usr/ports/www/opera
# make install clean
```

Ãéá ïá áãéáðáóðÐðáðá ðçí Linux Ýëäñóç ðñ **Opera**, áñðééáðáóðÐðáðá ïá linux-opera ðñ opera óðá ðáññáðÛñ ðáññááβáñíáðá. Ç Ýëäñóç Linux áβíáé ÷ ñÐóéñç óá éáðáóðÛðáéð ðñ áðáéðññí ðç ÷ ñÐóç plugins ðñ áβíáé áéáéÝóéñá ïñññ áéá Linux, ùðð ðñ **Adobe Acrobat Reader**. Óá êÛëá Ûëëç ðáññðððóç, ïé áëäñóáéð Linux éáé FreeBSD áβíáé éáéðññáéÛ éóññññáð.

6.2.6 Konqueror

Ï **Konqueror** áβíáé êññÛðé ðñ **KDE** áëëÛ ïðññáβ ïá ÷ ñçóéññðñéçèáβ éáé Ýñ ðñ ðñ **KDE** ïá ðçí áãéáðÛðáóç ðñ x11/kdebase3. Ï **Konqueror** áβíáé ðñ ðáñéóóúðáññ áðñ Ýíáð áðñð ððñññáðñçðð, áβíáé áðβóçð áéá÷-áéñéóðð áñ÷-áβññ éáé ðññáññññá ðññáññð áñ÷-áβññ ðñéðñÝóññ.

Ï **Konqueror** áéáðβèáðáé áðβóçð ïá Ýíá ðáð áðñ plugins, óðñ misc/konq-plugins.

Ï **Konqueror** ððñóðçññáé áðβóçð **Flash** éáé ïé ó÷-áðééÝð ïäçáβáð (How To) áβíáé áéáéÝóéñáð óðñ <http://freebsd.kde.org/howtos/konqueror-flash.php>.

6.3 ÁöäññíãÝò ãñáðáβñ

¼óñ áóññÛ ðéð áöäññíãÝò ãñáðáβñ, ïé ïÝñé ÷ ñÐóáð ðç ÷ ïÛ áñáççðñññ ïéá éáëÐ óñðβá áöäñññáññ ð Ýíá ðéééëñ áðáñáñááóðÐ éáéñÝññ. Áñ éáé êÛðñéá ãñáðééÛ ðáñéáÛéñññóá ùðð ðñ **KDE** ðáñÝ÷-ññ ðç áéëÐ ðñð ðñðβá áöäñññáññ ãñáðáβñ, ááñ ððÛñ÷-áé ùóðñññ ðññáðééáññ Ýñç áöäññíãÐ. Òñ FreeBSD ðáñÝ÷-áé ùðé ÷ ñáéÛááóðá, Ûó÷-áðá áðñ ðñ ðáñéáÛéññ ãñáðáβáð óáð.

Òñ ðññá ðçðñ éáéÿððáé ðéð ðáññáéÛðñ áöäññíãÝò:

¼ññá ÁöäññíãÐð	Áðáéðñññññé Ðñññé	ÁãéáðÛðáóç áðñ Ports	ÁáóééÝò ÁñáñðÐáééð
KOffice	ëβáñé (áéáöññéÛ)	ááññéÛ	KDE
AbiWord	ëβáñé (áéáöññéÛ)	áéáöññéÛ	Gtk+ ð GNOME
The Gimp	ëβáñé (áéáöññéÛ)	ááññéÛ	Gtk+
OpenOffice.org	ðñéññβ (ááññéÛ)	áñáéññáðééÛ ááññéÛ	JDK, Mozilla

6.3.1 KOffice

Ç éiefiúççά όiō KDE άnιδēβαάέ όi άnάόέέü όçð δάνέαΰέειi iά iέα όiōβόά άόάνiιāπi άnάόάβiō δiō iδiñάβ iά ÷ñçόειiδiέççāβ έάέ Yñ άδü όi **KDE**. Δάνέεάiαΰiάέ όά όYόόάnά άάόέέΰ δnιāñΰiιάόά δiō iδiñάβόά άδβόçð iά άnάβόά έάέ όά ΰέεάð όiōβόάð άnάόάβiō. Όi **KWord** άβiάέ i άδāiānāάόðð έάειYñiō, όi **KSpread** άβiάέ όi δnūāñāiιά όδiειāέόóέēπi όyέέüi, όi **KPresenter** άέά÷ άέñβαάόάέ όέð δāñiōóέΰόάέð, άπ iόi **Kontour** όάð άδέóñYδāέ iά άçiέiōñāβόάðά Yāāñάόά iά άnάόέέΰ.

Δñεί άāέάόάόðβόάðά όi όāέάðóάβi **KOffice**, άāāάέüèάβóá üðέ Y÷ άóā áiáíāñiYíç Yέāiōç όiō **KDE**.

Άέά iά άāέάόάόðβόάðά όi **KOffice** üð δāέYói, άpóðā όçí áέüειiðέç áióieP:

```
# pkg_add -r koffice
```

Άi όi δāέYói āāi άβiάέ άέάέYóειi, iδiñάβóá iά ÷ñçόειiδiέççāβ όçí óðέειāβ όüi ports. Άέά δāñΰāáέāiά, άέά iά άāέάόάόðβόáðά όi **KOffice** άέά όi **KDE3**, āñΰøðā:

```
# cd /usr/ports/editors/koffice-kde3
# make install clean
```

6.3.2 AbiWord

Όi **AbiWord** άβiάέ Yiά áέāyέāñi δnūāñāiιά άδāiāñāάόβāð έάειYñiō, üiειi óóçí áβóέçóç έάέ όçí āiðΰiέóç iά όi **Microsoft Word**. Άβiάέ έáðΰέέçειi άέά όçí δέççéðñiέüāçóç ΰñēñüi, āñāñΰóñi, áiáóñπi, óδāiέðiβóāñi έ.ι.έ. Άβiάέ δiέy āñPāñi, Y÷ άέ āñέāðYð áðiáóüðçðāð έάέ άβiάέ έέάέβóāñā óέέέέü óói ÷ñβóç.

Όi **AbiWord** iδiñάβ iά áέóΰāāέ P iά āiΰāāέ āñ÷άβā áέΰóññüi iññóπi, δāñέéāiāāñiYñiüi έάέ éΰδiέüi έέāέóðπi üðüð όi .doc όçð Microsoft.

Όi **AbiWord** άβiάέ άέάέYóειi üð δāέYói. Iδiñάβóá iά όi άāέάόάόðβόáðā āñΰiñiόáð:

```
# pkg_add -r abiword
```

Άi όi δāέYói āāi άβiάέ άέάέYóειi άέά éΰδiέi euāi, iδiñάβóá iά όi iāóāāέüðóβóāðά áδü όçí Óðέειāβ όüi Ports. Óā áóðP όçí δāñβðüðóç δέέáípð iά άāέάόάόðβόáðά iāpóāñç Yέāiōç óā ó÷Yóç iά όi Yóieñi δāέYói. Iδiñάβóá iά όi éΰiáóá üð āiPð:

```
# cd /usr/ports/editors/abiword
# make install clean
```

6.3.3 Όi GIMP

Όi **The GIMP** άβiάέ Yiά έέάέβóāñā āiāέέāiYñi δnūāñāiιά άέά÷ άβñέóçð āñάóέέπi άέά άçiέiōñāβā áέέüñi P άδāiāñāάóβā óüðiāñāóέēπi. Iδiñάβ iά ÷ñçόειiδiέççāβ üð áðέüi δnūāñāiιά æüāñāóέέPð P óáí όiōβόά άδāiāñāάόβāð έάέ áέüñēüóçð óüðiāñāóέēπi. ΔāñέY÷ άέ iāāΰειi āñέèüi áδü plugins άπi άέάέYóāέ έάέ scripting interface. Όi **The GIMP** iδiñάβ iά áέāāΰóáέ έάέ iά āñΰøáέ iāāΰειi óΰóiá āñ÷άβñi áέέüñiáð. Δāñέéāiāΰiάέ άδβόçð áέāðáóYð áέáóyíāáóçð iά óāñüðYð έάέ tablets.

Iδiñάβóá iά άāέάόάόðβόáðά όi δāέYói áβñiñiόáð όçí áióieP:

```
# pkg_add -r gimp
```

Άί ς οίδηέάόβá FTP δίο ÷ ñçóειίδηέάβδá ááf áεάεΰδáε áδóυ οί δάεΰδί, ίδηίñáβδá ίá ÷ ñçóειίδηέβδáδá όçί ÓóεειίáΠ όύí Ports. Ί έáóΰεειίáδò graphics (<http://www.FreeBSD.org/ports/graphics.html>) όçδò ÓóεειίáΠδò όύí Ports δáñéΰ ÷ áé áδβδóçδò έáé οί **The Gimp Manual** (áã ÷ áέñβáέί ÷ ñΠβόçδò). Άáβδá δáñáέΰδóυ δúδò ίá όί ááέáδáόδβδáδá:

```
# cd /usr/ports/graphics/gimp
# make install clean
# cd /usr/ports/graphics/gimp-manual-pdf
# make install clean
```

Όçίáβúδóç: Ί έáóΰεειίáδò graphics (<http://www.FreeBSD.org/ports/graphics.html>) όçδò óóεειίáΠδò όύí Ports ΰ ÷ áé áδβδóçδò όçί όδú áίΰέέίç ΰέáίόç όçδò áδóάνιιáΠδò **The GIMP** όδί graphics/gimp-devel. Ίδηίñáβδá ίá áñáβδá όçί HTML ΰέáίόç όίδò áã ÷ áέñέáβίδò, **The Gimp Manual** όδί graphics/gimp-manual-html.

6.3.4 OpenOffice.org

Όί **OpenOffice.org** δáñéΰ ÷ áé üεáδò όέδò áδáñáβδóçδáδò áδóάνιιáΰδò óá ίεá δέΠñç όίδβδá áδóάνιιáΠí áñáόáβίδò: áδáíñáááδβδò έáειΰίδò, όδίείáέόδóέέυ όýέει, áεá ÷ áέñέόδβδò δáñίδóέΰδóáñί έáé δñúáñáñá ό ÷ ááβáόçδò. Όί δáñéáΰεειί áñááόβáδò όίδò áβίáé δίεΰ üίίεί ίá ΰεéáδò όίδβδáδò áñáόáβίδò, έáé ίδηίñáβ ίá ÷ ñçóειίδηέβδáδá έέΰδóειίδò áçίίδóέéáβδò όýδίδò áñ ÷ áβúí. Άβίáé áεáéΰόειί óá δίεέΰδò áέáόíñáδóέέΰδò áεβδóáδò, όúόί ùδò δñíδò όί δáñéáΰεειί áñááόβáδò úόί έáé ùδò δñíδò óá έáίέέΰ έáé όίί íñείáñáόέέú ΰέáã ÷ í.

Ί áδáíñáááδβδò έáειΰίδò όίδò **OpenOffice.org** ÷ ñçóειίδηέέáβ ááááίβδò íñδβδò áñ ÷ áβίδò XML áéá áδίçίΰίç όίñçóúδóçδá έáé áδóáέείβá. Όί δñúáñáñá όδίείáέόδóέέβί όýέέúί áεáéΰδáé áεβδóá ίáέñίáίδóειίβί έáé ίδηίñáβ ίá áέáόδίááέáβ ίá áíúδáñέέΰδò áΰóáέδò áááñΰίúí. Όί **OpenOffice.org** áβίáé óááéáñβδò áδóάνιιáΠ έáé áέóáέáβδóáé ááááίβδò óóá Windows, όί Solaris™, όί Linux, όί FreeBSD, έáεβδò έáé óδί Mac OS X. Δáñέóóúδáñáδò δέçñίδóíñáδò áéá όί **OpenOffice.org** ίδηίñáβδá ίá áñáβδá όδç áέέδóáέβδò όίδηέáδóβá όίδò OpenOffice.org (<http://www.openoffice.org/>). Άέá δέçñίδóíñáδò ó ÷ áδóέέΰ ίá όçί ΰέáίόç áéá FreeBSD, έáεβδò έáé áéá áδáδóέáβáδò έáδΰááόίá δáéΰδóúí, ÷ ñçóειίδηέβδáδá όçί áέέδóáέβδò όίδηέáδóβá FreeBSD OpenOffice.org Porting Team (<http://porting.openoffice.org/freebsd/>).

Άέá ίá ááέáδáόδβδáδá όί **OpenOffice.org**, áñΰδóá:

```
# pkg_add -r openoffice.org
```

Όçίáβúδóç: Άί ÷ ñçóειίδηέέáβδá -RELEASE ΰέáίόç όίδò FreeBSD, όί δáñáδΰίú δñΰδáé ίá áíδéΰδáé. Άέáόíñáδóέέΰ, έá δñΰδáé ίá ááβδá όçί áέέδóáέβδò όίδηέáδóβá όίδò FreeBSD **OpenOffice.org** Porting Team áéá ίá έáδááΰóáδá έáé ίá ááέáδáόδβδáδá όί áίδβδóδίέ ÷ í δáéΰδóí ÷ ñçóειίδηέβδáδá όçί pkg_add(1). Όúόί ς δñΰ ÷ íδóá úόί έáé ς όδú áίΰέέίç ΰέáίόç áβίáé áéáéΰόειίáδò áéá έáδΰááόίá áδú όçί δáñáδΰίú όίδηέáδóβá.

Άδú όç óδéáίβδò δίδò όί δáéΰδóί ááέáδáόδóáέáβ, δñΰδáé ίá áñΰδóáδá áδέβδò όçί δáñáέΰδóυ áίδóεβδò áéá ίá áέóáéΰδóáδá όί **OpenOffice.org**:

```
% openoffice.org
```

Όçίáβúδóç: Έáóΰ όçί δñβδç áέέβίçδóç, έá óáδ áβίίόί áέΰδóíñáδò áñúδβδóáέδò έáé έá áçίείδóñáçέáβ ΰίáδò έáóΰεειίáδò ίá úίίá .openoffice.org ίΰόá όόίί δñίόúδóέέú óáδ έáóΰεειίá.

Άί όά όάέΰόά όιό **OpenOffice.org** άάί άβίάέ άεάέΰόείά, Ύ ÷ άόά όΰίόά όçí άόέειάP ίά ίάόάεùόόβόάά όι άίόβόόίέ ÷ i port. ΰόόúóí, ίά Ύ ÷ άόά όδúøç óάó úóέ άόóú άόάέόάβ άñέάóú ÷ jñí óóí άβóει έάέ έά ÷ ñάέάόόάβ έάέ όΰñά όίεΰ ÷ ñúíí άέά ίά ίεíεçñùέάβ.

```
# cd /usr/ports/editors/openoffice.org-3
# make install clean
```

Όçíάβúóç: Άί εΰέάόά ίά άçíέίóñάPόάόά ίέά Ύέάίόç ίά όέó άέέΰό óάó όίόέέΰό ñόειβóάέό, άίόέέάόάόόPόάό όçí όñíçāíγíάίç άñάίiP άίόίεβί ίά όçí άδúíάίç:

```
# make LOCALIZED_LANG=your_language install clean
```

ΌñΎόάέ ίά άίόέέάόάόόPόάόά όí *your_language* ίά όí óúóóú ISO έùάέέú άέά όç άεβóóά óάó. Ç έβóóά ίά όίόό όόίόόçñέæúíάííóó έùάέέίγ ό έεúóóβί άβίάέ άεάέΰόείç óóí άñ ÷ άβί files/Makefile.localized, όí ίόίβí άñβóέάόάέ όóí έάόΰεíάí όίό port.

Ίúεέό άβίάέ άόóú, ίόñάβόά ίά ίάέείPόάόά όçí άόάνηΰP **OpenOffice.org** άβñíóάó όçí άίόίεP:

```
% openoffice.org
```

6.4 Όñíñΰíáόά ΌñíñίεPò Άάñΰóúí

Όñúóóάόά Ύ ÷ íóí άβίάέ άñέάóΰ άçííóέέάβó έΰόίεάó íΎάó ññóΎό άñ ÷ άβúí. Óά όñíñΰíáόά όñíñίεPò όίό άόάέόίγíάέ άέά όά άñ ÷ άβá άόóΰΰ βóóó ίά ίçí άβίάέ άεάέΰόείά óóí άάóέέú óγóόçíá. Óóí όiPíá άóóú έά άíγíά όúó ίόñάβόά ίά όά άάέάόάόόPόάόά.

Óí όiPíá άóóú έάέγόόάέ όέó άόάνηΰΎó:

Ύñíñ ΆόάνηΰPò	Άόάέόίγíάίίέ Όññίέ	Άάέάóΰóóάόç άδú Ports	Άάóέέΰό ΆíáñόPόάέó
Acrobat Reader	εβāίέ (άέάóñέΰ)	άέάóñέΰ	ΆόάάέέP óóíááóúóçóά ίά Linux (Linux Binary Compatibility)
gv	εβāίέ (άέάóñέΰ)	άέάóñέΰ	Xaw3d
Xpdf	εβāίέ (άέάóñέΰ)	άέάóñέΰ	FreeType
GQview	εβāίέ (άέάóñέΰ)	άέάóñέΰ	Gtk+ P GNOME

6.4.1 Acrobat Reader®

Όreeΰ Ύάάñάόά άεάíΎííóάέ όεΎíí úó άñ ÷ άβá PDF όí ίόίβí óçíáβíάέ “Portable Document Format” (ΌñçόP ññόP Άάñΰóúí). ίά άδú όά óóíέóóβíáíá όñíñΰíáόά όñíñίεPò άέά άóóú όíí óγóóí άñ ÷ άβúí άβίάέ όí **Acrobat Reader**, όí ίόίβí ç Adobe άέάέΰόάέ άέά Linux. ΈάέPò όí FreeBSD ίόñάβ ίá ÷ ñçóέίíóίεPόάέ άέόάέΰόείά όíó Linux, ç άόάνηΰP άβίάέ άδβόçó άεάέΰόείç άέά όí FreeBSD.

Άέά ίά άάέάόάόόPόάόά όí **Acrobat Reader 8** άδú όç ÓóέειάP óúí Ports, άñΰóóá:

```
# cd /usr/ports/print/acroread8
```

```
# make install clean
```

Άάί οδΰñ ÷ áε áεάεΎοείη δάεΎοί, εüαù δάνέιμεόηηί όόçí Ũáάέα ÷ñΠόçð.

6.4.2 gv

Όί **gv** άβιάε Ύία δñüāñáíá δñíāíεΠð áāñŨòúí áέα áñ ÷ άβá PostScript έάε PDF. Άβιάε áñ ÷ έέŨ ááoóóíΎίí όόçí άóάνιιāΠ **ghostview** áεεŨ Ύ ÷ áε έάεýóáñç áìòŨίέόç ÷ Ũñç όόç áέαέείεΠεç **Xaw3d**. Άβιάε áñΠāññí, έάε όí interface όíò άβιάε íáεŨεάνí. Όí **gv** Ύ ÷ áε δíεεΎð áοíáóúòçðáð, üðùð δñíóáíáóίέέóíü έάε íŨāάειò ÷ áñóείΎ, áìòŨίέόç όδñü έεβιáέα έάε ááεòβùóç áìòŨίέόçð áñáíáóίóάέηηί (antialias). Ó ÷ áäüí έŨεά έάέóíòñāβá όíò íδñāβ íá áεðάέáoóáβ óüóí áδñü όí δεçέðñíεüάεί üóí έάε áδñü όí δñíóβέε.

Άέα íá ááέáoáoóΠóáðά όí **gv** ùð δάεΎοί, áñŨøðá:

```
# pkg_add -r gv
```

Άί όí δάεΎοί áāí άβιάε áεάεΎοείη, íδñāβðá íá ÷ñçóείηδñέΠóáðά όçí óðεεíāΠ óúí Ports:

```
# cd /usr/ports/print/gv
# make install clean
```

6.4.3 Xpdf

Άί εΎέáðά Ύία íέέñü δñüāñáíá δñíāíεΠð áñ ÷ άβñí PDF áέα όí FreeBSD, όí **Xpdf** άβιάε áέáoñý έάε áδñíüέέü. Άδάέóáβ áεŨ ÷ έóóíòð δññíòð έάε άβιάε έάέάβðáñá óóάέáñü. ×ñçóείηδñέáβ óέð ááoέέΎð áñáíáóίóάέñŨð óúí X έάε áāí áδάέóáβ ÷ñΠόç όíò **Motif** Π Ũέεçð áñāέάείεΠεçð óúí ×.

Άέα íá ááέáoáoóΠóáðά όí **Xpdf** ùð δάεΎοί, άπóðá όçí áíóίεΠ:

```
# pkg_add -r xpdf
```

Άί όí δάεΎοί áāí άβιάε áεάεΎοείη Π δñíóείŨðά íá ÷ñçóείηδñέΠóáðά όçí ÓðεεíāΠ óúí Ports, áñŨøðá:

```
# cd /usr/ports/graphics/xpdf
# make install clean
```

Íüέέð íεíεεçñùεáβ ç ááέáoŨóóáoç, íδññāβðá íá íáέείΠóáðά όí **Xpdf** έάε íá ÷ñçóείηδñέΠóáðά όí áāíβ δεΠεòñí όíò δñíóέέείΎ áέα íá áíāñāíδñέΠóáðά όí íāñý.

6.4.4 GQview

Όí **GQview** άβιάε Ύíáo áέα ÷ áέñέóóΠð áέέüñüí. Íδññāβðá íá áāβðá Ύία áñ ÷ άβí íā Ύία áδεü έέέέ, íá íáέείΠóáðά Ύία áñüðáñέέü δñüāñáíá áδāíāñāáoβáð, íá áāβðá δñíāδέóέüδçóç óá íññòΠ thumbnail έάε δíεεŨ Ũέεά. ΆέάεΎóάέ áδβóçð δñíāíεΠ δāñíòóβáoçð έάε έŨδñέáð ááoέέΎð έάέóíòñāβáð áñ ÷ άβñí. Íδññāβðá íá áέα ÷ áέñέóóáβðá óðεεíāŨð áέέüñüí έάε íá áñāβðá íá áýεíεí δññüδñí óέð áέδεΎð. Όí **GQview** íδññāβ íá ÷ñçóείηδñέçέáβ áέα δñíāíεΠ óá δεΠñç íεüíç έάε óδñíóçñβæάε óíδέέΎð / áέάείáβð ñòèíβóáέð.

Άί εΎέáðά íá ááέáoáoóΠóáðά όí **GQview** ùð δάεΎοί, áñŨøðá:

```
# pkg_add -r gqview
```

Άί οί δάέΎοί άάί άβίάέ άεάέΎοεί, ϐ δñíοείΎοά ίά ÷ñçόείñδιεϐοάοά οçí Óοείιäϐ ούι Ports, añÛοδå:

```
# cd /usr/ports/graphics/gqview
# make install clean
```

6.5 × ñçíáοííεéíñíεéΎο ΆοάνηιιάΎο

Άί, áεá ιδιεραϐδιδιå euuäi, εΎεάοå ίά áεá÷áεñβæåοόå οå ÷ñçíáοííεéíñíεéÛ οåο ίΎού οίο FreeBSD desktop οåο, οδÛñ÷ιδι éÛδιεåò εó÷οñΎο éáé áγέιεåò οόç ÷ñϐόç åοάνηιιäΎο, Ύοιεíåò δñíò ååéåòÛοόåόç. Ìñέοί Ύίåò åδú åοδΎò άβίάέ οδίαåò Ύò ίå áεåååññΎίåò ññòΎò åñ÷åβùí, uδùò åοδΎò διò ÷ñçόείñδιεíγίδåé οåá Ύåñååóå οίò **Quicken**® ϐ οίò **Excel**.

Όι οίϐιå áοδú éåéγδδåé οέδ åοάνηιιäΎο:

¼ññå Άοάνηιιäϐο	Άδåέοίγíåííε ðññíé	ΆåéåòÛοόåόç Άδú Ports	ΆåóééΎò Άίåñòϐοåéò
GnuCash	εβåíé (åéåöñéÛ)	ååñéÛ	GNOME
Gnumeric	εβåíé (åéåöñéÛ)	ååñéÛ	GNOME
Abacus	εβåíé (åéåöñéÛ)	åéåöñéÛ	Tcl/Tk
KMyMoney	εβåíé (åéåöñéÛ)	ååñéÛ	KDE

6.5.1 GnuCash

Όι **GnuCash** άβίάέ ίΎñíò οçδ δñíοδÛεåéåò οίò **GNOME** ίå δånΎ ÷åé οéééΎò åοάνηιιäΎò οοιòδ δåéééγò ÷ñϐοδåò. Ìå οί **GnuCash**, ïδñåβòå ίå εñåòÛòå εíååñéåοíú οúí åóúåñí éåé åíúåñí οåò, οúí οñåðåæéϐí οåò εíååñéåοíϐí éåé οúí ïåοí÷ϐí οåò. ΆéåéΎοåé δånéåÛεéíñ åñååóβåò οί ιδñβí άβίάέ áγέιεí οόç ÷ñϐόç ÷ññβò ίå ÷ñåÛæåòåé éåéåβòåñç åèìÛεçόç, åéèÛ åβίάέ οåοδú÷ññå éåé διéγ åðåååèíåòééú.

Όι **GnuCash** δånΎ ÷åé Ύíδñí óγóδçíå éåòå÷ñçόçδ, éåñåñ÷ééú óγóδçíå εíååñéåοíϐí, διéèÛ δεϐéδñå οóíοññåγóåúí δεçéδñíεíåβíò, éåèϐò éåé ïåéúåíòδ åδòúíåòçδ οδíδεϐñòçδ. Ìδñåβ ίå áεá÷ññβóåé ïéå οδíåééåäϐ óå διéèÛ éåðδñåñϐ οίϐιåóå. Όι **GnuCash** ïδñåβ ίå åéóÛååé éåé ίå οδå÷úíåγóåé åñ÷åβå **QIF** οίò **Quicken**. Ìδñåβ åðβόçδ ίå ÷åñéóóåβ οέδ δånéóóúδåñåò åéåéíåβò ññòΎò çìåññçíεϐí éåé ññéóíåðéϐí ññÛåúí.

Άéå ίå ååéåòåóòϐοåòå οί **GnuCash** οóí óγóδçíå οåò, añÛοδå:

```
# pkg_add -r gnucash
```

Άί οί δάέΎοί άάί άβίάέ άεάέΎοεί, ïδñåβòå ίå ÷ñçόείñδιεϐοάοå οçí óóééíäϐ οúí ports:

```
# cd /usr/ports/finance/gnuccash
# make install clean
```

6.5.2 Gnumeric

Όι **Gnumeric** άβίάέ Ύίå οδñεíåéóóééú óγééí éåé åðíååéåβ ίΎñíò οίò δånéåÛεéíñδíò åñååóβåò **GNOME**. ΆéåéΎοåé åñééϐ åòδúíåòç “δññúåéåøç” οçδ åéóúåíò οίò ÷ñϐόç óγíòúíå ίå οç ññòϐ οίò éåééíγ éåèϐò éåé óγóδçíå åδòúíåòçδ οδíδεϐñòçδ (autofill) áéå åéÛοíñåò åéιεíòεβåò. Ìδñåβ ίå åéóÛååé åñ÷åβå åéÛοíññí åçííóéϐí ññòϐí, uδùò åòδÛ

òïò ÷ ñçóεηηðηεήγίòáε óòï **Excel**, òï **Lotus 1-2-3**, Þ òï **Quattro Pro**. Òï **Gnumeric** òðηíòçñßæáε ãñáòÞηáòá ìÝòò òïò ðñηññÙηηáòòð ãñáòéέÞη math/guppi., ÷ áε ìááΰεη ãñέεηù áηóòηáòòηÝηηí óðηññòÞóáηí εáε áðέòñÝðáε ùεáò óέò óòïÞεáέò ηñòÝò εάεέÞη, ùðòò ãñέεηηγò, ηñέóηáóέεΰò ηηΰááò, çηññççηßáò, Þñáò εáε ðñέεΰò áέηηá.

Άέá ìá ãáεáòáóòÞóáòá òï **Gnumeric** ùò ðáεΰòï, ãñΰòá:

```
# pkg_add -r gnumeric
```

Άì òï ðáεΰòï ááη áßηáε áεáεΰóεη, ìðñáßòá ìá ÷ ñçóεηηðηεέÞóáòá òççí óòεεηñÞ òùη ports, ãñΰòηηáò:

```
# cd /usr/ports/math/gnumeric
# make install clean
```

6.5.3 Abacus

Òï **Abacus** áßηáε Ύηá ηέεñù εáε áγέηεηí óòç ÷ ñÞóç òðñεηηεóòéεù óγέεη. Ðáñέεáηáΰηáε ðñέεΰò áηóòηáòòηÝηáò óòηññòÞóáέò ηέ ìðñáò áßηáε ÷ ñÞóεηáò óá áεΰòηñá ðááßá, ùðòò ç óóáóέóóéέÞ, óá ÷ ñççηáòηηεεηñέεΰ εáε óá ìáεçηáòéέΰ. Ìðñáß ìá áέóΰááε εáε ìá áηΰááε ãñ÷áßá òïò **Excel**. Òï **Abacus** ìðñáß ìá ðáñΰááε Ύηηáη ηηñòÞò PostScript.

Άέá ìá ãáεáòáóòÞóáòá òï **Abacus** ùò ðáεΰòï, ãñΰòá:

```
# pkg_add -r abacus
```

Άì òï ðáεΰòï ááη áßηáε áεáεΰóεη, ìðñáßòá ìá ÷ ñçóεηηðηεέÞóáòá òççí óòεεηñÞ òùη ports, ãñΰòηηáò:

```
# cd /usr/ports/deskutils/abacus
# make install clean
```

6.5.4 KMyMoney

Òï **KMyMoney** áßηáε ηεá áòáññηñÞ áεá÷áßñέóçò òùη ðñηóòòðéέÞη óáò ηέεηññέéÞη, òðέááηÝç áεá òï ðáñέáΰεεηí **KDE**. To **KMyMoney** óòï÷áγáε ìá ðáñΰ÷áε εáε ìá áηóòηáòòÞóáε ùεáò óέò εáεòηòñáßáò ðηò áεáòÞεáηíóáε óá áηóòóòηε÷áò áðñηέεΰò áòáññηñÝò. Òï **KMyMoney** ìðñáß ìá áέóΰááε ãñ÷áßá òïò ðñηóγðηò QIF (Quicken Interchange Format), ìá òçñáß εáòááñáòÞ òùη áðáñáγóáηηí óáò, ìá ÷ áεñßæáòáε ðñέεáðéΰò ηñέóηáóέεΰò ηηΰááò εáε ìá ðáñΰ÷áε ðεÞεηò áηáòηñÞη. ÌÝóá áðù ìá÷ññέóòù plugin, ðáñΰ÷áòáε áðÞóçò ç áðηáòòðçòá áέóááñáÞò ãñ÷áßáηí OFX.

Άέá ìá ãáεáòáóòÞóáòá òï **KMyMoney** ùò ðáεΰòï, áέòáεΰóá òççí áηòηÞ:

```
# pkg_add -r kmy money2
```

Άì òï ðáεΰòï ááη áßηáε áεáεΰóεη, ìðñáßòá ìá ÷ ñçóεηηðηεέÞóáòá òççí ÓòεεηñÞ òùη Ports, ùðòò óáßηáòáε ðáñáεΰòò:

```
# cd /usr/ports/finance/kmy money2
# make install clean
```

6.6 Ðάνβεçç

Áί έάέ õì FreeBSD áβίáέ äçìòééΰò óõìòò ðάνι÷-άβò Internet (ISPs) áέά õçì áðüüìòç έάέ õç óòáèññüòçóá õìò, áβίáέ áðβòçò Ýðìéü έάέ áέá έáέçìññéìP ÷-ñPòç ùò desktop. Ìá áñéåòΰò ÷-éééÜááò áòáñιιáΰò áέáέÝóéìáð ùò ðáέÝòá (<http://www.FreeBSD.org/where.html>) P ports (<http://www.FreeBSD.org/ports/index.html>), ìðññάβòá íá äçìéìòññáPóáòá õì óΰέáéì desktop ðìò έáέýðòáέ üéáò óéò áíÜáéáò óáð.

ÐánáéÜòù, óáβίáòáέ íέá ãñPññç ðάνβεççç üéüì òùì desktop áòáñιιáPì ðìò ðάνιòóéÜóòçéáì óá áóòü õì έáòΰεάéì:

¼ññá ΆóáñιιáPò	¼ññá ÐáέÝóìò	¼ññá Port
Opera	opera	www/opera
Firefox	firefox	www/firefox
KOffice	koffice-kde3	editors/koffice-kde3
AbiWord	abiword	editors/abiword
The GIMP	gimp	graphics/gimp
OpenOffice.org	openoffice	editors/openoffice.org-3
Acrobat Reader	acroread	print/acroread8
gv	gv	print/gv
Xpdf	xpdf	graphics/xpdf
GQview	gqview	graphics/gqview
GnuCash	gnucash	finance/gnucash
Gnumeric	gnumeric	math/gnumeric
Abacus	abacus	deskutils/abacus
KMyMoney	kymoney2	finance/kymoney2

ΕὰοÛεάεί 7 ÐιέοἰÝόά

Àðáíñááóβά áðu οἱ Ross Lippert.

7.1 Óýíἰοç

Ôἰ FreeBSD ðḗἰόçñβæάέ ἰááÛεç ðιεέεεβá áðu εÛñόáð Þ÷ἰò, áðέοñÝḗἰόáð óáð Ýóόέ ἰά áðιεáýóáðá ðøçèÞð ðέóóυḗðçóáð Þ÷ἰ áðu οἱ ðḗἰιεάέóðÞ óáð. ÐáñέεáἰáÛἰáόάέ ç äἰἰáðυḗççóá ἰá ááñÛøáðá έάέ ἰá áἰáðáñÛááðá Þ÷ἰ MPEG Audio Layer 3 (MP3), WAV, έάέ Ogg Vorbis έάέð έάέ ðḗεÛ Ûεέá formats. Ôἰ FreeBSD Ports Collection áðβóçð ðáñέÝ÷áέ áóáñἰἰáÝð ḗἰò óáð áðέοñÝḗἰἰἰ ἰá áðáἰñáñááóðáβðá οἱ ç÷ἰñááóçἰÝἰἰ óáð Þ÷ἰ, ἰá ðñἰóέÝóáðá ç÷çóέέÛ áóÝ, έάέ ἰá áέÝἰἰáðá óóóέáðÝð MIDI.

Ἰá εβáἰ ðáέñἰáἰóέóἰἰ, οἱ FreeBSD ἰðἰñáβ ἰá ðḗἰόçñβἰáέ áἰáðáñááυḗÞ áñ÷áβἰἰ video έάέ DVD. Ἰ áñέεἰἰð ðυἰ áóáñἰἰáÞ ḗἰò εἰáέεἰðἰεἰýἰ, ἰáóáðñÝḗἰἰ, έάέ áἰáðáñÛáἰἰἰ áεÛἰñἰἰð ðýðἰἰð video áβἰáέ ðέἰ ðáñέἰñέóἰÝἰḗð áðu οἱ áñέεἰἰ ðυἰ áóáñἰἰáÞ Þ÷ἰ. Áέá ðáñÛááέáἰá, υḗðáἰ áñÛøççá áóóυ ðἰ έáβἰáñἰ, ááἰ ððÞñ÷á έáἰεÛ έάέÞ áóáñἰἰáÞ áðáἰáεἰáέἰἰἰβççð ðóç ðóέεἰἰáÞ ðυἰ Ports ḗἰò FreeBSD, ḗἰò έá ἰðἰñἰýóá ἰá ÷ñçóέἰἰðἰεççáβ áέá ἰáóáðñἰḗÞ ἰáóáἰý formats, υḗðυð οἱ audio/sox. Ðáñ' υέá áðóÛ, οἱ ḗἰðβἰ óá áðóυ οἱ ḗñÝá, έάέ υἰἰ áóἰñÛ ḗἰ εἰáέóἰεέυ, áέεÛæέ ñááááβá.

Ôἰ έáðÛεάεί áóóυ έá ðáñέáñÛøáέ óá áðáñáβðççá áÞἰáðá áέá ðç ñýεἰέóç ðçð εÛñóáð Þ÷ἰò óáð. Ç ñýεἰέóç έάέ ááέáóÛóóáç ḗἰò X11 (ΈáðÛεάεί 5) Ý÷áέ Þæç ðñἰἰóβóáέ áέá óá ðέέáἰÛ ðñἰáεÞἰáðá ðέέέἰý ðçð εÛñóáð áñáέέéÞἰ óáð, áἰ έάέ ἰðἰñáβ ἰá ÷ñáέÛæáðáέ ἰá áóáñἰἰóáðá εÛḗἰéáð áέυἰá ἰέέñἰ-ñðεἰβóáέð áέá έáέýðáñç áἰáðáñááυḗÞ.

Áóἰý áέááÛóáðá áóóυ οἱ έáðÛεάεί, έá ἰÝñáðá:

- Ðυð ἰá ñðεἰβóáðá οἱ óýóðçἰá óáð þóðá ἰá áἰáἰñἰñβæáðáέ ç εÛñóá Þ÷ἰò óáð.
- Ἰáεἰἰḗð áέá ἰá áέÝἰἰáðá ðç έáέóἰḗñáβá ðçð εÛñóáð óáð.
- Ðυð ἰá áðέéýóáðá ðñἰáεÞἰáðá ó÷áðέέÛ ἰá ðέð ñðεἰβóáέð Þ÷ἰò.
- Ðυð ἰá áἰáðáñÛááðá έάέ ἰá εἰáέεἰðἰεÞóáðá MP3 έάέ Ûεεἰḗð ðýðἰḗð áñ÷áβἰἰ Þ÷ἰò.
- Ðυð ðḗἰόçñβæáðáέ οἱ video áðu οἱ X server.
- ÊÛḗἰéá ports áἰáðáñááυḗÞð/εἰáέεἰðἰεÞççð video ḗἰò áβἰἰἰἰ έάέÛ áðἰóáέÝἰáðá.
- Ðυð ἰá áἰáðáñÛááðá DVD, έάέ áñ÷áβá .mpg έάέ .avi.
- Ðυð ἰá εÛἰáðá rip οἱ ðáñέá÷υἰáñἰ CD έάέ DVD óá áñ÷áβá.
- Ðυð ἰá ñðεἰβóáðá ἰέá εÛñóá ðççáἰñáóçð.
- Ðυð ἰá ñðεἰβóáðá Ýἰá óáñυðÞ áέέυἰñἰ.

Ðñéἰ áέááÛóáðá áóóυ οἱ έáðÛεάεί, έá ðñÝðáέ:

- Ἰá ἰÝñáðá ðυð έá ñðεἰβóáðá έάέ έá ááέáðáóðÞóáðá ἰÝἰ ðñÞἰá (ΈáðÛεάεί 8).

Ðñἰáέáἰἰἰβççç: Áἰ ðñἰóðáεÞóáðá ἰá ðñἰóáñðÞóáðá ἰἰóóέέÛ CD ἰá ðçἰ áἰἰἰεÞ mount(8) έá ðñἰέεçέáβ έáð' áεÛ÷έóóἰἰ óóÛεἰá, Þ ðóç ÷áέñυðáñç ðáñβðóóυç kernel panic. ÔÝóἰéá ἰÝóá Ý÷ἰἰἰ áἰáέáέέáἰἰÝἰáð εἰáέεἰðἰεÞóáέð ḗἰò áέáðÝñἰἰἰ áðu οἱ óἰççέéóἰÝἰἰ óýóðçἰá áñ÷áβἰἰ ISO.

7.2 Νύειέος όοò ÊÛñóáò ¹ ÷ ïò

ΌοίάέοοιñÛ áδï òιí Moses Moore. Άάέòέòεòεά άέά òι FreeBSD 5.X áδï òιí Marc Fonvieille.

7.2.1 Νòειìβαιίòáò òι Όόόçιά

Δñεί ίάέειΠρόάòá, έá ðñÝðáέ ίá ïÝñáòá òι ïιòÝεí όοòò ÊÛñóáò ðιò Ý ÷ áòá, òι ιεíεεçñùíÝíí έýέεùíá ðιò ÷ ñçóεíιðιεάβ, έáεòò έάέ áí áβίάέ PCI ð ISA. Όι FreeBSD òðιόòçñβæάέ ίááÛέç ðιεέέεβá έáñòðí ð ÷ ïò, òυóι PCI υóι έάέ ISA. ΆέÝáíòá òέò òðιόòçñæυíáíáò óòóέáòÝð ð ÷ ïò óóέò Όçíáεòóáέò Όέέειý (<http://www.FreeBSD.org/releases/8.1R/hardware.html>) áέá ίá ááβòá áí ç έÛñóá óáò òðιόòçñβæáòáέ. Όóέò Όçíáεòóáέò Όέέειý áíáòÝñáòáέ áðβóçò ðιεí ðñüáñáíá íáΠáçóçò òðιόòçñβæάέ όçí έÛñóá óáò.

Άέá ίá ÷ ñçóεíιðιεΠρόáòá όçí óòóέáòð ð ÷ ïò ðιò áέáέÝóáòá, έá ðñÝðáέ ίá òιñòðóáòá òιí έáòÛέεçεí íäçäü óòóέáòð. Άóòυ ïðñáβ ίá áðέóáò ÷ έáβ íá áýí òñυðιò. Ì áðεíευóáñιò áβίάέ áðεòò ίá òιñòðóáòá Ýíá module (Ûñεñùíá) áέá όçí έÛñóá ð ÷ ïò óòιí ðòñΠíá, ÷ ñçóεíιðιεΠíóáò όçí áíòιεð kldload(8), íá όç áíðεáέá όçò áñáñìðò áíòιεðí:

```
# kldload snd_emu10k1
```

ð ðñιòέÝóιíóáò όçí έáòÛέεçεç áñáñìð óòι áñ ÷ áβι /boot/loader.conf üðυò ðáñáέÛòυ:

```
snd_emu10k1_load="YES"
```

Όá ðáñáðÛíυ ðáñáááβáíáòá áβίάέ áέá ίέá έÛñóá ð ÷ ïò Creative SoundBlaster® Live!. ΌðÛñ ÷ ïòι áέáέÝóέíá έáέ Ûέέá modules áέá έÛñóáò ð ÷ ïò έáέ ïðñáβòá ίá óá ááβòá óòι áñ ÷ áβι /boot/defaults/loader.conf. Άí ááí áβòáòá óβáιòñιò áέá òι ðñüáñáíá íáΠáçóçò ðιò ðñÝðáέ ίá ÷ ñçóεíιðιεΠρόáòá, ïðñáβòá ίá ðñιòðáέΠρόáòá ίá òιñòðóáòá òι module snd_driver:

```
# kldload snd_driver
```

Δñüέáέóáέ áέá Ýíá ίáòá-ðñüáñáíá íáΠáçóçò, òι ïðιβι òιñòðíáέ íá ίέáò υέá óá έιεíÛ ðñιáñÛíáòá íáΠáçóçò áέá έÛñóáò ð ÷ ïò. Ìá òιí òñυðι áóòυ ïðñáβòá ίá áðέóá ÷ ýíáòá όçí áíβ ÷ íáòóç áέá òι óυòóυ íäçäü. Ìðñáβòá áðβóçò ίá òιñòðóáòá υέá óá ðñιáñÛíáòá íáΠáçóçò ïÝóυ ðιò áñ ÷ áβιò /boot/loader.conf.

Άí áðέέοíáβòá ίá áñáβòá òι áðέέááíÝíí ðñüáñáíá íáΠáçóçò όçò έÛñóáò óáò íáòÛ όç óüñòóóç òιò snd_driver, ïðñáβòá ίá áέÝáíáòá òι áñ ÷ áβι /dev/sndstat íá όçí áíðεáέá όçò áíòιεðð cat /dev/sndstat.

Íέá ááýóáñç ïÝεíáò áβίάέ ίá ίáòááευòòòβóáòá όçí òðιόòðñείç όçò έÛñóáò ð ÷ ïò óáò, óóáóέέÛ, áðáòέáβáò óòιí ðòñΠíá. Όι ðáñáέÛòυ òιðíá ðáñÝ ÷ áέ óέò ðεçñιòιñβáò ðιò ÷ ñáέÛæáòá áέá ίá ðñιòέÝóáòá òðιόòðñείç áέá òι ðέέέυ óáò íá áóòυ òιí òñυðι. Άέá ðáñέóóυòáñáò ðεçñιòιñβáò ó ÷ áðέέÛ íá όçí íáòááεòòóέç òιò ðòñΠíá, ááβòá òι ÊáòÛέάει 8.

7.2.1.1 Άçιεíòñáðíóáò ΔñιόáñιòíÝíí ΔòñΠíá íá Όðιόòðñείç ¹ ÷ ïò

Άñ ÷ έέÛ, ðñÝðáέ ίá ðñιòέÝóáòá òι ááíέέυ ðñüáñáíá íáΠáçóçò ð ÷ ïò (audio framework driver) sound(4) óòιí ðòñΠíá óáò. Έá ÷ ñáέáóáβ ίá ðñιòέÝóáòá όçí áέυεíòεç áñáñìð óòι áñ ÷ áβι ñòεìβóáυí òιò ðòñΠíá:

```
device sound
```

ðáέóá, έá ðñÝðáέ ίá ðñιòέÝóáòá òðιόòðñείç áέá όçí έÛñóá ð ÷ ïò óáò. ΔñÝðáέ ίá áíññβæáòá áδï ðñεί ðιεí ðñüáñáíá íáΠáçóçò όçí òðιόòçñβæάέ. ΆέÝáíòá όç εβóóá òυí òðιόòçñæυíáíáíí έáñòðí óóέò Όçíáεòóáέò Όέέειý (<http://www.FreeBSD.org/releases/8.1R/hardware.html>), áέá ίá έáέíñβóáòá òι óυòóυ íäçäü áέá όçí áέέð óáò. Άέá

ῥάνὔάεάιá, P Creative SoundBlaster Live!, ὀδῖόϷñβæáόáε áδῖ ὀῖῖ ῖäçäῖ snd_emu10k1(4). Ἄέá ῖá ḏñῖόεΎόáὀá ὀδῖόδPñέῖç áεá áδὀP ὀçῖ éὔñόá, ÷ñçόεῖῖδῖéPόά ὀçῖ áéῖεῖῖὀεç ãñáῖP:

```
device snd_emu10k1
```

Ἄáááεῖεáβὀá ῖὀε áεááὔόáὀá ὀçῖ ὀáεβáá ὀῖὀ manual áéá ὀῖ ḏñῖáñáῖῖá ῖáPαçόçð, βόὀá ῖá ÷ñçόεῖῖδῖéPόáὀá ὀç ὀῖὀὀP ὀῖῖόáῖç. Ç áεñéáPὀ ὀῖῖόáῖç áéá éὔεá ὀδῖῖόçñéæῖῖáῖç éὔñόá P÷ῖὀ ὀὀῖ áñ÷áβῖ ñὀεῖβόáῖῖ ḏñPῖá, ῖδῖñáβ ῖá ãñáεáβ áδβόçð ὀὀῖ áñ÷áβῖ /usr/src/sys/conf/NOTES.

Ἄέá éὔñόá P÷ῖὀ ὀῖῖόῖ ISA ḏῖὀ ááῖ áβῖáé Plug’N’Play ῖδῖñáβ ῖá ÷ñáéáόὀáβ ῖá áβόáὀá ὀὀῖῖ ḏñPῖá ḏεçñῖῖῖñβáð ὀ÷áὀééὔ ῖá ὀéð ñὀεῖβόáéð ὀçð (ῖδῖῖὀ ὀῖ IRQ, éῖñá I/O ééð), ῖδῖῖὀ áβῖáόáé ὀδḏééὔ ὀá áὀδΎð ὀéð ḏáñéððβόáéð. Ἄὀδῖῖ ῖδῖñáβ ῖá áβῖáé ῖΎόῖ ὀῖὀ áñ÷áβῖῖὀ /boot/device.hints. Ἐáὀὔ ὀç áéááééáόáβ ὀçð áééβῖççόçð, ῖ loader(8) éá áéááὔόáé ὀῖ áñ÷áβῖ éáé éá ῖáὀááéáὔόáé ὀéð ñὀεῖβόáéð ὀὀῖῖ ḏñPῖá. Ἄέá ḏáñὔááéáῖá, ῖéá ḏáééὔ Creative SoundBlaster 16 ISA ῖç-PnP éὔñόá ÷ñçόεῖῖδῖéáβ ὀῖ ḏñῖáñáῖῖá ῖáPαçόçð snd_sbc(4) ὀá ὀὀῖáὀáόῖῖ ῖá ὀῖ snd_sb16. Ἄέá ὀçῖ éὔñόá áὀδP ḏñΎðáé ῖá ḏñῖῖόáεῖῖῖ ῖé ḏáñáéὔὀῖ ãñáῖΎð ὀὀῖ áñ÷áβῖ ñὀεῖβόáῖῖ ḏñPῖá:

```
device snd_sbc
device snd_sb16
```

éáé ῖé ḏáñáéὔὀῖ ãñáῖΎð ὀὀῖ áñ÷áβῖ /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"
```

Ὀçῖ ḏáñβδὀῖὀç áὀδP, ç éὔñόá ÷ñçόεῖῖδῖéáβ ὀç éῖñá I/O 0x220 éáé ὀῖ IRQ 5.

Ç ὀῖῖόáῖç ḏῖὀ ÷ñçόεῖῖδῖéáβόáé ὀὀῖῖ áñ÷áβῖῖὀ /boot/device.hints áῖçááβὀáé ὀὀç ὀáéβáá manual ὀῖὀ sound(4) éáéβð éáé ὀὀç ὀáéβáá manual ὀῖὀ áῖὀβὀὀῖé÷ῖὀ ḏñῖáñὔῖáῖῖὀῖ ῖáPαçόçð.

ῖé ñὀεῖβόáéð ḏῖὀ ὀáβῖῖῖὀáé ḏáñáðὔῖῖ áβῖáé ῖé ḏñῖáðééááῖΎῖáð. Ὀá ῖñéὀῖΎῖáð ḏáñéððβόáéð, ῖδῖñáβ ῖá ÷ñáéáόὀáβ ῖá áééὔῖáὀá ὀῖ IRQ P ὔééáð ñὀεῖβόáéð βόὀá ῖá ὀáéñéὔæῖῖῖ ῖá ὀéð ñὀεῖβόáéð ὀçð éὔñόáὀ ὀáὀ. Ἄáβὀá ὀç ὀáéβáá manual ὀçð snd_sbc(4) áéá ḏáñéóὀῖὀáñáð ḏεçñῖῖῖñβáð ὀ÷áὀééὔ ῖá ὀçῖ éὔñόá áὀδP.

7.2.2 Ἄῖééῖὔæῖῖὀáὀ ὀçῖ Éὔñόá ¹÷ῖὀ

Ἄὀῖῖ éὔῖáὀá áðáῖáééβῖçç ῖá ὀῖῖ ῖΎῖ ḏñPῖá (P áὀῖῖ ὀῖñðβόáὀá ὀῖ áðáñáβðçὀῖ module), Ἐá ḏñΎðáé ῖá ááβὀá ῖçῖῖáὀá ὀ÷áὀééὔ ῖá ὀçῖ éὔñόá P÷ῖὀ ὀὀçῖ ḏñῖῖὀñéῖP ῖῖPῖç (buffer) éáὀááñáðPð ὀῖὀ ὀὀὀðPῖáῖῖὀῖ (dmesg(8)) áῖὀβὀὀῖé÷á ῖá ὀá ḏáñáéὔὀῖ:

```
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 éáὀὔὀáὀç ὀçð éὔñόáὀ P÷ῖὀ ῖδῖñáβ ῖá áéáá÷éáβ ῖΎόῖ ὀῖὀ áñ÷áβῖῖὀ /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 ιγίγιάοά οοι όγόογιά οάο ιδινάβ ίά άβίάέ άεάοινάοέέΰ. Άί άάί άάβδά οοόέάοΎο όγθιό pcm, άδέοοñΎοά έάέ άεΎάιόά οά άβιόά όιό έΰίόά όñιγαιόιΎιό. Έιέόΰίόά όι άñ÷άβι ñοέιβόάιι όοñβιá έάέ άάάάέέέάβδά υόέ Ύ÷άόά άδέέΎίάέ όι ούοόυ όñυάñáιá ιάβιγόο. Άέά όοιβέγ όñιáέβιáόά έάέ όγί άίόέιáοβδέόγ όιόο, άάβδά όι όιβιá Όιβιá 7.2.2.1.

Άί υέά δΰίá έάέΰ, γ έΰñόά β÷ιό οάο έά έάέοιόñάάβ. Άί ι ιάγαιό CD β DVD όιό έάέέΎοάόά άβιáέ οοιáñΎιό ιά όγί έΰñόά β÷ιό ιΎού όγδ άίάειάέέβδ όιό άιυαίό, ιδινάβδά ίά άΰεάόά Ύίá ιιόόέέυ CD έάέ ίά όι άίάδάνΰάάόά ιά όι όñυάñáιá cdcontrol(1):

```
% cdcontrol -f /dev/acd0 play 1
```

¶έέάό άόáñιáΎο, υδύδ όι audio/workman δάνΎ÷ιόι όέέέέυόáñι δάνέáΰέειί άñάάόβáδ. οούδ έΎέάόά ίά άάέάόάόόβδάόά ίέá άόáñιáβ υδύδ όι audio/mpg123 έέά ίά άίάδάνΰάάόά άñ÷άβá β÷ιό MP3.

Ίάδ ΰέειό áñβáñιό όñυδιό έέά ίά έέΎάιáόά όγί έΰñόά β÷ιό οάο, άβίáέ ίά οόάβέάόά άááñΎίá όόγί όόόέάδβ /dev/dsp, υδύδ δάνέáέΰδύ:

```
% cat filename > /dev/dsp
```

υδύδ όι filename ιδινάβ ίά άβιáέ ιδιέιáβδιόά άñ÷άβι. Γ δάñáδΰιό άίόιέβ έά δñΎδáέ ίά δάνΰάάέ έΰδιέι β÷ι (έυñόáι) άδέάάάέβιιόάδ όγ ούόδβ έάέοιόñάβά όγδ έΰñόάδ β÷ιό.

Γ Ύίόάόγ β÷ιό όγδ έΰñόάδ ιδινάβ ίά έέέΰίáέ ιΎού όγδ άίόιέβδ mixer(8). Δάñέόούδáñáδ δέγñιόιñβáδ ιδινάβδά ίά άñάβδά όόγί οάέβáá όιό manual όγδ mixer(8).

7.2.2.1 ΌόιγέέόιΎίá Δñιáέβιáόά

Δñυάέγιά	ΈΎόγ
“sb_dspwr(XX) timed out”	Άάί άβιáέ ούοόΰ ñοέιέόιΎιγ γ έγñá I/O.
“bad irq XX”	Όι IRQ άάί άβιáέ ούοόΰ ñοέιέόιΎι. Άάάάέέέάβδά υόέ όι IRQ όιό Ύ÷άόά άγέβόάέ άβιáέ όι βάέι ιά άόόυ όιό Ύ÷άέ ñοέιέόόάβ όόγί έΰñόά.
“xxx: gus pcm not attached, out of memory”	Άάί όδΰñ÷άέ άñέάδβ έέάέΎόέιγ ιιβιγ έέά ίά άβιáέ ÷ñβόγ όγδ όόόέάδβδ.
“xxx: can't open /dev/dsp!”	ΆέΎάιόά ιά όγί άιβέάέά όγδ άίόιέβδ fstat grep dsp άί έΰδιέá ΰέέγ άόáñιáβ áδάό÷ιέάβ όγ όδάέáέñέιΎιγ όόόέάδβ. Όόιβέάέδ γδιδιέι έβιáέ γ άόáñιáβ esound έάέβδ έάέ όι όγόόγιά όδιδόβñέιγδ β÷ιό όιό δάñέáΰέειίόιό KDE .

7.2.3 ×ñγόέιιδιδιέβιόάδ ΔιέέάδέΎο ΔγáΎο¹ ÷ιό

Όόιáέόοιñΰ áδύ όιι Munish Chopra.

Άβιáέ διέέΎο υñΎο άδέέόιγού ίά Ύ÷ιόιá διέέάδέΎο ΔγáΎο β÷ιό όιό ίά άίάδάνΰάιόάέ όάόόυ ÷ñιá, υδύδ υόái έέά δάνΰάάέάιá όι **esound** β όι **artsd** άάί άδέόñΎιόι έιέιβ ÷ñβόγ όγδ όόόέάδβδ β÷ιό όά έΰδιέá όδάέáέñέιΎιγ άόáñιáβ.

7.3 1 ÷ ìò MP3

ÓòτáέόοιñÛ áδù òιτ Chern Lee.

Óά áñ ÷ áβά P ÷ ìò MP3 (MPEG Layer 3 Audio) áðέόð ÷ Ûñòι ðιέιúòç óά P ÷ ìò ðιέϑ έιρòÛ óòι ñòóέέù CD, έάέ áβίάέ έάέù íá Õ ÷ áðά áðίάδúòç óά áíáðáñááùñP ðò òιòò óòι FreeBSD óγóðçíá óáð.

7.3.1 ΔñιáñÛìíáóά ÁíáðáñááùñP ðò MP3

Óι ðει áçιρòέέÛò, ìá ìááÛέç áέάóιñÛ, ðñúáñáìíá áíáðáñááùñP ðò MP3 áέά òι × 11, áβίάέ ç áóáñιíáP XMMS (X Multimedia System). Ìðιñáβðά íá ÷ ñçóέιðιέPðáðά óá skins òιò Winamp ìá òι XMMS έάέðò òι áñáóέέù òιò ðáñέáÛέειτ áβίάέ ó ÷ ááúτ ùιιέι ìá òι Winamp òçò Nullsoft. Óι XMMS Õ ÷ áέ áðβóçò áíóúíáòùìÛίç áðίáδúòç óά ÷ ñPçò ðlug-ins.

Óι XMMS ìðιñáβ íá ááέáðáóðáέáβ áδù òι port multimedia/xmms P áδù ðáέÛòι.

Óι ðáñέáÛέειτ òιò XMMS òι έάέóóÛ áγέιει óòç ÷ ñPçò, έάέðò áέάέÛðáέ έβóóά áíáðáñááùñP ðò (playlist), áñáóέέù έóιρòáέιέóðP έάέ Ûέéàð έάέòιñáβáð. ¼óιέ áβίάέ áñιέέáέùìÛίέ ìá òι Winamp έá áñιòι òι XMMS áðέù óòç ÷ ñPçò òιò.

Óι port audio/mpg123 áβίάέ Õίá áíáέέáέóέέù ðñúáñáìíá áíáðáñááùñP ðò MP3 ìÛóù òçò áñáìP ðò áíòιέPι.

Óι mpg123 ìðιñáβ íá áέðáέáóðáβ έάέìñβæιíóáð òç óðóέáðP P ÷ ìò έάέ òι áñ ÷ áβι MP3 óòç áñáìP áíòιέPι. ΈáññPíóáð ùòέ ç óðóέáðP P ÷ ìò áβίάέ òι /dev/dsp1.0 έάέ èÛέáðά íá áíáðáñááùñP ðò òι áñ ÷ áβι Foobar-GreatestHits.mp3, έá ÷ ñçóέιðιέPðáðά òçι ðáñáέÛòù áíòιέP:

```
# 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 ÁðιèPéáðóç (Rip) Áñ ÷ áβùí áδù ììóóέέÛ CD

Δñέι έùáέέιðιέPðáðά Õίá ñέùέçñι CD P Õίá έìñÛòέ áδù CD óά áñ ÷ áβι MP3, έá ðñÛðáέ íá áíóέáñÛðáðά óá ñòóέέÛ áááñÛίá áδù òι CD óòι óέέçñú óáð áβóέι. Áðòù áβίáðáέ áñÛòιðáð óá áááñÛίá òγðιò CDDA (CD Digital Audio) óά áñ ÷ áβá WAV.

Óι áñááέáβι cdda2wav, òι ìðιβι áíPéáέ óòç óðέέιáP áñááέáβùí sysutils/cdrtools ìðιñáβ íá ÷ ñçóέιðιέçέáβ òιòι áέá òçι áíÛέðçóç òιτ áááñÛίúι P ÷ ìò áδù ñòóέέÛ CD, ùòι έάέ ðέçñιòιñέPι ðιò ó ÷ áðβæιíóáέ ìá áðòÛ.

, ÷ ñíóáð òι ñòóέέù CD óòιτ ñáçáù, ìðιñáβðά íá ÷ ñçóέιðιέPðáðά òçι áέùέιρòέç áíòιέP (ùò root) áέá íá áðιέçέáγóáðά Õίá ñέùέçñι CD óά ÷ ùñέóðÛ (áíÛ έìñÛòέ) áñ ÷ áβá WAV:

```
# cdda2wav -D 0,1,0 -B
```


οῑο̄ δ̄η̄ῑᾱν̄ΰ̄ῑᾱο̄ῑο̄. Άεά̄ ο̄ῑ ε̄ῡᾱῑ ᾱο̄ο̄ῑ, β̄ο̄ῡο̄ ᾱβ̄ῑᾱε̄ ÷̄η̄β̄ο̄ε̄ῑ ῑᾱ ο̄ο̄ε̄ΰ̄ῑᾱο̄ᾱ ο̄ο̄ῑᾱε̄ε̄ε̄Ύ̄ο̄ ο̄ο̄ῑᾱΎ̄ο̄ᾱε̄ο̄ δ̄η̄ῑο̄ ο̄ε̄ο̄ δ̄η̄ᾱīāōēēΎ̄ο̄ ο̄ο̄ε̄āōΎ̄ο̄:

```
# ln -sf /dev/acd0 /dev/dvd
# ln -sf /dev/acd0 /dev/rdvd
```

Ό̄ζ̄ῑᾱε̄ρ̄ο̄δ̄ā ῡο̄ε̄ ε̄ῡāī ο̄ζ̄ο̄ ο̄γ̄ο̄ζ̄ο̄ ο̄ῑο̄ ο̄ο̄ο̄δ̄ῑāōīο̄ devfs(5), ᾱο̄ο̄ῑγ̄ ο̄ῑο̄ ᾱβ̄āīōō ῑε̄ ο̄ο̄īāΎ̄ο̄āēο̄ āāī δ̄ān̄āīΎ̄īōī īāōΰ̄ ο̄ζ̄ῑ āδ̄āīāēε̄β̄ῑζ̄ο̄ς̄ ο̄ῑο̄ ο̄ο̄ο̄δ̄ῑāōīο̄ ο̄āō. Άεά̄ ῑā āç̄īēīōn̄āīγ̄īōāē ῑε̄ ο̄ο̄īāε̄ēēΎ̄ο̄ ο̄ο̄īāΎ̄ο̄āēο̄ ᾱōōīāōā ο̄ā ε̄ΰ̄ēā āēε̄β̄ῑζ̄ο̄ς̄ ο̄īο̄ ο̄ο̄ο̄δ̄ῑāōīο̄ ο̄āō, δ̄η̄īōēΎ̄ο̄ā ōēō āēῡēīōēāō ān̄āīΎ̄ο̄ ο̄ōī ān̄ ÷̄āβ̄ī /etc/devfs.conf:

```
link acd0 dvd
link acd0 rdvd
```

Ά̄δ̄ε̄δ̄η̄ῡο̄ēāōā, ç̄ āδ̄īēῡāēēīōīβ̄ῑζ̄ο̄ς̄ DVD, ç̄ īδ̄īβ̄ā ÷̄η̄āēΰ̄āōāē ēēβ̄ο̄ç̄ āēāēēp̄ī ēāēōīōn̄āēp̄ī ο̄īο̄ DVD-ROM, āδ̄āēōāβ̄ ēāē ΰ̄āāēā āān̄āōp̄ō (write permission) ο̄ōēō ο̄ōōēāōΎ̄ο̄ DVD.

Ά̄ε̄ā ο̄ç̄ āāēōβ̄ῡο̄ç̄ ο̄ç̄ο̄ ēāēōīōn̄āβ̄āō ο̄ç̄ο̄ ēīēf̄ῡ ÷̄η̄ç̄ōōç̄ο̄ īf̄β̄ῑç̄ο̄ ο̄īο̄ ο̄ο̄ο̄δ̄ῑāōīο̄ X11, ο̄ōīβ̄ōōāōāē ῑā āōīβ̄ōāōā ōēō ōēīΎ̄ο̄ ēΰ̄δ̄īēῡ īāōāāēç̄ōp̄ī sysctl(8):

```
kern.ipc.shmmax=67108864
kern.ipc.shmall=32768
```

7.4.1 Δ̄η̄īōāēīn̄ēōīō Δ̄ōīāōīōβ̄ōῡī È̄ΰ̄n̄ōāō Ά̄n̄āōēēp̄ī

Ό̄δ̄ΰ̄n̄ ÷̄īōī ān̄ēāōīβ̄ āēāōīn̄āōēēīβ̄ δ̄η̄ῡδ̄īē āēā ο̄ç̄ī āδ̄āēēῡīēōç̄ video ο̄ōī X11. Ό̄ī ο̄ē ēā āīōēΎ̄ōāē ōāēēēΰ̄, āīān̄ōΰ̄ōāē ο̄ā īāāΰ̄ēī āāēīῡ āδ̄ῡ ο̄ī ōēēēῡ ο̄āō. È̄ΰ̄ēā īΎ̄ēīāō δ̄īō δ̄ān̄ēān̄ΰ̄ōīōīā δ̄ān̄āēΰ̄ōū ēā āβ̄ōāē āēāōīn̄āōēēp̄ δ̄īēῡōç̄ōā ο̄ā āēāōīn̄āōēēῡ ōēēēῡ. Ά̄δ̄β̄ōç̄ο̄, ç̄ āīāδ̄ān̄āāūāp̄ video ο̄ōī X11 āβ̄īāē Ύ̄īā ēΎ̄īā ο̄ōī īδ̄īβ̄ī δ̄η̄ῡōōāōā āβ̄īāōāē īāāΰ̄ēç̄ ο̄ç̄īāōβ̄ā, ēāē δ̄ēēāf̄ῡī ēā ο̄δ̄ΰ̄n̄ ÷̄īōī ān̄ēāōΎ̄ο̄ āāēōēp̄ōāē ο̄ā ēΰ̄ēā īΎ̄ā Ύ̄ēāīōç̄ ο̄īο̄ **Xorg**, β̄ ο̄īο̄ **XFree86**.

È̄āōΰ̄ēīāō ēīēīp̄ī āēāδ̄āōp̄ī video:

1. X11: Ό̄ōīç̄ēēōīΎ̄īç̄ Ύ̄īāō ο̄īο̄ X11 īā ÷̄η̄β̄ο̄ç̄ ēīēf̄ῡ ÷̄η̄ç̄ōōç̄ο̄ īf̄β̄ῑç̄ο̄.
2. XVideo: ῑēā āδ̄Ύ̄ēōāōç̄ ο̄ç̄ο̄ āēāδ̄āōp̄ō X11 δ̄īō δ̄ōīōç̄n̄β̄āēāē āīāδ̄ān̄āāūāp̄ video ο̄ā īδ̄īēāāp̄δ̄īōā ο̄ ÷̄āāēΰ̄ōēīç̄ āδ̄ēōΰ̄īāēā ο̄īο̄ X11.
3. SDL: Simple Directmedia Layer.
4. DGA: Direct Graphics Access.
5. SVGAlib: Ά̄δ̄β̄δ̄āāī ān̄āōēēp̄ī ÷̄āīç̄ēīγ̄ āδ̄ēδ̄Ύ̄āīō āēā ēīīōῡēā.

7.4.1.1 XVideo

Ό̄ī **Xorg** ēāē ο̄ī **XFree86 4.X** āēāēΎ̄ōīōī ῑēā āδ̄Ύ̄ēōāōç̄ δ̄īō īīn̄ΰ̄āōāē XVideo (āf̄ῡōōp̄ ēāē ῡò Xvideo, Xv, xv) ēāē ο̄ī īδ̄īβ̄ī āδ̄ēōn̄Ύ̄δ̄āē ο̄ç̄ī āδ̄āōēāβ̄āō āδ̄āēēῡīēōç̄ video ο̄ā ο̄ ÷̄āāēΰ̄ōēīā āīōēēāβ̄īāīā īΎ̄ōū āēāēēp̄ō āδ̄ēōΰ̄ ÷̄ōīōç̄ο̄. Ç̄ āδ̄Ύ̄ēōāōç̄ āōδ̄p̄ δ̄ān̄Ύ̄ ÷̄āē āīāδ̄ān̄āāūāp̄ δ̄īēγ̄ ēāēp̄ō δ̄īēῡōç̄ōāō, āēῡīā ēāē ο̄ā īç̄ ÷̄āīp̄īāōā ÷̄āīç̄ēp̄ī δ̄η̄īāēān̄āōp̄ī.

Ά̄ε̄ā ῑā āāβ̄ōā āī ÷̄η̄ç̄ōēīῡδ̄īēāβ̄ōāē ç̄ āδ̄Ύ̄ēōāōç̄, ÷̄η̄ç̄ōēīῡδ̄īēp̄ōā ο̄ç̄ī āīōīēp̄ xvinfo:

```
% xvinfo
```

Ό̄ī XVideo δ̄ōīōç̄n̄β̄āēāōāē āδ̄ῡ ο̄ç̄ī ēΰ̄n̄ōā ο̄āō āī ο̄ī āδ̄īōΎ̄ēāōīā āāβ̄ ÷̄īāē ῡδ̄ῡò δ̄ān̄āēΰ̄ōū:

```
X-Video Extension version 2.2
```

```

screen #0
  Adaptor #0: "Savage Streams Engine"
    number of ports: 1
    port base: 43
    operations supported: PutImage
    supported visuals:
      depth 16, visualID 0x22
      depth 16, visualID 0x23
    number of attributes: 5
      "XV_COLORKEY" (range 0 to 16777215)
        client settable attribute
        client gettable attribute (current value is 2110)
      "XV_BRIGHTNESS" (range -128 to 127)
        client settable attribute
        client gettable attribute (current value is 0)
      "XV_CONTRAST" (range 0 to 255)
        client settable attribute
        client gettable attribute (current value is 128)
      "XV_SATURATION" (range 0 to 255)
        client settable attribute
        client gettable attribute (current value is 128)
      "XV_HUE" (range -180 to 180)
        client settable attribute
        client gettable attribute (current value is 0)
    maximum XvImage size: 1024 x 1024
  Number of image formats: 7
    id: 0x32595559 (YUY2)
      guid: 59555932-0000-0010-8000-00aa00389b71
      bits per pixel: 16
      number of planes: 1
      type: YUV (packed)
    id: 0x32315659 (YV12)
      guid: 59563132-0000-0010-8000-00aa00389b71
      bits per pixel: 12
      number of planes: 3
      type: YUV (planar)
    id: 0x30323449 (I420)
      guid: 49343230-0000-0010-8000-00aa00389b71
      bits per pixel: 12
      number of planes: 3
      type: YUV (planar)
    id: 0x36315652 (RV16)
      guid: 52563135-0000-0000-0000-000000000000
      bits per pixel: 16
      number of planes: 1
      type: RGB (packed)
      depth: 0
      red, green, blue masks: 0x1f, 0x3e0, 0x7c00
    id: 0x35315652 (RV15)
      guid: 52563136-0000-0000-0000-000000000000
      bits per pixel: 16
      number of planes: 1
      type: RGB (packed)

```

```

depth: 0
red, green, blue masks: 0x1f, 0x7e0, 0xf800
id: 0x31313259 (Y211)
guid: 59323131-0000-0010-8000-00aa00389b71
bits per pixel: 6
number of planes: 3
type: YUV (packed)
id: 0x0
guid: 00000000-0000-0000-0000-000000000000
bits per pixel: 0
number of planes: 0
type: RGB (packed)
depth: 1
red, green, blue masks: 0x0, 0x0, 0x0

```

ΔανάοçñΠόοά άδβçò ùεé óá formats ðĩò àìöáíβæĩíóáé (YUV2, YUV12, é.é.ð.) àáí áεάóβεάίóáé óá üεάò óεò àεäüóáεò ðĩò XVideo, éáé ç áðĩòóβά ðĩòò ìðĩñáβ íá áðçñáÛóáé éÛðĩεά ðñĩñÛìíáóá áíáðáñáäüãÐò.

Áí ðĩ áðĩòÝεάóíá àáβ ÷ íáé éÛðò Ûóóé:

```

X-Video Extension version 2.2
screen #0
no adaptors present

```

Ôúóá ðεεάíþò ðĩ XVideo àáí ððĩòóçñβæáóáé áðü óçí éÛñóá óáò.

Áí ðĩ XVideo àáí ððĩòóçñβæáóáé áðü óçí éÛñóá óáò, áðòü óçíáβíáé áðεÛ ùεé εá áβíáé ðεĩ äýóεĩεĩ ì ððĩεĩεéóòþò óáò íá áíóáðĩεñεéàβ óóεò ððĩεĩεéóóééÝð áðáεòþóáεò óçò áðáεéüĩεóçò video. Ûóóüóĩ, áíÛεĩäá ìá óçí éÛñóá àñáóεéþĩ éáé ðĩí áðáíáñááóòþ óáò, áβíáé áεüíá ðεεáíüí íá Ý ÷ áòá éεáíðĩεçóéεþ áíáðáñáäüãÐ. ðòòð ðñÝðáé íá áεááÛóáóá ìáεüãĩòð áεá óç ááéòβùóç óçò áðüäĩóçò, óóá ðñĩ ÷ ùñçĩÝíá èÝíáóá, ÔìÐíá 7.4.3.

7.4.1.2 Ôĩ Áðβðáäĩ Simple Directmedia Layer

Ôĩ Simple Directmedia Layer, SDL, ðñĩññβæĩíóáí íá áβíáé Ýíá áðβðáäĩ óðĩááðüòçóóáð ìáóáíý ðüí Microsoft Windows, BeOS, éáé ðĩò UNIX, áðεóñÝðĩíóáð áíÛðòòĩç áòáññĩãþĩ Þ ÷ ìò éáé áεéüíáð, éáðÛεεçεáð áεá éÛεá ìεá áðü áóðÝð óεò ðεáóóüññíáð (cross-platform). Ôĩ áðβðáäĩ SDL ðáñÝ ÷ áé ÷ áĩçεĩý áðεðÝäĩò ðñüóááóç óòĩ óεééü, éáé óá ìñεóĩÝíáð ðáñεðòþóáεò ìðĩñáβ íá áβíáé ðεĩ áðĩãĩðééü áðü óçí áεáðáòþ X11.

Ôĩ SDL ìðĩñáβ íá àñáεáβ óòĩ devel/sdl112.

7.4.1.3 Ôĩ Áðβðáäĩ Direct Graphics Access

Ôĩ Direct Graphics Access áβíáé ìεá áðÝéðáóç ðĩò X11 ðĩò áðεóñÝðáé óá Ýíá ðñüãñáííá íá ðñĩòðáñÛóáé ðĩí X server éáé íá áεéÛíáé áðáóεáβáð óá ðáñεá ÷ üíáíá ðĩò framebuffer (ìíÐĩçò àñáóééþĩ). ÁáãñÝíĩò ùεé ááóβæáóáé óá áεá ÷ áβñεóç ìíÐĩçò ÷ áĩçεĩý áðεðÝäĩò, óá ðñĩñÛìíáóá ðĩò ðĩ ÷ ñçóεĩðĩεĩýí ðñÝðáé íá áεòáεĩýíóáé ùò root.

Ç áðÝéðáóç DGA ìðĩñáβ íá áεáã ÷ εáβ éáé íá ìáòñçεáβ ùò ðñĩò óçí áðüäĩóç óçò ìá ðĩ ðñüãñáííá dga(1). ¼ðáí áεòáεáβóáé ç áĩóĩεþ dga, áεéÛæáé óá ÷ ñþíáóá óçò ìεüĩçò óá éÛεá ðβáóç áíüò ðεþεòñĩò. Áεá íá áεòñþóáðá óçí áεòÝεáóç, ðεÝóðá q.


```
# mplayer -vo 'sdl:dga' testfile.avi
```

Άίβæάε οίι έυδι ίά äieeiΎοάάä üeäð áððΎð ðeð äðeëiãΎð, éæèð ç áðuäiðç ðiðð äiãñðΎðáé áðu ðieëiγð ðãñΎäiðáð éáé äeáoiñiðieáßðáé äñeäðΎ äíΎeíãä iä ði ðeééü ðið ððieíæeððð óáð.

Άéá äíáðãããüãð áðu DVD, äíðeéáðáððððá ði testfile.avi iä dvd://N -dvd-device DEVICE üðið ði N äßiáé i äñeèiüð ðið ðßðeëð (title number) ðið äðeéðiãßðá íá äíáðãñΎããðä éáé DEVICE äßiáé ði üñiá óððeäððð ðið DVD-ROM. Άéá ðãñΎããeäiä, äéá íá äíáðãñΎããðä ðið ðßðeëi 3 áðu ðç óððeäðð /dev/dvd:

```
# mplayer -vo xv dvd://3 -dvd-device /dev/dvd
```

Όçiãßüòç: Ç ðñiãðeéããiΎiç óððeäðð DVD iðñiãß íá éæeíñeóðáß éáðΎ ðç äeΎñeáéá ðçð iäðáäeðððeóçð ðið **MPlayer** port iΎóü ðçð äðeéiãðð WITH_DVD_DEVICE. Άðu ðñiãðeéiãð, ç óððeäðð áððð äßiáé ç /dev/acd0. iðñiãßðä íá äñiãßðä ðãñeóóüðãñäð ðeçñiðiñßáð óði äñ÷ãßi Makefile ðið port.

Άéá óá ðeðeðñá ðið ÷ñçóeíiðieíγiðáé äéá ðáγóç, äeáeëðð, iäðáeßiçðç èeð. éáðΎ ðç äeΎñeáéá ðçð äíáðãããüãðð, óðiäiðeäððáßðä ðçí äiðeáéá ðið iðñiãßðä íá äãßðä äeðäeðiðáð mplayer -h ð äeááΎóðá ðç óäeßiáá ðið manual.

Άðeðñüóeäðá, óçiáíðeéΎð äðeéiãΎð äíáðãããüãðð äßiáé: -fs -zoom ði iðñiãß äiãñãiðieáß äðäeéüieóç óá ðeðñç iðeüiç éáé ði -framedrop ði iðñiãß äiçeΎäé óðçí áγiçðç ðçð áðuäiðçð.

Άéá íá iäßiáé ði iΎããeëð ðçð äñãñiðð äíðieði ði äóíáðüi iéèñü, i ÷ñððçð iðñiãß íá äçieíðñãðóáé Ύiá äñ÷ãßi .mplayer/config éáé íá iñßðáé äeäß ðeð ðñiãðeéããiΎiäð äðeéiãΎð:

```
vo=xv
fs=yes
zoom=yes
```

ΌΎeëð, i mplayer iðñiãß íá ÷ñçóeíiðieçeäß äéá ðçí äiããüãð (rip) áñüð ðßðeëð DVD óá Ύiá äñ÷ãßi .vob file. Άéá ðçí äiããüãð ðið ääγðãñið ðßðeëð áðu Ύiá DVD, äñΎððä:

```
# mplayer -dumpstream -dumpfile out.vob dvd://2 -dvd-device /dev/dvd
```

Όi äñ÷ãßi áñüäið, out.vob, éä äßiáé ðγðið MPEG éáé iðñiãßðä íá ði iäðá÷äeñeóðáßðä iΎóü Üeëüið ðáéΎðüi video ðið ðãñeãñΎüiðáé óá áððü ði ðiðiá.

7.4.2.1.3 mencoder

Ðñeí ÷ñçóeíiðieððáðä ði mencoder äßiáé éáeð éãΎiá íá äñieéäeüeäßðä iä ðeð äðeéiãΎð ðið äiáóΎñiðáé ðççí ðäeìçñßüòç HTML. ΌðΎñ÷äé óäeßiáá manual, äeèΎ ääi äßiáé ðieγ ÷ñðóeìç ÷ññðð ðçí HTML ðäeìçñßüòç. ΌðΎñ÷iði ðΎñá ðieëið ðñüðie äéá íá ääeðeððáðä ðçí ðieüðçðá, íá iäeððáðä ði ððeüi äããñΎñi (bitrate) íá äeèΎiäðä iññðð äñ÷ãßið, éáé eΎðieá áðu áððΎ óá eüeðá iðñiãß íá eΎñiði ðç äeáoiñi iäðáíγ éáeðð éáé éáeðð áðuäiðçð. Άðð éä äãßðä iãñeèΎ ðãñãããßiãiðá äéá íá iäeéiððáðä. Ðñððá iéá áðeð äiðeãñãðð:

```
% mencoder input.avi -oac copy -ovc copy -o output.avi
```

ÉáfeáóíΎñe óðiaðáóñið ðçç äñãñið äíðieði, iðñiãß íá äðóíði äñ÷ãßi áñüäið ðá iðñiãß ääi iðñiãß íá äíáðãñΎããe iγðä i ðäeëið i mplayer. ðóe, äí äðeðð eΎeäðá íá eΎiãðä rip Ύiá äñ÷ãßi, iäßiãðä ðççí äðeéiãðð -dumpfile ðið mplayer.

Άéá íá iäðáðñΎðáðä ði input.avi óá codec MPEG4 iä ð÷i MPEG3 (äðäeðáßðáé ði audio/lame):

Άέά ίά οάο άάβηιόια όέο έέάιúòçòáò òιò transcode, άάβòá Ύία ðáñÛάέέαιά ίάόάòñιòðò áñ÷áβιò DivX óá PAL MPEG-1 (PAL VCD):

```
% transcode -i input.avi -V --export_prof vcd-pal -o output_vcd
% mplex -f 1 -o output_vcd.mpg output_vcd.m1v output_vcd.mpa
```

Ôι áñ÷áβι MPEG ðιò ðñιέýðòáέ, òι output_vcd.mpg, ίðιñáβ ίά άίάðáñá÷έáβ áðu òιí **MPlayer**. Ìðιñáβòá áðβòçò ίά áñÛòáòá òι áñ÷áβι óá Ύία CD-R áέά ίά äçιέιòñáðòáòá Ύία Video CD, έάέ óçí ðáñβðòùòç áòðð έá ÷ñáέáóðáβ ίά ááέáóáóòðóáòá óá ðñιáñÛιáóá multimedia/vcdimager έάέ sysutils/cdrdao.

ÔðÛñ÷áέ óáέβáá manual áέά òι transcode, áέέÛ ðñΎðáέ áðβòçò ίά óòιáιòέáòðáβòá òι transcode wiki (<http://www.transcoding.org/cgi-bin/transcode>) áέά ðáñέóóúòáñáò ðέçñιòιñβáò έάέ ðáñáááβáιáóá.

7.4.3 ΆðέðéΎιí ΆέÛάáóιá

ÔðÛñ÷áέ ñááááβá áιΎέέιç óóá áέάέΎóέιá ðáέΎóá video áέά òι FreeBSD. Άβίáέ áñέáòÛ ðέέáιú ùέέ óòι Ûιáóι ίΎέεηι ðιέέÛ áðu óá ðñιáέðιáóá ðιò áίáò Ύñιíóáέ ááð έá Ύ÷ιòι áðέέòέáβ. Óòι áίáέÛιáóι áέÛóçιá, ùοιέ áίáέáóΎñιíóáέ ίά ÷ñçóέηιðιέðóιòι óέð áòιáúòçòáò A/V òιò FreeBSD óòι Ύðáέñι έá ðñΎðáέ ίά óòιáòÛóιòι áιðóáέð áðu áέÛóιñá FAQ έάέ tutorials έάέ ίά ÷ñçóέηιðιέðóιòι áñέáòÛò áέáóιñáòέέÛò áóáñιιáΎò. Ôι òιðιá áóòú òðÛñ÷áέ áέñέáðð áέά ίά ááβιáέ óòιí áίááιðòç ðιò ίðιñáβ ίά áñáέ óΎòιέáò ðñιúέáòáò ðέçñιòιñβáò.

Ç Ôáέιçñβùòç òιò Mplayer (<http://www.mplayerhq.hu/DOCS/>) áβίáέ áñέáòÛ ðέçñιòιñέáέð ùòι áóιñÛ òι òá÷ιέúι áðβðááι. Áί Ύ÷áòá óέιðú ίά áðιέòðóáòá ðççέú ðιòιóòú áιðáέñβáò óá ó÷Ύóç ίá òι video óòι UNIX, έá ðñΎðáέ ιðùóáðιòá ίά óçι óòιáιòέáòðáβòá. Ç έβóðá áέççέιñáòáβáò òιò **MPlayer** áβίáέ á÷έñέέð óá ùðιέιí ááι Ύ÷áέ έÛιáέ òιí έúðι ίά áέááÛóáέ óçι òáέιçñβùòç, Ύóóέ áι óέιðáýáòá ίά έÛιáòá áίáóιñΎò óóáέιÛòúι, ááááέúέáβòá ùέέ óçι Ύ÷áòá áέááÛóáέ.

Ôι xine HOWTO (http://dvd.sourceforge.net/xine-howto/en_GB/html/howto.html) ðáñέΎ÷áέ Ύία έáòÛέáει ó÷áòέέÛ ίá óçι ááέòβùòç ðçò áðuáιòçò, òι ιðιβι áβίáέ έιέιú áέá ùέá óá ðñιáñÛιáóá áίáðáñááùáðò.

ÔΎέιò, òðÛñ÷ιòι έÛðιέáò Ûέέáð ðιέέÛ òðιó÷ιιáíáò áóáñιιáΎò ðιò βòùð áðέέòιáβòá ίά áιέέιÛóáòá:

- Ôι Avifile (<http://avifile.sourceforge.net/>) òι ιðιβι áβίáέ áðβòçò port, multimedia/avifile.
- Ôι Ogle (<http://www.dtek.chalmers.se/groups/dvd/>) òι ιðιβι áβίáέ áðβòçò port, multimedia/ogle.
- Ôι Xtheater (<http://xtheater.sourceforge.net/>)
- Ôι multimedia/dvdauthor, òι ιðιβι áβίáέ áóáñιιáð DVD authoring áιέέέòιý έðáέέá.

7.5 Ñýèιέóç ÊÛñóáò Ôççáüñáóçò

Áñ÷έέð ðòιáέóòιñÛ áðu òιí Josef El-Rayes. Ááέðέðèçέá έάέ ðñιóáñιιúòççέá áðu òιí Marc Fonvieille.

7.5.1 Άέóáüñáð

Ïέ έÛñðáò ðççáüñáóçò óáò áðέòñΎðιòι ίά áέΎðáòá ðççáüñáóç, έáñιέέð ð έáέúáέáέð, óòιí ððιέιáέóòð óáò. Ïέ ðáñέóóúòáñáò áðu áóòÛò áΎ÷ιíóáέ áðβòçò óðιá óýιέáòιò (composite) video, ίΎóú áέóúáιò RCA ð S-video, έάέ έÛðιέáò áðu áóòÛò áέáέΎòιòι έάέ ñáέέιòúιέέú áΎέòç FM.

ÊäöÛëáéí 8 Ñõèìβæííôáò ôíí ÑõñÞíá ôíõ FreeBSD

Áíáíâþèçèà éáé áíááííþèçèà áðu ôíí Jim Mock. Áñ÷-éêþ óóíâéóóííÛ áðu ôíí Jake Hamby.

8.1 Óýííøç

Ï ðõñÞíáð áβíáé ç éáñáéÛ ôíõ éáéóíõñáééíý óóóðÞíáðíð FreeBSD. Áβíáé ððáýèðíð áéá ðç áéá÷-áβñéóç ðçð ïÞíçð, ðçí áðéáíèþ ðíí ðõèìβóáúí áóóáéáβáð, ðç áééðýùóç, ðçí ðñíóááóç óóí áβóèí, éáé ðíèèÛ Ûëéá. Íá óóíá÷-þð áóíáííáíí ïÝñíð ôíõ FreeBSD ïðíñáβ íá ðõèìéóðáβ áóíáíééÛ, áéèÛ ððÛñ÷-íðí áéúíá ðáñéððþóáéð íé ïðíβáð áðáéóíýí ðõèìβóáéð éáé ïáðááèþðóéóç ôíõ ðõñÞíá ðíõ FreeBSD ïá ðñíóáñííóíÝíáð ðáñáíÝðñíðð.

Áóíý áéááÛóáðá áðóú ôíí êäöÛëáéí, éá íÝñáðá:

- Áéá ðíéíðð èúáíðð ïðíñáβ íá ÷ ñáéáóðáβ íá ððèÛíáðá Ýíá ðñíóáñííóíÝíí ðõñÞíá.
- Ðùð íá áñÛðáðá Ýíá áñ÷-áβí ðõèìβóáúí ðõñÞíá, Þ íá áéèÛíáðá Ýíá ððÛñ÷-íí áñ÷-áβí ðõèìβóáúí.
- Ðùð íá ÷ ñçóèíðíéþóáðá ðíí áñ÷-áβí ðõèìβóáúí ôíõ ðõñÞíá áéá íá ððèÛíáðá éáé íá ïáðááèþðóéóç Ýíá íÝí ðõñÞíá.
- Ðùð íá ááéáóáóðþóáðá ðíí íÝí ðõñÞíá.
- Ðùð íá áðééýóáðá ðð÷-úí ðñíáèÞíáðá ïá ðíí íÝí ðõñÞíá.

¼éáð íé áíóíèÝð ðíõ áíóáíβæííðáé óá áðóú ôíí êäöÛëáéí ùð ðáñáááβáíáðá ðñÝðáé íá áèðáèáóóíýí ùð root áéá íá áβíáé áðéóð÷-áβð.

8.2 Áéáòβ íá ÕðéÛíáðá ÑñíóáñííóíÝíí ÑõñÞíá;

ÊáðÛ ðáñÛáíøç, ðí FreeBSD áβ÷-á áðóú ðíõ áðíéáéíýíá “íííéééèè” ðõñÞíá. Áðóú óçíáβíáé ùðé ï ðõñÞíáð þóáí Ýíá ïááÛèí ðñíáñáííá, ððíóðþñéæá Ýíá óðáèáñíí áñéèíí óóóèáðþí, éáé áí èÝéáðá íá áéèÛíáðá ðç óóíðáñéóííÛ ôíõ, éá Ýðñáðá íá ïáðááèþðóéóç éáéíýñèí éáé íá áðáíáééíþóáðá ôíí ððíéáéóðþ óáð ïá áðóúí.

Óþíáñá, ðí FreeBSD ééíáβóáé óá÷-ýóáðá ðñíð Ýíá ííóÝèí ùðíð íé ðáñéóóúðáñáð éáéóíõñáβáð ôíõ ðõñÞíá ðáñéÝ÷-ííðáé óá modules (áñèñþíáðá) óá ïðíβá ïðíñíýí íá ïíñðùèíýí éáé íá áðíóíñðùèíýí éáðÛ áðáβðçóç, áóíáíééÛ óðíí ðõñÞíá. Áðóú áðéðñÝðáé óðíí ðõñÞíá íá ðñíóáñííáðáé óá ðèèè ðíí ïðíβí áíáñáíðíéáβðáé ðç áááííÝíç óðéáíþ (ùðùð áéá ðáñÛááéáíá ùðáí áéóÝñ÷-áðáé íéá èÛñóá PCMCIA óá Ýíá ïíñçðú ððíéáéóðþ). Áðβóçð áðéðñÝðáé óðíí ðõñÞíá íá áðáèðáβíáé áóíáíééÛ ðç éáéóíõñáéèùðçðÛ ôíõ, ðñíðèÝðííðáð ÷-áñáéðçñéóðééÛ óá ïðíβá ááí þóáí áðáñáβðçóçá ùðáí áβ÷-á ïáðááèþðóéóçáñ áñ÷-éèÛ. Áóóíý ôíõ áβáíðð ï ðõñÞíáð áβíáé áíñóóúð ùð modular (áñèñùòúð).

Ðáñ' ùéá áðóÛ, áβíáé áéúíá áðáñáβðçðí íá áβííóí èÛðíéáð óðáóééÝð ðõèìβóáéð óðíí ðõñÞíá. Óá ïñéóíÝíáð ðáñéððþóáéð, áðóú óóíááβíáé áðáéáþ ç óðáèáñéíÝç éáéóíõñáβá áβíáé óúóí óðáíÛ óóíáíÝç ïá ðíí ðõñÞíá þóðá ááí ïðíñáβ íá ïíñðùèáβ áóíáíééÛ. Óá Ûëéáð, óóíááβíáé áðáéáþ áðèÛ éáíáβð ááí Ý÷-áé áéúíá áó÷-íèçèáβ íá áñÛðáé Ýíá áóíáíééèú module ðíõ íá ðáñÝ÷-áé áððþ ðç éáéóíõñáéèùðçðá.

Ç áçíéíðñáβá ðñíóáñííóíÝííð ðõñÞíá áβíáé áðu ðéð ðèÝíí óçíáíðééÝð ðáèáóíõñáβáð èÛèá ðñí÷-ùñçíÝííð ÷-ñþóç ðíõ BSD. Ç áéááééáóá áððþ, áí éáé ÷-ííííáñá, éá áðíááβ éáéáβðáñá ùðÝèéç áéá ðí FreeBSD óýóðçíá óáð. Óá áíðèáóç ïá ðíí ðõñÞíá GENERIC, ï ïðíβíð ðñÝðáé íá ððíóðçñíáé ïááÛèí áýñíð óóóèáðþí, Ýíáð ðñíóáñííóíÝííð ðõñÞíáð ðáñéÝ÷-áé ððíóðþñéçíç íííí áéá ðí ðèèè ðíõ áééíý óáð ððíéáéóðþ. ðóé Ý÷-áðá èÛðíéá ïÝèç, ùðùð:

Το `options MD_ROOT` είναι σημαντικό για συστήματα που χρησιμοποιούν `MD` ως ρίζα. Η `MD` είναι μια εναλλακτική λύση για το `ROOT` και χρησιμοποιείται για να δημιουργηθεί ένα σύστημα αρχείων που μπορεί να χρησιμοποιηθεί ως ρίζα. Η `MD` είναι σημαντική για συστήματα που χρησιμοποιούν `MD` ως ρίζα. Η `MD` είναι σημαντική για συστήματα που χρησιμοποιούν `MD` ως ρίζα.

```
options MD_ROOT # MD is a potential root device
```

Το `options NFSSERVER` είναι σημαντικό για συστήματα που χρησιμοποιούν NFS ως ρίζα. Η `NFSSERVER` είναι σημαντικό για συστήματα που χρησιμοποιούν NFS ως ρίζα. Η `NFSSERVER` είναι σημαντικό για συστήματα που χρησιμοποιούν NFS ως ρίζα.

```
options NFSSERVER # Network Filesystem Server
options NFS_ROOT # NFS usable as /, requires NFSCIENT
```

Το `options MSDOSFS` είναι σημαντικό για συστήματα που χρησιμοποιούν MS-DOS ως ρίζα. Η `MSDOSFS` είναι σημαντικό για συστήματα που χρησιμοποιούν MS-DOS ως ρίζα. Η `MSDOSFS` είναι σημαντικό για συστήματα που χρησιμοποιούν MS-DOS ως ρίζα.

```
options MSDOSFS # MSDOS Filesystem
```

Το `options CD9660` είναι σημαντικό για συστήματα που χρησιμοποιούν ISO 9660 ως ρίζα. Η `CD9660` είναι σημαντικό για συστήματα που χρησιμοποιούν ISO 9660 ως ρίζα. Η `CD9660` είναι σημαντικό για συστήματα που χρησιμοποιούν ISO 9660 ως ρίζα.

```
options CD9660 # ISO 9660 Filesystem
```

Το `options PROCFS` είναι σημαντικό για συστήματα που χρησιμοποιούν PROCFS ως ρίζα. Η `PROCFS` είναι σημαντικό για συστήματα που χρησιμοποιούν PROCFS ως ρίζα. Η `PROCFS` είναι σημαντικό για συστήματα που χρησιμοποιούν PROCFS ως ρίζα.

```
options PROCFS # Process filesystem (requires PSEUDOS)
```

Το `options PSEUDOS` είναι σημαντικό για συστήματα που χρησιμοποιούν PSEUDOS ως ρίζα. Η `PSEUDOS` είναι σημαντικό για συστήματα που χρησιμοποιούν PSEUDOS ως ρίζα. Η `PSEUDOS` είναι σημαντικό για συστήματα που χρησιμοποιούν PSEUDOS ως ρίζα.

```
options PSEUDOS # Pseudo-filesystem framework
```

Το `options GEOM_GPT` είναι σημαντικό για συστήματα που χρησιμοποιούν GEOM_GPT ως ρίζα. Η `GEOM_GPT` είναι σημαντικό για συστήματα που χρησιμοποιούν GEOM_GPT ως ρίζα. Η `GEOM_GPT` είναι σημαντικό για συστήματα που χρησιμοποιούν GEOM_GPT ως ρίζα.

```
options GEOM_GPT # GUID Partition Tables.
```

Το `options COMPAT_43` είναι σημαντικό για συστήματα που χρησιμοποιούν COMPAT_43 ως ρίζα. Η `COMPAT_43` είναι σημαντικό για συστήματα που χρησιμοποιούν COMPAT_43 ως ρίζα. Η `COMPAT_43` είναι σημαντικό για συστήματα που χρησιμοποιούν COMPAT_43 ως ρίζα.

```
options COMPAT_43 # Compatible with BSD 4.3 [KEEP THIS!]
```


device atadisk # ATA disk drives

Ç áðéεήαβ άδδβ άδάέδδβδδάέ ίάαβ ίά όι device ata áεά όçί δδθίόδβñέίç áβδδδύí ATA.

device ataraid # ATA RAID drives

Ç áðéεήαβ άδδβ άδάέδδβδδάέ ίάαβ ίά όιdevice ata áεά όçί δδθίόδβñέίç áβδδδδύí ATA RAID.

device atapicd # ATAPI CDROM drives

Ç áðéεήαβ άδδβ άδάέδδβδδάέ ίάαβ ίά όι device ata áεά όçί δδθίόδβñέίç ίάçāβί ATAPI CDROM.

device atapifd # ATAPI floppy drives

Ç áðéεήαβ άδδβ άδάέδδβδδάέ ίάαβ ίά όι device ata áεά όçί δδθίόδβñέίç ίάçāβί áέóέΨόάδ ATAPI.

device atapist # ATAPI tape drives

Ç áðéεήαβ άδδβ άδάέδδβδδάέ ίάαβ ίά όι device ata áεά όçί δδθίόδβñέίç ίίíŰäüí δάέίβδδ ATAPI.

options ATA_STATIC_ID # Static device numbering

Íά όçί áðéεήαβ άδδβ, ί áñέέίüδ όίδ άεάάέδβ άβίάδδάέ δδάδδδδδ. ×üñβδ άδδβ, ίέ áñέέίüβ δδδδδδδβί 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
    
```

Άεάάέδδδδδδδδ SCSI. Íδβñάβδδά ίά ίάδδδδñΨδδδδά δά ό÷ üεέί ίδβέίíαβδδδδδδά äáí Ψ ÷ äδδά όδδδ όýóδçíá δάδ. Áí όí όýóδçíá δάδ Ψ ÷ áέ ίüíí δδδδδδδδδδ IDE, ίδβñάβδδά ίά áóáέñΨδδδδά üεάδ δέδδ äñáüΨδ. Íέ äñáüΨδ όýδθíδ * _REG_PRETTY_PRINT ÷ ñçóέííδδβέίýíδάέ áεά ίά áβñíδδí δδñέóóüδδñδδδ άέáíüóδδέΨδ δέçñííδδβñδδδ áεά δδδδδ άίδδδδδδδδδδ ÷ íδδ ίάçāýδδ.

οέο δάνΰεεççάο αέαόοίάΎοάέο αάρ δνιάρΎθιρσάε άδεείρΎδ νγείεοçο άδεείρΎιβσάο, εΰιρσάοο όçί νγείεοç όιθό άίάέησάοέεΰ άδθρ.

Ίέ δάνΰεεççάο αέαόοίάΎοάέο άβίάε άιυόόΎδ έάέ υò αέαόοίάΎοάέο “Centronics”, ιιησάοά δνιάρ ÷ υιάρç άδυ όιρ όγθθ όιθ αέηιρΎέοç όιθ άέοδδθδρ.

- Ίέ αέαόοίάΎοάέο USB, όοίόηιησάοόβσ άδυ όι Universal Serial Bus, αιόεάγίοί σά άέυιç ισάάέγδσάησ όά ÷ γόçοάο άδυ όçί δάνΰεεçç έάέ όçί RS-232 σάέηέάθρ αέαόγίσάόç. Όά έάθρσάέ όιθό άβίάε άθρΰ έάέ σόçίΰ. Ç USB άβίάε άίρδσάηç άδυ όçί Όάέηέάθρ RS-232 έάέ άδυ όçί Δάνΰεεçç όόçί άέόγθδύοç, άέεΰ αοόόο ÷ ηò αάρ όδιόόçηβσάόάέ έάεΰ άδυ όά όόόδρσάόά UNIX. Ίάδ όηυθιό αέα ίά άθιρσάσάόά άόόυ όι δηυάεçίά άβίάε ίά άσινΰόσάόά άέοδδθδρ θιθ όΎησ αέαόγίσάόç USB έάέ Δάνΰεεçç, υδθδ όόισάβίάε ίά θιέιργθ άέοδδθδΎδ.

Άάίέεΰ, ιέ Δάνΰεεççάο αέαόοίάΎοάέο δηιόόΎηιόί όοίρθδ υβσάό έάόάγέόοίόç άδεείρΎιβσά (άδυ όιρ όθιέιρσάόδρ όοιρ άέοδδθδρ) άίρ ç σάέηέάθρ έάέ ç USB άβιρσάό άιόβσάηç. Όόι FreeBSD ιέ δέι δηυόσάόάο δάνΰεεççάο έγησά (EPP έάέ ECP) έάόάόΎηιόί άιόβσάηç άδεείρΎιβσά ίά όιθό άέοδδθδΎδ, υόάί ÷ ηçόέηιθιέιργίόάέ έάθρσάέ θιθ όόηιησάόίσάέ ίά όι δηυόόθι IEEE-1284.

Ç άιόβσάηç άδεείρΎιβσά ίά άέοδδθδΎδ αέαιΎοιθό δάνΰεεççό έγησά ίθιησά ίά άδέοσά ÷ εάβ άάίέεΰ ίά άγί όηυθιόδ. Ί θηρθιό όηυθιό ÷ ηçόέηιθιέίσά Ύίά δηιόσάηιόίΎι δηυάσάηιά ίσρσόçό άέοδδθδρ, ηόσά ίά ίθιησά όι FreeBSD ίά όοηιέεάβ όόçί άθρσάό όιθό άέοδδθδρ. Άόόυ άβίάε όγίççάο ίά άέοδδθδΎδ inkjet έάέ ίθιησά άθρσόç ίά ÷ ηçόέηιθιέççάβ αέα άίάσινΎδ αέάεΎόέιçό θιόυόçσάό ίάέάίέιγ έάέ αέα Ύεσάό θεçηισινβσάό έάέόιθσάβσά. Ç άάγδσάηç ιΎέιρσάό ÷ ηçόέηιθιέίσάόάέ υόάί ι άέοδδθδρ Ύ ÷ άέ σάιόσάόόά όθιόόρηέιçό PostScript.

Ίέ σάησάόβσά PostScript άβίάε όόçί δησάηιόέευόçόά δηιάρΰιησάόά θιθ άθιόόΎέειρσάέ όοιρ άέοδδθδρ, αάρ άβίάε άδσάησçόθι ίά δάνΰεεççάό άέοδδθρσάό, άίρ ίθιηγί ίά άδέοθΎγθιόί όι άθιθΎέσάόιά όιθό άδσάόεσάόό όοιρ όθιέιρσάόδρ. Όι PostScript ÷ ηçόέηιθιέίσά άιόβσάηç άδεείρΎιβσά αέα ίά άίçίησάόάέ όιρ όθιέιρσάόδρ αέα όσ ÷ υι δηιάρσάόά, υδθδ όσΎειρσάόά όοι δηυάσάηιά PostScript ρ ιθιέιρΎηέσάόά όηιόιρσάόά ÷ άηόέιγ. Ίέ ÷ ηρσάόά σάδ, έά σάδ άβίάε άσάηιησάό αέα άόθΎδ όέδ θεçηισινβσάό. ΆδέθρΎι, ι έάέγδσάηιό όηυθιό αέα ίά εΰιρσάόά όυόόρ έάόάιΎθηçόç ίά Ύίά άιόβσάηι άέόγθδύσά PostScript άβίάε: ίά ηυòρσάόά όιρ άέοδδθδρ αέα όçί όοηιέεθρ έάόάιΎθηçόç όυι σάέβσυι όιθ (θυόσάό σάέβσάό άέόγθδύσά σά υεç όç αέΰηέσάέ συρθό όιθ), ίσάΰ ίά άθιόσάβέσάόά όçί σάησάόά όιθ ÷ ηρσάόç, έάέ Ύθσάέσά ίά ίσάηυòρσάόά αέα όçί έάόάιΎθηçόç όυι σάέβσυι όιθ. ΆόάέηΎόσά όέδ άγί όέιΎδ έάέ έά σάηηβσάόά θυόσάό σάέβσάό ίά ÷ ησάόάόά όοιρ ÷ ηρσάόç.

9.3.1.1.2 Δάνΰεεççάο Έγησά

Άέα ίά σάησάόά Ύίάί άέοδδθδρ σά δάνΰεεçç έγησά, όόισάΎόσά όι έάθρσάέι Centronics ίσάόάγί άέοδδθδρ έάέ όθιέιρσάόδρ. Ίέ ισάçσάό θιθ όόηιησάόί όιρ άέοδδθδρ έάέ όιρ όθιέιρσάόδρ έά σάδ έάέισάçσάόιόί ίά ιέιέççηρσάόά όçί όγίσάόç.

Έοιçέσάόά θιέά δάνΰεεçç έγησά ÷ ηçόέηιθιέίσάόά όοιρ όθιέιρσάόδρ. Ç δηρθç δάνΰεεçç έγησά όοι FreeBSD άβίάε ç ppc0, ç σάγδσάηç άβίάε ç ppc1, έάέ ιγού έάέάιρδ. Όι υιησά όόόέσθρδ όιθό άέοδδθδρ ÷ ηçόέηιθιέίσά όçί βέάά σηβέιçόç: /dev/lpt0 αέα όιρ άέοδδθδρ όόçί δηρθç δάνΰεεçç έγησά έ.θ.έ.

9.3.1.1.3 ΌάέηέάέΎδ Έγησά

Άέα ίά σάησάόά Ύίάί άέοδδθδρ ÷ ηçόέηιθιέίρσάόά σάέηέάθρ αέαόγίσάόç, όόισάΎόσά όι έάόΎεεççέι σάέηέάέυ έάθρσάέι ίσάόάγί άέοδδθδρ έάέ όθιέιρσάόδρ. Ίέ ισάçσάό θιθ όόηιησάόί όιρ άέοδδθδρ έάέ όιρ όθιέιρσάόδρ σάδ, έά σάδ έάέισάçσάόιόί ίά ιέιέççηρσάόά όçί όγίσάόç.

Άί αάρ άβόσά όβσιρσάέ θιέι άβίάε όι “έάόΎεεççέι σάέηέάέυ έάθρσάέι”, ίθιησάόά ίά σάέεΰόσάόά ίβσά άδυ όέδ άέυιρσάόά άίάέσάέόέεΎδ:

ΰιαόά άδδϋ έάβιαίί, έάέ άδδϋδ άβιαέ άεήέαρò ι όϋδϋδ όçò αέρράόό άέοδδϋδρ δϋδ έά δñÝδάέ ίά
άέάδδδδρράόια έάδΰέέçέά.

9.3.1.4.1_έάά÷ ìò Δάñΰέέçέç Æέοδδϋδρ

Άδδρ ç áíυδçδά δδϋάέέίγέέ δϋδ ίά άεÝάίάδά άί όι FreeBSD ίδñάβ ίά άδέέίέίϋίρράέ ίά Ýίάί άέοδδϋδρ όοίάάάάιÝίί όά
δάνΰέέçέç έýñά.

Άέά ίά άεÝάίάδά Ýίάί άέοδδϋδρ όά δάνΰέέçέç έýñά:

1. Άβίαδδ root ίά su(1).

2. Όδδβέδδ άάάñÝίά όοίί άέοδδϋδρ.

- Άί ι άέοδδϋδρδδ ίδñάβ ίά άέοδδρράέ άδδϋ έάβιαίί, δϋδδ ÷ ñçόέίίδδέρδδδ όι lptest(1). Δέçέδñέίρράόά:

```
# lptest > /dev/lptN
```

¼δϋδ N άβιαέ ι άñέέϋδδ όçδ δάνΰέέçέçδ έýñάδ, ίάέέίρράδ άδϋ όι ίçäÝί.

- Άΰί ι άέοδδϋδρδδ έάδάέάάάβιαέ PostScript P εΰδδία ΰέέç αέρράόά άέοδδϋδρ, δϋδδ όδδβέδδ Ýίά ίέέñϋ
δñϋάñάιά όοίί άέοδδϋδρ. Δέçέδñέίρράόά:

```
# cat > /dev/lptN
```

δάέόά δέçέδñέίρράόά όι δñϋάñάιά ίβά δñϋδ ίβά άñάιρ, δñϋάέδέέΰ, άέάδβ άάί ίδñάβδδ ίά άδάίñάάόδδβδδ ίέά
άñάιρ άούδϋδ Ý÷άδδ δέÝόάέ όι δέρδδñϋ RETURN P ENTER. Άόίγ όάέέρράδδδ ίά όçί έάόά÷ρñέόç όϋδ
δñίñΰίιάδδδ, δέÝόδδ CONTROL+D, P ΰέέί δέρδδñϋ δάñάόέόίγ άñ÷άβιδ.

Άίάέάέόέέΰ, ίδñάβδδ ίά όϋδδδδρράόά όι δñϋάñάιά όά Ýίά άñ÷άβι έάέ ίά δέçέδñέίρράόάδδ:

```
# cat file > /dev/lptN
```

¼δϋδ file άβιαέ όι ϋñά δϋδ άñ÷άβιδ δϋδ δάñέÝ÷άέ όι δñϋάñάιά δϋδ εÝέάδδ ίά όδδβέδδδ όοίί άέοδδϋδρ.

Έά άάβδδ εΰδδέ ίά άέοδδρράόάέ. Ιçί άίçδδ÷άβδδ άί όι έάβιαίί άάί όάβιαόάέ όυόδϋ. Έά όι άέίñερράόια άñϋδδάñά.

9.3.1.4.2_έάά÷ ìò Όάέñέάέίγ Άέοδδϋδρ

Άδδρ ç áíυδçδά δδϋάέέίγέέ δϋδ ίά άεÝάίάδά άί όι FreeBSD ίδñάβ ίά άδέέίέίϋίρράέ ίά Ýίάί άέοδδϋδρ όοίάάάάιÝίί όά
όάέñέάέρ έýñά.

Άέά ίά άεÝάίάδά Ýίάί άέοδδϋδρ όά όάέñέάέρ έýñά:

1. Άβίαδδ root ίά su(1).

2. Άδάίñάάόδδβδδ όι άñ÷άβι /etc/remote. ΔñϋέέÝόδδ όçί άέϋέίδδç έάόά÷ρñέόç:

```
printer:dv=/dev/port:br#bps-rate:pa=parity
```

¼δϋδ port άβιαέ ç έάόά÷ρñέόç όδδέάδδδ άέά όçί όάέñέάέρ δϋñδά (ttyd0, ttyd1, έδδ.), bps-rate άβιαέ ç
όά÷γόçδά bits-per-second άδέέίέίϋίβδδ ίά όίί άέοδδϋδρ, έάέ parity ç έόίδέίβά δϋδ άδάέδδβδδ άδϋ όίί
άέοδδϋδρ (even, odd, none, P zero).

Δάñάέΰδδ όάβιαόάέ Ýίά δδϋάέέίά έάόά÷ρñέόçδ, άέά Ýίάί άέοδδϋδρ όοίάάάάιÝίί ιÝόϋ όάέñέάέρδδ άñάιρδ όόçί
δñβδç όάέñέάέρ έýñά ίά δά÷γόçδά 19200 bps έάέ ÷ϋñβδ parity:

```
printer:dv=/dev/ttyd2:br#19200:pa=none
```

3. Ὀδίαάεάβδὰ οοίί ἀέδοδθροάε ιὰ tip(1). Δεχεδθνιειάροά:

```
# tip printer
```

Άί αδοθι οί οδῦαεί αάι αῖρεάγáε, ἀδáiāāáοδáβδὰ δῦεε οί αñ÷áβι /etc/remote εάε δñιόδáεροά οί ÷ñçοείιθιερίοάδ /dev/cuaan αίδβ áεά /dev/ttydN.

4. Ὀάβεοά αāāñÝία οοίί ἀέδοδθροάε.

• Άί ι ἀέδοδθροάε ιδññáβ ίá ἀέδοδθροάε áδευ εάβιáñ, ÷ñçοείιθιεροά lptest(1). ἌñῘοά:

```
% $lptest
```

• Ἄῦί ι ἀέδοδθροάε εάοάεάάβίáε PostScript P εῦθιεά ῦεεç æεροά ἀέδοδθροά, ουοά οάβεοά Ýία ιέεñι δññāññίá οοίί ἀέδοδθροάε. Δεχεδθνιειάροά οί δññāññίá, ιβá δñιθ ιβá āññιP, θιεγ θñιόáεθεεῦ, εάεθδ ι ἀέδοδθροάε ιδññáβ ίá āñçíáγáε áεάοññáοεεῦ οçí ÷ñPοç ÷āñáεδPñιí ιδθδ οί backspace P ῦεεñι θιθ δāñῘāññίá αδθι áεῦοññá δεPεθñá ἀδáiāāáοδáδ. Ιδññáβ áδβοçδ ίá ÷ñáεάοάβ ίá δεχεδθνιειάροά εῦθιεί áεάεευ δεPεθñι δāññáοεοίγ αñ÷áβιθ áεά οίι ἀέδοδθροάε ροά ίá āñññæáε θυοά ιειεçñίáοάε οί δññāññίá. Ἄεά ἀέδοδθροάε PostScript, θεÝοάá CONTROL+D.

Άίáεάεοεεῦ, ιδññáβδὰ ίá οίθιεάοPοά οί δññāññίá οά Ýία αñ÷áβι εάε ίá δεχεδθνιειάροά:

```
% >file
```

¼θιθ file áβίáε οί υññá οίθι αñ÷áβιθ θιθ δāñεÝ÷áε οί δññāññίá. Ἄοίγ οί tip(1) οάβεάε οί αñ÷áβι, θεÝοάá οί εάοῦεεçει δεPεθñι δāññáοεοίγ αñ÷áβιθ, áí áδáεάβδάε.

Ἐá αάβδὰ εῦθιε ίá ἀέδοδθροάε. Ιçí áίçοδ÷áβδὰ áí οί εάβιáñ αάι οάβίáοάε ουοου. Ἐá οί áειñεροίθι áñññοāñá.

9.3.1.5 Ἀíāññίθιβçοç οίθ Spooler: οί Ἄñ÷áβι /etc/printcap

Ὀá αδοθι οί οçíáβι, ι ἀέδοδθροάε οάδ εá δñÝθáε ίá áβίáε οοíáññÝñιθ, ι δθñPíáδ οάδ ñθειεοίÝñιθ ίá áδεείεñιáβ ίáæβ οίθ (áí ÷ñáεῦááοάε), εάε Ý÷áδá δáογ÷áε ίá οάβεάδὰ εῦθιεά αῖεεíáοεεῦ αāāñÝία οοίί ἀέδοδθροάε. Ἄβροά ορñá Ýοίειε ίá ñθειβóáδὰ οί LPD áεά ίá áεÝá÷áδá οçí δññοάáoç οοίί ἀέδοδθροάε οάδ.

Ιδññáβδὰ ίá ñθειβóáδὰ οί LPD ιá ἀδáiāāáοδá οίθ αñ÷áβιθ /etc/printcap. Ὀί οýοόçíá δāññι÷Ýδáδοçδ LPD áεάáῦáεαε αδοθι οί αñ÷áβι εῦεá οññῘ θιθ ÷ñçοείιθιεάβδάε ι spooler, áδñÝñιθ δεεárÝδ áíááεìβóáεδ οίθ ιδáβñιθί Ῐíáοά οá áοāññιáP.

Ἄβίáε áγειεί ίá εάοáñPοά οçí ιññοP οίθ αñ÷áβιθ printcap(5). ×ñçοείιθιεPοά οίι εάειáññῘοι θιθ δñιθειῦδá áεά ίá εῦíáδá áεεááÝδ οοί /etc/printcap. Ç ιññοP οίθ áβίáε δāññιειá ιá ῦεεá αñ÷áβá δāñεāñáοδδ áοíáοιθPουί, ιδθδ οá /usr/share/misc/termcap εάε /etc/remote. Ἄáβδὰ οçí cgetent(3) áεά εáδθññāññáδ δεçñιθññáδ ó÷áδεεῦ ιá οçí ιññοP οίθ αñ÷áβιθ.

Ç θεί áδεP ñγειεόç οίθ spooler áθιθáεáβδάε áδθι οá áευεíθεá áPíáοá:

1. ἌδεεÝιθá Ýία υññá (εάε εβáá αῖεεεῦ δāññιγíεá) áεά οίι ἀέδοδθροάε, εάε οίθιεάοPοά οá οοί αñ÷áβι /etc/printcap. Ἄáβδὰ οçí áñιοçδá Ιññáοíññιθçοç Ἀέδοδθροά áεá δāñεοουδāññá δεçñιθññáδ ó÷áδεεῦ ιá οçí ιññáοβá ουί ἀέδοδθροάε.
2. ἌδáiāññιθιεPοά οεδ οáεβáδ εáοáεβáδ (áβίáε áíāñáÝδ áδθι δññáδεεíáP) áεοῦáññιόáδ οçí εεáñιοçδá sh. Ἄεá δāñεοουδāññá δεçñιθññáδ ááβδὰ οçí áñιοçδá Δāññιθññáεοç Ὀáεβáñι Ἐáοáεβáδ.


```
bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:
```

Όά άοδου οι δάνΰάάέαιά, ι δθρσάέο άέοδδθρσάέο ράτταν έάέ Ύ÷άέ υδ δάνΰιγίέά όά line, diablo, lp, έάέ Diablo 630 Line Printer. Άδϋ όç óóέαιθ διθ Ύ÷άέ οι δάνΰιγίέι lp, άβιάέ έάέ ι δθρσάέέέαιΎιϋ άέοδδθρσάέο. Ί άάγδάνθδ ράτταν έάέ bamboo, έάέ Ύ÷άέ υδ δάνΰιγίέά όά ps, PS, S, panasonic, έάέ Panasonic KX-P4455 PostScript v51.4.

9.3.1.5.2 Δάναιδϋάέόç Óάέβαιι Έάόάέβσάδ

Όι όγόόçιά δάνι÷Ύόάδóçδ **LPD**, άδϋ δθρσάέέειρθ, άέοδδθρσάέ έάέ *όάέβαιι έάόάέβσάδ* άέά έΰέά άθάάόβά. Ç óάέβαιι έάόάέβσάδ δάνέέαιιΎιρ έί οι υνίά ÷θρσάέό διθ άέοδθρσάέ όçι άθάάόβά, οιθ όθρσάέέόδθρσάέ άδϋ οιθ ιθιβίι δθρσάέέά ç άθάάόβά, έάέ οι υνίά όçδ άθάάόβσάδ, ιά ιάάΰειθδ υιιθσάέθδ ÷άθάέδθρσάέ. Άδóóδ ÷θδ άοδου οι δθρσάέέόθ έάβιαιι άέρσάέέάθ όçι άέάάέέάόβά άθρσάέέΰόδóçδ όçδ άάέάόΰόάόçδ άιϋδ άθρσάέέ άέοδδθρσάέ, άθιιΎιϋδ έά δάναιδθρσάέόθιά όέδ όάέβσάδ έάόάέβσάδ.

Άέά όçι δάναιδϋάέόç δϋι όάέβαιι έάόάέβσάδ, δθρσάέΎόά όçι έέάιϋόçόά sh όόçι έάόά÷θρσάέέ άέά οιθ άέοδδθρσάέ όθι άθ÷άβι /etc/printcap. Άθρ άέΎδάόά Ύιρ δάνΰάάέαιά διθ /etc/printcap ιά δθρσάέέç όçδ sh:

```
#
# /etc/printcap for host rose - no header pages anywhere
#
rattan|line|diablo|lp|Diablo 630 Line Printer:\
      :sh:
```

```
bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
      :sh:
```

Δάνάόçθρσάέόδ δϋδ ÷άέθέόδθρσάέιά όύόόΰ όç ιιθσάέ: ç δθρσάέ άθαιιθ ιάέέίΰ όόçι άθέόδθρσάέ όδθρσάέ, έάέ ιέ άέϋειθέάδ άθαιιΎδ άβιάέ όθιέ÷έοιΎιρ (indented). Έΰέά άθαιιθ έάόά÷θρσάέόδ (άέοϋδ άδϋ όçι όάέάόόάβά) όάέάέθρσάέ ιά ιέά άθέόδθρσάέόδθρσάέ έΰέάόθι.

9.3.1.5.3 Άçιέιθθάβά Έάόάέϋαιθ Δάνι÷Ύόάδóçδ

Όι άδϋιαιι άθρσάέ όθιρ άθέϋ όθϋδθι άάέάόΰόάόçδ άβιάέ ç άçιέιθθάβά άιϋδ *έάόάέϋαιθ δάνι÷Ύόάδóçδ (spool)*, υδθρσάέ έά όέέθαιιγίόάέ ιέ άθάάόβσάδ άέόδδθρσάέ Ύϋδ υθιθ ιά άέοδδθρσάέέιρ έάέ υθιθ άδθρσάέ όδέΰόθιόάέ έάέ έΰθρσάέέ ΰέέά άιçέçóέέΰ άθ÷άβι όιθ όδóδθρσάέόθδ άέόδδθρσάέ.

Έϋαιθ όçδ ιάόάάέέϋαιθίρ όγόόçδ δϋι έάόάέϋαιι δάνι÷Ύόάδóçδ, όθιçέβθάάέ ιά οιθρσάέέόθρσάέ έΰδϋ άδϋ οιθ έάόΰειρ /var/spool. Άθι άβιάέ άίάάέάβι ιά δάθρσάέά άίθβθάθάάά άόόάέάβσάδ δϋι έάόάέϋαιι δάνι÷Ύόάδóçδ. Ç άδάίάάçιέιθθάβά όιθδ άβιάέ δϋοι άδθρσάέ υθι ιά όθΎιρσάέ όçι άίθρσάέ mkdir(1).

Άβιάέ άδθρσάέόδ όθιçέέοιΎιρ ιά ράτταν έάέ έάόΰειρσάέ ιά οι θρσάέ υνίά ιά οιθ άέοδδθρσάέ, υδϋδ όάβιάόάέ δάνάέΰδϋ:

```
# mkdir /var/spool/printer-name
```

ΰόδϋοι, άί Ύ÷άόά άθέάόθρσάέ άέοδδθρσάέόθδ όθι άβέόθι, βόδδ άδέέσάβσάέ ιά οιθρσάέέόθρσάέ όιθδ έάόάέϋαιθδ δάνι÷Ύόάδóçδ έΰδϋ άδϋ Ύιρ ιιρσάέέϋ έάόΰειρσάέ διθ έά ÷θçέθρσάέέάβσάέ άδθρσάέέόέέΰ άέά άέοδδθρσάέόδ ιά οι **LPD**. Έά έΰθρσάέέ άέθέθρσάέ άόδϋ άέά όά δάνάάάβθαιάόά ιάδ ιά όιθδ άέοδδθρσάέόθδ rattan έάέ bamboo:

```
# mkdir /var/spool/lpd
# mkdir /var/spool/lpd/rattan
```



```
:sh:sd=/var/spool/lpd/bamboo:\
:lp=/dev/ttyd5:
```

Αί αάι εάεινβόαόα οά εὔδρειί ἀέοδδῆροά οçí εέαίυόçοά lp οόí αν÷άβι /etc/printcap, οί LPD ÷ñçοείνδρειάβ αδι δνιιαδέειαP οί /dev/lp. Οί /dev/lp αάι οδὔñ÷άε οçí ααανΎίç οόείαP οόí FreeBSD.

Αὔι ι ἀέοδδῆροά οί οά εάεάεοόὔοά αβιáε οοίαααίΎνι οά δανὔεεçç εýνά, αέαάὔοά αδαδδεάβδ οçí αίυόçοά ιά οβδει Ααέαόὔοόαόç Ὀβεδνιῶ ἘάειΎνι. Ἀέαοιναόεεὔ, αειεῖοεPοόα δνιιόάεοεεὔ οέο ιαçαβδ οί οάειεῖοεῖι οόçí αδιιιáç αίυόçοά.

9.3.1.5.5 Ἴοειβόαέο ΔανάιΎονι Ἀδέειεῖυίβδ οῖο Spooler

Ἄεά ἀέοδδῆροά οά οάειεάεP δνιιόα, οί LPD ιδνιαβ ιά νῶειβόαέ οçí οά÷ýόçοά οά bps, οί parity, εάε Ὑεεαδ δανιιΎονι οάειεάεPδ ἀδέειεῖυίβδ αέα ειααεάοιυ οίο δνιιανὔιαοιῶ οβεδνιῶ οί οόΎεíáε ααανΎίá οοίι ἀέοδδῆροά. Ἀδου αβιáε δεανΎέοçíá αέαοβ:

- Οάο αδεόνΎθαε ιά αειεῖὔοαόα αέὔοιναδ δανιιΎονι οδ ἀδέειεῖυίβδ δνιιόεΎοιιόαδ οέο αδεὔ ιά αδαίνααόβδ οί οαν÷άβιῶ /etc/printcap. Αάι ÷ñáεὔεαόαε ιά αδαίιαδδαεὔοδβόαόα οί δνιιανιιá οβεδνιῶ.
- ἈδεόνΎθαε οοί οýοόçíá δανιιΎοαδ οçí ÷ñçοείνδρειάβ οί βαει δνιιανιιá αέα δρειεαδειýδ ἀέοδδῆροά, ιε ιδνιιέ ιδνιαβ ιά Ύ÷ιῶι αέαοιναόεεὔδ οάειεάεὔδ νῶειβόαέο ἀδέειεῖυίβδ.

Ἴε αειεῖοεαδ εέαίυόçοά οίο /etc/printcap αεΎα÷ιῶι οέο δανιιΎονι οάειεάεPδ ἀδέειεῖυίβδ ουι οόόεαῶPι οίο αίáοΎνιιόαε οόçí εέαίυόçοά lp:

br#bps-rate

Ἴνβæáε οçí οά÷ýόçοά ἀδέειεῖυίβδ οçò οόόεαῶPδ οά bps-rate, υδιῶ οί bps-rate ιδνιαβ ιά αβιáε 50, 75, 110, 134, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, P 115200 bits-per-second.

ms#stty-mode

Ἴνβæáε οέο ἀδέειαΎδ οçò οόόεαῶPδ οανιιόεεῖι ιάοὔ οί Ὑιτέιá οçò οόόεαῶPδ. Ç stty(1) αίçααβ οέο αέαέΎοεíαδ ἀδέειαΎδ.

¼οάι οί LPD αίβæáε οçí οόόεαῶP οίο ινβæáοάε αδι οçí εέαίυόçοά lp, οειεάδδβ οά ÷ánáεδçñεοóεεὔδ οçò οόόεαῶPδ ιά εέαίυόçοά ms#. ÷ιῶι εέαέβδδανιι áíαέαῶΎνι ιε εάοάοόὔοάεο εάεοιῶνναβδ parenb, parodd, cs5, cs6, cs7, cs8, cstopb, crtscts, εάε ixon, οίο αίçαῖιόαε οόçí οάεβáá αίçεάβδ stty(1).

Ἀδ δνιιόεΎοιῶι οοί δανὔααεαίá ιάο Ύίáι ἀέοδδῆροά οόçí Ὑέδç οάειεάεP εýνά. Ἐά εΎοιῶιá οçí οά÷ýόçοά bps οά 38400. Ἀέα οçí εάοὔοόαόç εάεοιῶνναβδ εά εΎοιῶιá, no parity ιά -parenb, ÷ánáεδPñαδ 8-bit ιά cs8, no modem control ιά clocal εάε Ὑεαα÷ιῶιδ ιΎού hardware ιά crtscts:

```
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:
```

9.3.1.5.6 Ἀαέαόὔοόαόç Ὀβεδνιῶ ἘάειΎνι

Ὀπná αβιáοά Ὑοιεῖε ιά διιιá οοί LPD δρει οβεδνιῶ εάειΎνι ιά ÷ñçοείνδρειPοάε αέα ιά οδάβεáε αναάοβδ οοίι ἀέοδδῆροά. Οί οβεδνιῶ εάειΎνι, ανυόου εάε υδ οβεδνιῶ αέουανῶ, αβιáε Ύίá δνιιανιιá οίο ἀέοάεάβ οί LPD υδái οδὔñ÷άε αναάοβδ δνιιῶ ἀέοδδῆροά. ¼οάι οί LPD ἀέοάεάβ οί οβεδνιῶ εάειΎνι αέα εὔδρειί ἀέοδδῆροά, εΎοάε οçí

- Ç áñúòçðá Õβεòñá Áñúáτò δάνεάνΰσάε Υία ÷ άñάέδçñέóóέεù òτò **LPD** δτò άάτ ÷ ñçóετττρεάβδσάε óð÷τΰ: óá òβεòñά áñúáτò. Ιδττñάβδσά ίά δñττòδάνΰσάσά άóδρ òçτ ίάúòçðá, άέδúδ άτ òδδρττáδά óάεβááδ έάóάεβááδ (άάβδσά òέδ Óάεβááδ Έάóάεβááδ).
- Ç áñúòçðá lpf: Υία Õβεòñτ ΈάετΥττò δάνεάνΰσάε òτ lpf, Υία δñάάτáóέέΰ δεβñάδ, άτ έάé áδεù, òβεòñτ έάετΥττò άέά άέóδδúδΰδ άñάττδ (έάé άέóδδúδΰδ laser δτò τδττττττ ίά έάέóττòñάρòττò έάé ùδ άέóδδúδΰδ άñάττδ) δτò δάνεΥ ÷ άδσάé óòτ FreeBSD. Άτ ÷ ñάéΰάéóδά Υία άñράτττ òñúδτ άέά ίά εΰτáδά òçτ έάóάτΥòñçóç óάéβáùτ ίά άτòέάγάé óά áδεù έάβτáττ, ρ άτ Υ ÷ άδά εΰδτττττ άέóδδúδρ δτò άάΰάé έάδτττδ úδάτ άέΥδάé ÷ άñάέδρñάδ backspace, έá δñΥδάé τδúóάρδττòά ίά άτáδΰóάδά òçτ δάνβδδúδç δτò lpf.

Όçτáβúòç: Ιδττñάβδσά ίά άñάβδσά άτòβάñάóτ òúτ άέΰòτττττ scripts δτò άτáóΥñτττòάé δάνάέΰδú, óòττ έάóΰεττττ /usr/share/examples/printing.

9.4.1.1 Δúδ Άτòέάγττò óά Õβεòñά

¼δúδ άτáóΥñάτá δñτçάττòΥττúδ, òβεòñτ άβτáé Υία άέóάéΥóέττ δñúάñάτá δτò άτáñάτττρεάβδσάé áδú òτ **LPD** άέά ίά ÷ άέñβάéδσάé òτ òτττá òçδ άδέέττττττβáδ τά òτττ άέóδδúδρ δτò άτáñδΰóάé áδú òττ òγδτ òçδ βάέάδ òçδ óóóέάδρδ.

¼óάτ òτ **LPD** εΰέάé ίά άέóδδρρσάé Υία άñ ÷ άβτ τεάδ άñάάóβáδ, τάέέτΰ òτ δñúάñάτá òτò òβεòñτò. ÈΥóάé ùδ standard input òτò òβεòñτò òτ άñ ÷ άβτ δτò δñΥδάé ίά άέóδδúδέάβ, ùδ standard output òττ βάέτ òττ άέóδδúδρ έάé ùδ standard error òτ άñ ÷ άβτ άτáóτττΰδ òóάέτΰδúτ (άτáóΥñάδσάé óóçτ έέάττúòçðá lf òτò /etc/printcap, ρ áδú δñτáδέέττáρ òτ /dev/console).

Ότ òβεòñτ δτò έá τάέετρσάé òτ **LPD** έάετδ έάé τέ δάνΰτáδòñτέ òτò òβεòñτò, άτáñδρττòάé áδú òτ òé Υ ÷ άδά άçετρσάé óòτ άñ ÷ άβτ /etc/printcap έάé áδú òτ òé δάνάτΥòñτòδ Υ ÷ άé έάέττβóάé τ βάέτò τ ÷ ñρóçð òéá òçτ άñάάóβά τά òçτ άñάττ άτòτρεδò lpr(1). Άέά δάνΰάέéτá, άτ τ ÷ ñρóçð δεçέòñττρεάρσάé lpr -t, òτ **LPD** έá τάέéτρσάé òτ òβεòñτ troff, δτò òδτáçετρτáδάé τά òçτ έέάττúòçðά tf άέά òττ άέóδδúδρ δñτττέóτττ. Άτ τ ÷ ñρóçð άδέέδτáβ ίά άέóδδρρσάé áδεù έάβτáττ, έá τάέéτρσάé òτ òβεòñτ lf (άóδú δñΰάτáδé έó ÷ γάé òέδ δάνέóóúδάñάδ òτττΰδ: άάβδσά óά Õβεòñά Áñúáτò άέά έάδδòñΥñάέáδ).

Όδΰñ ÷ τòτ òñάέδ òγδττέ òβεòñττ δτò τδττñάβδσά ίά δñτòάέττβóάδά óòτ /etc/printcap:

- Ότ òβεòñτ έάετΥττò, άδττττáετττáτττ έάé ùδ òβεòñτ άέóúáτò òðçτ òάέτçñβúòç òτò **LPD**, ÷ άέñβάéδσάé άέóδδρρσάéδ έάτττέετγ έάετΥττò. Έάñτρóδά òτ ùδ òτ δñτáδέéάάτΥττ òβεòñτ. Ότ **LPD** άτáτΥτáé δúδ úεττέ τέ άέóδδúδΰδ, áδú δñτáδέéττáρ, άβτáé óά εΥóç ίά άέóδδρρòτòτ áδεù έάβτáττ, έάé άβτáé άτòέάέΰ òτò òβεòñτò έάετΥττò ίά άάάέúέάβ τúé óά backspaces, óά tabs, έάé úεττέ τέ ΰεεττέ άέάέέτβ ÷ άñάέδρñάδ άάτ δñúέάéóάé ίά δñτáέçτáóβòτòτ òτττ άέóδδúδρ. Άΰτ άñβóέάóóά óά Υία δάνεάΰεετττ úδτò έá δñΥδάé ίά έάóάτáδòñρóάδá òçτ ÷ ñρç òúτ άέóδδúδρτ, òτ òβεòñτ έάετΥττò έá δñΥδάé áδβóçδ ίά έάóάτáδòñρóάé òέδ άέóδδúδΰτáδ óάεβááδ, óòτρεúδ τáδòñρτòά òτττ άñέέττ òúτ άέóδδúδΰτττ άñάτττ έάé óóάéñβττττòάδ òτττ τά òτττ άñέέττ òúτ άñάττττ δτò òδτòóçñβάé τ άέóδδúδρδ άτΰ óάεβáá. Ότ òβεòñτ έάετΥττò τάέέτΰ τά òçτ áέúεττòεç εβδóά δάνάτΥòñττ:

filter-name [-c] -wwidth -llength -iindent -n login -h host acct-file

úδτò

-c

άτòάτβάéδσάé άτ ç άñάάóβά Υ ÷ άé áδτòóάéάβ τά lpr -l


```
#!/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 δiο άέέάοάοδPοάiά iά ÷ ùñέοóŰ áέά iά iάοάοñŰδiοiά áδeu έάβiάñi οά PostScript. Iδññάβόά iά ÷ ñçóειñδiεάβόά iδiεiάPδiοά δñuāñāiά iάοάοññδPδ άδñ έάβiάñi- οά-PostScript. Ç ÓδέειάP οñí Ports (άάβόά Ç ÓδέειάP οñí Ports) δññέŰ ÷ áέ άδβόçδ Ύία δέPñάδ δñuāñāiά iάοάοññδPδ άδñ έάβiάñi οά PostScript, οι a2ps δiο βóùδ άδέέοiάβόά iά áέññάñiPοάόά.

9.4.1.3 Δñiόññβùç PostScript áέά ΆέòδδùδŰδ δiò ááñ οι Óδiόçñβæiόi

Όi PostScript άβιάέ οι *de facto* δñuòδδi áέά οóιε ÷ áειèάóβá έάέ áέóŰδùç òççèPδ δiέuòçóáδ. Űóóuóí, οι PostScript άβιάέ eŰδùδ *adátçñu* δñuòδδi. Άóδò ÷ ðδ, ç Aladdin Enterprises δññŰ ÷ áέ Ύία δññāiòññŰδ áeáŷeāñi PostScript δiò ññŰæáóáé **Ghostscript** έάέ äiòèáŷáé Űøñāá οóñ FreeBSD. Όi Ghostscript áeáāŰæáé οά δññέóóuòññá áñ ÷ άβá PostScript έάέ iδññάβ iά áδiāpóáé δéδ οάέβāáδ οiòδ οά iάāŰèç áeŰñiá οóóéáòpí, οóñδññééññāŰññiόáδ δiεèñŷòδ óŷδiòδ áéòδδùδpí δiò ááñ òδiόçñβæiόi PostScript. Άééáééóδpíóáδ οι **Ghostscript** έάέ ÷ ñçóειñδiεpíóáδ Ύία áéáéeu òβèòññi έáειŰñiò áéá οι áéòδδùδP οáδ, iδññάβόά iά eŰñiáδá οι έiεññi áéòδδùδP οáδ iά éáéóñññāáβ οáñ Ύiáδ δññāñiáóééuò áéòδδùδPδ PostScript.

Όi **Ghostscript** áñβóéáóáé óçñí ÓδéειάP οñí Ports οιñ FreeBSD, έάέ iŰééóóá οά δièèŰδ áéäñuóáéδ. Ç δéñ áeáāñññŰŰñç άβιάέ οι print/ghostscript-gpl.

Άέά iά eŰñiáδá δññiόññβùç PostScript, δñŰδáé οι òβèòññi έáειŰñiò iά áñé ÷ iáŷóáé áñ áéòδδpñiáδá áñ ÷ άβñ PostScript. ΆŰñ ù ÷ é, οñòá οι òβèòññi éá δññŰóáé οι áñ ÷ άβñ éáóáðéáβáñ οóññ áéòδδùδP. ΆéáñññáééŰ, éá ÷ ñçóειñδiεPóáé οι **Ghostscript** áéá iά iάοάοñŰøáé áñ ÷ ééŰ οι áñ ÷ άβñ οá Űñiá óŷδiò δiò éá éáóáéáááβiáé i áéòδδùδPδ.

Éáñŷ Űñiá δññŰæáéññi: οι áeñèñiòèñ script άβιάέ Ύία òβèòññi έáειŰñiò áéá áéòδδùδŰδ Hewlett Packard DeskJet 500. Άéá Űéèñδ áéòδδùδŰδ, áñééáóáóδPóóá οι ùñéóñiá -sDEVICE óçñí áññièP gs (**Ghostscript**). (ΔéçèòññièññPóóá gs -h áéá iά ááβóá óçñí èβóá óóóéáòpí δiò òδiόçñβæiáé ç δññŰ ÷ iòóá áééáóŰóóáç οιñ **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
```

ÔÝεïð, ÷ñáεÛæáoáε íá áιçìãñρóáðá òι **LPD** áεά òι òβέòñι ìá òçí εέάíüòçðά íf:

```
:if=/usr/local/libexec/ifhp:
```

Άðòü áβίáε üει. Ìðñãβòá íá ðεçêòñιεíãρóáðá lpr plain.text εάε lpr whatever.ps εάε ðά äýì εά áεòððùειγí áðέòð÷ρò.

9.4.1.4 Ôβέòñá ìáðáòñιðρò

Ôι áðüìãñ áβιá ìáòÛ òçí ïεíεβñùòç òçð áðερò áæέáòÛóðάóçð ðιò ðãñεãñÛøáìá óðέò
 ΆάóέεÝð Ñòεìβóáέò Άέòððùòρι, áβίáε óòιρèùð ç áæέáòÛóðάóç òβέòñι ìáðáòñιðρò áεά ðιòð òýðιòð áñ÷áβιù ðιò
 ðñιòεíÛðá (áêòüð áðü áðεü εάβιãñ ASCII).

9.4.1.4.1 Άέάòβ íá áæέáòáóòρóáðá Ôβέòñá ìáðáòñιðρò;

Ôá òβέòñá ìáðáòñιðρò εÛñιòι òçí áεòýðùòç áεάòüñιù òýðüí áñ÷áβιù áýεíεç òðüεάóç. Άέά ðãñÛæέáìá, áð
 òðιεÝòιòìá üòε Ý÷ιòìá íá εÛñιòìá áñεάòρ áñãáóβá ìá òι óýóðçíá óðιε÷áεíεάóβáò T_EX, εάε üòε Ý÷ιòìá áεòððùòρ
 PostScript. ÊÛεà òñÛ ðιò áçεíεòñáγιá Ýíá áñ÷áβι DVI ìá òι T_EX, ááí ìðñιγιá íá áεòððρòιòìá εáòáòεáβái Ýùð üòιò
 íá ìáðáòñÝòιòìá òι áñ÷áβι DVI óá PostScript. Ç áεíεíòεβá áíòιερι ðιò ðñÝðáε íá áεíεíòερòιòìá áβίáε:

9.4.1.4.3 Άάέάοΰόόάοζ Όβεόηνί ιάόάοηίδθρ

Άδν όζ όέέαιθ δθ όά όβεόηά ιάόάοηίδθρ άβιάέ δθθάηηάοά δθ άά ίάίθείοί όόί άάόέέυ όύόόείά άάέάοΰόόάοζ όθ FreeBSD, άβιάέ όεί όούόυ ίά άάέάόάόάέιγί όόί έάόΰείαι /usr/local. ίάό όόίθέζ όθθθέόίυό όθ δθθάηαιΰόθί άόθρ άβιάέ ί έάόΰείαι /usr/local/libexec, ίέά δθ όθυέέάέόάέ άέά άίάέάέέάοίγίά δθθάηαιΰηάόά δθ άέόάέιγίόάέ ίυί άδν όθ **LPD**. Ίέ άόέιβ ÷ηθόόά άάί έά ÷ηάέάόάβ δθγ ίά όά άέόάέγίόί.

Άέά ίά άάηάηίθίέθόάόά γίά όβεόηι ιάόάοηίδθρ, δθθάέηθβόά όζ άέάηηθ όθ όόί άη÷άβι /etc/printcap, άέέΰάηίόάό όζ έάόΰέέζέζ έέάίυόζόά όόί άέόόδθδθ δθ άόέέόίάβόά ίά όι ÷ηζόέιθίέθόάόά.

Όόί δάηΰάάέαιά ίάό, έά δθθίόέγίόίά όι όβεόηι ιάόάοηίδθρ DVI όόζί έάόά÷θέόζ ίάό άέά όί άέόόδθδθ ιά όι ύηηά bamboo. Άέέιθέάβ, έίέδύι, όι δάηΰάάέαιά άέά όι άη÷άβι /etc/printcap, ιά όζ ίγίά έέάίυόζόά df άέά όί άέόόδθδθ 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:
```

Όι όβεόηι DVI άβιάέ γίά shell script δθ ηηΰάάόάέ /usr/local/libexec/psdf, όι ίθίβι έάέ δάηάέγίόίά δάηάέΰό:

```
#!/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 "$@"
```

Άόόυ όι script όηγ÷άέ όι dvips όά έάόΰόόάόζ όβεόηθ (ιά όζ δάηΰάόηθ -f) όόζί standard input, άδν υδθ έάέ έάίάΰίάέ όζ άηάάόά δθ άέόγδθόζ. Άόόυ ίάέέΰ όι όβεόηι άέόγδθόζ PostScript lprps (άάβόά όζ άίυόζόά Όθίάάόυόζόά Άηάάέθρ Άόέγ Έάέγθ όά άέόόδθδθ PostScript) άβίθόάό όθ έάέ όέό δάηάγθθθόό δθ δγθάόά όθ **LPD** όόί δάηάδΰθ script. Όι lprps έά ÷ηζόέιθίέθόάέ άόόγδ όέό δάηάγθθθόό άέά όζ έάόάγθθζόζ όθ άέόόδθδΰίυίά όάέβάι.

9.4.1.4.4 Άέυιá ιάηέέΰ Δάηάάάβαιάόά Όβεόηνί ιάόάοηίδθρ

Άδν όζ όέέαιθ δθ άά όδΰη÷άέ άόόηάόθίθίέζίγίζ ίγέιαιό άέά όζ άάέάοΰόόάόζ όυί όβεόηνί ιάόάοηίδθρ, άό ίάό άόέόηάδάβ ίά δάηγ÷θίά ιάηέέΰ άέυιζ δάηάάάβαιάόά. Ίθθάβόά ίά όά ÷ηζόέιθίέθόάόά όά ίαζάυ άέά όζ άζέιθθάβά όυί άέέθρ όάό όβεόηνί. Άί ηθβάόά δθ άβιάέ έάόΰέέζέά άέά όζ δάηθδθόζ όάό ίθθάβόά ίά όά ÷ηζόέιθίέθόάόά έάέ έάόάόέάβαι.


```

# 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

```


υοάι οἶο οόάβεάε αῦι bytes: Ἰία ASCII 031 αέιειοειγῖαῖι αδῦ Ἰία ASCII 001. ¼οάι Ἰία οβέοῆι αῖυαῖο αέΥδαέ αοδῦ οά αῦι bytes (031, 001), εά δῆΥδαέ ἰά οόαῖαδῦ οδΥέῖῖιόαδ οβῖα SIGSTOP οδῖι αάοδῦ οἶο. ¼οάι οἶ **LPD** ῖειέεçῆρβόάε οçῖ αέοΥεαός εάε οῖι οδῖειβδῦι οβέοῆι, εά δαῖαέεειρβόάε οἶ οβέοῆι αῖυαῖο οδΥέῖῖιόαδ οἶο οἶ οβῖα SIGCONT.

Αῖ οδῦῆ ÷ αέ οβέοῆι αῖυαῖο, αέεῦ *αῖι οδῦῆ ÷ αέ* οβέοῆι εάειΥῖο εάε οἶ **LPD** ῖιόεάγáε οά ἀῆαόβá αδεῖγ εάειΥῖο, οἶ **LPD** ÷ ῆçοείῖιέάβ οἶ οβέοῆι αῖυαῖο αέα οçῖ αέοΥεαός οçδ ἀῆαόβáδ. ¼δῦο αῖαόΥῆαῖα εάε δαῆαδῦῖ, οἶ οβέοῆι αῖυαῖο εά αέοδθροάε εῦεά ἀῆ ÷ áβι ἀῆαόβáδ οδç οάεῆῦ, áβ ÷ ῦδ αῖοῖαδῦοçδá δαῆαῖαῖερβδ εαῖρβδ οάεβáαδ ρ Ὑεεῖι ῆδῖεβδáῖι οδçῖ οῆῖοῖαῖοβá ÷ ἀῆοείγ, εάε δεεαῖρβδ αδῦ ἰά ἰçῖ áβῖαέ αδῖεδῖçδῦ. Ó ÷ áαῖι οά ῖεάδ οεδ δαῆεδθροάεδ, εά ÷ ῆαέáοάβδá Ἰία οβέοῆι εάειΥῖο.

Οἶ δῆυαῆαῖα ῖρ, δῖο αῖαόΥῆαῖα ῖῆβδáῆα οάῖ οβέοῆι εάειΥῖο, ἰδῖῆáβ ἰά οῆΥῖαέ εάε οάῖ οβέοῆι αῖυαῖο. Αῖ ÷ ῆαέῦαάοά Ἰία ἀῆρῖῖι οβέοῆι αῖυαῖο αέεῦ áαῖ εΥεάοá ἰά ἀῆῦθáοá οἶ ερπέεά αῖβ ÷ ἰάοçδ οῖι byte εάε οἶ ερπέεά αδῖοῖερβδ οçῖῦδῖ, αῖεῖῦδá οἶ ῖρ. Ἰδῖῆáβδá áδβçδ ἰά ÷ ῆçοείῖιέρβόá οἶ ῖρ ἰΥόá αδῦ Ἰία shell script οἶ ἰδῖῖι εά ÷ αέῆβáεάε οἶοδ εῦαέείγδ ἀῆ ÷ εέῖῖιβççδ δῖο βδῦ ἰά ÷ ῆαέῦαάοάε ἰ αέοδθῦδ.

9.4.1.6 ῖρ: Ἰία Ὀβέοῆι ἘάειΥῖο

Οἶ δῆυαῆαῖα /usr/libexec/lpr/ῖρ δῖο δαῆΥ ÷ áοάε ἰá οç αέáῖῖ αέδáεΥόείῖι οἶο FreeBSD áβῖαέ Ἰία οβέοῆι εάειΥῖο (οβέοῆι áεούαῖο) δῖο ἰδῖῆáβ ἰά δαῆαῆαῖοῖῖιέάβ οçῖ Ἰῖαῖ (ἀῆαόβáδ δῖο Υ ÷ ῖοῖ οόάεáβ ἰá ῖρ -ῖ), ἰá áδῖοῆΥδαέ οçῖ αέΥεáοç literal ÷ ἀῆáεδῖῖῖ (ἀῆαόβáδ δῖο Υ ÷ ῖοῖ οόάεáβ ἰá ῖρ -ῖ), ἰá ῆδῖεβáε οçῖ εΥόç áέδῖδῦοçδ ἰá οç ÷ ῆρç ÷ ἀῆáεδῖῖῖ backspace εάε tab οδçῖ ἀῆαόβá, εάε ἰá εῦῖαέ εάοáῖΥδῆççδ οῖι áέοδθῦῖῖῖ οάεβáῖ. Ἄδβçδ ἰδῖῆáβ ἰá αῖῆῆáβ εάε οάῖ οβέοῆι αῖυαῖο.

Οἶ ῖρ áβῖαέ εάδῦεεçῖ αέα αέῦοῖῆα δαῆεáῦεῖῖοá áέδῖδῦοçδ. Αῖ εάε áαῖ Υ ÷ áε αῖοῖαδῦοçδá αδῖοῖερβδ αέῖῖοεçῖ ἀῆ ÷ εέῖῖιβççδ οδῖι áέοδθῦδ, áβῖαέ αῖεῖῖ ἰά ἀῆῦθáοá Ἰία shell script αέα ἰá εῦῖαδá οçῖ αδῖῆáβççδ ἀῆ ÷ εέῖῖιβççδ εάε ἰá áέοáεΥόáδá Ἰδαέόá οἶ ῖρ.

Ἄέα ἰá εῦῖαέ οῦοδῦ εάοáῖΥδῆççδ οάεβáῖ, οἶ ῖρ ÷ ῆαέῦαάοάε εάδῦεεçῖαδ οείΥδ αέα οεδ εέáῖῖçδáδ pw εάε pl οἶι ἀῆ ÷ áβι /etc/printcap. ×ῆçοείῖιέáβ αδῖδῦ οεδ οείΥδ αέα ἰá δῆῖοáεῖῆβόáε δῖοῖ εáβῖαῖ ἰδῖῆáβ ἰá ÷ ῆῆΥάε οá ἰβá οάεβáá εάε αδῦ δῖοáδ οάεβááδ αδῖοáεáβδáε ç ἀῆαόβá οἶο ÷ ῆρç. Ἄέα δαῆεόοῦοáῆαδ δεçῆῖοῖῆáδ ÷ ÷ áδῖεῦ ἰá οçῖ εάοáῖΥδῆççδ οάεβáῖ, οἶαῖῖεáδáβδá οçῖ ἘáοáῖΥδῆççδ × ῆρçδ Ἄέοδθῦδῖ.

9.4.2 Ὀάεβááδ Ἐáοáεβááδ

Αῖ Υ ÷ áοá *áῆεáδῖγδ* ÷ ῆρçδ, εάε ῖεῖε οἶοδ ÷ ῆçοείῖιέῖῖῖ αέῦοῖῆοδ áέοδθῦδ, οῖοá δεεαῖρβδ ἰá εáῆáβδá οεδ *οάεβááδ εáοáεβááδ* ῦδ αῖαάεáβι εάεῖ.

Ἰε οάεβááδ εáοáεβááδ, αῖῖοδῦδ áδβçδ εάε ῦδ *banner ρ οάεβááδ burst* αῖαῖῖῆβῖοῖ οá δῖεῖι áῖρῖοῖ ἰε ἀῆαόβáδ ἰáδῦ οçῖ áέδῖδῦοç οἶοδ. Οἶρῖεῦδ οδθῖῖῖοáε ἰá ἰáῦεá, Ἰῖοῖῖá ἀῆῦῖαόá, εάε βδῦδ ἰá αέáεῖοῖçεεῦ δαῆεáῆῖῖαόá, ρóóá οá ἰεá οἶῖβáá áέοδθροáῖ ἰá ἰá ÷ ῆῆβῖοῖ αδῖ οá δῆαῖαόεεῦ Ἰῖαῆαόá ἀῆαόεῖρ οῖι ÷ ῆççῖ. ἌδῖοῆΥδῖοῖ Ἰόóε οἶοδ ÷ ῆρçδ ἰá ῆῆβῖοῖ ἀῆρῖῖῖ οεδ ἀῆαόβáδ οἶοδ. Οἶ δῆῖοáῖΥδ ἰáεῖῖΥέδçῖα οá ἰεá οάεβáá εáοáεβááδ áβῖαέ δῦδ δῆῖεáεόáε ἰá áέοδθῦεáβ ἰεá αέῖῖá οάεβáá αέα εῦεá ἰβá ἀῆαόβá. Ç áοβῖαῆç ÷ ῆçοείῖῖçδá οἶοδ αέáῆεáβ εβáá εáδδῦ, εάε ἰ δῆῖῖεῖοῖδ οἶοδ áβῖαέ ἰ εῦῖαδ ÷ ῆρçδ/áῖαέγῖεεῦοçδ. (Δαῆαδçῆρçδá δῦδ ἰε οάεβááδ εáοáεβááδ áβῖαέ áῖῦ ἀῆαόβá, εάε ῦ ÷ εῖ áῖῦ ἀῆ ÷ áβι οá ἰεá ἀῆαόβá, áδῆῖῖῦδ οἶ ÷ ῆççδáοῖῖῖ ÷ ἀῆδβ βδῦδ ἰá ἰçῖ áβῖαέ οῖοῖ δῖεγ).

Οἶ ογóçῖá **LPD** ἰδῖῆáβ ἰá δαῆΥ ÷ áε αδῖοῖαόá οάεβááδ εáοáεβááδ αέα οεδ áέοδθροáεδ οáδ, *áῖ* ἰ áέοδθῦδ οáδ ἰδῖῆáβ ἰá áέοδθροάε Ὑῖαόá αδεῖ εáβῖαῖ. Αῖ Υ ÷ áοá áέοδθῦδ PostScript, εá ÷ ῆαέáοάβδá Ἰία ἰῖοáῆεῖῖ δῆυαῆαῖα αέα ἰá αçῖεῖῖῖρβόáδá οçῖ οάεβáá εáοáεβááδ. Ἄáβδá οἶ Ὀάεβááδ Ἐáοáεβááδ οá Ἄέοδθῦδ PostScript.


```

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
                                     yyy

```

```

                                     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 êãßiãñi Ýðóé þóðà ç ãñááóßá íá iãééiðóáé óá rÝá óäëßáá (ãêôüð áí Ý ÷ ãðã ðñiðáéiñßóáé ôçí ééáíüðçðá sF (suppress form feeds) ãéá ôii áêðððððð ðóôí ãñ ÷ ãßi /etc/printcap).

Áí ðñiðéiÛðá, ôi LPD iðñiãß íá ððéÛiáé iéá iéññüðãñið iðéiðð éäðáéßáá. ðñiðáéiñßóðá sb (short banner) óôí ãñ ÷ ãßi /etc/printcap. Ç óäëßáá éäðáéßááð éä iieÛæáé óái áððð:


```

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

```

Ὅπνά, ἐαέΥία ἀδὺ δά ὀβεοῆνά ἰαόαόνιθρὸ ἐαέ οἱ ὀβεοῆνι ἐαείΥίῃ ἰδῖνιγί ἰά ἐαέΥίοῖοἱ οἱ script, θῆρῶά ἀέα ἰά ἀείροῆθρῶοἱ ὄς ὀαέβαά ἐαόαέβααό, ἐαέ Υῆαέοά ἀέα ἰά ἀέδοδθρῶοἱ ὄς ἠῆαάοβᾶ οἱ ÷ ἠρῶδς. Ἀείροεᾶθ οἱ ὀβεοῆνι ἰαόαόνιθρὸ DVI θῖο ἀᾶβῖᾶ ἰῆνθῶᾶᾶ, ἀέᾶέῤ ᾶεᾶῖῃ ἰᾶ ἰά ὀδεῤῖοῖᾶ ἰέα ὀαέβαά ἐαόαέβααό:

```

#!/bin/sh
#
# psdf - DVI to PostScript printer filter
# Installed in /usr/local/libexec/psdf
#
# Invoked by lpd when user runs lpr -d
#

```


δññσάσζ όοñí áέοδδθδρσ áδñ ΰεεñòδ òδñεñεσóÝò òñò áέέóÝñò. Ç áññòçσά Άέοδδθδρσ ΆάέσάσóçñÝñíέ σά ΆδññáέñòσñÝññòδ ÕδñεñεσóÝò áñçááβ óέò áδññáβòçσάò áñÝññáέσáò.

- Δññσάσζ σά áέοδδθδρσ σññáááñÝññí έσáðáέσáβáñ σññí áβέòδñ. Άέέòñò (P áñòβ) òçò σññááóέέρδ σáέñέσáέρδ P δáñΰεέççò έýñáò, ï áέοδδθδρò δñÝðáέ íá Ý ÷ áέ áδέδññòέσáò íέá áέέðσáέρ áέσóÝñáσç. ðáò ò Ýòñεñò áέοδδθδρò áñòέáÝáέ ùò áñρò:
- Ìðññáβ íá έσáðáέσáβñέ σññí δññòñεεñεñí **LPD** έáέ íá áçñεñòñááβ ðññΰ áñáññρò áέá óέò áñááóβáò δñò δññÝññ ÷ ïñóáέ áδñ áδññáέñòσñÝññòδ òδñεñεσóÝò. Óá σóδρ òçñí δáñβδòòòç, áñáñááβ σáñ Ýñáò έáññεέñò òδñεñεσóρò δñò áέòáέáβ òñ **LPD**. Άέñεñòδρòá òçñí βáέá áέááέέσáóβá ïá òçñí áññòçσά Άέοδδθδρσ ΆάέσáσóçñÝñíέ σά ΆδññáέñòσñÝññòδ ÕδñεñεσóÝò áέá íá ááέσáσóδρòáòá σóδññí òñí áέέòδθδρ.
- Ìðññáβ íá òδññòçññáέ σýñááσç áέέòðσáέρδ ðñρò áááñÝñññ (data stream). Óá σóδρ òçñí δáñβδòòòç, “σññáÝáòá” òñí áέέòδθδρ σά Ýñáñ òδñεñεσóρò σññáááñÝññí σññí áβέòδñ, ï ïðñβñò έá áβñáέ σðáÝέðññò áέá òçñí δáññí ÷ Ýðáòòç òññí áññáσέρñ έáέ òçñí áδññòñερ òñòδ òóññí áέέòδθδρ. Ç áññòçσά Άέοδδθδρσ Ìá ÓññáÝóáέò ΆέέóÝñò áβñáέ ïáñέέÝò òññáñòεÝò áέá òçñí ááέσáðσóáσç áέέòδθδρñ áóðñÝ òñò óÝðñò.

9.4.3.1 Άέέòδθδρσ ΆάέσáσóçñÝñíέ σά ΆδññáέñòσñÝññòδ ÕδñεñεσóÝò

Õñ óýòóçñá δáññí ÷ Ýðáòòçò **LPD** Ý ÷ áέ áñòññáòññÝñç òδññòðñέñç áέá òçñí áδññòñερ áññáσέρñ σá ΰεεñòδ òδñεñεσóÝò δñò áέòáέññí òñ **LPD** (P δñò áβñáέ σññááòñβ ïá òñ **LPD**). Άóδñ òñ ÷ áñáέòçñέóóέέñ σáð áδέòñÝðáέ íá ááέσáσóδρòáòá Ýñáñ áέòððθδρ σά Ýñáñ òδñεñεσóρò έáέ íá Ý ÷ áòá δññσááσç σá σóδññí áδñ ΰεεñòδ. Άðβòçò áñòέáÝáέ έáέ ïá áέέòδθδρσ Õòδñ Ý ÷ ïðñí áέέòðσáέÝð áέáóññáÝóáέò δñò έáðáέáááβñññ òñ δññòñεεñεñí **LPD**.

Άέá íá áñáñáññερòáòá σóδññí òñ óÝðñí áδññáέñòσñÝñçò áέóÝðòòçò, ááέσáσóδρòá δñρòá Ýñáñ áέέòδθδρ σά Ýñáñ òδñεñεσóρò, òññí òδñεñεσóρò *áέóÝðòòçò (printer host)*, ÷ ðñçóέññðñερñóáð òçñí áδέρ ááέσáðσóðáσç áέέòδθδρ δñò δáñέáñΰóáóáέ òçñí áññòçσά ΆáóέέÝò Ñðèñβóáέò Άέέòδθδρñ. Èΰñóá ïóáò δññí ÷ ùñçñÝñáò ðñèñβóáέò ÷ ðñáέΰáέòá ùðòò áñáòÝññáóáέ óðέò Ñðèñβóáέò Άέέòδθδρñ áέá Δññí ÷ ùñçñÝññòδ. ΆέÝáñòá òññí áέέòδθδρ έáέ ááβòá áñ áñòέáÝáέ ïá óá ÷ áñáέòçñέóóέέΰ òñ **LPD** δñò Ý ÷ áòá áñáñáññερòáέ. Άðβòçò ááááέñέáβòá ðñò ï òñðέέñò òδñεñεσóρò (local host) áβñáέ áñòóέññòçñÝññí íá ÷ ðñçóέññðñεñáβ óέò òççñáòβáò òñ **LPD** σññí *áδññáέñòσñÝññí òδñεñεσóρò (remote host)* (ááβòá Δñáñáñññέσç Άñááóέρñ áδññí ΆδññáέñòσñÝññòδ ÕδñεñεσóÝò).

Άΰñ ÷ ðñçóέññðñεñáβòá áέέòδθδρ ïá áέέòðσáέρ áέσóÝñáσç δñò áβñáέ σññááòñò ïá òñ **LPD**, òñòá ï ï òδñεñεσóρò *áέóÝðòòçò (printer host)* áβñáέ ï áñ έñáñ áέέòδθδρò, έáέ òñ *ñññá òññí áέέòδθδρ* áβñáέ òñ ïññá δñò Ý ÷ áòá ðñβóáέ áέá òññí áέέòδθδρ. Άáβòá òçñí òáέñçñβòòç δñò σñññáÝáέ òññí áέέòδθδρ σáð έáέ/P òçñí έΰñòá áέέóÝñò òñò.

Õðñááέñç: Άñ ÷ ðñçóέññðñεñáβòá Hewlett Packard Laserjet ïá ïññá áέέòδθδρ text έá áβñññóáέ áðòññáòá ïέ ïáòáðñññò áδññí LF óá CRLF, áδññÝññò ááñ ÷ ðñáέΰáέòáέ íá òñÝñáòá òñ script hpif.

ΆδññÝññò, σñññò òðñεñεðñòδ òδñεñεσóÝò ùðññí áðέέðñáβòá íá Ý ÷ áòá δññσááσç σñññí áέέòδθδρ, áδέΰ έΰñóá ïέá έáòá ÷ ðñέóç σññí áñ ÷ áβññ /etc/printcap ïá òá áέñεñòέá óññε ÷ áβá:

1. Ìññΰóá òçñí έáòá ÷ ðñέóç ùðòò áðέέðñáβòá: Άέá áέέρ σáð áðέñεβá ðέέáñρò íá εΰέáòá íá ÷ ðñçóέññðñερòáòá òñ βáέñ ïññá έáέ óá βáέá δáñññññέá ïá σóδΰ òñò òδñεñεσóρò áέóÝðòòçò.
2. Άðρòá òçñí έέáññòçσά lp έáñρ, áέá òçñí áέñβááέá (: lp=).
3. Άçñεñòñáρòá Ýñá έáðΰέñññí spooling έáέ δñññóáέññβòá òçñí òñðñέáòβá òñò ïá òçñí έέáññòçσά sd. Õñ **LPD** έá áðñεçέáÝáέ ááρ óέò áñááóβáò δñέñ òçñí áδññòñερ òñòδ òóññí òδñεñεσóρò áέóÝðòòçò.

4. Οἰθῖεάδθρσά όἰ υἱνά όἰθ όδῖεῖεάέσθθρσ άέδύδδδθρσ όδζἰ έέάἰυδζόά rm.
5. Οἰθῖεάδθρσά όἰ υἱνά όἰθ άέδδδδθρσ όδζἰ έέάἰυδζόά rp, όόἰθ δδῖεῖεάέσθθρσ άέδύδδδθρσ.

Άδδδθρσ άβἰάέ υῖεἰ. Άάἰ ÷ ἱάέΰεάάέά έά άζἰεἰθῖεάθρσάά έβθσά όβέθθἱἰ ἰάόάθἱθρσ, άέάσθθρσάέδ σάέβάάδ, θ ἱόέαθρσάά ΰεἰεἰ όόἰ άἱ ÷ άβἰ/etc/printcap.

Άάθ άβἰάέ ΰἰά δάἱΰάάέάἰά. Ἰ όδῖεῖεάέσθθρσ rose ΰ ÷ άέ άἱἰ άέδδδδθρσΰδ, όἰἰ bamboo έάέ όἰἰ rattan. Εΰεἰθἰά έά άἰάἱἰθῖεθρσἰά όέδ άέδδδθρσάέδ σά άδδθρσ όἰθ άέδδδδθρσΰδ άέά όἰθ ÷ ἱθρσάά όἰθ άδἱάέθσἰΰἰθ όδῖεῖεάέσθθρσ orchid. Άάθ άβἰάέ όἰ άἱ ÷ άβἰ/etc/printcap όἰθ όδῖεῖεάέσθθρσ orchid (άάθσά δέἰ δθού όδζἰ άἰυδζόά Άἰάἱἰθῖεθρσ Όάέβάἱ Εάόάέβάάδ). ἰάζ ΰ ÷ άέ ἰέά έάόά ÷ ἱἱέσζ άέά όἰἰ άέδδδδθρσΰδ teak. Άάθ θἱἰόέΰόάἰά όέδ άδἱάἱθρσάά έάόά ÷ ἱἱθρσάέδ άέά όἰθ άἱἰ άέδδδδθρσΰδ όἰθ όδῖεῖεάέσθθρσ rose:

```
#
# /etc/printcap for host orchid - added (remote) printers on rose
#

#
# teak is local; it is connected directly to orchid:
#
teak|hp|laserjet|Hewlett Packard LaserJet 3Si:\
    :lp=/dev/lpt0:sd=/var/spool/lpd/teak:mx#0:\
    :if=/usr/local/libexec/lfhp:\
    :vf=/usr/local/libexec/vfhp:\
    :of=/usr/local/libexec/ofhp:

#
# rattan is connected to rose; send jobs for rattan to rose:
#
rattan|line|diablo|lp|Diablo 630 Line Printer:\
    :lp=:rm=rose:rp=rattan:sd=/var/spool/lpd/rattan:

#
# bamboo is connected to rose as well:
#
bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
    :lp=:rm=rose:rp=bamboo:sd=/var/spool/lpd/bamboo:
```

Οἰ ἰυἱθ όἰθ άδἱΰἰάέ άβἰάέ έά άζἰεἰθῖεάθρσἰά όἰθ έάόάέυἰἰθδ spooling όόἰ έυἰἰ orchid:

```
# mkdir -p /var/spool/lpd/rattan /var/spool/lpd/bamboo
# chmod 770 /var/spool/lpd/rattan /var/spool/lpd/bamboo
# chown daemon:daemon /var/spool/lpd/rattan /var/spool/lpd/bamboo
```

Όθἱά, ἰέ ÷ ἱθρσάά όἰθ orchid ἰδἱἱἰἰ έά άέδδδθρσἰθί όόἰ rattan έάέ όόἰ bamboo. Άἰ, άέά δάἱΰάάέά, ΰἰάδ ÷ ἱθρσάά όἰθ orchid δέζέθἱῖεἰθρσάέ:

```
% lpr -P bamboo -d sushi-review.dvi
```

όἰ όύόδζἰά LPD όόἰ orchid έά άἰόέἱἱΰθάέ όζἰ άἱάάόβά όόἰ έάδΰεἰἰ spooling /var/spool/lpd/bamboo έάέ έά όζἰάέθρσάέ δδδ θἱἱέάέόάέ άέά άἱάάόβά DVI. ἰυέέδ ἰ όδῖεῖεάέσθθρσ rose ΰ ÷ άέ άέάέΰόεἰ ÷ ἱἱθί όόἰ έάδΰεἰἰ spooling όἰθ bamboo, σά άἱἰ LPDs έά ἰάόάόΰἱθί όἰ άἱ ÷ άβἰ όόἰ rose. Οἰ άἱ ÷ άβἰ έά ἰδἰάέ σά ἰθἱΰ άἰάἱἱθρσ όόἰ όδῖεῖεάέσθθρσ rose ΰδδ υἰθθ άέδδδδθρσάέ. Εά ἰάόάθἱάδἱ άδδ DVI σά PostScript (άόἰἰ ἰ bamboo άβἰάέ άέδδδδθρσ PostScript) όόἰ όδῖεῖεάέσθθρσ rose.

9.4.3.2 Άέοδδθρσάετ ιά ΟσίάΎσάετ Άέέδγίτ

Όδ ÷ιΎ, υδσί άάηΎεάδσ εΎηδσ άέέδγίτ άέά άέοδδθρσ, Ύ ÷άδσ όç άδίσδυιόçσά άδέετΎδ άγί άέάυδσάυτ: ç ιβά άβίσέ δñιόηιβδός ότσ spooler (ç δέτ άέηέάτ Ύέαιός) άη ç Ύέεç άδέΎ σάδ άδέδñΎδσά ίά σδ Ύέτδσά άάηΎΎίά ιΎσδ άδδθρδ σάί ίά ÷ñçσέηιδτέτγσάδσ ίέά σάέηέάετ τ δάνΎέεççç εγñά (ç όδçίτ Ύέαιός). Άδδθτ ç άίυδçσά δάνέανΎσάε δυδ ίά ÷ñçσέηιδτέτγσάδσ όçί όδçίτ Ύέαιός. Άέά όçί δέτ άέηέάετ Ύέαιός ιδñάβδσά ίά άñάβδσά δάνέσδσδσάñδ δέçñιτσñβδσ όδçί δñιçάτγίάτç άίυδçσά Άέοδδθρσδ ΆάέάδσόçίΎίτ σά ΆδñάέηδσίΎίτδ ΌδτέτσέσδΎδ.

Ç ηñθτ ότσ άñ ÷άβτδ /etc/printcap σάδ άδέδñΎδσά ίά ηñβδσάδσ όç άέάόγίάσός - σάέηέάετ τ δάνΎέεççç - δτδ εά ÷ñçσέηιδτέτγσάδσ, έάέ (άί ÷ñçσέηιδτέτγσάδσ σάέηέάετ άέάόγίάσός) όητ ηδελι baud, δέέάτγδ άεΎά ÷τδ ητδ, έάέδδσάñτδσάέδ άέά tabs, ιάδσάδñτδΎδ άέά ÷άñάέδτñδ ιΎάδ άñάητδ, έάέ Ύέέά. ΆέέΎ άάτ όδΎñ ÷άέ όñυδτδ ίά ηñβδσάδσ ίέά όγίάσός σά άέοδδθρσδ ότσ άέτγάέ σά εγñά TCP/IP τ Ύέέτ όγδτ άέέδγίτ.

Άέά ίά σδάβέσάδσ άάηΎΎίά σά Ύίά άέέδσάέυ άέοδδθρσ, ÷ñάέΎεάδσά ίά άίάδδγίάδσ δñιτñΎηιάσά άδέέτέτγίβδσ ότδ ίά έάέτγίσάέ άδυ οβέδñά έάέτΎίτ έάέ οβέδñά ιάδσάδñτδθρδ. Άάη Ύ ÷τδσά Ύίά δΎδτέτ δάνΎάέέτ: ότ script netprint δάβñτσάέ υέά σά άάηΎΎίά άδυ ότ standard input έάέ σά σδΎέτσάέ σά Ύίά άέοδδθρσ σδτσάάηΎίτ σδτ άβέδστ. Ιñβάετδσά σδτ netprint ότ υñτά ότσ άέοδδθρσ υδ δñθç δάνΎιάδσ, έάέ όητ άñέετυ εγñάδ σόçί τδτβά σδτΎάσάέ υδ άάγδσάç. Όçίάέτδσά δυδ σδδυδ τ όñυδτδ όδτδóçñβάέ ηυτ άδέέτέτγίβά ίέάδ έάδάγέδτδçδ (άδυ ότ FreeBSD σδτ άέοδδθρσ). Δτέετβ άέέδσάέτβ άέοδδθρσδ όδτδóçñβάετδτ άτδβάñτç άδέέτέτγίβά, έάέ άβίσάέ δτέγ δέέάτυ ίά άδέέτδσάδσά ίά άέτσάέέσδσάβδσά σά δñτδάντδσάδσ ότδ (άέά ίά άέΎά ÷άδσ όçί έάδΎδσάσός ότσ άέοδδθρσ, άέά έάδσάΎδñççç άέοδδθρσάτ, 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;
```

Ιδñάβδσά ίά ÷ñçσέηιδτέτγσάδσ άδδυ ότ script σά άέΎστñά οβέδñά. Άδ όδτέΎστδσά δυδ Ύ ÷τδσά Ύίά άέοδδθρσ άñάητδ Diablo 750-N σδτσάάηΎίτ σδτ άβέδστ. Ι άέοδδθρσδ άΎ ÷άσάέ άάηΎΎίά δñτδ άέδγδθρσ όδçί εγñά 5100. Ότ υñτά ότσ άέοδδθρσ ότσ άβέδστ άβίσάέ scrivener. Άάη άβίσάέ ότ οβέδñτ έάέτΎίτ άέά όητ άέοδδθρσ:

```
#!/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:
```

×ñçóειιθιέθρóaó οçί έέάιυόçóá sc, θñιέάιáÛιιόιá οçί ÷ñρóç ουι άίόιέθρί lpr -#, áεεÛ áái Ý÷ιόιá áέυιç οçί áóíáóυόçóá íá θáñáιθιιáβóιόιá οιόδ ÷ñρóáó íá óñÝιιόι οçί άίόιέθρ lpr(1) θιέεÛò οιñÝò, ρ íá áθιόóáβειόι οι βáει áñ÷áβι θιέεÛò οιñÝò óá ιβá ιιιáέέθρ áñááóβá, υθùð ááρ:

```
% lpr forsale.sign forsale.sign forsale.sign forsale.sign forsale.sign
```

ÏðÛñ ÷ιόι θιέειβ óñυθιέ θñυέççò áóóθρ ουι áíáñááεθρ (óοιθáñέέάιáÛιιόáó έάέ οçί θáñβθóυόç íá οι ááñιρóáóá) θιό áβóóá áεáγέáñιέ íá áíáñáóιρóáóá.

9.4.4.2 θáñέιñβειιόáó οçί θñυóááóç óá ΆέóðùòÝò

Ïθιñáβóá íá áεÛá÷áóá θιέυò ïθιñáβ íá áέóðθρίáε óá θιέύι áέóðθùòθρ ÷ñçóειιθιέθρóaó οιόδ ιç÷áιέóιιγò ñÛáυι (groups) οιό UNIX έάέ οçί έέάιυόçóá rg οοι /etc/printcap. ΆðεÛ οιθιέáóθρóóá οιόδ ÷ñρóáó θιό εÛεáóá íá Ý÷ιόι θñυóááóç óá εÛθιέιι áέóðθùòθρ óá ιέá óóáέáñειÝιç ñÛáá (÷ñçóóθρί), έάέ áçεθρóá áóóθρ οçί ñÛáá óóçί έέάιυόçóá rg.

¼ειέ έ ÷ñρóáó θιό áái άιθειόι óóçί ñÛáá (óοιθáñέέάιááñÝιιò έάέ οιό root) έá áÛ÷ιόáέ οι áέυιέιòει ιθιόιá: “lpr: Not a member of the restricted group” υóái θñιόθáειγί íá áέóðθρóιόι óοιι áεáá÷ιιáñι áέóðθùòθρ.

¼θùð έάέ íá οçί έέάιυόçóá sc (θáñέιñέóιιγ θιέεáðεθρί áίóεáñÛóυι), έá ÷ñáέáóóáβ íá θñιόáειñβóáóá οçί rg óοιόð áθñáέñóóιÝιιò ευιáιόð θιό έá Ý÷ιόι θñυóááóç óοιόð áέóðθùòÝò óáó, áι ññβáεáóá θùð áóóυ áβιáέ óóóóυ (ááβóá οçί áιυόçóá ΆέóðθùòÝò ΆáέáóáóóçιÝιέ óá ΆθñáέñóóιÝιιò ÏθιέιáέóóÝò).

Άέá θáñÛááέáιá, έá áóθρóιόιá áέá υειόð áεáγέáñç οçί θñυóááóç óοιι áέóðθùòθρ rattan, áεεÛ ιυιι έ ÷ñρóáó οçò ñÛááó artists έá ïθιñιγί íá ÷ñçóειιθιέθρóιόι οιι bamboo. Άáρ áβιáέ οι áιυóóυ ιáó /etc/printcap áέá οιι ευιáι 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:\
```


Ἀέα δάνῦααέαία, ἀδ δνῖοεῖοῖοῖα ῖα ἄν ÷ ἄβι minfree ἄέα οῖι ἄέδοδθρῶP bamboo. Ἀῖαδῦαεῖοῖα οῖ /etc/printcap ἄέα ἰά ἄνῖῖῖα οῖι ἄαδῦεῖῖῖ spool ἄέα ἀδουῖ οῖι ἄέδοδθρῶP. Ἀἄρ ἄβῖἄε ς ἄαδῶ ÷ ἡνέορ ἄέα οῖι bamboo:

```
bamboo|ps|PS|S|panasonic|Panasonic KX-P4455 PostScript v51.4:\
:sh:sd=/var/spool/lpd/bamboo:sc:rg=artists:mx#5000:\
:lp=/dev/ttyd5:ms#-parenb cs8 clocal crtscs:rw:mx#5000:\
:if=/usr/local/libexec/psif:\
:df=/usr/local/libexec/psdf:
```

Ἴ ἄαδῦεῖῖῖ spool ἄεῖῖῖῖῖῖῖ ὀδρῖ ἄέαῖῖῖῖῖ ἄδ sd. Ἐὰ εῖοῖοῖα δνῖῖῖ megabytes (εῖοῖοῖαῖῖῖ ἰῖ 6144 disk blocks) ὑδ οῖ ἰῖῖῖῖ οῖο ἄεῖῖῖῖῖῖ ÷ ἡνῖο δῖο δνῖῖῖ ἄέα ἰά οδῦῖ ÷ ἄε οῖο ὀγῶδρῖῖ ἄν ÷ ἄβῖ, ἡρῶῖ οῖ **LPD** ἰά ἄῖ ÷ ἄδῶε ἀδῖῖῖῖῖῖῖ ῖῖῖῖ ἄν ἄῖῖῖῖῖ:

```
# echo 6144 > /var/spool/lpd/bamboo/minfree
```

Ἐἄνῖῖῖῖῖ ÷ ἡνῖοῖῖ

Ἰδῖῖῖῖῖ ἰά ἄεῖῖ ÷ ἄῶῖ δῖεῖῖδ ἀδῖῖῖῖῖῖῖ ῖῖῖῖ ÷ ἡρῶδρδ ἰδῖῖῖῖ ἰά ἄέδοδθρῖῖῖ ὀοῖῖδ οῖδῖεῖῖῖ ἄέδοδθρῖῖ ῖῖῖῖῖῖῖ ὀρῖ ἄέαῖῖῖῖῖ ῖῖ ὀοῖ /etc/printcap. Ἰῶῖῖ ἄῖῖῖῖῖῖῖ ῖῖ ῖῖ ὀῖ ἰέα ἄαδῶ ÷ ἡνέορ εῖῖῖῖῖ οῖδῖεῖῖ ὀοῖῖῖῖῖ ῖῖῖῖ ἄέδοδθρῖῖ, οῖ **LPD** ἄα ἄῖ ÷ ἄῖῖ ἄῖῖῖῖῖῖῖ ἄδῖ ἀδῖῖῖῖῖῖῖ ῖῖῖῖ ὀδῖεῖῖῖῖῖῖ ῖῖ ἄῖ ῖ ÷ ἡρῶδρδ δῖο ἀδῖῖῖῖῖῖῖ ὀρῖ ἄῖῖῖῖῖ ῖῖ ÷ ἄε ῖῖῖῖῖῖῖῖ ὀοῖῖ οῖδῖεῖῖ ὀδῖεῖῖῖῖῖῖ ἄέα ἰῖ οῖ βῖῖῖ ὑῖῖῖ ÷ ἡρῶδρδ. Ἀέαῖῖῖῖῖῖῖ, οῖ **LPD** ἄα ἀδῖῖῖῖῖῖ ὀρῖ ἄῖῖῖῖῖῖ.

Ἀῶδρ ς ἄέαῖῖῖῖῖ ἄβῖῖῖ ἄεῖῖῖῖῖῖ ÷ ἡρῶεῖρ ὀῖ δῖῖῖῖῖῖῖ ὀδῖῖῖ ÷ ῖῖῖ (ἄέα δάνῦααέαία) ἄεῖῖῖῖῖῖῖ ἄδῖ ÷ ἄεῖρῶεῖῖῖ ὀῖῖῖῖῖ ὀῖ ῖῖῖῖῖῖῖ ὀῖ ἄβῖῖῖ, ἄε εῖῖῖῖῖ ÷ ἡρῶῖῖ δνῖῖῖ ἄέα ἰά οδῖῖῖῖῖῖῖ ὀῖ ὀγῖῖῖ ὀῖῖῖῖῖ. Ἀῖεῖῖῖῖῖῖῖῖ ῖῖῖῖῖῖῖ ὀῖῖ ὀῖῖῖῖῖῖῖ ὀῖῖ ὀῖῖῖῖῖῖῖ ὀῖῖ ἄέδοδθρῖῖ ὀῖῖ ἄδῖ ὀῖ ἄεῖῖ ὀῖῖδ ὀῖῖῖ ὀρδ ἄδῖ ÷ ἄβῖῖῖῖῖ. Ἀῖ ἄδῖῖῖῖῖῖῖ ἰά ὀῖῖδ ἄδῖῖῖῖῖῖῖ ἰά ÷ ἡρῶεῖῖῖῖῖῖῖ ῖῖῖ ὀῖῖδ ἄέδοδθρῖῖ ὀῖῖ ἄεῖῖ ὑ ÷ ε ὀῖ ἰῖ ÷ ἄῖῖῖῖῖ ὀῖῖ, ὀῖῖῖ ἰδῖῖῖῖῖῖ ἰά ἄῖεῖῖῖῖῖῖῖ ῖῖῖῖῖῖῖῖ “token”, ἄβ ÷ ὑδ δνῖῖῖῖῖῖῖ ἄεῖῖ ἰῖ εῖῖῖῖῖῖ ὀῖῖ ἄῖ ἰδῖῖῖῖῖ ἰά ÷ ἡρῶεῖῖῖῖῖῖῖ, ὑδῖδ οῖ /usr/bin/false.

9.4.5 Ἐῖῖῖῖῖῖῖ × ἡρῶδρδ Ἀέδοδθρῖῖ

Ἀδῖῖῖῖῖῖῖ ὑδῖ ÷ ἡῖῖῖῖῖῖ ἰά ÷ ἡῖῖῖῖῖῖ ἄεῖ ὀῖῖ ἄέδοδθρῖῖῖ ὀῖῖ. Ἐῖῖ ἄεῖῖῖ ὑ ÷ ε; ὀῖ ÷ ἄῖῖῖ ἄεῖ οῖ ἰῖῖῖῖ ῖῖῖῖῖῖῖ ÷ ἡρῖῖῖῖ. Ἐῖῖ ἄδῖῖῖ ῖῖῖ ὀδῖῖῖ ÷ ἄε ἄῖῖῖῖῖ ὀοῖῖῖῖῖῖ — ἰε ἄέδοδθρῖῖ ἄδῖῖῖῖῖῖῖ ἄῖῖ ἄεῖῖῖῖ ἰῖῖῖ ῖῖῖῖ ῖῖῖῖ ὀρῖ ὀῖῖῖ ἰά ÷ ἄεῖῖῖ. ÷ ἄῶῖ ἄῖῖῖῖῖ ὀῖῖδ ἄέδοδθρῖῖ ὀῖῖ ὀῖῖ, οῖῖ ὀῖῖῖῖ ὀῖῖ ÷ ἡρῶεῖῖῖῖῖῖῖ, ἄεῖ οῖ ἄῖῖῖῖῖ ὀοῖῖῖῖῖῖ ἄεῖ ῖ ÷ ἄῶῖ ὀδῖεῖῖῖῖῖ ἰέα ÷ ἡῖῖῖῖ ἄῖῖ ὀῖῖῖῖῖ (P ἄῖῖ ἰῖῖῖ, ἄῖῖ ὀῖῖῖ, P ῖῖῖῖ ῖῖῖῖ ἰῖῖῖῖῖῖ). ὀῖ εῖῖῖ ἄβῖῖῖ ὀῖῖῖ ὀῖῖ ἰδῖῖῖῖῖῖ ὀῖῖῖῖῖῖ ἰά ἰῖῖῖῖῖῖῖ ἰά ἄῖῖῖῖῖῖῖ ἰά ἄῖῖῖῖῖῖῖ ὀῖῖ ἄέδοδθρῖῖῖ ὀῖῖ.

ὀῖ ῖῖ ÷ ῖῖ ἰῖῖ ἄβῖῖῖ ὀῖῖ ὀγῶδρῖῖ ὀῖῖ ÷ ῖῖῖῖῖῖ ὀῖῖ **LPD** ἄῖῖ ὀῖῖ ῖῖ ÷ ἄε δῖῖῖ ἄῖῖῖῖ ὀῖ ἄῖῖῖῖ ὀῖῖ ὀῖῖῖ. ς ἄῖῖῖῖῖῖῖ ἄῖῖῖῖῖῖ ὀῖ ἰῖῖῖῖ ἄῖῖῖ ἄῖῖῖ ἄῖῖ ὀῖῖ ὀγῖῖ ὀῖῖ ἄέδοδθρῖῖ ὀῖῖ ÷ ἡρῶεῖῖῖῖῖῖῖ, ὀῖῖδ ὀγῖῖῖ ἄῖ ÷ ἄβῖῖ ὀῖῖ ἄέδοδθρῖῖῖῖ, ἄεῖ ὀῖῖ ἄῖῖῖῖῖῖ ἄῖῖ ὀρῖ ÷ ἡῖῖῖῖ ὀῖῖ ἄέδοδθρῖῖῖ.

Ἀέα ὀρῖ ἄῖῖῖῖῖῖῖ, ἄα δνῖῖῖ ἰά ἰῖῖῖῖῖῖῖ ὀῖ ὀβῖῖῖῖ ἄεῖῖῖῖῖ (ἄέα ὀρ ÷ ἡῖῖῖῖῖ ἄῖῖῖῖῖῖ ἄδῖῖῖ ἄεῖῖῖῖῖ) ὀῖῖ ἄέδοδθρῖῖ ἄεῖ ὀῖ ὀβῖῖῖῖ ἰῖῖῖῖῖῖῖῖ (ἄέα ὀρ ÷ ἡῖῖῖῖῖ ὑῖῖῖ ὀῖῖ ῖῖῖῖ ὀγῖῖῖ ἄῖ ÷ ἄβῖῖ) ἡρῶῖ ἰά ἰῖῖῖῖῖ ὀῖῖῖῖῖ P ἰά ἄῖῖῖῖ ἰά ἰῖῖῖῖ ἄῖῖ ὀῖῖ ἄέδοδθρῖῖ ὀῖῖ ἄῖῖῖῖ ὀῖῖ ἄέδοδθρῖῖῖῖ ὀῖῖ ὀῖῖῖῖ. Ἀῖῖ ἄα ὀῖῖ ἄῖῖῖῖῖῖ ἄῖῖῖῖῖῖ ῖῖ ÷ ἡρῶρ ὀβῖῖῖῖ ἄῖῖῖῖ, ἄῖῖ ὀρ ὀῖῖῖῖ ὀῖῖ ἄῖῖ ἰδῖῖῖῖ ἰά εῖῖῖῖ ἄῖῖῖῖῖῖῖ. Ἀῖῖῖῖ ὀρῖ ἄῖῖῖῖῖῖ ὀβῖῖῖῖ.

Ἀῖῖῖῖ, ὀδῖῖῖ ÷ ῖῖῖ ἄῖῖ ὀῖῖῖῖ ἄεῖ ἰά εῖῖῖῖῖ ἄῖῖῖῖῖῖῖῖ:

- ς *Ἐἄνῖῖῖῖῖ ἄῖῖῖῖῖῖῖ* ἄβῖῖῖῖ ἰ δῖῖ ὀῖῖῖῖῖῖῖ ὀῖῖῖῖ, δῖῖῖῖῖ ἄεῖῖῖ ἄβῖῖῖ ἰ ἄῖῖῖῖῖῖῖῖ. Ἐῖῖῖῖ ὀῖῖῖ ἄῖῖῖῖῖ ἄέδοδθρῖῖῖ ἰέα ἄῖῖῖῖῖῖ, ὀῖ ὀβῖῖῖῖ ἄῖῖῖῖῖῖῖ ῖῖ ἰά ἄῖ ÷ ἄβῖ ἄῖῖῖῖῖῖῖ ὀῖῖ ἄῖῖῖῖῖῖ ὀῖῖ ÷ ἡρῶρ, ὀῖῖ

¼όái áβόά Ýðιείε ίά ÷ ñáρóaά ðιò ÷ ñρóaά άέα όέο áέοδδθρóaέο, áέοάεΰόόά ðι ðññáñáíá ρac(8). Άðεΰ ίάόάάβόά όóι έáoΰεíαι spool άέα ðιí áέοδδθρóaέο ðιò έΰίάόά έáoáiΰόñçόç έάέ ðεçέðñιέíáρóaά ρac. Έά áιόάίέόόάβ ΰίάό άðιεíáέόιυò ίά ÷ ñáρóaέο όά áρεΰñέα, υðυò áεΰðάόά όόç όóιΰ ÷ άέα:

Login	pages/feet	runs	price
orchid:kelly	5.00	1	\$ 0.10
orchid:mary	31.00	3	\$ 0.62
orchid:zhang	9.00	1	\$ 0.18
rose:andy	2.00	1	\$ 0.04
rose:kelly	177.00	104	\$ 3.54
rose:mary	87.00	32	\$ 1.74
rose:root	26.00	12	\$ 0.52
total	337.00	154	\$ 6.74

Ðáñáέΰόυ άβίáέ ίέ ðáñΰίáðñιέ ðιò áΰ ÷ áόάέ ðι ρac(8):

-Pprinter

Άέα ðιέυ printer ίά έΰίáέ άðιεíáέόιυ. Άόδρ ç áðέεíáρ áιòεáγáέ ίυíí áί όðΰñ ÷ áε ç ðερñçò áέαáññíρ όόçί έέαíυόçόά af όóι /etc/printcap.

-c

Ôáίεíñáβ ðι áðιòΰέάόίá áíΰ έυόόιò áίòβ όçò áέόάáçóέερð όáίέíυìçόçò ðυí ÷ ñçόðί.

-m

Άáñáβ ðι υíñá ðιò ððιεíáέόðρ όόá áñ ÷ áβá έáoάáñáόðρ. Íá áόðρ όçί áðέεíáρ, í ÷ ñρόçò smith όóι ððιεíáέόðρ alpha άβίáέ í βáέíð ÷ ñρόçò ίá ðιí smith όóι ððιεíáέόðρ gamma. ×ññò όçί áðέεíáρ áόðρ, άβίáέ áέαóíñáóέεíβ ÷ ñρóaά.

-pprice

Ôðιεíáβáέ όέο ÷ ñáρóaέο ίá price (όέίρ) όά áρεΰñέα áíΰ όáεβáá ρ áíΰ ðυíáέ áίòβ áέα όçί όέίρ áðu όçί έέαíυόçόά pc όóι /etc/printcap, ρ áέέερð áγí όáίòð (áðu ðñíáðέεíáρ). Íðñáβόά ίá ññóáόá υò price ίέα όέίρ ίá ááέááέέΰ ρçöβá (floating point).

-r

Áίόέόðñΰόáέ όçί όáέñΰ όáίέíυìçόçò.

-s

Άçιεíòñááβ ΰίá áñ ÷ áβι άðιεíáέόιϰ ðυí έáoáίáðñόáυí έάέ έáεáñβáέ όá ðáñέα ÷ υíáíá ðυí áñ ÷ áβυí έáoάáñáόðρ.

name ...

Ôððíáέ ðεçñιοíñáò áíáοíñΰò ίυíí áέα όá όðáέáðñειΰίá name (ííυíáόá) ÷ ñçόðί.

Óóιí ðñíáðέεááíΰíí άðιεíáέόιυ ðιò ðáñΰááέ ðι ρac(8), áεΰðάόά ðυí áñέèíυ ðυí όððυíΰíυí όáεβáυí áíΰ ÷ ñρόç άðu ðιò áεΰοíñιòð ððιεíáέόðρ. Άί, όóι ÷ ðñι όáò, í ððιεíáέόðρ ááí ΰ ÷ áέ όçίáόβá (áέαóβ ίέ ÷ ñρóaάò ίðñιγí ίá ÷ ñçόέíυðιερóιòí ίðιεíáρðιòá εΰεíοí), áέοάεΰόόά όçί áíόíερ ρac -m, áέα ίá áçιεíòñáρóaά ðιí áέυεíοεí άðιεíáέόιυ:

Login	pages/feet	runs	price
andy	2.00	1	\$ 0.04

Όοι δάνΰάέαιά ιάο έά άέοδδθέάβ ιέα ιάαΰέç έβρόά άñ÷άβυι όιό όñÝ÷ιίόιό έάόάέυιάρό όοιι άέοδδθόð ðιό ιιñΰάέόάέ rattan:

```
% ls -l | lpr -P rattan
```

Άοιγ άάι άίάόΰñιόάέ ιιñιάόά άñ÷άβυι όόçί άίόιέð lpr(1), όι lpr άέάάΰάέ όά άάññÝιά ðιό έά άέοδδθρόάέ άðu όι standard input, όά ιθιβά άβιáέ ç Ýñιάρό όçð άίόιέðð ls -l.

Ç άίόιέð lpr(1) ιθιñάβ ιά άá÷έάβ Ýιά ιάαΰέι άñέειυ άðέειάπι άέά ιά άέÝá÷άέ όçί ιñιόιθιβçόç, ιά ιάόάόñÝðάέ άñ÷άβ, ιά άçιέιθñάάβ ðιέέάðέΰ άίόβññάόά, έ.έ.ð. Άέά ðññέόóυόññάð ðέçñιιθιñβάð, άάβόά όçί άιυόçόά ΆðέειάÝð Άέόýðuόçð.

9.5.2 έάά÷ιό Άññάόέπí

¼όάι άέοδδθρiάόά ιά όι lpr(1), όά άάññÝιά ðιό έÝέάόά ιά άέοδδθρόάόά όιðιέάόιγiάόά έά Ýιά ðάέÝόι (package) ðιό ιιñΰάέόάέ “άññάόβá άέόýðuόçð (print job)”, ç ιθιβά άðιόóΰέέάόάέ όοι όγόόçιά ðñññ÷Ýόάόçð **LPD**. Έΰέά άέοδδθóðð Ý÷άέ ιέα ιθñΰ άίάιιñðð άññάόέπí, έάέ ç άññάόβá όάó άίάιÝιάέ ιάεβ ιά ΰέέáð άέέÝð όάó έάέ ΰέέυ ÷ñçόóπí. Í άέοδδθóðð ðέð άέοδδθρiάέ ιά όçί όάέñΰ ΰέέιçð όόçί ιθñΰ άίάιιñðð.

Άέά ιά άιόάιβόάάó όçί ιθñΰ άίάιιñðð άέά όιι ðññáðέέάñÝñι άέοδδθóðð, ðέççέðñιέiñβóá lpr(1). Άέά έΰðιέiι όóάέάñέiÝñι άέοδδθóðð, ÷ñçόέiιðιέðóá όçί άðέειñβ -P. Άέά ðññΰάέάiά, ç άίόιέð:

```
% lprq -P bamboo
```

άιόάιβάέέ όçί ιθñΰ άίάιιñðð άέά όιι άέοδδθóðð ιά όι υññiά bamboo. Άέιέιθέάβ Ýιά ðññΰάέάiά άιυιάρό όçð άίόιέðð lprq:

```
bamboo is ready and printing
Rank  Owner  Job  Files  Total Size
active kelly  9    /etc/host.conf, /etc/hosts.equiv  88 bytes
2nd    kelly  10   (standard input)    1635 bytes
3rd    mary   11   ...                  78519 bytes
```

Άιόάιβáιιόάέ όññάέð άññάόβáð όόç έβρόά άίάιιñðð άέά όιι bamboo. Όόçί ðññðç άññάόβá, ðιό Ý÷άέ όόάέάβ άðu όιι ÷ñβóç kelly, Ý÷άέ άðιιέάβ í “άñέειυð άññάόβáð (job number)” 9. Έΰέά άññάόβá άιυð άέοδδθóðð ÷άñάέçñβάέόάέ άðu Ýιά ιιñάέέυ όÝόιέiι άñέειυ. Όέð ðññέόóυόññάð όιñÝð ιθιñάβόά ιά όιι άάññβóáð, άέέΰ έά όιι ÷ññάέόóάβóά άί έÝέάόά ιά άέάññΰθáðά έΰðιέá άññάόβá. Άάβόά όçί άιυόçόά Άέάññάóð Άññάόέπí άέά ðññέόóυόññάð ðέçñιιθιñβáð.

Ç άññάόβá ιά όι ηγiάñι άίγiά άðιόάέάβóάέ άðu άγi άñ÷άβ. Όά ðιέέάðέΰ άñ÷άβ ðιό άυέçέáι όόç άñññð άίόιέπí όιό lpr(1) έáññιγiάέ Ýñιð ιβáð ιυñι άññάόβáð. Άóðð άβιáέ έάέ ç ðñÝ÷ιθóά άíñññβ άññάόβá (ðññάóçñβóáð όç έÝiç active όçð όððέçð “Rank”), ðιό όçιáβιáέ ðυð ç άññάόβá άέοδδθρiάόάέ áððð όç όóέáñð. Ç άáyόáñç άññάόβá άðιόάέάβóάέ άðu άάññÝιά ðιό Ý÷ιθi ðññΰόάέ όόçί standard input όçð άίόιέðð lpr(1). Ç όñβóç άññάόβá ðññÝñ÷άόάέ άðu όιι ÷ñβóç mary, έάέ ðññέέάέόάέ άέά ιέα ðιέý ιάεβç άññάόβá. Όι υññiά áέάñññðð όιό άñ÷άβιό ðιό ðññέέάέόάέ ιά άέοδδθέάβ άβιáέ ðιέý ιάαΰέι άέά ιά ÷ññÝόάέ όόç όððέç, έάέ άέά áððυ ç άίόιέð lprq(1) άðέΰ όι óðιáιέβáέέ ιά όññάέð óáέάβáð.

Ç ðññðç άñññðð όçð άιυιάρό άðu όçί lprq(1) άβιáέ άðβóçð ðιέý ÷ñβóç: ιάð άiçιáññρiáέ άέά όι όέ έΰiáέ όçί ðññιγiά όóέáñð í άέοδδθóððð (ð όιθέΰ÷έόóιι άέά όι όέ ðέόóáyáέ όι **LPD** ðυð έΰiáέ í άέοδδθóððð áððð όç όóέáñð).

Ç άίόιέð lprq(1) άðβóçð óðιόóçñβáέέ όçί άðέειñβ -l άέά ιά άçιέιθññβóáέ ιέα ιάαΰέç, έáððιññβ έβρόά. Άέιέιθέάβ Ýιά ðññΰάέάiά όιό lprq -l:

```
waiting for bamboo to become ready (offline ?)
kelly: lst [job 009rose]
      /etc/host.conf 73 bytes
```

```

/etc/hosts.equiv          15 bytes

kelly: 2nd      [job 010rose]
      (standard input)    1635 bytes

mary: 3rd      [job 011rose]
      /home/orchid/mary/research/venus/alpha-regio/mapping 78519 bytes

```

9.5.3 Άοάβñάοç Άñāάόεπί

Άί άέεÛίτáά άίρìç áέα ίέα άñāάόβá θίρ άβ ÷ áόά άθίρóaβέάέ θñίò áέóýðυόç, ίθññáβóá ίά όçί áóáέñÝόάόά áðu όçί έβóόά άίάίííðò ίá όçί άίóίτēð lprm(1). Ιθññáβóá áέυιç ίά ÷ ñçóέííθίέρóόά όçί lprm(1) áέα ίά áóáέñÝόάόά ίέα άίάñāð άñāάόβá, áέεÛ θέέάίíí έÛθίέí ίÝñίò όçò ίά áέóððυέάβ Ýóέέ έάέ άέέερò.

Άέα ίά áóáέñÝόάόά ίέα άñāάόβá áðu όíí θñíáθέέάáíÝíí áέóððυóð, ÷ ñçóέííθίέρóόά θññρóά όçί lprq(1) áέα ίά άñáβóá όíí άñέέíí όçò. θάέόά θέçέòñíέíāρóόά:

```
% lprm job-number
```

Άέα ίά áóáέñÝόάόά ίέα άñāάόβá áðu έÛθίέíí óóáέáέñέíÝíí áέóððυóð, θñίóέÝόόά όçί άðέέíāð -P. Ç áέυέííòέç άίóίτēð áóáέññáβ όçί άñāάόβá ίá άñέέíí 10 áðu όçί ίòñÛ άίάίííðò áέα όíí áέóððυóð bamboo:

```
% lprm -P bamboo 10
```

Ç άίóίτēð lprm(1) Ý ÷ áέ ίáñέέÝò óóίòñāýόάέò:

lprm -

Άóáέññáβ υέáò óέò άñāάόβáò (άέα όíí θñíáθέέάáíÝíí áέóððυóð) θίρ άίρēíóί óá άóÛò.

lprm user

Άóáέññáβ υέáò óέò άñāάόβáò (άέα όíí θñíáθέέάáíÝíí áέóððυóð) θίρ άίρēíóί óóίí ÷ ñρóóç (user). Ι óðññ ÷ ñρóóçò (superuser) ίθññáβ ίά áóáέñÝόάέ άñāάόβáò Ûέέυí ÷ ñçóóβί, áóáβò ίθññáβóá ίά áóáέñÝόάόά ίυíí óέò áέέÝò óáò.

lprm

Ç άίóίτēð lprm(1) ÷ ùñβò άñέέíí άñāάόβáò, υííñá ÷ ñρóóç, P - θίρ άìöáίβæáóάέ óóçί άñáíñð άίóίτēβί, áóáέññáβ όçί óñÝ ÷ ίóóά άίάñāð άñāάόβá óóíí θñíáθέέάáíÝíí áέóððυóð, άί άίρēáέ óá óÛò. Ι óðññ ÷ ñρóóçò (superuser) ίθññáβ ίά áóáέñÝόάέ ίθίέάáðθίóά άίάñāð άñāάόβá.

Άέα ίά άίóίτēð άóáέññáβ óá έÛθίέíí óóáέáέñέíÝíí áέóððυóð άίóβ όίò θñíáθέέάáíÝíí, áðέÛ ÷ ñçóέííθίέρóόά όçί άðέέíāð -P ίá óέò θáñáðÛíí óóίòñāýόάέò. Άέα θáñÛááέáíá, ç áέυέííòέç άίóίτēð áóáέññáβ υέáò óέò άñāάόβáò όίò óñÝ ÷ ίóíò ÷ ñρóóç áðu όçί ίòñÛ άίάίííðò όίò áέóððυóð rattan:

```
% lprm -P rattan -
```

Όçίáβυόç: Άί άñāÛέάόóά óá θáñέáÛέέíí áέέóýíò, ç lprm(1) έá óáò άðέóñÝóáέ ίά áóáέñÝόάόά άñāάόβáò ίυíí áðu όíí óðíέííáέóðð θίρ óέò Ý ÷ áóá óóáβέάέ, άίάίÛñόçóά άί í áέóððυóðò áβίáέ θñίóáÛóέίíò έάέ áðu Ûέέíòò óðíέííáέóóÝò. Ç áέυέííòέç άίóίτēð άðέááέίýáέ áέñέáρò áóóυ όí ÷ άñáέòçñέóóέέυ:

```
% 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 άδδ òι Άδëü Êάβιáñ: Δáñέóóüðáñáð ÆδέεϊãÝò Æέôýðυóçð

Ç áιóιεP lpr(1) δδιόδçñβæáέ ιέα äêÛιá άδέεϊãπí áέα öιí Ýεää÷ι ιιñοιðιβçóçð έάειÝíò, ιάδóáðñιððò ãñáóέεπí έάέ Ûεεüí ιιñòπí áñ÷άβιí, δáñάáüãððò ðιεεάδθεπí áíóεãñÛöüí, ÷άέñέóιíý ãñááóέεπí, έάέ Ûεεá. Ιέ άδέεϊãÝò áδδÝð δáñέãñÛöüííóáέ óççí δáñιýóá áíúççά.

9.5.4.1 ΆδέεϊãÝò ιιñοιðιβçóçð έάέ ιάδóáðñιððò

Ιέ áεüειòεäð άδέεϊãÝò óççð lpr(1) äêÝã÷ιòι óççí ιιñοιðιβçóçð öüí áñ÷άβιí óççð ãñááóβáð äέóýðυóçð. ×ñçóέιíðιέPóðá óέδ άί ç ãñááóβá óáð äáí δáñέÝ÷άέ άδëü έάβιáñ P άί άδέεðιáβðá íá ιιñοιðιέPóáðá άδëü έάβιáñ äέáÝóιò öιò ãñááέáβιò pr(1).

Άέα δáñÛááέáιá, ç áεüειòεç áíóιεP öððθιáέ Ýíá áñ÷άβιí DVI (άδδ òι óýóççíá óðιέ÷άέεαóβáð T_EX) ιá üñíá *fish-report.dvi* óðιí äέðððððP ιá üñíá bamboo:

```
% lpr -P bamboo -d fish-report.dvi
```

ΆδδÝð ιέ άδέεϊãÝò áðáñιüæιíóáέ óá êÛεá áñ÷άβιí óççð ãñááóβáð, έάέ Ýóóέ äáí ιðιñáβðá íá áíáιβιáðá (áð ðιγíá) áñ÷άβá DVI έάέ ditroff ιάæβ óççí βáέá ãñááóβá. Άθθεðò óðáβεðá óá áñ÷άβá óáí äέáöιñáðέέÝð ãñááóβáð, ÷ñçóέιíðιέπíóáð äέáöιñáðέέÝð άδέεϊãÝò ιάδóáðñιððò áέα êÛεá ãñááóβá.

Óççíáβυóç: ¼έäð áδδÝð ιέ άδέεϊãÝò äέðυð óççð -p έάέ óççð -T άδáέóιýí ááέáðáóðçιÝíá öβέðñá ιάδóáðñιððò áέα öιí äέðððððð ðñιιñέóιíý. Άέα δáñÛááέáιá, ç άδέεϊãP -d άδáέéðáβ öι öβέðñι ιάδóáðñιððò DVI. Ç áíúççά Öβέðñá ιάδóáðñιððò äβιáέ δáñέóóüðáñáð έáððιíÝñáέáð.

-c

Άέðððθιáέ áñ÷άβá cifplot.

-d

Άέðððθιáέ áñ÷άβá DVI.

-f

Άέοδδθρóaέ άñ ÷ άΒά έάει Ýñò FORTRAN.

-g

Άέοδδθρóaέ άάάñÝía ó ÷ άάΒάόçò (plot).

-i *number*

Άέοδδθρóaέ όçí Ýñäí ìá άόí ÷ P *number* όόçεπί. Άί δάñάέάβθάòά όí *number*, ç άόí ÷ P έά άβίαέ 8 όòPεάò. ΆòòP ç άδέείäP άíòέάýáέ ìüñ ìá ìέóíÝía öβέòñá ìάόάòññòPò.

Όçíaβúóç: ìçí όíðíεάòáòáòá έáíü äéÛóόçía ìάόάý όíò -i έάέ όíò άñέέìíý.

-l

Άέοδδθρóaέ άάάñÝía έάειÝñò έάóÛ äñÛñá (literal), όóðñáñέέáíáÛñíόάò έάέ όíòð ÷ άñάέòPñáò äéÝä ÷ ñ.

-n

Άέοδδθρóaέ άάάñÝía ditroff (άάάñÝía troff άíäñÛñόçòά áðü όç όòóέάòP).

-P

Ûññòñíεάβ όí áðeu έάβñäñ ìá όçí pr(1) ðñέí íá όí äέòððρóaέ. Άάβòá όçí pr(1) äέá ðñáέóóüòáñáò ðεçññíöññáò.

-T *title*

×ñçόέññíεάβ όí *title* όόçí έάóáέβáá όíò pr(1) άíòβ äέá όí üññá άñ ÷ äβñò. ΆòòP ç άδέείäP άδέéäñÛ ìüñ üóáí ÷ ñçόέññíεάβóáέ ìá όçí άδέείäP -p

-t

Άέοδδθρóaέ άάάñÝía troff.

-v

Άέοδδθρóaέ άάάñÝía ñÛóóáñ.

Άäp άβίαέ Ýía δάñÛäέéäíá: áòòP ç άíóíεP äέòððρóaέ ìέá εñòÛ ìññòñíεçíÝíç Ýέäíóç όçò óáέβááò äñçέáβáò ls(1) óóñ ðññáðέέäñÝñ äέòððòòP:

% zcat /usr/share/man/man1/ls.1.gz | troff -t -man | lpr -t

Ç άíóíεP zcat(1) áðíóòíðéÝæáέ όñ ðçäáβñ έρπέέá όçò óáέβááò äñçέáβáò ls(1) έάέ όñ ðññíÛäέ όόçí άíóíεP troff(1), ç ñðñá όñ ìññòñíεάβ έάέ äçíεíòñäáβ όόçí Ýñäí όçò άάάñÝía GNU troff, óá áðíóòÝέέáέ όόçí lpr(1), ç ñðñá ìá όç óáέñÛ όçò áðíóòÝέέáέ όçí äñááóβá όóí **LPD**. ΆðäέäP ÷ ñçόέññíεέPóáíá όçí άδέείäP -t όóí lpr(1), ñ spooler, έáóÛ όç äéÛñέáέά όçò äέóýðòóçò, έá ìάόáòñÝθáέ όçí Ýñäí GNU troff óá Ýía óýðñí άάάñÝññí έáóáñçòü áðü όñ ðññáðέέäñÝñ äέòððòòP.

`topq printer-name job-or-username`

ἈίεάέσÙόάίε όçð ïòñÙò áíáíííðð ãέα όíí *printer-name*. Ὀíðíεάόííýíόάε δñðòáð íε áñááóβáð ìá áñέέìù áíáóííñÙò *job* ð áððÝð ðíò áíðέíóí όóí ÷ ñðóðç *username*. Ἄέα áððð όçí áíóíεð, ááí ìðíñáβòá íá ÷ ñçóέííðíεðóáðá `all` όóçí εÝόç όíò *printer-name*.

`up printer-name`

Ίαçááβ όíí áέòððùòð óá "áíÝááόíá" (up). Ὀí áíóβεáðí όçð áíóíεðð down. Ἐόíáðíáíáβ ìá όçí start áέíεíòεííýíáíç áðù όçí áíóíεð enable.

Ὀí `lpc(8)` áÝ ÷ áðáé óέð δáñáðÙíù áíóíεÝð óóçí áñáííð áíóíεðí. Ἀί ááí áέóÙááðá έáíβá áíóíεð, όí `lpc(8)` ìðáβíáé óá έáðÙóóáóç áέέçεáððñáñáóçð (interactive), ùðíò ìðíñáβòá íá ðεçέðñíεíááβòá áíóíεÝð ìÝ ÷ ñε íá áðóáðá `exit`, `quit`, ð `end-of-file`.

9.6 ἈίέέέáέéééÝð Ἐýóáέò áέα όíí ὈóÙíóáñ Spooler

Ἀί Ý ÷ áðá ìáέáððóáé δέóóÙ ùεí όí έáòÙεάéí ìÝ ÷ ñε ááð, έá Ý ÷ áðá ìÙεáé ó ÷ ááúí óá δÙíóá ó ÷ áðέέÙ ìá όí óýóóçíá δáñí ÷ Ý óáðóçð **LPD** ðíò áέαðβεáðóáé ìá όí FreeBSD. Ἐá Ý ÷ áðá έáóáííðóáé έáé ðíεéÝð áðù óέð áέέáβðáέò όíò, ðíò óðóέέÙ ááíííýí όí áñðόçíá: “ðíέα Ἐέέα óðóððíáóá δáñí ÷ Ýóáðóçð (ðíò íá έáέóíòñáíýí όóí FreeBSD) ððÙñ ÷ íóí áέαéÝóéíá;”

LPRng

Ὀí **LPRng**, όí ìðíβí óέúðέíá óçíáβíáé “LPR: the Next Generation (ç Ἄðùíáíç ἌáίέÙ)” áβíáé íέα áðù όçí áñ ÷ ð óεíðíβçóç όíò **PLP**. Ἰ Patrick Powell έáé ì Justin Mason (έýñέíð óðíóçñçððð όíò **PLP**) óðíáñáÙóðçέáí áέα íá óέέÙííóí όí **LPRng**. Ç έýñέα όíðíεáóβá όíò **LPRng** áβíáé ç <http://www.lprng.org/>.

CUPS

Ὀí **CUPS**, ð áέέéðð Common UNIX Printing System, δáñÝ ÷ áé íέα öíñçðð ðεááðöüñíá áέòððóáùí áέα έáέóíòñáέέÙ óðóððíáóá ááóέóíÝíá óóí UNIX. Ἀίáððý ÷ εçέá áðù όçí Easy Software Products áέα íá δñíùèðóáé íέα óðÙíóáñ έýçð áέòððóáùí áέα ùεíòð όíòð ÷ ñðóðáð έáé έáóáéáέáóóÝð UNIX.

Ὀí **CUPS** ÷ ñçóέííðíεáβ όí δñùòùεíεéí Internet Printing Protocol (IPP) ùð áÙóç όíò áέα όç áέα ÷ áβñέόç áñááóéðí áέóýðùóçð έáé ðñðí áíáíííðð. Ὀðíóçññáεííóáé áðβóçð, áέέÙ ìá ìáέùÝíç έáέóíòñáέέúòçóá, óá δñùòùεíεéá Line Printer Daemon (LPD), Server Message Block (SMB), έáé AppSocket (áíùóóù ùð JetDirect). Ὀí **CUPS** δñíóéÝóáé áðíáóúòçðáð áíβ ÷ íáðóçð áέέððáéðí áέòððùòðí, áíð ìÝóù òùí áðέéíáðí PostScript Printer Description (PPD) áβíáðáé áέέéðð ç ððíóððñέíç óýá ÷ ñííúí áέòððùòðí óóí έúóíí όíò UNIX.

Ç έýñέα όíðíεáóβá όíò **CUPS** áβíáé ç <http://www.cups.org/>.

HPLIP

Ὀí **HPLIP**, ð Óýóóçíá Ἀðáέέúίέóçð έáé Ἀέóýðùóçð όçð HP áέα Linux, áβíáé íέα óíòβóá áóáñííáðí áέα óóóέáðÝð όçð HP, ðíò ððíóçññáε áέóóíòñáβáð ùðùð ç áέóýðùóç, ç óÙñùóç έáé ç áðíóóíεð / εðθç óáí. Ç óíòβóá áððð ÷ ñçóέííðíεáβ όí **CUPS** ùð backend áέα έÙðíεáð áðù óέð έáέóíòñáβáð áέóýðùóçð ðíò δáñÝ ÷ áé.

Ç έýñέα áέέððáéð όíðíεáóβá όçð áóáñííáðð **HPLIP** áβíáé <http://hplipopensource.com/hplip-web/index.html>.

9.7 Άίοιδείοιυò Άέάαπí

Ίάοΰ όçí áέοΎεάόç õïò áδθéřý óάóò ìά òí lptest(1), áίóβ òçò éáíñíέέρò áέóýδύòçò, ìδññάβ íά Ύ ÷ άòά èΰάάέ ùò áδñòΎεάóíá ìβá áδñ òέò áέυεíρδέάò éάóάóòΰόάέò:

Ί άέοδδύòρò éάέοóóΎñçόά íá ìάέείρρóάέ ρ ááí áέóýδύòά íευέέçñç òç óάέβáá.

Ί άέοδδύòρò óýδύòά òí óάóò, áέεΰ ááí ìάέβίçóά áíΎóòò. ρóòò ÷ ñάέΰóççéά íá δέΎóάόά òí δέρòññí PRINT REMAINING ρ òí FORM FEED òíò áέοδδύòρ óάò áέά íá ìòάίέóóάβ òí áδέέòìçòú áδñòΎεάóíá.

Άΰí áβίάέ υíòòò áòòρ ç δññβδòòóç óάò, ì άέοδδύòρò δέεάίρò íá ρóάí óά áíáíñíρ áέά íá áíáέñέáρóάέ áí òδρñ÷áí δññóέάóά áááñΎíá óóçí áñάάóβá áέóýδύòçò δñéí ìάέείρρóάέ íá áέοδδθρίáέ ìóέáρδñòά. Άέά íá áέíñερóάòá òí δññúáέçíá, ìδññάβòά íá èΎóάóά òí òβέòññí éáέíΎñò íá óóΎεíáέ Ύíá ÷ áñάέòρñά FORM FEED (ρ ΰέεí éάòΰέέççéí) óóíí áέοδδύòρ. Άóòú óóíρεùò áβίáέ áñέáòú áέá íá ìδññάβòά íá áέοδδθρίáòá éάóάòéáβáí ìδññéáρδñòά éáβñáñí áδññΎíáέ óά áíáíñíρ óóçí áóòúáñέέρ ìρìç (buffer) òíò áέοδδύòρ. Άβίáέ áδβóçò ÷ ñρóέíí íá ñòèìβεάòά òέò áέοδδθρóάέò óάò ρóóά íá óάέáέρññòí ìά ááìΰòç òçí òάέáòóáβá óάέβáá, ρóóά ç áδññáíç áñάάóβá íá ìçí áñ÷βεáέ áδñ òά ìέóΰ òíò δññçáññíáññò óýέéíò.

Ç áέυεíρδέç òññδññíβçóç óóí shell script /usr/local/libexec/if-simple áέòδθρίáέ Ύíá form feed ìάòΰ òçí áδñòóíερ òçò áñάάóβáò óóíí áέοδδύòρ:

```
#!/bin/sh
#
# if-simple - Simple text input filter for lpd
# Installed in /usr/local/libexec/if-simple
#
# Simply copies stdin to stdout. Ignores all filter arguments.
# Writes a form feed character (\f) after printing job.

/bin/cat && printf "\f" && exit 0
exit 2
```

Ç áέóýδύòç δáññòóέΰεάέ “óάέíññáñí óέΰεάò (staircase effect).”

Όóçí áέóýδύòç óάò óάβñáòάέ òí áέυεíρδéí:

```
!"#$%&'()*+,-./01234
      "$%&'()*+,-./012345
                #$%&'()*+,-./0123456
```

Άβñáòά Ύíá áέυñá εýíá òíò óάέññΎñò óέΰεάò, δñò δññéερççéá áδñ áíðέóάóέéΎò áñìçíáβáò òúí ÷ áñάέòρññí ìά òíòò ìδññβíòò áçέρñáòάέ ç òññòññáíóβá ìΎáò áñáñìρò. Όά éάέòññάέέΰ óòóòρñáòά óýδñò UNIX ÷ ñçóέíñδñéířýí Ύíáí ìññí ÷ áñάέòρññá ASCII ìά èùáέéú 10, òíí line feed (òññòññáíóβá áñáñìρò, LF). Όí MS-DOS, òí OS/2®, éáέ áέΰóññá ΰέéá, ÷ ñçóέíñδñéířýí Ύíá εáýáñò ÷ áñάέòρññí ASCII èùáέéýř 10 éáέ ASCII èùáέéýř 13 (òíí carriage return ρ áέέέρò CR). Δñééíβ áέòδδύòΎò ÷ ñçóέíñδñéířýí òçí óýñíáóç òíò MS-DOS áέá òçí áέέááρ áñáñìρò.

¼óáí áέòδδθρñáòá ìά òí FreeBSD, òí éáβñáñí óάò áδέΰ ÷ ñçóέíñδñéáβ òíí ÷ áñάέòρññá òññòññáíóβáò áñáñìρò (line feed). Ί άέοδδύòρò, ìυέέò áíðέέççòéáβ òíí ÷ áñάέòρññá line feed, δñññùέáβ òí ÷ áñòβ éάòΰ ìβá áñáñìρ, áέεΰ éñáòΰάέ òçí βáέá èΎóç ìñέáññíóéá éáέρò éáέáòάέ íá áέòδδθρóάέ òíí áδññáñí ÷ áñάέòρññá. Όά áòòú òí òçíáβñí ÷ ñçóέíñδñéáβòάέ òí CR (carriage return): ìάðáέέíáβ áçέááρ òçí èΎóç áñάάóβáò áέá òíí áδññáñí ÷ áñάέòρññá òíò δññúέáέóάέ íá áέòδδύòéáβ óóí áñέóóáññú ΰέññí òíò ÷ áñòέýř.

Όí FreeBSD áδέέòíáβ ì άέòδδύòρò íá ìδññάβ íá áíáñάáβ ùò áñρò:

```
¼óáí ì άέòδδύòρò éáíáΰíáέ CR                Íá áέòδδθρñáέ CR
```

¼óáí ì áέοδδθòδρò εάíáŨíáέ LF

Íá áέοδδθρίáέ CR + LF

ŌðŨñ ÷ τóí áεŨοιñíέ οñυðíέ áέá íá áðέοáσ ÷ εάβ áδóυ:

- ×ñçóείιðíερòóá óá ðερêóñá ñýεíέçòç òιò áέοδδθòδρ ρ òιí ðβίáέá áεŨá ÷ ιò áέá íá áεεŨíáðá òιí ðñυðι íá òιí ιðιβι áñιçíáýáέ áóοιγò òιòð ÷ áñáέòρñáò ì áέοδδθòδρò óáò. Ōòíáιρεάòóáβòá òι áá ÷ áέñβáεί ÷ ñρòçò òιò áέá íá ááβòá ðυò ιðιñáβ íá áβίáέ áδóυ.

Ōçíáβυòç: Άí Ũ ÷ áðá éáέ Ũεéá εáέòιòñáέέŨ òòι óγòóçíá óáò áέòυò áðυ òι FreeBSD, ðέέáíúí íá ÷ ñáέáóòáβ, υòáí òá ÷ ñçóέίιðíέáβòá, íá áðáíáñòει/βòáðá òιí áέòδδθòδρ óáò ρòá íá áñιçíáýáέ áέáοιñáðέέŨ òιòð ÷ áñáέòρñáò CR éáέ LF. Ōðçí ðáñβðòυòç áðòρ, βòυò áβίáέ éáέγòáñι íá ðñιòέιρòáðá εŨðíέá áðυ òέò εýóáέò ðιò áέιτèòείγí.

- Ííáçáυò (driver) òçò óáέñέáέρò áñáìρò òιò FreeBSD ιðιñáβ íá íáðáòñŨðáέ áðòυíáðá áðυ LF óá CR+LF. ŌðóέέŨ, áðóυ áιòεáýáέ *lpr* óá óáέñέáέŨð éγñáò. Άέá íá áíáñáιðíερòáðá áðòρ òçí εáέòιòñáβá, ÷ ñçóέίιðíερòóá òçí εέáíúíòçòá ms# éáέ ìñβòá òçí εáòŨóóáóç εáέòιòñáβáò onlcr òòι áñ ÷ áβι /etc/printcap áέá òιí áέòδδθòδρ.
- Ōðáβεòá Ũíá *εùáέέυ áέáòðáρò (escape code)* òòιí áέòδδθòδρ ρòá íá ÷ áέñβáεáðáέ ðñιòυñέíŨ òιòð ÷ áñáέòρñáò LF íá áέáοιñáðέέυ ðñυðι. Ōòíáιρεάòóáβòá òι áá ÷ áέñβáεί ÷ ñρòçò òιò áέòδδθòδρ óáò áέá òιòð ερáέέáò áέáòðáρò ðιò ððιòóçñβáειòáέ. ¼óáí áíáέáέγòáðá òιí εáòŨεεçει, íáðáòñŨðóá òι òβεòñι éáεíŨíò ρòá íá óðŨεíáέ ðñρá òιí εùáέέυ, éáέ Ũðáέðá òçí áñááóβá òòιí áέòδδθòδρ.

Άρρ áβίáέ Ũíá ðáñŨááέáíá òβεòñιò éáεíŨíò áέá áέòδδθòŨð ðιò εáðáέáááβιòí òιòð εùáέέγò áέáòðáρò PCL òçò Hewlett-Packard. Άðóυ òι òβεòñι εŨíáέ òιí áέòδδθòδρ íá ÷ áέñβáεáðáέ òιòð ÷ áñáέòρñáò LF ùò LF éáέ CR. ðáέðá áðιòóŨέέáέ òçí áñááóβá, óðŨέñιòáò òòι òŨεìò òçò Ũíá ÷ áñáέòρñá áέέááρò óáέβááò (form feed) ρòá íá áβίáέ òυòòρ áíááυáρ òçò ðáέáðóáβáò óáέβááò. Ōí òβεòñι áðóυ εá ðñŨðáέ íá áιòεáýáέ íá ó ÷ ááυí υέιòð òιòð áέòδδθòŨð òçò 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
```

Άρρ áβίáέ Ũíá ðáñŨááέáíá áέá òι /etc/printcap áíυò ððιτèíáέóòρ íá υíñá orchid. ÷ áέ Ũíá ìυíí áέòδδθòδρ òðçí ðñρòç ðáñŨεεçεç éγñá òιò, Ũíá Hewlett Packard LaserJet 3Si íá υíñá teak. ×ñçóέίιðíέáβ òι ðáñáðŨíυ script ùò òβεòñι éáεíŨíò:

```
#
# /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 των υπηρεσιών είναι ελεύθερη. Απαιτείται όμως να εγκαταστήσετε το λογισμικό (log) (όχι στην ίδια διεύθυνση, /var/log/rattan.log) αλλά να βεβαιωθείτε ότι ο κατάλογος υπάρχει. Για αυτό ο διαχειριστής πρέπει να δημιουργήσει τον κατάλογο /var/log/rattan.log.

Αν θέλετε να χρησιμοποιήσετε το LPD, τότε πρέπει να εγκαταστήσετε το λογισμικό LPD στο /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 óðáóεéÛ ðçì ððìóðPñéíç 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 ìÝí ððñPíá ùðò ðáñεáñÛóáóáε óðì ÊäöÛεάεί 8.

10.2.1 ÁäεáóÛóóáóç ðùí Linux Runtime Libraries

Áðòò ìðìñáß ìά áßìáε ìá äýí ðñúðìòð. Áßðά ìá ðç ÷ ñPðç ðìò linux_base-fc4 port, P ìá ÷ áéñìεßíçðç áäεáóÛóóáóç ðìòð.

10.2.1.1 ÁäεáóÛóóáóç ìÝóò ðìò linux_base Port

Áðòò ðáßìáε εáóÛ ááíεéP ññεíáßá ì áðεíεúðáñìò ðñúðìò áεά ðçì áäεáóÛóóáóç ðùí runtime libraries. Áßìáε ç ßáεá äεááεéáóá áäεáóÛóóáóç ðìò áéíεíðεáßðáε εáε áεά ìðìéíáPðìòá Ûεéí port áðú 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 ðPñá ìά Ý ÷ áðά εáñíéεP óðìááóóóçðά ìá áεðäεÝóεìά ðìò Linux. ìáñεéÛ ðñìáñÛìáðά ðáñáðìéíýíðáε ùðε ìé áεáééíεPεáð óðóðPíáðìò (system libraries) ááí áßìáε óðç ðáεáððáßá ðìòð Ýεáíóç. ÁáíεéÛ ùòð, áðòò ááí áðìóáεáß εáíÝíá ðñúáεçìá.

Óçìáßúóç: ìðìñìýí ìά ððÛñ ÷ ìò ðìεεáðεÝò áεäúóáεò ðìò emulators/linux_base, ðìò ìά áíðεóðìé ÷ ìýí óðεò áεáóìñáðééÝò áεäúóáεò ðùí áεáíñPí Linux. Éá ðñÝðáε ìά εÛíáðά áäεáóÛóóáóç ðùí ports ðìò ðñìáðáεðìýíðáε áðú ðéð áðáñìáÝò Linux ðéð ìðìßáð εÝεáðά ìά áäεáóáóðPóáðά.

10.2.1.2 ×άεινέβίζαζ άάεάοΰόόαζ ούι Libraries

Άί άάί Ύ÷άοά άάεάοάοόΠόάε οζί οόεείαΠ ούι “ports”, ιδίνάβόά ίά άάεάοάοόΠόάοά οέο άεάεείεΠεάο ÷άεινέβίζαζ. Έά ÷ήάεάοάβόά όά Linux shared libraries όά ιδίνά άδάεόάβ όι δνίναήιιά. Άδβόζο, έά ÷ήάεάοάβ ίά άζιείρөнπόάόά έάέ Ύίάί έάοΰείαι “shadow root”, /compat/linux, άεά οέο άεάεείεΠεάο Linux δίο έά οδΰñ÷ίοί όοι FreeBSD. ΙδρεάαΠδίοά είεΎδ άεάεείεΠεάο (shared libraries) ίε ιδίνά ÷ήζόεινδιείΎίόάέ άδύ άοάνηιΎδ Linux έάέ άεάεΎίόάέ όοι FreeBSD έά είεόΰίοί δνπόά όά άοοίι όι έάοΰείαι. ΆδñΎιυò, άί ίεά άοάνηιΎδ Linux οίηόπόάέ άεά δάνΰάεάια όι /lib/libc.so, όι FreeBSD έά δνιόδάεΠόάέ ίά οίηόπόάέ δνπόά όι /compat/linux/lib/libc.so, έάέ άί άοοίι άάί οδΰñ÷άέ, ούοά έά δνιόδάεΠόάέ ίά οίηόπόάέ όι /lib/libc.so. Όά shared libraries έά δñΎδάέ ίά άάεάοάοόάειΎί όοι shadow tree /compat/linux/lib άίόβ άεά οέο οίδρεάόβάδ δίο άίάοΎñάέ όι ld.so όοι Linux.

Άάίεέΰ, οίεΰΰ÷έοοίι οόέο δνπόάο όάο άάεάοάοόΰόάέο άοάνηιΎδ Linux, έά ÷ήάεάοάβ ίά οΰίάόά άεά οέο είεΎδ άεάεείεΠεάο άδύ όά άίόβόοίε÷ά άεάεΰόειά. Ιάοΰ άδύ εΰδρειέ άεΰόόζιά έά Ύ÷άοά Ύίά έεάιηδρεζόεέυ άνέειυ Linux shared libraries όοι όύόοζιΰ όάο έάέ δεΎίί άά έά ÷ήάεΰεάόάέ άδεδεΎίί άηάάόβά δΎñά άδύ οζί άάεάοΰόόαζ οζο άοάνηιΎδ.

10.2.1.3 Άάεάοΰόόαζ Δνιόεάοοί Shared Libraries

Έάέ όε άβίάόάέ οόζ δάνβδουόζ δίο Ύ÷άοά άάεάοάοόΠόάέ όι linux_base port έάέ ίε άοάνηιΎδ όάο άεΎιζ δάνάδνιείΎίόάέ άεά shared libraries δίο έάβδίοί; Δπò ιδίνάβόά ίά ίΎñάόά δρειά shared libraries ÷ήάεΰεάόάέ εΰδρειά άοάνηιΎδ, έάέ δίο ιδίνάβόά ίά όά άηάβόά; Άάόεέΰ, οδΰñ÷ίοί 2 άδεείαΎδ (άεά ίά άείεϊοεΠόάόά οέο δάνάεΰου ήαζάβάδ έά δñΎδάέ ίά άβόόά root όοι όύόοζιΰ όάο).

Άί Ύ÷άοά δνιόεάόζ όά εΰδρειέ ιζ÷Ύίζιά Linux, ηβίόά ίεά ίάόεΰ όόά shared libraries δίο ÷ήάεΰεάόάέ ίεά άοάνηιΎδ, έάέ άίόεάνΰόά όά όοι FreeBSD. Άάβόά όι δάνάεΰου δάνΰάεάια:

Άδ οδρειΎοίοιά υόε έάόάΰΰόάόά ίΎού FTP όι άεάεΰόείι όιό **Doom** άεά όι Linux, έάέ όι άΰεάόά όοι Linux όύόοζιά όοι ιδίνβι Ύ÷άοά δνιόεάόζ. Ιδίνάβόά όόζ όοίΎ÷άεά ίά άεΎάιήάόά δρειά shared libraries ÷ήάεΰεάόάέ ζ άοάνηιΎδ ιά οζί άίόιεΠ ldd linuxdoom, υδδò:

```
% ldd linuxdoom
libXt.so.3 (DLL Jump 3.1) => /usr/X11/lib/libXt.so.3.1.0
libX11.so.3 (DLL Jump 3.1) => /usr/X11/lib/libX11.so.3.1.0
libc.so.4 (DLL Jump 4.5p126) => /lib/libc.so.4.6.29

/compat/linux/usr/X11/lib/libXt.so.3.1.0
/compat/linux/usr/X11/lib/libXt.so.3 -> libXt.so.3.1.0
/compat/linux/usr/X11/lib/libX11.so.3.1.0
/compat/linux/usr/X11/lib/libX11.so.3 -> libX11.so.3.1.0
/compat/linux/lib/libc.so.4.6.29
/compat/linux/lib/libc.so.4 -> libc.so.4.6.29
```

Όζιάβυόζ: Όζιάεπόά υόε άί Ύ÷άοά Παζ εΰδρειέ Linux shared library δίο ι άνέειυδ Ύεάιόζο άβίάέ ι βάείο ιά άοοίι οζο δνπόζο όόΠεζο όίο ldd, άά έά ÷ήάεάοάβ ίά άίόεάνΰόάόά όι άñ÷άβι υδδò άοου ιιιΰεάόάέ όόζ οάεάοόάβά όόΠεζο, όά οδΰñ÷ίοά άñ÷άβά έά δñΎδάέ ίά εΰίιόί οζ άίόεάεΰ όίοδ. Όάο όοιαιρεάΎίοιά υδδò ίά άίόεάνΰόάόά όι shared library άί άβίάέ εΰδρειά ίάυδάηζ Ύεάιόζ. Ιδίνάβόά ίά άεάάνΰόάόά όά δάεεΰ άñ÷άβά, άηέάβ υιυò ίά άίάίάπόάόά όίοδ όοιαιρεέΎιζο άοοίιζο πόόά ίά ήαζάΎίι όόά ίΎά άñ÷άβά. ΆδñΎιυò, άί Ύ÷άοά οέο δάνάεΰου άεάεείεΠεάο όοι όύόοζιΰ όάο:


```
# rpm2cpio -q < /path/to/linux.archive.rpm | cpio -id
```

×ñçóéíðíéðóáá ôçí brandelf(1) ñéá íá ôððíðíéðóááá êáóÛëëçéá óá äêðäëÝóéíá (ü÷é óéð äéáëéíèðéáð!) ùð äóáñíñáÝð Linux. Äáí éá ððíñáðóá íá áðäáéáóáóóðóááá óéð äóáñíñáÝð ðá êáéáññü ðñüðí, áëëÛ éá ððíñÝóááá íá êÛíáðá óéð äíééíÝð ðíð äðëéðíáðóá.

10.2.4 Ñýèíéóç ôíð Hostname Resolver

Áí ôí DNS äá äíðéäýáé ð áí óáð äíðóáíðæáðóáé ôí ðáñáéÛðù óóÛéíá:

```
resolv+: "bind" is an invalid keyword resolv+:
"hosts" is an invalid keyword
```

Ëá ðñáéáóóáð íá ñðèíðóááá ôí /compat/linux/etc/host.conf þóáá íá ðáñéÝ÷áé:

```
order hosts, bind
multi on
```

Ç óáéñÛ äáð äçèðíáé ùðé áñ÷éÛ äéÝñ÷áðáé ôí áñ÷áðí /etc/hosts êáé óðç óðíÝ÷áé í DNS server. ¼ðáí ôí /compat/linux/etc/host.conf äáí áðíáé äéáèÝóéí, íé äóáñíñáÝð Linux ðñçóéíðíéýí ôí /etc/host.conf ôíð FreeBSD êáé ðáñáðííéýíðáé ùðé ç óýíðáíç ôíð áñ÷áðí äáí áðíáé óóðð. Ëá ðñÝðáé íá áóáéñÝóááá ôçí áíáíñÛ óóí bind áí äáí Ý÷áðá ñðèíðóáé Ýíá name server íÝðù ôíð /etc/resolv.conf.

10.3 Äêðäëéóóðíóáò ôí Mathematica®

Áíáíðèçéá äéá ôí Mathematica 5.X áðü ôí Boris Hollas.

Ôí êáðíáñ áðü ðáñéññÛðáé ôç äéááééáóáá äêðáðÛóóáóçð ôçð Ýéäíóçð Linux ôíð **Mathematica 5.X** óá Ýíá óýóðçíá FreeBSD.

Ïðíñáðóá íá ááíñÛóááá ôçí êáííééð ð íáççóééð Ýéäíóç ôíð **Mathematica** ñéá Linux, áðäðèáðáð áðü ôç Wolfram óóí <http://www.wolfram.com/>.

10.3.1 Ôí ðñüñáñíá ÄêðáðÛóóáóçð ôíð Mathematica

Áñ÷éÛ, éá ðñÝðáé íá ðáðóáá óóí FreeBSD ùðé óá äêðäëÝóéíá ñéá Linux ôíð **Mathematica** êÛííðí ðñðç ôíð Linux ABI. Í äðéñüðáñíð ðñüðíð äéá íá ôí êÛíáðá áðü áðíáé íá ðñóááðá ôíð óýðí ôíð ELF ùð Linux óá ùéáð óéð äóáñíñáÝð ðíð äáí áðíáé ðáç branded, êÛííðáð ðñðç ôçð áíðíèðð:

```
# sysctl kern.fallback_elf_brand=3
```

Áðü éá êÛíáé ôí FreeBSD íá ððíèÝóáé ùðé óá äêðäëÝóéíá ELF ðíð äáí áðíáé branded, êÛííðí ðñðç ôíð Linux ABI êáé Ýóóé éá ððíñáðóá íá ðñÝíáðá ôí ðñüñáñíá ôçð äêðáðÛóóáóçð áðäðèáðáð áðü ôí CDROM.

Ôþñá, áíðéññÛðáá ôí áñ÷áðí MathInstaller óóíí óéëçññü óáð äðóéí:

```
# mount /cdrom
# cp /cdrom/Unix/Installers/Linux/MathInstaller /localdir/
```

Άνβίωά οί αν÷άβι έάε άίόέεάόάόδΠόάά οί /bin/sh όόç ðñþç ãñáñΠ ιά οί /compat/linux/bin/sh. Άδóυ έά όέαιρñΰφάε ύόε οί ðññáñáιá ááέάóΰόάόçδ έά ðñΰ÷άε ιά όçί Ύέαιόç sh(1) ãέά Linux. Óόç όóίΎ÷άέά, άίόέεάόάόδΠόάά üεάδ όέδ ááñáóΎò Linux) ιά FreeBSD) ÷ñçόέιιðίεΠίόάό Ύίái όóίóΰέόç έάέιΎίτò Π ιά οί ðñáñέΰδóù script όόçί áðñáιç áíúόçόά. Άδóυ έά ðñáε όóί ðññáñáιá ááέάóΰόάόçδ οίω **Mathematica**, οί ιðίβι ðñΰ÷άε όçί άίόίεΠ uname -s áέά ίά áέάðέόδóáέ οί έάέοίτñάέέυ όύόόçίá, ίά άίόέίáδóðβóάέ οί FreeBSD όái Ύίá έάέοίτñάέέυ ðáñáιðáñΎò ιά οί Linux. Ç áέóΎέάόç οίω MathInstaller έά ίáέέίΠόάέ όþñά όçί ááέάóΰόάόçδ οίω **Mathematica**.

10.3.2 ΟñίðίðίεΠίόάό όá Άέóáεΰόείά οίω Mathematica

Óá shell scripts όá ιðίβá áçίέίτñááβ οί **Mathematica** έάóΰ όç áέάέέέάόβá όçδ ááέάóΰόάόçδ ðñΎðáέ ίά όñίðίðίεçέίί ðñέί ÷ñçόέιιðίεçέίί. Άί áðέέΎίáδá οί /usr/local/bin ùδ οίί έάóΰέίáí áέά όá áέóáεΰόείά οίω **Mathematica**, έά áñáβóá áέáβ όóίáίεέέίýδ ááóίίýδ (symlinks) ðñίð όá áñ÷άβá math, mathematica, Mathematica, έάέ MathKernel. Óá έΰέá ðáñβðóùόç áðñ όέδ ðáñáðΰίù, άίόέεάόάόδΠόάά όέδ ááñáóΎò Linux) ιά FreeBSD) ιά έΰðίέίί όóίóΰέόç έάέίΎίτò Π ιά οί ðñáñέΰδóù shell script:

```
#!/bin/sh
cd /usr/local/bin
for i in math mathematica Mathematica MathKernel
do sed 's/Linux)/FreeBSD)/g' $i > $i.tmp
sed 's/\bin/sh/\compat/linux/bin/sh/g' $i.tmp > $i
rm $i.tmp
chmod a+x $i
done
```

10.3.3 Άðίέόþίόάό Èùάέέυ áέά οί Mathematica

¼όái áέέέίΠόάάά οί **Mathematica** áέά ðñþç öíñΰ, έá áñùόçέáβóá áέά Ύίái έùάέέυ. Άί ááί Ύ÷άόá έΰðίέίί έùάέέυ όá áóðυ οί όóΰΰάέί, ðñΎίτò οί ðññáñáιá mathinfo ðίτò áñβóέάόáέ όóίί έáóΰέίáí ááέάóΰόάόçδ áέά ίά όáó áñέáβ οί “machine ID”. Οί “machine ID” áβίáέ áí” ιείεέΠñò ááόέóίΎίί όόç áέáyέðίόç MAC όçδ έΰñóáð áέέόýίτò ðίτò Ύ÷άόá. Άδóυ όçίáβίáέ ύόε ááί ιðίñáβóá ίά ðñΎίáδá οί **Mathematica** όá ΰέέίτò ððίείáέóóΎð.

¼όái ááñáóáβóá όόç Wolfram, ιά e-mail, όçéΎóυίί Π fax, έá ÷ñáέάόáβ ίá áþóáðá οί “machine ID” έάέ έá όáó áðáίόþóίóί ιά Ύίái άίόβóóίε÷ί έùάέέυ ðίτò έá áðίéáέáβóáέ áðñ ίέá όáέñΰ áñέέίþί.

10.3.4 ΟñΎ÷ίίόáό οί Mathematica Frontend ιΎóù Άέέόýíó

Οί **Mathematica** έΰίáέ ÷ñþç έΰðίέίί áέάέέþί áñáιáóίóáέñþί áέά ίá áιόáίβóáέ ÷áñáέðΠñáð ιέ ιðίβίε ááί óðΰñ÷ίóί όóá όóίçέóίΎίá όáð (ιείεççñþίáόá, áέñίβóίáόá, Άέεçίέέΰ áñΰιáόá, έεð). Το ðññóυείεέί X áðáέóáβ áóðΎð ιέ áñáιáóίóáέñΎð ίá óðΰñ÷ίóί όóί *ðíðέέυ* όύόόçίá. Άδóυ όçίáβίáέ ύόε έá ÷ñáέάόáβ ίá άίόέáñΰφáðá όέδ áñáιáóίóáέñΎð áóðΎð áðñ οί CDROM Π áðñ áðñ έΰðίέίί ΰέέίί ððίείáέóóð ðίτò Ύ÷άέ οί **Mathematica**. ÓóίΠέùð áóðΎð ιέ áñáιáóίóáέñΎð ιðίñίýί ίá áñáέίýί ίΎóá όóί έáóΰέίáí /cdrom/Unix/Files/SystemFiles/Fonts οίω CDROM, Π όóίί έáóΰέίáí /usr/local/mathematica/SystemFiles/Fonts όóίί ðίðέέυ όέεçññü áβóέί. Ιέ ðñááíáóέέΎð áñáιáóίóáέñΎð áñβóέίíóáέ όá ððίεáóáέüáίτò üðùð type1 έάέ x. Óðΰñ÷ίóί áñέáóίβ ðññðίε ίá όέð ÷ñçόέιιðίεΠóáάό, ιέ ιðίβίε ðáñέáñΰίííóáέ όόç όóίΎ÷άέά.

Ι ðñþðíð ðññðíð áβίáέ ίá όέð άίόέáñΰφáðá ίΎóá όá Ύίái óðΰñ÷ίóá έáóΰέίáí όóί /usr/X11R6/lib/X11/fonts. Έá ÷ñáέάόáβ üùð ίá ðñίðίείΠóáάά οί áñ÷άβι fonts.dir, þóáά ίá ðñίóéΎóáðá όá ιíυíáόá ðυί áñáιáóίóáέñþί ίΎóá

óá áððü, éáé íá áëëÛíáðá ôíí áñéëü òüí áñáííáðíóáéñþí óðç ðñþç ãñáíð. ÁíáééáéðéëÛ, áβíáé óðíðèùð áñéáðü íá áêðäëÛóáðá áððö ðçí áíðíëð mkfontdir(1) ðÛóá óðíí éáðÛéíáí ðíð Û ÷ áðá áíðéáñÛðáé ðéð ãñáííáðíóáéñÛð.

Ï ääÛðáñíð ðñüðíð áβíáé íá áíðéáñÛðáðá ôíðð ðáñáðÛíü éáðáéüüíðð ðÛóá óðí /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
```

Ïþñá ðñíóëÛóáðá ôíðð íÛíðð éáðáéüüíðð ðá ðéð ãñáííáðíóáéñÛð óðí font path:

```
# xset fp+ /usr/X11R6/lib/X11/fonts/X
# xset fp+ /usr/X11R6/lib/X11/fonts/MathType1
# xset fp rehash
```

Áí ÷ ñçóéíðíéáβðá ôí **Xorg**, ððíñáβðá íá öíñðñíáðá ðéð ãñáííáðíóáéñÛð áððÛð áððüíáðá, ðñíóëÛóáðá ôíðð íÛíðð éáðáéüüíðð óðí áñ ÷ áβí xorg.conf.

Óçíáβúç: Áéá ôíí áíððçñáðçðð **XFree86**, ôí áñ ÷ áβí ñðéíβóáúí áβíáé ôí XF86Config.

Áí ááí Û ÷ áðá Þáç Ûíáí éáðÛéíáí ðá ôí üññá /usr/X11R6/lib/X11/fonts/Type1, ððíñáβðá íá áëëÛíáðá ôí üññá ôíð MathType1 áðü ôí ðáñáðÛíü ðáñÛäéáíá óá Type1.

10.4 ÁêðäëÛóóðíóáð ôí Maple™

ÓðíáéóöíñÛ ôíð Aaron Kaplan. Áð ÷ áñéóðβáð óðíí Robert Getschmann.

Ïí **Maple™** áβíáé ðá áððíñéëð áðáñíñáð íáççíáðééþí ðáñüííéá ðá ôí **Mathematica**. Éá ðñÛðáé íá ááíñÛóáðá ôí éíáéóíéëü áðü ôí <http://www.maplesoft.com/> éáé óðç óðíÛ ÷ áéá íá êÛíáðá áβðçç áéá íéá Ûäáéá ÷ ñÞçð. Áéá íá ááéáóáóðÞáðá ôí éíáéóíéëü óðí FreeBSD, áéíéíðèÞóáðá óá ðáñáéÛðü áðéÛ áÞíáðá.

1. ÁêðäëÛóáðá ôí INSTALL shell script áðü ôí ðÛóí ááéáðÛóáóçð ðíð Û ÷ áðá. ÁðééÛíðá “RedHat” üðáí áñðççáβðá áðü ôí ðñüáñáííá ááéáðÛóáóçð. Ï ðððéëüð éáðÛéíáíð áβíáé í /usr/local/maple.
2. Áí ááí Û ÷ áðá ááíñÛóáé áéüñç êÛðíéá Ûäáéá áéá ôí **Maple**, ááíñÛóáðá ðá áðü ôí Maple Waterloo Software (<http://register.maplesoft.com/>) éáé áíðéáñÛðáðá ôí áñ ÷ áβí ðíð éá óáð äíéáβ óðí /usr/local/maple/license/license.dat.
3. ÁáéáóáóðÞáðá ôí **FLEXlm** license manager áêðäëÛóáðá ôí INSTALL_LIC shell script ôí ððíβá ðáñÛ ÷ áðáé íáæβ ðá ôí **Maple**. ÁÞóáðá ôí ááóéëü üññá ôíð ððíéíáéóðÞ óáð ôí ððíβí áðáéóáβðáé áðü ôíí áíððçñáðçðð áéá ÷ áβñéóçð ðüí áááéþí (license server).
4. ×ñçóéíðíéáÞóáðá ôí ðáñáéÛðü patch óðí áñ ÷ áβí /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 ðñíéäéÿíò íá áíôïðéóðäð ôï ùñíá ôïð éäéóíðäééíý óóóððíäôïð. Áíáéüäü ðä ôï ðñéí éäéóíðäééü àñäéäð, éá ðñçóéíðñéçéíý éäé óá áíððóðéé÷á äêðäÿóéíä àñ÷äá.

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 ôïð **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 üüðð 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

- ðüðð 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 óðáêéñéíÝíç ðñðP áééêð ç áéðÝéáóç ôíð éá áðíðý ÷ áé. Íá óüóðü áñ ÷ áβí Ûäáéáð ÷ ñPóçð ðñÝðáé áβíáé óá ááíééÝð áñáñÝð üðüð ôí ðáñáéÛüð:

```
# =====
# License File for UNIX Installations ("Pointer File")
# =====
SERVER chillig ANY
#USE_SERVER
VENDOR maplelmg

FEATURE Maple maplelmg 2000.0831 permanent 1 XXXXXXXXXXXX \
    PLATFORMS=i86_r ISSUER="Waterloo Maple Inc." \
    ISSUED=11-may-2000 NOTICE=" Technische Universitat Wien" \
    SN=XXXXXXXXXX
```

Óçíáβüóç: Í óáéñéáéüð áñééüð éáé ôí êéáéáβ ðáβíííóáé áâð ðá 'X'. Ôí chillig áβíáé ôí üñíá ôíð óðóðβíáðüð.

Ïðíñáβðá íá ðñíðíðíéPóáðá ôí áñ ÷ áβí óçð Ûäáéáð ÷ ñPóçð, áñéáβ íá íçí áéèÛíáðá óçí áñáñP “FEATURE” (ç íðíβá ðñíóóáðáýáðáé áðü ôí êéáéáβ óçð Ûäáéáð).

10.5 Áäêéééóðβíáðá ôí MATLAB®

ÓðíáéóöíñÛ ôíð Dan Pelleg.

Ôí éáβíáñ áðüð ðáñéáñÛðáé óç áéááééáóβá áäéáðÛðóáóçð óçð Linux Ýéäíóçð ôíð **MATLAB® 6.5** óá Ýíá óýðóçíá FreeBSD. Äíðêéáýáé 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>. Óéáññáððáβðá üðé ðPñáðá éáé ôí áñ ÷ áβí ðíð ðáñéÝ ÷ áé óçí Ûäáéá ÷ ñPóçð P íäçáβáð áéá ôí ðüð íá ôí äçíéíðñáPóáðá. Íéá éáé éá áðééíéíñíPóáðá ðá óçí áðáéñáβá, ðáβðá ôíðð üðé éá èÝéáðá íá ððÛñ ÷ áé áðβóçð ððíóðPñéíç áéá ôí FreeBSD.

10.5.1 ÁëëáóÛóóáóç ðíð MATLAB

Ãéá íá áäëáóóóóóóóá ðíð **MATLAB**, èÛíðá ðá ðáñáëÛòù:

1. ÁéóÛááóá ðíð CD éáé ðñíóáñðóóá ðíð ððí óýóóçíá óáð. Óðíááëáððá ùð ðñðóóçð root, ùððò óðíéóóÛ ðíð script óçð áäëáóÛóóáóçð. Ãéá íá íáëéíðóóá ðíð script óçð áäëáóÛóóáóçð äðóðá ðçí áíðíëð:

```
# /compat/linux/bin/sh /cdrom/install
```

Óðùääéíç: Õí ðñüãñáííá ðçð áäëáóÛóóáóçð áðíáé ðá ãñáðéëü ðáñéáÛëëíí. Áí éáíáÛíáðá óóÛëíáðá ððáðéëÛ ðçí íëüíç, äðóðá ðçí áíðíëð: `setenv HOME ~USER`, ùðíð `USER` áðíáé í ðñðóóçð áðù ùðíð äðóðá ðçí áíðíëð `su(1)`.

2. ¼ðáí áñùðçëáððá áéá ðíð éáðÛëíáí ðíð **MATLAB**, äðóðá: `/compat/linux/usr/local/matlab`.

Óðùääéíç: Ãéá áðëíëüðáñç äéááééáóðá áäëáóÛóóáóçð, ïñðóðá ðíð ðáñáëÛòù: `set MATLAB=/compat/linux/usr/local/matlab` óçç áñáíð áíðíëðí ðíð éäëýðíðð óáð.

3. Õñíðíðíéðóóá ðíð áñðáðí ðçð Ûááéáð (license file) óýíòùíá ðá ðéð íäçáðð ðíð èÛááóá ðá ðçí Ûááéá ðíð **MATLAB**.

Óðùääéíç: Ìðíñáððá íá áðíéíÛóóáðá äé ðùí ðñíðóçíí ðíð áñðáðí áððù éáé íá ðíð áíðéáñÛðáðá ððí `$MATLAB/license.dat`, ðñéí éáí óáð ðáé ðíð ðñüãñáííá áäëáóÛóóáóçð íá ðíð ðñíðíðíéðóóáðá.

4. Íëíëððñùóç ðçð ÁäëáóÛóóáóçð

Óá áððù ðíð ðçíáðí, ç áäëáóÛóóáóç ðíð **MATLAB** Ýðáé íëíëçñùëáð. Óá áðùíáíá áðíáðá ðñáéÛæííðáé áéá íá ðíð Ýóáðá íá ðíð äíðéÝðáðá óùóóÛ ðá ðíð FreeBSD.

10.5.2 Áëëáóçç ðíð License Manager

1. Äçíéíðñáðá óðíáíëéëðí ððíáÝóííí áéá ðá scripts ðíð license manager:

```
# ln -s $MATLAB/etc/lmboot /usr/local/etc/lmboot_TMW
# ln -s $MATLAB/etc/lmdown /usr/local/etc/lmdown_TMW
```

2. Äçíéíðñáðóðá ðíð áñðáðí áëëáóççð `/usr/local/etc/rc.d/flexlm.sh`. Õí ðáñÛááéáíá ðáñáëÛòù áðíáé íéá ðñíðíðíéçíÝíç Ýéáíóç ðíð `$MATLAB/etc/rc.lm.glnx86`. Íé áéëááÝð áðíáé óðéð ðíðíëáððáð ðùí áñðáðí, éáé óççí áëëáóçç ðíð license manager óðí ðáñéáÛëëíí áñíííðóçð Linux ðíð 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 áðßóçð íá áíóééáóáóððáðá ôí ðáñáðÛíú *username* ðä Ýíá ððáñêêüü üííá ÷ ñßóçç ôïð óóóðßáðüð óáð (êáé íá íçí áßíáé í *root*).

3. Äêéíßððá ôíí license manager ðä ôçí áíóíëß:

```
# /usr/local/etc/rc.d/flexlm.sh start
```

10.5.3 Óýíááóç ðä ôí ÐáñéáÛëëíí ôïð Java Runtime Environment

ÄëÛíðá ôíí óýíááóíí ôïð Java Runtime Environment (JRE) óá Ýíáí í ððíßò èá äïðëäýáé óðí FreeBSD:

```
# cd $MATLAB/sys/java/jre/glnx86/
# unlink jre; ln -s ./jre1.1.8 ./jre
```

10.5.4 Äçíéïñãßðáá ôí Script Äêêßíççðð ôïð MATLAB

1. Ôíðíèáðððá ôí ðáñáéÛüð script óðí /usr/local/bin/matlab:

```
#!/bin/sh
/compat/linux/bin/sh /compat/linux/usr/local/matlab/bin/matlab "$@"
```

2. Óçç óóíÝ ÷ áéá äßððá ôçí áíóíëß `chmod +x /usr/local/bin/matlab`.

Öüüääéíç: ÁíÛëíáá ðä ôçí Ýéäíóç ôïð `emulators/linux_base`, ðïð Ý ÷ áðá, ððíñáß íá áíóáíéóóíýí íáñééÛ óóÛëíáðá üðáí ðñÝíáðá ôí script. Äéá íá ôí áðíöýááðá áóóü, ðñíðíðíéßððá ôí áñ ÷ áßí /compat/linux/usr/local/matlab/bin/matlab, êáé áëëÛíðá ôç ãñáííß ðïð ëÝáé:

```
if [ `expr "$lscmd" : '.*->.*'` -ne 0 ]; then
```

(óççí Ýéäíóç 13.0.1 ãñßóéáðáé óçç ãñáííß 410) óá áóðß ôç ãñáííß:

```
if test -L $newbase; then
```

10.5.5 Äçìéìðñãßá Script Óãñìáóέóìü ðìò MATLAB

Óά äðüìáíá äßìáðά ÷ ñäéÛæíðáé äéá íá éýóáðά Ýíá ðñüäéçìá ðìò ððÛñ ÷ äé ìá ðìí ðãñìáóέóìü ðìò MATLAB.

1. Äçìéìðñãßáððá ðìí äñ ÷ äßìì \$MATLAB/toolbox/local/finish.m, éáé ìÝóá óá áðüü ðñìóèÝóðá ìüíì ðç ãñáììß:


```
! $MATLAB/bin/finish.sh
```

Óçìáßüóç: To \$MATLAB ãñÛððá ðìí áéñéáðò üðüò ðìí äéÝðáðá.

Óðüááéìç: Óðìí ßáéí éáðÛéìáí, éá äñáßðá ðá äñ ÷ äßá finishsav.m éáé finishdlg.m, ðá ìðíßá éá óáò äßììí ðç äðìáðüòçðá íá óðæáðá ðçìí äñááóßá óáò ðñéí ééáßóáðá ðìí ðñüäñáìá. Áí ðñüéáéðáé íá ÷ ñçóéìðñéáßðá éÛðñéí áðü áððÛ, ðñìóèÝóðá ðìò ðçìí ðáñáðÛíü ãñáììß áìÝóðò ìáðÛ ðçìí áíðìèß save .

2. Äçìéìðñãßáððá ðìí äñ ÷ äßìì \$MATLAB/bin/finish.sh, ðìí ìðíßì éá ðáñéÝ ÷ äé óá ðáñáéÛðü:


```
#!/usr/compat/linux/bin/sh
(sleep 5; killall -1 matlab_helper) &
exit 0
```
3. ÊÛíðá ðìí äñ ÷ äßìì áéðáéÝóéí:


```
# chmod +x $MATLAB/bin/finish.sh
```

10.5.6 ×ñçóéìðñéðìáðò ðìò MATLAB

Óá áðüü ðìí óçìáßì éá ðñÝðáé íá äßððá Ýðìéìé íá äðáðá ðçìí áíðìèß matlab éáé íá äñ ÷ ßóáðá íá ÷ ñçóéìðñéáßðá ðçìí áðáñìãß.

10.6 ÁãéáðÛóðáóç ôçò Oracle®

ÓðìáéóðìÛ ðìò Marcel Moolenaar.

10.6.1 Áéóáãüãß

Óí éáßìáñ áðüü ðáñéãñÛðáé ðç äéáäééáóßá ääéáðÛóðáóçðò ðìí Oracle 8.0.5 éáé Oracle 8.0.5.1 Enterprise Edition äéá Linux óá Ýíá óýóðçìá FreeBSD.

10.6.2 ÁãéáóÛóóáç ðíð ÐáñéáÛëëííð Linux

Óçáíðñáððáðá ùðé Ý ÷ áðá áãéáóóóçðáé ðá emulators/linux_base éáé devel/linux_devtools áðñ ðç óðëëíáð ðñí Ports. Áí áíóëíáðñððáðá áðóçëððáð ðá ðá ðáñáðÛíù, Ñóòð ÷ ñáéáóóóðá ðá ðá áãéáóóóçðáðá áðñ ðáéÝðá ð áðñ ðáéëíðáññð áêäíóáéð ðçð óðëëíáðð ðñí Ports.

Áí èÝëáðá íá ðñÝíáðá ðñí intelligent agent, èá ÷ ñáéáóóóðá ðá áãéáóóóçðáðá éáé ðí ðáéÝðí Red Hat Tcl:

tcl-8.0.3-20.i386.rpm. Ç áíóíëð áéá ðçí áãéáóÛóóáç ìÝóò ðíð áððóçíð **RPM** port (archivers/rpm) áðíáé:

```
# rpm -i --ignoreos --root /compat/linux --dbpath /var/lib/rpm package
```

Ç áãéáóÛóóáç ðíð *package* èá ðñÝðáé íá áðíáé ñáéÛ éáé ÷ ùñðð ðñíáëðíáðá.

10.6.3 Ñðëíðáëííðð ðí ÐáñéáÛëëíí áéá ðçí Oracle

Ðñéí ðçí áãéáóÛóóáç ðçð **Oracle**, èá ðñÝðáé íá ñðëíðáðá ðóðóÛ ðí ðáñéáÛëëíí ðíð óðóððíáððð óáð. Õí ðáñáéÛðñ èáðíáñ ðáñéáñÛóáé ðé *áñéáðð* ðñÝðáé íá èÛíáðá áéá íá áéðáëÝóáðá ðçí **Oracle** áéá Linux ðíð FreeBSD, éáé ááí ðáñéáñÛóáé ùðé ððÛñ ÷ áé ðáç óðñí ðáçäí áãéáóÛóóáçðçð ðçð **Oracle**.

10.6.3.1 Ñýëíéóç ðíð Ððñðíá

¼ðñð ðáñéáñÛóáé ì ðáçäíð áãéáóÛóóáçðçð ðçð **Oracle**, èá ðñÝðáé íá ññðáðá ðéð ðéíÝð ðçð shared memory óðí ìÝáéóðí. Ìçí ÷ ñçóéííðíéððáðá ðí SHMMAX óðí FreeBSD. Õí SHMMAX ððíëíáðáðáé áðëðð áðñ ðí SHMMAXPGS éáé ðí PGSIZE. ÁðñÝíùð èáéññðáðá ðí SHMMAXPGS. ¼éáð ñé Ûëéáð áðéëíáÝð ìðñíýí íá ñéóðíýí ùðñð ðáñéáñÛóáéé óðñí ðáçäí. Áéá ðáñÛááéáíá:

```
options SHMMAXPGS=10000
options SHMMNI=100
options SHMSEG=10
options SEMMNS=200
options SEMMNI=70
options SEMMSL=61
```

Ïñðáðá ðéð ðéíÝð ðñí áðéëíáðí Ýóóé ððáð íá ðáéñéÛáëíðí óðç ÷ ñðóç ðçð **Oracle** ðíð èÝëáðá íá èÛíáðá.

Áððóçð, áðéáááéððá ùðé Ý ÷ áðá áíáñáñðíéððáé ðéð ðáñáéÛðñ áðéëíáÝð ðóéð ñðëíðáðéð ðíð ððñðíá:

```
options SYSVSHM #SysV shared memory
options SYSVSEM #SysV semaphores
options SYSVMSG #SysV interprocess communication
```

10.6.3.2 Ì × ñðóóçð Oracle

Äçíéíðñáððá Ýíá ÷ ñðóóçð óðóððíáððíð ðá ùñíá oracle, ðá ðñí Ñáéí ðññðí ðíð èá äçíéíðñáýóóáðá éáé ððíëíáððíðá Ûëëíí ÷ ñðóóçð. Õí ùñí éáéáððáñí ÷ áñáéðçñéóðéëù ðíð ÷ ñðóóçð oracle áðíáé ùðé ÷ ñáéÛáðáé íá ðíð áððáðá Ýíá èÝëðíðð Linux. ÐñíðéÝóðá ðí /compat/linux/bin/bash óðí /etc/shells éáé ññðáðá ðí èÝëðíðð ðíð ÷ ñðóóçð oracle óá /compat/linux/bin/bash.

10.6.3.3 Õí ÐáñéáÛëëíí

Áëòóò ðùí óðéçëóíÛííí ðáðááëçðí óçð **Oracle**, ùðòò íë ORACLE_HOME éáë ORACLE_SID éá ðñÛðáë íá ðñðóáðá éáë óëð áëüëíðëáð ðáðááëçðÛð ðáñéáÛëëííðíð:

ðáðááëçðí	Óëíð
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 óðíëóðíÛíá íá ðñðóáðá ùëàð óëð ðáðááëçðÛð ðáñéáÛëëííðíð óðí áñ÷áßí .profile. Íá íëíëççñùíÛíí ðáñÛááëáíá áßíáë ðí ðáñáëÛòò:

```
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 ÁäëáðÛóóáóç óçð Oracle

Ëüáù íëá íëëñðò Ûëëáëçðð óðíí áññíëùðð ðíð Linux, éá ÷ñáëáóðáß íá äçíëíðñáðóáðá Ûíáí éáðÛëíáí ðá ðí ùíñá .oracle ðíóá óðí /var/tmp, ðñëí ðáëëíðóáðá ðí ðñüáññáíá áäëáðÛóóáóçð. Ì éáðÛëíáíð áðòóò éá ðñÛðáë íá áíðëáë óðíí ÷ñðóç oracle. Ëá ðñÛðáë óðñá íá ðñááíáðíðíëðóáðá óçí áäëáðÛóóáóç óçð **Oracle** áß÷ò éáíÛíá ðñüáëçíá. Áí áíðëáðòððëáðá ùíðð áëüíç ðñíáëðíáðá, áëÛáíðá óçí Ûëáíóç óçð **Oracle** ðíð Û÷áðá ð/éáë óëð ðñèíðóáëð óáð! Áóóóíð Û÷áðá ðñááíáðíðíëðóáë óçí áäëáðÛóóáóç óçð **Oracle**, áðáñíüóðá óá patches ðíð ðáñéáñÛóíðáë óðëð äÛí ðáñáëÛòò áíüóçðáð.

Íá óð÷íü ðñüáëçíá áßíáë ùðë ááí áßíáðáë óóóðð áäëáðÛóóáóç ðíð ðñíóáññíáÛá ðíð ðñüóíëüëëíð TCP. Áóðü Û÷áë ùð áðíðÛëáóíá íá íçí ðññáßðá íá ðáëëíðóáðá ðíðð TCP listeners. Ìë áëüëíðëáð ðáçáßáð éá óáð áíçððóíðí íá ëÛóáðá áóðü ðí 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 ðá÷Ûóáðá íá ðñÛíáðá íáíÛ ðí root.sh

10.6.5 ΆέοΎέάοζ οζο Oracle

Άοίγ Ύ ÷ άοά αέιεεοεΠοάε άδοΎδο οέο ιάζαββδ, εά δñΎδαέ ίά ιδñαββδ ίά άεοάεΎόοά οζί **Oracle** οάί ίά άñέοέουοάοάί οά Ύία ούόοζία Linux.

10.7 ΆάέάοΎόοάοζ οίο SAP® R/3®

ΟδιάέοοίμΎ οίο Holger Kipp. Άñ÷έεΠ ιάδοάοññδΠ οά SGML άδñ οίι Valentino Vaschetto.

Ç άάέάοΎόοάοζ οσοόζιΎοδñι **SAP** ÷ñζοέιιδñέπιδάο οί FreeBSD άάί οδñόοζñβεάοάέ άδñ οζί ñΎάά οδñόοβñέιζο οζο SAP — οδñόοβñέιζο δάñΎ ÷άοάέ ιññι οά οοάεάεñέιΎίαδ, οδñόοζñέεñιάφάδ, δέάοοññιάδ.

10.7.1 ΆέόάάñäΠ

Οί εάβιαñι άοδñ δñέεññΎοάέ Ύία δέεάφñ οññδñι άέά οζί άάέάοΎόοάοζ οίο **SAP R/3 System** ιά ιβά άΎοζ άάññΎιñι **Oracle** άέά Linux οά Ύία ούόοζία FreeBSD, δñέέάίαñΎιñιόάδ οζί άάέάοΎόοάοζ οίο FreeBSD έάέ οζο **Oracle**. Έά δñέεññΎοδñιά άγίι άέάοññάοέέΎ άβζ ñδèιβόάι:

- **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' ùέι δñο άοδñ οί εάβιαñι δññιόδαέάβ ίά δñέεññΎοάέ ιά έάδδññΎñάέδ ùέά οά άδñάβδζοά άβιαόά, άάί έά δñΎδαέ ίά έάññέεάβ ùδ άίόέέάοάοδΎοδζο οñι ιάζαββι άάέάοΎόοάοζο οζο **Oracle** έάέ οίο **SAP R/3**.

Άάββδ οίι ιάζαβñ οίο **SAP R/3** άέά Linux άέά άññδΠοάέο ο ÷ άοέέΎ ιά οί **SAP** έάέ οζί **Oracle**, έάέ άέά δζαΎδ άδñ οζί **Oracle** έάέ οί **SAP OSS**.

10.7.2 Έίιέόίέέñ

Οά άέñέιñδέά CD-ROMs Ύ ÷ ιδñι ÷ñζοέιιδñέζεάβ άέά οζί άάέάοΎόοάοζ οίο **SAP**:

10.7.2.1 SAP R/3 4.6B, Oracle 8.0.5

¼ññά	Άñβèιζοζ	ΔñέέññάοΠ
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

ΆδέδέΎιñ, ÷ñζοέιιδñέΠοάίι οί **Oracle 8 Server** (Pre-production version 8.0.5 άέά Linux, Kernel Version 2.0.33) CD

οί ιδίδι άάί άβιάε άδανάβδζοί, έάε οί FreeBSD 4.3-STABLE (Ύία όόεάιέυόδδδϊ έββãð ìüíí ìΎñãð ìãðÛ όζί Ύέãïόζ 4.3-RELEASE).

10.7.2.2 SAP R/3 4.6C SR2, Oracle 8.1.7

¼ññá	Άñβείζόζ	Δãñέãñãöþ
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

Άίαέυãùð ìã όέð ãεþόόãð δϊð εΎέãðã íã äãέãóãóðþόãðã, έã ÷ñãέãóóãβðã äðέðεΎίí óã áίόβόοίε ÷ã CDs. Άìãβð ÷ñζόεíðίεíγíã ΆãñíáíέέÛ (DE) έáέ ΆããέέέÛ (EN), ìðüðã ÷ñãέãæííãóðã ìüíí òí δñþðí CD. Ìέã ìέεñþ óζíãβùóζ, ζ ãñβείζόζ ðüí EXPORT CDs άβιάε áεñέãþð ζ βãέã. ¼εã óã CDs ðüí ãεùóóþí Ύ ÷íðí όζí βãέã ãñβείζόζ (ãððü ãέãóΎñãέ óã ó ÷ Ύόζ ìã όζí ãñβείζόζ όζð Ύέãïόζð 4.6B IDES). Óζί þñã δϊð ãñÛöñíóáέ áððΎð ìέ ãñãñìΎð, ζ äãέãðÛóóáόζ έãέóíðñããβ óã FreeBSD 4.5-STABLE (20.03.2002).

10.7.3 Óζíãέþόáέð SAP

Ìέ áεüεíðεãð óζíãέþόáέð έã δñΎðáέ íã äέãããóóíγí δñέí όζí äãέãðÛóóáόζ οίò **SAP R/3** ìέã έáέ άβιάε ÷ñþόείãð ãέã όζ äέããέãóóβã äãέãðÛóóáόζð:

10.7.3.1 SAP R/3 4.6B, Oracle 8.0.5

Άñβείζόζ	Όβόεíð
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

10.7.5 Άεάοΰόόός οίο FreeBSD

Άν ÷ εέΰ δñΎδαέ ίά άεάόάόόΠόάά οί FreeBSD. Άόου ιδñάβ ίά άβίάέ ίά άεΰοιñιόδ οñυδίοδ, άέά δάñέόουόάñάδ δεçñιοñιñάδ άάβόά οίο ΌιΠιά 2.13.

10.7.5.1 Άέΰόάιç Äβόειο

Άέά ίά εñάδΠόιñιά οç άεάάέέάόβá áδèΠ, ÷ñçόειñδιεΠόάίá οçί βάέά άεΰόάιç άβόειο, ούοί οίο **SAP R/3 46B** υοί έέέ οίο **SAP R/3 46C SR2**. Ιñιñ δά ιñιñάόά ούι οδóέάσπñ ΰέέάίá, έέèð ç εΰεά άεάόΰόόός Ύάείá δά άέάοιñάδέέυ ιç ÷ Ύίçίá. (/dev/da έέέ /dev/amr άίόβόοίέ ÷ á, ιδñόά άί ÷ñçόειñδιεάβόά Ύίáí AMI MegaRAID®, έά άάβόά οί /dev/amr0s1a άίόβ οίο /dev/da0s1a):

Όγόδçιά άñ ÷ άβυί	Ύΰάέειο (1k-blocks)	Ύΰάέειο (GB)	Δñιόΰñδçόç οίο
/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

Ñδειβόόά áδñ δñεί οίòδ άγί άβόειοδ ιά οί εϊñέόίέέυ Mylex Π οί PERC/3 RAID. Ιδññάβόά ίά άέόΎέέάδά οά áόδñ έάόΰ οç οΰόç άέέβίçόçδ οίο BIOS.

ΔñιόΎιόά άäπ υόέ ç άεΰόάιç οίο άβόειο άέάόΎñάέ έβäñ υò δñιò οç οόίέόδπíáç áδñ οç SAP, έέèð ç SAP δñιόάβίáέ ίά δñιόáñδΠόάά οίòδ οδñεάόάέυäñòδ οçδ **Oracle** (έέέ εΰδñιέιòδ ΰέειòδ) ίá ÷ υñέόόΰ — άιáβδ δñιòέιΠόάίá, άέά έυñäñòδ áδέυδçόάδ, ίá äçιέιòñäΠόιñιá έáñίέέίγδ έάδάέυäñòδ.

10.7.5.2 make world έέέ ΎΎιò ΔδñΠíáδ

Έάδάάΰόόά οίι δççáβι έπáέέά οίò δάέäδóάβιò δδñΠíá -STABLE. Ιάόάάέυòδδβόόά οί world (άάόέέυ όγόδçιά) έέέ οίι δδñΠíá οάδ áóñγ äçιέιòñäΠόάάδ δñπóá Ύίá δñιόáñιοίΎίñ άñ ÷ άβι ñδειβόάυί δδñΠíá. Άäπ έá δñΎδαέ ίά οóιδäñέέΰáάόά έέέ οέδ δáñáíΎδñιòδ δδñΠíá (kernel parameters) ιέ ιδñιβáδ ÷ñáέΰäειíόάέ ούοί άέά οί **SAP R/3** υοί έέέ οçί **Oracle**.

10.7.6 Άεάόΰόόός οίο Δáñέáΰέέιíοίò Linux

10.7.6.1 Άεάόΰόόός οίο Linux Base System

Άñ ÷ εέΰ ÷ñáέΰäάάέ ίá Ύ ÷ áδά άεάόάόόΠόάέ οί linux_base port (υò ÷ ñΠόόçδ root):

```
# cd /usr/ports/emulators/linux_base
# make install distclean
```

10.7.6.2 Äêäóóðçôä ôíö ÐäñéäÛëëííôíö ÁíÛððôíçð Linux

Ôí ðäñéäÛëëíí áíÛððôíçð Linux ÷ñäëÛäðäé áí ëÿéäðä íä äêäóóðçôäððäðäðä ðçí **Oracle** óðí FreeBSD ùðùð ðäñéäñÛðäðäé óðí ÔíÐíä 10.6:

```
# cd /usr/ports/devel/linux_devtools
# make install distclean
```

Äêäóóðçôäððäðäðä ôí ðäñéäÛëëíí áíÛððôíçð Linux ïüíí äéä ðçí äêäóóðçôäðçôä ôíö **SAP R/3 46B IDES**. Áí ÿ ÷äðä äêäóóðçôäðäðäé ðçí **Oracle DB** äðü ðçí **Oracle** äéä óðóððíäðä Linux, ôüðä ääí ÷ñäëÛäðäé íä óäð äðäð÷íëäð.

10.7.6.3 Äêäóóðçôäðçôä ðüí Äðäñäðçðçúí RPMs

Äéä íä íäëëíððäé ôí ðñüäñäíä R3SETUP, ÷ñäëÛäðäé íä ððÛñ÷äé ððíóððñéíç PAM. ÊäóÛ ðç äëÛñëäéä ðçð ðñðçðð äêäóóðçôäðçôä ôíö **SAP** óðí FreeBSD 4.3-STABLE, ðñíóðäëððäíä íä äêäóóðçôäððäðäðä ôí PAM ðä ùëä ðä äðäñäðçðçúä ðäëÿðä äéä ðäëëÛ äíäíäëÛóäíä ðçí äêäóóðçôäðçôä ôíö ðäëÿðíö PAM, ôí ïðíðí äéä äÿÿëäðä. Äéä ôí **SAP R/3 4.6C SR2** äíäíäëÛóäíä Ûíäðä ðçí äêäóóðçôäðçôä ôíö ðäëÿðíö PAM, ôí ïðíðí äððçðð äÿÿëäðä, ðñÛäíä ðíð óçíäðíäé ùéä ðä ðäëÿðä ðíð äíäðÿñíðäé ùð äíäñðððäéðð ôíð, ääí ÷ñäëÛäðäé:

```
# rpm -i --ignoreos --nodeps --root /compat/linux --dbpath /var/lib/rpm \
pam-0.68-7.i386.rpm
```

Äéä ôíí intelligent agent ôíö **Oracle 8.0.5**, ÿðñäðä íä äêäóóðçôäððäðäðä ôí ðäëÿðí Tcl ðçð RedHat tcl-8.0.5-30.i386.rpm (äéäðñäðéëÛ ç äðäíäðçÿíäðçôä êäóÛ ðç äëÛñëäéä ðçð äêäóóðçôäðçôä ðçð **Oracle** ääí ëä ððäí äóëëðð). ÔðÛñ÷íðí êäé ëÛðíëä Ûëëä ðñíäëðíäðä ó÷äðéëÛ ðä ðç äðäíäðçÿíäðçôä ðçð **Oracle**, äëÛ äððü äðíäé ëÿíä ðçð **Oracle** äéä Linux, êäé ù÷é ôíö FreeBSD.

10.7.6.4 Äðéðëÿíí Óðíäíðëÿð

ððùð äðíäéä äððçðð êäëð êäÿä íä ðñíðëÿóäðä ðí linprocfs óðí /etc/fstab. Äéä ðäñéðóóððäñäð ðçñíðíðñäð, ääððä ðç óäëðäá manual linprocfs(5). Ìéä Ûëëç ðäñÛíäðñíð ðíð ïðñäððä íä ðñððäðä äðíäé ç kern.fallback_elf_brand=3 ç ïðíðä ðñðäðäé óðí äñ÷äðí /etc/sysctl.conf.

10.7.7 Äçíëíðñäðä ôíö ÐäñéäÛëëííôíö SAP R/3

10.7.7.1 Äçíëíðñäðä ðüí Äðäñäéððçúí ÓðóðçíÛðçúí Äñ÷äðí êäé Ðñíóäñððäðäí

Äéä ðä äðëð äêäóóðçôäðçôä, äñëäð íä äçíëíðñäððäðä ðä ðäñäéÛððð óðóððíäðä äñ÷äðí êäé ðñíóäñððäéð:

óçíäðí ðñíóÛñçðçðçð	ìÿääëíð óä GB
/compat/linux/oracle	45 GB
/compat/linux/sapmnt	2 GB
/compat/linux/usr/sap	2 GB

Äðíäéä äððçðð äðäñäðçðçúí íä äçíëíðñäððäðä êäé ðäñéÿððð óðíäÿðíðð. ÄéäðñäðéëÛ ôí ðñüäñäíä äêäóóðçôäðçôä ôíö **SAP** êä ðäñäðñíäëäð.

íðíβò ðáβíáé áéáéÿóéíò ðííí áí áβóðá ðáéÛòçð ðá ðñíóááç OSS). Ááβðá çç óçíáβòç 0171356 áéá çç ëβóðá áðí ðáéÿðá RPMs ðíð ðñáéÛáóðá.

Áβíáé áðβòçð áóééòí ðá äçíéíðñáðóðá áðëðð òíðð éáðÛéççíòð óðíáÿòíòð (áéá ðáñÛááéáíá áðí ðá *de_DE* éáé *en_US*), áééÛ ðñíðáβíòíá ðá íç ðÛíáðá ðÛðé óÿóéíí áí ðñíéáéðáé áéá íç ðÛíçíá ðáñááüáðð (òóóóóíí áóóó ÿ ðáé ðÿ ðñé óðéáíðð äíðéÿðáé ðññð ðñíáççíá óá óýóóçíá IDES). Éá ðñáéáóðáβðá ðéð áéüéíððð ðíðééÿð ðñéíβóáéð:

```
de_DE.ISO-8859-1
en_US.ISO-8859-1
```

Ïé óýíááóíé ðííííí ðá äçíéíðñáççíí ðá ðíí áéüéíðð ðñíðí:

```
# 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 ðé óýíááóíé ááí ððÛñ ðíðí, éá äçíéíðñáççíí ðñíáéðíáðá éáðÛ ççí ááéáðÛóðáç. Áí ááñíðóðá áððÛ ðá ðñíáéðíáðá, (íñβáííðáð ðí STATUS ðí ðñíáççíáóééðí äçíÛòí óá OK óðí áñ ðáβí CENTRDB.R3S), βòðð áβíáé ááýíáðí ðá óðíááéáβðá óðí SAP ðññð ðÛðíéá áðéðéÿí ðñíóðÛéáéá éáé óðáðÛçç ðñííð.

10.7.7.6 Ñýèíéóç ðíð ððñíá

Ôí SAP R/3 ðñáéÛáóðá áñéáðíýð ðñíððð áðí ðí óýóóçíÛ óáð. Áéá áóóó ðí éüáí ðñβóáíá ðéð ðáñáéÛòð ðáñáíÿðíðð óðéð ðñéíβóáéð ðíð ððñíá:

```
# 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 ðéóðáð ðéíÿð ðíð ðÿóíòíá ðñíÿñ ðíðáé áðí çç óáéíçñβòç ðíð SAP. Ïéá éáé ááí ððÛñ ðíðí ðáçáβáð áéá Linux, áéá ðáñéóóóðáñáð ðççñíòíññáð, ðñíðá ðéá ðáðéÛ óá áððÿð áéá ðí HP-UX (32-bit). Ïéá éáé ðí óýóóçíá áéá ççí ááéáðÛóðáç ðíð 4.6C SR2 ÿ ðáé ðáñéóóóðáñç íðíç, ðá áéáíéñáæüíáíá ðíðíáðá ðííííí ðá áβíáé ðáááéýðáñá, ðüóí áéá ðí SAP üóí éáé áéá ççí Oracle. Áðñÿíòð, áðééÿíðá ÿíáí ðáááéýðáñí áñééíü áéá ðá shared memory pages.

Óçíáßóóç: Ìá òçí ðñíáðéëááìÝíç áãéáðÛóóáóç òíð FreeBSD óá ì386, áðßóðá òá MAXDSIZ éáé DFLDSIZ óðí 1 GB òí ðíëÿ. ÁéáóñíáðéëéÛ, ìðñíáß ìá ááßóá ìá áìóáíßæííóáé ðáñíßáñáá óðÛëíáðá ùðòò "ORA-27102: out of memory" éáé "Linux Error: 12: Cannot allocate memory"

10.7.8 ÁãéáðÛóóáóç òíð SAP R/3

10.7.8.1 ÐñíáðéíÛæííóáð òá SAP CDROMs

Óðç áéááééáóßá òçð áãéáðÛóóáóçð àðëÝëííóáé áñêáðÛ CDROMs. Áí Ý ÷ áðá áñêáðÿð ìäçäíÿð, éá ìðñÝóáðá ìá òá ðñíóáñðßóáðá ùéá ìá ìéáð óðí óýóðçíá óáð. Áìáßð áðñíóáßóáìá ìá áíðéáñÛðñíðá òí ðáñéá ÷ ùíáñí òùí CDROMs óðíðð áíðßóðíé ÷ ìðð éáðáéùíáðð:

```
/oracle/SID/sapreorg/cd-name
```

ùðíð *cd-name* áíðéóðíé ÷ áß óá Ýíá áðù òá KERNEL, RDBMS, EXPORT1, EXPORT2, EXPORT3, EXPORT4, EXPORT5 éáé EXPORT6 áéá òçí áãéáðÛóóáóç óá 4.6B/IDES, éáé KERNEL, RDBMS, DISK1, DISK2, DISK3, DISK4 éáé LANG áéá òçí áãéáðÛóóáóç òíð 4.6C SR2. ¼éá òá ìíííáðá òùí áñ ÷ áßùí òóá ðñíóáñðçíÝíá CDs éá ðñÝðáé ìá áßíáé ìá éáðáéáßá, áéáóñíáðéëéÛ éÛííá ÷ ñßóç òçð áðééíáßð -g éáðÛ òçí ðñíóÛñóçç. ×ñçóéííðñéáßóðá éíéðùí òéð ðáñáéÛòù áíðñëÝð:

```
# mount_cd9660 -g /dev/cd0a /mnt
# cp -R /mnt/* /oracle/SID/sapreorg/cd-name
# umount /mnt
```

10.7.8.2 ÒñÝíðá òí Script òçð ÁãéáðÛóóáóçð

Áñ ÷ ééÛ ðñÝðáé ìá ðñíáðéíÛóáðá òíí éáðÛëíáí install:

```
# cd /oracle/SID/sapreorg
# mkdir install
# cd install
```

Óðç óðíÝ ÷ áéá ìáééíßóðá òí script òçð áãéáðÛóóáóçð, òí ìðñíßí éá áíðéáñÛðñáé ùéá òá ó ÷ áðééÛ áñ ÷ áßá ìÝóá óðíí éáðÛëíáí install:

```
# /oracle/SID/sapreorg/KERNEL/UNIX/INSTTOOL.SH
```

Ç áãéáðÛóóáóç òíð IDES (4.6B) Ýñ ÷ áðáé ìá Ýíá ðëßñòð ðñíóáñííóíÝíí óýóðçíá áðßááéíçð òíð SAP R/3, Ýóóé òðÛñ ÷ ìðí Ýíé CD EXPORT áíðß áéá ðñßá. Óá áðòù òí óçíáßí òí ðñùòððí áñ ÷ áßí áãéáðÛóóáóçð CENTRDB.R3S ðñííñßæáðáé áéá òçí áãéáðÛóóáóç òíð ááóééíÿ óðòðßíáðíð (òí ðáéí òí **R/3** éáé òç áÛóç áááñÝííí), ù ÷ é òçí éáíðñééß áðáñííáß IDES, Ýóóé ÷ ñáéÛæáðáé ìá áíðéáñÛðñáðá éáé òí áíðßóðíé ÷ ì CENTRDB.R3S áðù òíí éáðÛëíáí EXPORT1, áéáóñíáðéëéÛ òí R3SETUP éá æçðßóáé ìùíí òá ðñßá EXPORT CDs.

Ç ìáùðáñç Ýéáíóç **SAP 4.6C SR2** ðáñéÝ ÷ áé óÝóóáñá EXPORT CD. Òí áñ ÷ áßí òí ìðñíßí áéÝá ÷ áé òá áßíáðá òçð áãéáðÛóóáóçð áßíáé òí CENTRAL.R3S. Óá áíðßéáóç ìá òéð ðñíçäíÿíáíáð áéáùóáéð, ááí òðÛñ ÷ ìðí áéáóñíáðééÝð ìñòÝð áãéáðÛóóáóçð, áéá éáíðñééß áãéáðÛóóáóç ìá ð ÷ ùññð áÛóç áááñÝííí. Òí **SAP** ÷ ñççóéííðñéáß ðëÝíí ìéá áéáóñíáðééß áéááééáóßá áéá òçí áãéáðÛóóáóç òçð áÛóçð áááñÝííí. Áí éÝéáðá ùíðð ìá áðáíáéééíßóáðá òçí áãéáðÛóóáóç áñáùðáñá, áñêáß ìá ÷ ñççóéííðñéáðáðá ìáíÛ òí áñ ÷ ééù áñ ÷ áßí.

Ôüóí êáðÛ ðç äéÛñêáéá üóí êáé ðáðÛ ðçí áäéáðÛóóáç, ðí **SAP** áðáéðáß ç áíðíðP hostname íá áðéóðñÝóäé ðüí ðí ðñíá ðíð óðóððíáðíð óáð êáé ü÷é ðí ðññáð ðñíá (ðá ðíí ðñÝá). ÁðñÝíð, áððá ðñèìðóðá ðí ðñíá ðá áóðü ðíí ðñüðí, P ÷ ðçóéíðíéðóðá êÛðíéí alias áðñíðáð alias hostname='hostname -s' ðüóí áéá ðíí ÷ ðñðóç orasid üóí êáé áéá ðíí ÷ ðñðóç sidadm (êáé áéá ðíí root ðíðÛ÷éóóíí êáðÛ ðçí áäéáðÛóóáç, ðéáð êáé üéá ðá áðíáðá áðñíðáé ððroot). Áðíáé áððóçð ðééáíü íá ðñíðíðíéðóðáðá ðá áñ÷áß .profile êáé .login ðüí äýí ÷ ðçóððí ðíð äçíéíðñáðéçéáí êáðÛ ðç äéÛñêáéá áäéáðÛóóáçð ðíð **SAP**.

10.7.8.3 Áêêðíçðç ðíð R3SETUP 4.6B

Áäáééüèáððá 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 áäéáðÛóóáçð:

```
# cd /oracle/IDS/sapreorg/install
# ./R3SETUP -f CENTRDB.R3S
```

Ôí script éá óáð êÛíáé ðñééÝð áñüððóáéð (ðé ðñíððééíáÝð óáðñíðáé ðá áäéýéáð, êáé áéíéíðéíýíðáé áðü ðçí ðéíð ðíð äüèçéá ðð áðóíáð):

Áñðóçç	Ðñíáðééíáð	Áðóíáðð 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		850 Enter (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 áíóεäñÛðáε ðá CDð ðá äεáóìñáðέέëíýð εáóáεüüäìòð, ðüðá ðì ðñüäñäñìá ääεáðÛóðáççð ðìò SAP ää εá ìðìñÝóáε íá äñáε ðá CD ðá ìðìßá ÷ ñáεÛäáðáε (εáε ðá ìðìßá áíááññßæííðáε áðü ðì äñ ÷ äßì LABEL . ASC ðìò äñßóεáðáε ìÝóá ðá áððÛ) εáε εá óáð æçðçεäß íá áεóÛäáðá εáε ðñìóáñðÞóáðá ðá CD εáε íá äðéääáεðóáðá ðì óçìäßì ðñìóÛñðççð.

Ïì CENTRDB . R3S ìðìñáß üìð ñá ðáñÛäáε ìáñέÛ óóÛεíáðá. Óçç ðáñßððòóÞ ñáð, ñáð æÞççóá ñáíÛ ðì EXPORT4 CD äεÛ ñáð Ýäáεíä ðì óúóðü εεáεäß (6_LOCATION, ñáðÛ 7_LOCATION εεð.), εáε Ýðóε ìðìñáßðá íá óðíä ÷ Þóáðá äÛæííðáð ðéð óúóðÝð ðεíÝð.

Áεòüð áðü εÛðíεá ðñìæÞíáðá ðìò áíáóÝñìíðáε ðáñáεÛòü, ç ääεáðÛóðáççð εá ðñÝðáε íá εðεßóáε ñáεÛ, ìÝ ÷ ñé ðì óçìäßì ðìò εá ÷ ñáεáóðáß íá ääεáðáóðÞóáðá çç äÛçç äääñÝíúí ççð Oracle.

10.7.8.4 Áέêßççç ðìò R3SETUP 4.6C SR2

Áääáεüεäßðá üðé Ý ÷ äðá ññßóáε óúóðÛ ðì LD_LIBRARY_PATH. Ç ðεíÞ ççð ñáðááεççðð äßíáε äεáóìñáðέέëÛ áðü ççí áíðßóðíé ÷ ççð ääεáðÛóðáççð ðìò 4.6B ñá ççí **Oracle 8.0.5**:

```
# export LD_LIBRARY_PATH=/sapmnt/PRD/exe:/oracle/PRD/817_32/lib
```

ÍäεéíÞðá ðì R3SETUP ùð root áðü ðìí εáðÛεíäí ääεáðÛóðáççð:

```
# cd /oracle/PRD/sapreorg/install
# ./R3SETUP -f CENTRAL.R3S
```

Τì script εá óáð εÛíáε ìáñέÛÝð äñððóáεð (íé ðñìáðέέëíäÝð óáßñìíðáε ðá ääεýεäð εáε áεíεíðεíýíðáε áðü ççí ðñáñìáðέέëÛ äßóíäí):

Άñðççç	ÐñìáðέέëíäÞ	ΆέóáäüäÞ äääñÝíúí
Enter SAP System ID	[C11]	PRD Enter
Enter SAP Instance Number	[00]	Enter
Enter SAPMOUNT Directory	[/sapmnt]	Enter
Enter name of SAP central host	[majestix]	Enter
Enter Database System ID	[PRD]	PRD Enter
Enter name of SAP db host	[majestix]	Enter
Select character set	[1] (WE8DEC)	Enter

10.7.11.1 Öüñòùòç òçð ÄÛòçð ÄääñÝíúí

Óòç òðíÝ ÷ áëá, áíÛëíäá ðä ôí áí äß ÷ áðá ðñéí äðéëÝíäë Ýíñäí ð ü ÷ é, ððñäßðá äßðá íá íäëéíðóáðá ôí R3SETUP áðü òçí äñ ÷ ð, ð íá òðíä ÷ ðóáðá òçí äêðÝëäòç ôíð. Ôí R3SETUP êá äçìéíðñäðóáë êáë êá öíñððóáë ðá äñ ÷ éëÛ äääñÝíá òçð äÛòçð (äëá 46B IDEs, áðü ðá EXPORT1 ðá EXPORT6, äëá 46C áðü DISK1 ðá DISK4) ëÛííðáð ÷ ñðòç ôíð R3load.

¼ðáí ç öüñòùòç òçð äÛòçð äääñÝíúí íëíëççñùëäß (ððñäß íá ÷ ñäëáóðíýí íäñéëÝð ðñäð), êá ÷ ñäëáóðáß íá ññóáðá íäñéëíýð ëùäëéíýð. Äëá äíëëíáðóéëÝð ääëáðáððÛóáëð, ððñäßðá íá ÷ ñçóéíðíëðóáðá ôíðð áíùóðíýð ðñíäðéëääíÝíðð êùäëéíýð (áí ððÛñ ÷ äë èÝíá áóðÛëäëáð, ÷ ñçóéíðíëðóáðá äëáóíñäðéëíýð!):

Äñðòçòç	Äßóíäíð äääñÝíúí
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 áðòü ôí òçíäßí äß ÷ äíá íäñéëÛ ðñíäëðíáðá ðä òçí áíòíëð ðíðñtab êáðÛ òçí ääëáðÛóðáòç ôíð 4.6B.

10.7.11.2 Listener

Íäëéíðóáðá ôí Oracle Listener ùð ÷ ñðòçð orasid ðä ôí áëüëíðèí ðñüðí:

```
% umask 0; lsnrctl start
```

Áí ää ôí ëÛíäðá, ððñäß íá óáð äíðáíéóðáß ôí óðÛëíá ORA-12546 êáëðð óðá sockets äáí êá Ý ÷ íðí ññéóðáß íë êáðÛëççëäð Ûäëäð. Ääßðá òçí Óçíäßòçð 072984 ôíð SAP.

10.7.11.3 Áíáíäðííðáð ðíðð ðßíäëäð MNLS

Áí Ý ÷ äðá óëíðü íá áëóÛäðá äëðóáðð äêòüð ðñí Latin-1 óðí SAP, êá ðñÝðäë íá áíáíäðóáðá ôíðð ðßíäëäð Multi National Language Support. Áðü ðññëñÛððáðé óðá SAP OSS Notes 15023 êáë 45619. ððñäßðá ùíùð áí èÝëäðá íá ðññäëÛððáð áðòü ôí äðíá êáðÛ òçí ääëáðÛóðáòç ôíð SAP.

Óçíäßòçð: Äêùìç êáë áí äáí ÷ ñäëÛäëáðá ôí MNLS, êá ÷ ñäëáóðáß íá äëÝíäðá ôí ðßíäëä TCPDB êáë íá ôí äñ ÷ éëíðíëðóáðá, áí áðòü äáí Ý ÷ äë ðäç äßíäë. Ääßðá óðí SAP óêð óçíäëðóáëð 0015023 êáë 0045619 äëá ðññéóóüðñäð ðëçñííðíäð.

10.7.12 Äðíáðá ðäðÛ òçí ÄäëáðÛóðáòç

10.7.12.1 ¶ääëá ÷ ñðòçð äëá ôí SAP R/3

Êá ðñÝðäë íá æçððóáðá Ýíá Êëäëäß ¶ääëáð - License Key - äëá ôí SAP R/3. Ôí ÷ ñäëÛäëáðá, íëáð êáë ç ðñíóüñëíð

ΰάεά δίο ÷ ñçóείñδιεΠρόαά έαδΰ όçí ååέαδΰόόάόç, Ύ ÷ åέ έó÷ý ìüñ åέα δΎόόåñέδ åååñΰååδ. ΔñΎδαέ δñράά ίά άδιεδΠρόαάά οί hardware key. Οόίååέåβάά ùδ ÷ ñΠρόόçδ ìdsadm έάέ åέδåΎόάά οί saplicense:

```
# /sapmnt/IDS/exe/saplicense -get
```

Άέδåεπίδάδ οί saplicense ÷ ùñβδ δάνåΎδñίδ, όάδ åβίάέ ίέα έβόάά åδέεραπί. ¼όάί εΰååάά οί έέåέåβ ΰåέάδ, ìδñåβάά ίά οί ååέάόάόδΠρόαάά ίά οί δάνåΎδου δñüδí:

```
# /sapmnt/IDS/exe/saplicense -install
```

Όçç όóíΎ ÷ åέα, έá ÷ ñåέάόδåβ ίά åέδΰååάά δέδ åéüείδεåδ δέίΎδ:

```
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 Άçιείδñåβά × ñçόδπί

ΆçιείδñåΠρόαά Ύίάί íΎí ÷ ñΠρόόç όóí client 000 (åέα ìåñέΎδ åñåάόβåδ δίο ÷ ñåέΰæåόάέ ίά åβñóí ìΎόά όóí client 000, åέέΰ ìå ÷ ñΠρόόç åέάóñåδέέü åδü οίδδ sap* έάέ ddc). ΰδ ùñå ÷ ñΠρόόç όóíΠεùδ åδέέΎåíδåά οί wartung (P service όάå Åååέέέΰ). Όά δññóβε δίο ÷ ñåέΰæííόάέ åβίάέ όά sap_new έάέ sap_all. Άέα åδέδέΎíí áóδΰέåέά, ίέ εùåέεíβ öüí δññåδέέååñíΎíñí ÷ ñçόδπί όά üεíδδ οίδδ clients έά δñΎδαέ ίά åέέá÷εíýí (åóδü δåñέέåñåΰίάέ έάέ οίδδ ÷ ñΠρόδåδ sap* έάέ ddc).

10.7.12.3 Ñýεìέόç öüí Transport System, Profile, Operation Modes, έέδ.

ΎΎόά όóí client 000, ÷ ñΠρόδåδ åέöüδ öüí ddc έάέ sap*, ìδññíýí ίά εΰñóí δίδεΰ ÷ έόóíí όά åéüείδεå:

Åñååόβά	Transaction (Όόίåέέååβ)
Ñýεìέόç οίο Transport System, δ. ÷. ùδ Stand-Alone Transport Domain Entity	STMS
Άçιείδñåβά / δññíδñíβçόç οίο Profile ΌδóδΠιáδíδ	RZ10
ΌóíδΠñçόç Operation Modes έάέ Instances	RZ04

Άδδü έάέ üεά όά δδüεíδéά åΠιáόά ό÷ åδέέΰ ìå δέδ ñδèíβόåέδ ìåδΰ όçí ååέάδΰόόάόç δåñέåñΰóííόάέ όóíδδ íåçåíýδ ååέάδΰόόάόçδ οίο SAP.

10.7.12.4 Οñíδñδñβçόç οίο initsid.sap (initIDS.sap)

Όí åñ÷åβí /oracle/IDS/dbs/initIDS.sap δåñέΎ ÷ åέ οί åíδβåñåóí áóóåέåβåδ οίο δññóβε οίο SAP. Ååρ ÷ ñåέΰæåόάέ ίά ìñβόάάά οί ìΎååèδ όçç όάέίβåδ δίο έά ÷ ñçóείñδιεçεååβ, οίí όýδí όóíδβåόçδ έάέ üεά όά ό÷ åδέέΰ. Άέα ίά ìδñΎόíδåά ίά οί åέδåΎόíδåά ìå οί sapdba / brbackup, åέέΰííåά δέδ δάνåΎδου δέίΎδ:

```
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
```

Áðáíçãßóáéð:

compress: Ç ðáéíßá ðíð ÷ ñçðéíððíéíÿíá áßíáé ìßá HP DLT1 ç ðíðßá ðáñÛ ÷ áé óðíðßáóç ìÛóù ðëééíÿ.

archive_function: Áððü ìñßæáé ðíð ðñíáðééááíÛí ðñüðí ìâ ðíð ðíðßí èá áðíèçéáÿííðáé ðá áñ ÷ áéíèáðçíÛíá logs ðçð Oracle: ðá ìÛá logs áðíèçéáÿííðáé óðçí ðáéíßá, ðá Ñaç áðíèçéáðíÛíá áðíèçéáÿííðáé ìáíÛ èáé óðç óðíÛ ÷ áéá áéááñÛíðáé. Áððü óáð óßæáé áðü ðç ðáéáéðññßá áí ÷ ñáéáóðáß ìá áíáéðßóáðá ðç áÛóç áááíÛíáí ðá ðáñßððóç ðíð ìéá áðü ðéð ðáéíßáð Û ÷ áé ðñüáéçíá.

cpio_flags: ÐñíáðééááíÛíç áßíáé ç ÷ ñßóç ðíð -B ðíð ðíðßí ìñßæáé ðíð ìÛááèð èÛèá block óðá 5120 Bytes. Áéá ðáéíßáð DLT, ç HP ðñíðáßíáé ðíð èéáüðáñí 32 K ìÛááèð block, ððüðá èé áíáßð áßóáíá --block-size=128 áéá 64 K. Õí --format=newc ÷ ñáéÛæáðáé áéüðé Û ÷ ðíðá inode ìâ áñßèìçóç ìáááéÿðáñç áðü 65535. Ç ðáéáððáßá ðáñÛíáðñíð --quiet ÷ ñáéÛæáðáé áéáóß áéáóíñáðééÛ ðíð brbackup èá ðáñáðííáéáß ìâ ðíð ðíð cpio áíðáíßóáé ðíð áñéèíü ðüí blocks ðíð Û ÷ ðíð áðíèçéáððáß.

cpio_in_flags: Óá Flags ÷ ñáéÛæíðáé ðñíèáéíÛíð ìá ðíððéíÿíá ðá áááñÛíá áðü ðç ðáéíßá. Ç ìñðß áíé ÷ ìáÿáðáé áððüíáðá.

tape_size: Ç ðáñÛíáðñíð áððß áßíáé ÷ ðíðñééÛ ðíð ìÛááèð ÷ ññçðééüðççðáð ðçð ðáéíßáð. Áéá èüáèðð áóðÛèáéáð (÷ ñçðéíððíéíÿíá hardware óðíðßáóç), ç óéíß ðçð ðáñáíÛðñíð áßíáé èßáí ìééñüðáñç áðü ðíð ðñááíáðééü ìÛááèðð.

tape_address: Õí ðñíá óððéáððð (÷ ññßð áðíáðüðççðá áðáíáðÿééíçð ðçð ðáéíßáð) ðíð èá ÷ ñçðéíððíéçéáß ìâ ðíð cpio.

tape_address_rew: Õí ðñíá óððéáððð (ìâ áðíáðüðççðá áðáíáðÿééíçð ðçð ðáéíßáð) ðíð èá ÷ ñçðéíððíéçéáß ìâ ðíð cpio.

10.7.12.5 Ñðéíßóáéð ìáðÛ ðçí ÁæéáðÛóóáóç

Ëé áéüèèèé ðáñÛíáðñíð ðíð SAP èá ðñÛðáé ìá ñðéíèóðíÿíá ìáðÛ ðçí áæéáðÛóóáóç (ðáñáááßáíáðá áéá IDES 46B, èáé ìíßìç 1 GB):

¼ñíá	Õéìß
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 Óçíáßüóç 0013026:

¼ñíá	Õéìß
ztta/dynpro_area	2500000

SAP Óçíáßüóç 0157246:

¼íííá	Ôëíð
rdisp/ROLL_MAXFS	16000
rdisp/PG_MAXFS	30000

Óçíáßóóç: ðá ðéð ðáñáðÛíó ðáñáíÝðñíòð óá Ýíá óýóóçíá ðá 1 gigabyte ðíðíçð, ððíñáß íá äáßðá êÛðé óáí ðí ðáñáéÛòóó ðóí áóíñÛ ðçí éáðáíÛëóóç ðíðíçç:

Mem: 547M Active, 305M Inact, 109M Wired, 40M Cache, 112M Buf, 3492K Free

10.7.13 Ðñíáëðíáðá éáðÛ ðçí ÆêéáðÛóóáóç

10.7.13.1 Æðáíáêéëßçóç ðíö R3SETUP ðáðÛ ðçí Æéüñèóç Ðñíáëðíáðíð

Ôí R3SETUP éá óðáíáððóáé áí áíðéççðèäß êÛðíëíí óóÛëíá. Áí êíëóÛíáðá éáëÛ óá logfiles éáé áëíñèðóáðá ðí óóÛëíá, éá ðñÝðáé íá ðáéíðóáðá ðí R3SETUP áðü ðçí áñ÷ð, óðíðèòð äðéëÝáííóáð REPEAT óðí ðáëäððáßí áðíá áéá ðí ððíßí ðáñáðñíÝççá ðí R3SEÖUP.

Æéá íá äðáíáêéëßçóç ðí R3SETUP, áðèðð áðóðá ðçí ðáñáéÛòóó ðíðíçç ðá ðí áíðóðíé÷íí áñ÷ðáßí R3S:

```
# ./R3SETUP -f CENTRDB.R3S
```

ãéá ðçí Ýêáíóç 4.6B, ð ðçí áíðíççð

```
# ./R3SETUP -f CENTRAL.R3S
```

ãéá ðçí Ýêáíóç 4.6C, ÷ññðð íá Ý÷áé óçíáóáá áí ðí óóÛëíá ðñíèèðèççá áðü ðí CENTRAL.R3S ð ðí DATABASE.R3S.

Óçíáßóóç: Óá êÛðíëííá óðÛáéá, ðí R3SETUP ððíëÝðáé ððé ðóóíç ç áÛóç äááñíÝííí ðóí éáé ðí SAP Ý÷ííí ðáéëíðóáé éáé áêððáëíÝííáé éáíííëÛ (éáèðð ðññèáéðáé áéá áðíáðá ðíö Ý÷íííí ðáç ðíëèççññèáß). Áí ðñíëÝðííí êÛç, éáé áéá ðáñÛäáééíá äáí ððññáóá íá ðáéíðóáé ç áÛóç, ðáéëíðóáé ðçí áÛóç éáé ðí SAP ðá ðí ÷Ýñé, áóíÝ áëíñèðóáðá óá êÛç éáé ðñéí áêððáëÝóáðá íáíÛ ðí R3SETUP.

Ïç ðá÷Ûóáðá áðßóçð íá áêéëíðóáðá ðí Oracle listener (áêððáëÝóóá ðí ðð ÷ñððçð orasid ðá umask 0; lsnrctl start) áí áß÷á áéáéíðáß éáé áððü (áéá ðáñÛäáééíá óá ðéá áíááéáßá äðáíáêéëßçóç ðíö óóóðíáðíðíð).

10.7.13.2 OSUSERSIDADM_IND_ORA éáðÛ ðí R3SETUP

Áí ðí R3SETUP ðáñáðñíéÝðáé óá áððü ðí óçíáßí, ðñíðíðíéðóáðá ðí ðññóððííí áñ÷ðáßí ðíö R3SETUP ðíö ÷ñçóëííðíéáßðáé áêéëßç ðçí óðéáíð (ðí CENTRDB.R3S (4.6B) ð êÛðíëííí áðü óá CENTRAL.R3S ð ðí DATABASE.R3S (4.6C)). Æññáðá ðí [OSUSERSIDADM_IND_ORA] ð ðÛíðá ðíÝóá óðí áñ÷ðáßí áéá ðçí ðíááéëð äáñáð STATUS=ERROR éáé ðñíðéÝóóá óá ðáñáéÛòóó:

```
HOME=/home/sidadm (was empty)
STATUS=OK (had status ERROR)
```

Όζο οοίΎ ÷ áέά ιδιναβόά ιά ιάέείΠοάοά έάέ δΰέε οί R3SETUP.

10.7.13.3 OSUSERBSID_IND_ORA έάοΰ οί R3SETUP

Δέεάιι άβίάέ ιά δδΰñ ÷ áέ δñúáεçιά έάέ οά áοδú οί άΠία ιά οί R3SETUP. Οί δñúáεçιά άπ άβίάέ δάνúιεί ιά οί δñιçáιγίάι, οίο OSUSERSIDADM_IND_ORA. Άδεΰ οñιδιέΠοά οί άñ ÷ άβι δñιόγδιό διο ÷ ñçοείιδιέάβόά ιά οί R3SETUP (CENTRDB.R3S (4.6B) Π έΰδιεί άδú οά CENTRAL.R3S Π DATABASE.R3S (4.6C)). Άñάβόά οί [OSUSERBSID_IND_ORA] Π οΰίοά ιΎοά οοί άñ ÷ άβι áέά οçί ιιíáέέΠ άάñάοΠ STATUS=ERROR έάέ δñιόέΎοά οά δάνάέΰδú:

```
STATUS=OK
```

Οπñά οñΎίοά ιάίΰ οί R3SETUP.

10.7.13.4 “oraview.vrf FILE NOT FOUND” έάοΰ οç áέΰñέάέ Άάέάοΰοάοç οçο Oracle

Οί οοΰείά áοδú οçιάβίάέ úοέ Ύ ÷ άδú άδέέΎίάέ οί Oracle On-Line Text Viewer δñεί ιάέείΠοάοά οçί άάέάοΰοάοç. Ç άδέείάΠ άοδΠ άβίάέ δñιάδέέάñΎίç, δάν’ úεί διο άάί άβίάέ áέάέΎοείç οοί Linux. ΆοάέñΎοά έιέδúι άοδΠ οçί άδέείάΠ άδú οί ιάñΎ άάέάοΰοάοç έάέ ιάέείΠοάοά ιάίΰ.

10.7.13.5 “TEXTENV_INVALID” έάοΰ οçί ΆέοΎέάοç R3SETUP, οίο RFC Π οίο SAPgui

Άί άñάέάβόά άίοείΎδúδιέ ιά áοδú οί οοΰείά, οúοά άάί Ύ ÷ άδú οέδ οúοόΎδ οίδέέΎδ ñδèιβόάέδ. Ç οçίάβúοç 0171356 οίο SAP άίάοΎñάέ úέά οά RPMs διο ÷ ñάέΰειíοάέ ιά άάέάοάοάέιγί (δ.÷. saplocales-1.0-3, saposcheck-1.0-1 áέά RedHat 6.1). Οόçί δάνβδδúοç διο άάñΠοάοά úέά οά ο ÷ άδóέΰ εΰέç, έάέ άί áέúìç Ύ ÷ άδú ιñβόάέ οί STATUS άδú ERROR οά OK (οοί CENTRDB.R3S) έΰέά οññΰ διο δάνάδιέúοάί οί R3SETUP έάέ άδέβδ οί ιάέείñγοάοά άδú οçί άñ ÷ Π, οί SAP άάί έά ñδèιόόάβ οúοόΰ έάέ άάί έά ιδιναβόά ιά οοίάάέάβόά οοί ογόοçιά ιΎού διο SAPgui, áέúìç έάέ άί οί ογόοçιά οάδ Ύ ÷ áέ ιάέείΠοάέ. Δñιόδάεβίοάδ ιά οοίάάέιγί ιά οί δάέέú SAPgui Linux, άιόάίβόδçά οί δάνάέΰδú οοΰείά:

```
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 occured [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 οοιδάñέοιñΰ άοδΠ ιöάβέάοάέ οοί úοέ οί SAP R/3 άάί ιδιναβ ιά ιñβόάέ οúοόΰ οέδ οίδέέΎδ ñδèιβόάέδ έάέ άάί ιδιναβ οόç οοίΎ ÷ áέά ιά ñδèιβόάέ οίι άάοδú οίο (άέέάέδΠ άάñΎίά οόç áΰοç άάñΎίúι). Άέά ιά ιδιñΎοάοά ιά οοίάάέάβόά δñιόέΎοά οέδ δάνάέΰδú έάοά ÷ ùñΠοάέδ οοί DEFAULT.PFL (άάβόά Οçίάβúοç 0043288):

```
abap/set_etct_env_at_new_mode = 0
install/collate/active = 0
rscp/TCP0B = TCP0B
```

ἸάέεἰΠóðá ἰάἰÛ ðἰ **SAP**. Ὀþἠά ἰðἰἠάβðá ἰά óðἰάάεάβðá áέüçç έάέ áἰ ἰε ἠðεἰβóáέð ÷ þἠάð έάέ äεþóóáð äá äἰðέäÛἰóἰ üðüð έά ὕðἠáðá. ἈóἰÛ äεἰἠεþóáðá ðέð ἠðεἰβóáέð ðçð ÷ þἠάð (έάέ ἠἠβóáðá ðέð óúóðÛð ðἰðέέÛð ἠðεἰβóáέð), ἰðἰἠάβðá ἰά áóáέἠÛóáðá ðá ðáἠáðÛἰú áðü ðἰ DEFAULT.PFL έάέ ἰά äέðäεÛóáðá ðἰ **SAP** áðü ðçἰ áἠ÷P.

10.7.13.6 ORA-00001

Ὀἰ óóÛεἰά áððü ðἰ óðἰáἰðPóáἰá ἰüἠἰ ἰά ðἰ **Oracle 8.1.7** ðἰἰ FreeBSD. Ἰ έüáἰð Pðáἰ üðε ç áÛóç **Oracle** äáἰ ἰðἰἠἰóá ἰά ἠἠβóáέ ðέð óúóðÛð ðáἠáἰÛðἠἰðð áέá ðçἰ äέέβἰççP ðçð ἰá áðἰðÛέáóἰá ἰά έἰεεÛáέ, áðPἠἰðáð ðçἰáðἰἠἠáβð έάέ έἰεἰü ÷ἠçóðç ἰἰPἰç óðἰ óÛóðçἰá. Ç áðüἰáἰç ðἠἰððÛέáέá ἰά ἰάέεἰPóἰἰἰá ðç áÛóç äááἠÛἰú ἰáð äἰðÛἰέóá ðἰ óóÛεἰά ORA-00001.

Ἀἠάβðá ðἰðð ἰá ðçἰ áἰðἰεP `ipcs -a` έάέ áóáέἠÛóðá ðἰðð ἰá ðçἰ `ipcrm`.

10.7.13.7 ORA-00445 (Background Process PMON Did Not Start)

Ὀἰ óóÛεἰά áððü ἰðἰἠάβ ἰά äἰðáἰέóðáβ ἰá ðἰ **Oracle 8.1.7** üðáἰ ç áÛóç äááἠÛἰú ὕ ÷ äé äέέέἰçέáβ ἰá ðἰ script `startsap` (áέá ðáἠÛüáέáἰá `startsap_majestix_00`) έάέ óáἰ ÷ἠPóðçð `prdadm`.

Ἰέá ðέέáἰP έÛóç áβἰáέ ἰά ἰάέεἰPóáðá ðç áÛóç üð ÷ἠPóðçð `oraprd` έάέ ἰÛóü ðἰð `svrmgrl`:

```
% svrmgrl
SVRMGR> connect internal;
SVRMGR> startup;
SVRMGR> exit
```

10.7.13.8 ORA-12546 (ἸάέεἰPóðá ðἰἰ Listener ἰá ðέð ÓúóðÛð Pἠááéáð)

ἸάέεἰPóðá ðἰἰ **Oracle** listener üð ÷ἠPóðçð `oraids`, ἰá ðέð áέüεἰðέáð áἰðἰεÛð:

```
# umask 0; lsnrctl start
```

ἈέáðἠἠáðέέÛ ἰðἰἠάβ ἰά äἰðáἰέóðáβ ðἰ óóÛεἰά ORA-12546 ðἰð óçἰáβἰáέ üðε ðá sockets äáἰ ὕ ÷ἠἰóἰ óúóðÛð Üááέáð. Ἀάβðá ðç óçἰáβüðç 0072984 ðἰð SAP.

10.7.13.9 ORA-27102 (έέάέøç ἰἰPἰçð)

Ὀἰ ðἠüáέçἰá áððü ðáἠἰðóέÛóðçéá üðáἰ ÷ἠçóέἰðἰεPóáἰá ðέἰÛð ἰáááέÛðáἠáð ðἰð 1 GB (1024X1024X1024) óðέð ἰáðááέçðÛð MAXDSIZ έάέ DFLDSIZ. ἈðέðεÛἰἰ, ἰáð äἰðáἰβóðçéá ðἰ óóÛεἰά “Linux Error 12: Cannot allocate memory”.

10.7.13.10 [DIPGNTAB_IND_IND] έáðÛ ðçἰ ἈέðÛέáðç ðἰð R3SETUP

Ὀá äáἰέέÛð áἠáἠÛð, äáβðá ðç óçἰáβüðç 0130581 ðἰð SAP (R3SETUP step DIPGNTAB terminates). ἘáðÛ ðçἰ äáέáðÛóðáç IDES, áέá έÛðἰεἰ έüáἰ ç äέááέέáóβá äáέáðÛóðáçðð äá ÷ἠçóέἰðἰεἰÛá ðἰ óúððü üἠἠá óðóðPἰáðἰð ðἰð **SAP** “IDS”, áέέÛ ðἰ έáἠü " ". Ἀððü ἰäççááβ óá έÛðἰεá ἰέέἠÛ ðἠἰäεPἰáðá ἰá ðç ðἠüóááçç óðἰðð έáðáέüáἰðð ἰέá έάέ óá ἠἠðÛóέá äçἰεἰðἠáἰÛἰóáέ äἰáἰέέÛ ἰá ðç ÷ἠPóç ðἰð *SID* (óðç ðáἠβððüðP ἰáð IDS). ðἠÛáἰá ðἰð óçἰáβἰáέ üðε áἰðβ ἰá äβἰáέ ç ðἠüóááçç óðἰ:

```
/usr/sap/IDS/SYS/...
```

```
/usr/sap/IDS/DVMGS00
```

εά ðñíóðáèÐóáé íá áβíáé óðí:

```
/usr/sap//SYS/...
/usr/sap/D00
```

Ãέα íá óðíá÷βóíòíá ìá ðçí áãéáðÛóðáóç, äçìéíðñáÐóáíá Ýíáí óýíááóíí êáé Ýíáí áðéðëÝíí êáðÛëíáí:

```
# 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 áðüü ðí áβáíáí áðβóçð óðéð ðçíáεðóáéð 0029227 êáé 0008401 ðíð SAP. Ãáí áíðéíáðüððβóáíá üíüð êáíÝíá áðü áððÛ óá ðñíáèÐíáðá ìá ðçí áãéáðÛóðáóç ðíð **SAP 4.6C**.

10.7.13.11 [RFCRSWBOINI_IND_IND] êáðÛ ðçí ÁêðÝéáóç ðíð R3SETUP

Ïí óðÛëíá áðüü áíðáíβóðçéá êáðÛ ðçí áãéáðÛóðáóç ðíð **SAP 4.6C**, êáé Ðóáí ðí áðíòÝéáóíá áíüð Ûεεíò óðÛëíáðíò ðíð ðñíÝéððá ðññβóáíá óðçí áãéáðÛóðáóç. Óá ðÝóíεáð ðñéðððβóáéð εá ðñÝðáé íá ááβðá óá áíðβóðíé÷á logfiles êáé íá áéíñèðóáðá ðí áñ÷ééü ðñüáεçíá.

Áí áóíý áεÝáíáðá óá logfiles áεáðéóððβóáðá üðé ðí óðÛëíá áβíáé ðñÛñáíáðé áðüü (εíεðÛíðá ðéð ðçíáεðóáéð ðíð SAP), ìðññáβðá íá ðñβóáðá ðí STATUS óá áðüü ðí áÐíá áðü ERROR óá OK (óðí áñ÷áβí CENTRDB.R3S) êáé íá áêðáεÝóáðá íáíÛ ðí R3SETUP. ÌáðÛ ðçí áãéáðÛóðáóç, ðñÝðáé íá áêðáεÝóáðá ðí RSWBOINS áðü ðç óðíáεéááÐ SE38. Ááβðá ðç ðçíáβüóç 0162266 ðíð SAP áéá óá RFCRSWBOINI êáé RFCRADDBDIF.

10.7.13.12 [RFCRADDBDIF_IND_IND] êáðÛ ðçí ÁêðÝéáóç R3SETUP

¼ðüð êáé ðñéí, êáé ááþ εó÷ýáε ç βáéá εíáεèÐ: óéáíòñáððáβðá ðíεí áβíáé ðí ðñüðáñ÷ééü óðÛëíá εíεðÛáεííðáð óá logfiles.

Áí áðéááááεðóáðá üðé ç ðçíáβüóç ðíð SAP 0162266 áíðáðíññβíáðáé óðí ðñüáεçíÛ óáð, áðéÛ ðñβóáðá ðí STATUS óá áðüü ðí áÐíá áðü ERROR óá OK (óðí áñ÷áβí CENTRDB.R3S) êáé ðñÝíðá ðÛéé ðí R3SETUP. ÌáðÛ ðçí áãéáðÛóðáóç, ðñÝðáé íá áêðáεÝóáðá ðí RADDBDIF áðü ðç óðíáεéááÐ SE38.

10.7.13.13 sigaction sig31: File size limit exceeded

Ïí óðÛëíá áðüü ðñññáβ íá áíðáíéóðáβ êáðÛ ðçí áêèβíçóç ðüí áεáññááóéðí ðíð **SAP disp+work**. Áí ðáééíÐóáðá ðí **SAP** ìá ðí script startsap, íé ððíáεáññááóβáð εá áñ÷βóííí ðíðð, ðáééíðíðáð ðéð ððüεíéðáð áεáññááóβáð ðíð áðáéðíýíðáé áðü ðí **SAP**. Áðüü Ý÷áé ðð áðíòÝéáóíá ðí βáéí ðí script íá íçí áíññæáé áí éÛðé ðÐáá óðñááÛ.

Ãέα íá áεÝáíáðá áí üíðüð ðáεβíçóáí óüóðÛ íé áεáññááóβáð ðíð **SAP**, ðñíðá íéá íáðéÛ óçç εβóóá áεáññááóéðí ìá ðçí áíðíèÐ ps ax | grep SID, ç ððíβá εá óáð áðéóðñÝðáé íεáð εβóóá ìá üεáð ðéð áεáññááóβáð áðü óá **Oracle** êáé **SAP**. Áí óáβíáðáé óáí íá εáβðíòí ðáééÝð áεáññááóβáð, Ð áí ááí ðñññáβðá íá óðíááεáβðá óðí **SAP**, εíεðÛíðá óá áíðβóðíé÷á

logfiles óä ðíðá ðíðíííí íä äñäëííí óðíí êáðÛëíäí /usr/sap/SID/DVEBMGSnr/work/. Óä äñ÷äá ðíð ðñÝðäé íä êíéðÛíäðä äáíäé óä dev_ms êäé dev_disp.

Ôí Signal 31 êä äíðáíéóððáß áí ç ðíóóóçðá ðçð êíéíðð ðíðíçð ðíð ÷ñçóéíðíéäáððäé áðí óä Oracle êäé SAP íäðñÛóäé ôí ðíðäëíð ðíð Ý÷äé ðäç ðíéóððáß êáðÛ ðç ðíýíéóç ðíð ðñðíá. Ìä ôí íä ðíððáðä íéä ðääéýððñç ðéíð êä ðíð Ýóððä íä ðñíððñÛóððä ôí ðñíðäéçíä áððí:

```
# ðääéýððñç ðíðíç äéä óððððíäðä ðñäáäùäðð 46C:
options SHMMAXPGS=393216
# ðéñíððñç ðíðíç äéä óððððíäðä 46B:
#options SHMMAXPGS=262144
```

10.7.13.14 Áíäðéðð ÷ ðð Äêéðíçççç ôíð saposcol

ÔðÛñ÷íðí äððçð ðñééÛ ðñíäéðíäðä íä ôí ðñíðññíä saposcol (Ýéäíóç 4.6D). Ôí SAP ÷ñçóéíðíéäáð ðíð saposcol äéä íä óðéëÝíäé ääñíÝíä ó÷äðééÛ ðä ðéð äðéäüóäéð ðíð óððððíäðíð. Ôí ðñíðññíä áððí ääí ôí ÷ñäéÛäóððä äéä íä äêðäéÝóððä ôí SAP, ðíððä ðíðñáß íä êäññçéäß ðð ðéñíððñç ççíäóððäð. Ðäéäéüðññð äêäüóäéð (4.6B) äíðéäýíðí, äééÛ ää óðéëÝíðí ðéä óä ääñíÝíä (ðíéëÝð êéððáéð äðéóðñÝíðí 0, äéä ðñÛäéäíä ç ÷ñðçç ðçð CPU).

10.8 Ðñí÷ñçíÝíä ÈÝíäðä

Áí Ý÷äðä ççí äñíðá ððð êäéðíðñäáß ç óðíäáóóóçðá íä äóäñíäÝð Linux, ðúðä êä ðñÝðäé íä äéäáÛóððä ðç ðñäéÛðð äíðóçðä. Óä ðñäéóóóððñä áðí ðóä Ý÷íðí äñäððáß äáíäé ääóéóíÝíä óðçí çäéðñíééð éðððä ääíéðí óðççððáíí ðíð FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-chat>) êäé Ý÷íðí äñäððáß áðí ôí Terry Lambert <tlambert@primenet.com> (Message ID: <199906020108.SAA07001@usr09.primenet.com>).

10.8.1 Ððð Èäéðíðñäáß;

Ôí FreeBSD ðñééÝ÷äé Ýíä äðððäñí äóäðñäóçð (abstraction) ðíð ðñíÛäðäé “execution class loader”. Áððí ääóðäðäé óðí execve(2).

Áððí ðíð óðíäááíäé äáíäé ððé ôí FreeBSD Ý÷äé ðéä éðððä ðíððððí (loaders), áíðð äéä Ýíä ðíð íä êáðäðäýääé óä ðñðððððçç äðíðð÷äð óðí #! äéä íä ðñÝíäé êÛðíéí shell interpreter ð shell script.

ÉóðíñééÛ, ð ðíðð ðíððððððð óðç ðéäðððñíä ðíð UNIX Ýéää÷ä ðíð ðäééü äñéèü (äáíééÛ óä ðñððä 4 ð 8 bytes ðíð äñ÷äáíð) äéä íä ääé áí äáíäé êÛðíéí äêðäéÝóéí / äóäñíäð äíðððð ðíð óýóðçíä, êäé óðçí ðñðððððçç áððð íä êäéÝóäé ôí áíðððíé÷í ðíððððð.

Áí ôí äñ÷äáí ääí ððáí äêðäéÝóéí ðä äÛóçç ðíð óýððí ðíð óððððíäðíð, ç êéðçç óðí execve(2) äðÝóððñäðä êÛðíéí óðÛéíä, êäé ôí shell ðñíððäéíýðä íä äêðäéÝóäé ôí äñ÷äáí ððáí shell script.

Ç ääíééð êäÝä ððáí “áí ääí äáíäé äêðäéÝóéí, ðñíððððççç íä ôí ðñÝíäéð ðð shell script ðä äÛóççç ôí ðñÝ÷íí shell”.

Äñäüðñä, äñÝççä Ýíäð Ýíððíð ðñðððð ðððä ôí sh(1) íä äéÝä÷äé ðíðð ðñððíðð äýí÷ä äñäéððñäð, êäé áí ððáí : \n, ðúðä êäéíýðä ôí shell csh(1) (ðéóðäýíðíä ððð ç éýóçç áððð äñÝççä äñ÷äéÛ áðí ðç SCO).

Áððí ðíð êÛíäé ððñä ôí FreeBSD äáíäé íä äéäðñÝ÷äé ðç ðéððä ðä ðíððð ðíðð ðíððððð, ðä Ýíä ääíééü ðíððððð #! ð ðíððð äíäáíðñäé ðð äéäñíçíÝíä (interpreter) ðíðð ÷äñäéððñäð áðí ôí äðíðñí êäíí ðäðÛ ðíð! êäé ðÝ÷äé ðíð ðÝéíð, äñð áí ääí äíäáíðñéóððáß êÛðíéíð, ÷ñçóéíðíéäáððäé ðð Ýó÷äçç éýóççç ðíð /bin/sh.

Ãéá ôçí ððíóðÞñéíç ôíð Linux ABI, ôí FreeBSD äëÝðáë ôíí íááëéü àñëèü ôíð ELF binary (ää áíááñññäëéä ôç äéáöíñÛ áíÛíáóá óá FreeBSD, Solaris, Linux, P êÛðíëí Ûëëí äéäôíðñäëéü óýóðçíá ôí ððíðí ÷ ñçóëíððíëáá ãñ ÷ ááá óýðíð ELF).

Ï òíñðüððð ELF êíëðÛäë äéá Ýíá äéäéëü *brand*, ôí ððíðí ááíáé íéá áíüðçðá ó ÷ ðëòí ìÝóá óðí ELF image, éáë ôí ððíðí äáí ððÛñ ÷ äé óá ELF binaries äéá SVR4/Solaris

Ãéá íá äéäôíðñäëéü óá äéðäëÝóëíá ôíð Linux, éá ðñÝðáë íá ááííóí *branded* (íáñëáñëóðíýí) ùð Linux ìÝóá óçð *brandelf(1)*:

```
# brandelf -t Linux file
```

¼óáí ááíáé áððü, Ï òíñðüððð ELF éá äëÝðáë ôí Linux brand ðÛíü óðí ãñ ÷ ááí.

¼óáí Ï òíñðüððð ELF äáë ôí Linux brand, éá áíðééáðáóððáë Ýíáí äáëððç ìÝóá óçç ãñP *proc*. ¼éäð íë êëðóáëð ôíð óðóððíáðíð óáíëíñíýíðáë ìÝóá áðü áððüí ôíí äáëððç (óá Ýíá ðñááííóéáëü óýóðçíá UNIX, Ï äáëððçð éá ððáí Ï ðáíáéáð *sysent[]*, ðíð ðñáñÝ ÷ äé ðéð êëðóáëð ôíð óðóððíáðíð (system calls)). ÁðëðëÝíí, ç äéáñááóáá óçíáëðíáðáë äéá äéäéëP ìáðá ÷ ááñéóç ôíð trap vector éáë Ûëëäð (íéëñÝð) äéíðëðáëð, ðéð ððíðáð ÷ äéñäëáðáë ôí Ûñëñüíá ððñíá óçð óðíááðüðçðáð Linux.

Ïí system call vector ôíð Linux ðñáñÝ ÷ äé, ìáðáíý Ûëëüí, íéá êëðóá íá óá äááñÝíá ôíð *sysent[]* ðüí ððíðí ðé äéäðëýíðáë ãñðéííðáë ìÝóá óðí Ûñëñüíá ôíð ððñíá.

¼óáí ááíáðáë íéá êëðç óðóððíáðíð áðü íéá äóáñíñäP Linux, Ï êðáééáð (trap code) ðñíðíðíëáá ôíí äáëððç ðçð ìÝóá óçç ãñP ððíð ðíð Ý ÷ äé äááñáóáá óðí *proc*, éáë äéëÛäë óçí äéáýðéíóç ððáá íá äáá ÷ íáë óðí óçíááí äéóüüíð ðçð óðíÛñðççð ôíð Linux, éáë ù ÷ é ôíð FreeBSD.

Áððçðð, ôí óýóðçíá óðíááðüðçðáð ìá Linux ððíñáá éáë ðñíóáñíñäë äóíáíëÛ ðéð ðíðíëáðáð áíáëððççðð.

ÏðóéáðéëÛ áððü êÛíáé éáë ç äðëéíäP *union* éáðÛ óçí ðñíóÛñðççç áíüð óðóððíáðíð ãñ ÷ ááí (ääí áíñíýíá äáð ôí óýóðçíá ãñ ÷ ááí ððíñ *unionfs*!). Áñ ÷ éëÛ, ááíáðáë áðððáëñá íá ãñäéáá ôí ãñ ÷ ááí óðíí éáðÛëíñ

```
/compat/linux/original-path, éáë ìüíí áí áððü áðíóý ÷ äé, éá ááíáé áíáëððççç óðíí éáðÛëíñ /original-path.
```

Ï ðí ðñüðí áððü óéáíðñáýíðíá ùðé óá äéðäëÝóëíá ðíð ÷ ñáëÛäëíðáë Ûëëá äéðäëÝóëíá éá ðñÝíðí (äéá ðñáÛäáëäíá, ôí óýñëí ãñááëááüí ôíð Linux ððíñáá íá äéðäëÝóëíá ìÝóá óçç ððíðððñéíçð ôíð Linux ABI). Áððçðð óçíááíáé ùðé óá äéðäëÝóëíá ôíð Linux ððíñíýí íá òíñððíðí éáë íá äéðäëÝóëíá ãñ ÷ ááí ôíð FreeBSD áí äáí ððíñíýí íá áíóððáóíð óá áíððóðíé ÷ á ãñ ÷ ááí óðí Linux. Ïðíñááðá áððçðð íá ðíðíëáððáðá íéá áíóíëP *uname(1)* ìÝóá óðí */compat/linux* ðñíëáëÝíñ óá ãñ ÷ ááí ôíð Linux íá ìç ððíñíýí íá áíááñññððíðí ùðé äáí ÷ ñçóëíððíëýíðáë ðñááíáðéëÛ óá Linux.

ÏðóéáðéëÛ, ððÛñ ÷ äé Ýíáð ððñíáð Linux ìÝóá óðíí ððñíá ôíð FreeBSD. Íë äéÛòíñáð äéäôíðñäëéü ðé ððíðáð ðëíðíëýíýí ùéäð ðéð ðççñáðáð ðíð ðñáÝ ÷ ííðáë áðü ôíí ððñíá ááíáé ðáéäð ðüóí óðíí ðáíáéá êëðóáí óðóððíáðíð ôíð FreeBSD ùóí éáë óðíí áíððóðíé ÷ Ï ôíð Linux: äéäôíðñäëéü ôíð óðóððíáðíð ãñ ÷ ááí, äéëíéëP ðíðç, äéá ÷ ááñéóç óçíÛðüí, System V IPC êëð. Ç ìüíç äéáöíñÛ ááíáé ùðé ôí äéðäëÝóëíá ôíð FreeBSD êÛííðí ÷ ñðçç ðüí óðíáñððáüí *glue* ôíð FreeBSD, áñ ðá äéðäëÝóëíá ôíð Linux, êÛííðí ÷ ñðçç ðüí óðíáñððáüí *glue* ôíð Linux (ðíëëÛ áðü óá ðáéëÛ äéäôíðñäëéü áá ÷ áí ðéð äéëÝð ðíðð óðíáñððáëð *glue*: íë äéäðëýíðáëð ðüí óðíáñððáüí ãñðéííðáí óðíí óáðáéëü ðáíáéá *sysent[]*, áíðá íá äéäðëñéíäëéü ìÝóá áíüð äóíáíëéýí äáëðç óçç ãñP *proc* ðçð äéáñááóááð ðíð ðñááíáðíðíëáá óçí êëðçç).

ðíëí ááíáé ùíðð ôí äááñÝð FreeBSD ABI; Äáí Ý ÷ äé éáë ðíëý óçíáóá. Ç ìüíç ááóéëP äéáöíñÛ ááíáé (êÛðé ôí ððíðí ððíñáá áýéíëá íá äéëÛíáé óá ìáëéíðéëÝð äéäüðáëð, éáë ðíëý ðéäáíí íá äéëÛíáé) ùðé íë óðíáñððáëð *glue* ôíð FreeBSD ááíáé óáðáéëÛ óðíáááíÝíáð óðíí ððñíá, áñ íë áíððóðíé ÷ äð ôíð Linux ððíñíýí ááðá íá ááíáé óðíáááíÝíáð óáðáéëÛ, ááðá íá ááíáé ðñíóáÛóëíáð ìÝóá áíüð ãñëñíáðíð ððñíá.

Ááíáé áððü ùíðð ðñááíáðéëP ãñíñáóç; ¼ ÷ é. Ááíáé íéá ðëíðíðççç ôíð ABI, ù ÷ é ãñíñáóç. Äáí ððÛñ ÷ äé êáíáá ãñíñáóç (P ðñíóñíáóç, äéá íá ðñíëÛáíðíá óçí áðüíáç óáð ãñðçççç).

άδτι Υία gigabyte ÷ þñī, áεεŪ έάέυ άβίαέ ίά Υ ÷ άδά έάδŪ ñō υόέ δñŸðάέ ίά άβίαέ άñέάδŪ ίάάŪέί έάά ίά έñάδŪάέ όά δάέŸόά δīō έŸέάόά ίά άάέάόάόδΡόάόά.

Ç έάδŪόιζός /usr δάñέŸ ÷ άέ όά δάñέόόυόάñά άñ ÷ άβά δīō άδάέόίγίόάέ έάά όçί όδīόόðñέίç όīō όόόόðίάόīδ, όç όόέέίάð όύί ports(7) (δñīόάβίάόάέ) έάέ όίí δçάάβί έðάέά (δñίάέñάόέέυ). Έάέ όά άγί άόδŪ άβίαέ δñίάέñάόέέŪ έάόά όçί άάέάόŪόόάç. ÓīōέŪ ÷ έόόίí 2 gigabytes δñīόάβίíόάέ έάά άόδð όçί έάδŪόιζός.

¼όάί άδέέŸάάόά ίŸάάέίδ έάά όέό έάόάόίΡόάέό, ίά Υ ÷ άόά όδŷόέί όάό όέό άδάέόðόάέό όά ÷ þñī. Ìδñίάβ ίά άβίαέ έβáí δñūάέçίά όί ίά ίάβίάόά ÷ ùñβδ ÷ þñī όά ίέά έάδŪόιζός άíð ÷ ñçόέίíδīέάβόά άέŪ ÷ έόόά ίέά Ūέεç.

Óçίάβύός: ÌάñέέŸό όīñŸό ç άδέέίάð Auto-defaults όīō έάόάόιçόð όīō sysinstall(8) ίδīñάβ ίά άδέέŸίάέ όīέý ίέέñū ίŸάάέίδ έάά όέό έάόάόίΡόάέό /var έάέ /. Δñīόόάέάβόόά ίά άδέέŸίάόά Ÿίόδīά έάέ άáίάέύάñά ίάάŸέç έάά όέό έάόάόίΡόάέό όάό.

11.2.1.2 Swap ΈάδŪόιζός

Íάό άìδάέñέέυδ έάíυíάό έάά ίά άδέέŸίάόά ίŸάάέίδ έάά όçί έάδŪόιζός swap άβίαέ: δñŸðάέ ίά άβίαέ δάñβδīō άέδέð άδī όί ίŸάάέίδ όçδ ίðìçδ (RAM) όīō όόόόðίάόīδ. Άέά δάñŪάέέάíá, άί όί ίç ÷ Ūίçίá Ÿ ÷ άέ 128 megabytes ίðìçδ, ç έάδŪόιζός swap δñŸðάέ ίά άβίαέ 256 megabytes. Óόόόðίάόά ίá έέάýδάñç ίðìç ίδīñίγί ίά άδīάβáíóí έάέýόάñά ίá δάñέόόύόάñī swap. Έέάýδάñī άδī 256 megabytes swap άáí δñīόάβίάόάέ έάέ δñŸðάέ ίά άíάόάόάβ ç άδŸέόάόç όçδ ίðìçδ. Íέ έέάýñέέίέ VM paging όīō δδñðίά άβίαέ Ÿόόέ όόέάáŸíñέ þόόά ίά άδīάβáíóí έάέýόάñά υόάί ç έάδŪόιζός swap άβίαέ όīōέŪ ÷ έόόίí άγί όīñŸό όί ίŸάάέίδ όçδ έάíόñέέðδ ίðìçδ. Άί ñόέíβόάόά όīέý ίέέñū swap, ίδīñάβ ίά Ÿ ÷ íóí ίάέύíŸç άδŷáíóç íέ έέάýñέέίέ όŪñύόçδ όάέβáυí όīō όδīόόόðίάόíδ VM έάέ ίδīñάβ άñáýδάñά ίά çìέíóñάçέíγί δñīάέðίάόά άí δñīόάέάβ δάñέόόύόάñç όόόέéð ίðìç.

Óά ίάάάέýόάñά όόόόðίάόά ίá δīέέάδέíýδ SCSI άβόέíóδ (ð δīέέάδέíýδ IDE άβόέíóδ όά έέάóīñάόέέíýδ έέάάέóŸό), άβίαέ δñīόέíυόάñī όί swap ίά άβίαέ ñόέíóçíŸí όά έŪέá άβόέí (íŸ ÷ ñέ όŸόόáñέό άβόέíóδ). Íέ ίá ÷ ùñέόóŸό έάόάόίΡόάέό swap έάέυ άβίαέ ίά Ÿ ÷ íóí δάñβδīō όί βáέí ίŸάάέίδ. Í δδñðίάό ίδīñάβ ίá ÷ άέñέόόάβ άδέάβñάόά ίάάŸέç swap, áέέŪ íέ άóυδάñέέŸό áñŸό áááñŸíυí ñόέíβáíóáέ ίá áŪόç όί ίŸάάέίδ όçδ ίάάάέýόάñç έάδŪόιζόςδ swap. Έñάόðíάό όçί έάδŪόιζός swap ó ÷ ááýí óóí βáέí ίŸάάέίδ έá άδέόñŸόάέ όóíí δδñðίά ίá άάέόέóóíδīέΡόάέ όçί ÷ ñþόç όīō swap, ñέñŪάέíóάό δέí έάέŪ όί óυñóí όά έŪέá άβόέí. Άáí δάέñŪάέ ίά Ÿ ÷ άόά ίάάŪέí ίŸάάέίδ swap, áέύíá έάέ άί áá ÷ ñçόέííδīέάβόάέ άñέάδŪ. Ìδīñάβ ίά άβίαέ άόέíέυόάñç ç άíŪέάíçç άδī Ÿíá έέóυδ άέŸá ÷ íō δñūάñάíá δñīóíý ÷ ñάέάόόάβ ίá άδáíάέέέíðόάόά όí óýόçίá.

11.2.1.3 Άέάόβ ίά όέέŸίάόά έάόάόίΡόάέό;

Άñέάóíβ ÷ ñþόόάό ññβáíóí υόέ ίβá ίάάŪέç έάδŪόιζός έá άβίαέ άíóŪίáέ, áέέŪ όδŪñ ÷ íóí άñέάóíβ έυáíέ έέάόβ άόóυ άβίαέ έάέð έáŸá. Έάόáñ ÷ ðí, έŪέá έάδŪόιζός Ÿ ÷ άέ έέάóīñάόέέŪ έάέóíóñάέέŪ ÷ άñάέóçñέόέέŪ, ίδŷóá ίá ÷ ùñβáíóíάό όέό έάόάόίΡόάέό άδέόñŸíðíóíá όóí óýόçίá άñ ÷ άβυí ίά άíáññíβáέόάέ άíŪέíáá. Άέά δάñŪάέέάíá, íέ root έάέ /usr έάόάόίΡόάέό άβίαέ έδñβδ έάά άíŪáíυóç, ÷ ùñβδ δīέέŸό áááñáóŸό. Άíóβέáόά, áβñíóáέ δīέέŸό áíááíðόάέό έάέ áááñáóŸό όόέό /var έάέ /var/tmp.

ΈŪñíόάό óυóðð έάδŪόιζός όά Ÿíá óýόçίá, í έάόάέáñíáόέóíυδ δīō óóíáάβίáέ όά ίέέñūόáñάό έάέ δάñέόόύόάñī áááñŪóέíáδ έάόάόίΡόάέό ááí έá έέáññáýόáέ óóέó έάόάόίΡόάέό δīō έέάáŪάέíóáέ δέí óð ÷ íŪ áδŷ υόέ áñŪóííóáέ. Έñάόðíάό όέó δάñέόόύόάñī áááñŪóέíáδ έάόάόίΡόάέό δέí έííóŪ όόçí Ūέñç όíō άβόέíó, έá áóίçέáβ ç I/O άδŷáíóç óóέó έάόάόίΡόάέό υδīō έάέ ÷ ñáέŪάέόáέ δέí óð ÷ íŪ. Óþñά áíð ç áδŷáíóç I/O ÷ ñáέŪάέόáέ óóέó ίάάάέýόáñάό έάόάόίΡόάέό, áέέŪάέíóάό áóóŸό δέí έííóŪ όόçí Ūέñç όíō άβόέíó ááí έá íäçáðόáέ όά óçíáíóέέð άγίçç όçδ áδŷáíóç υóí όί ίá ίáόάέέíðόάόά όçí /var óóçí Ūέñç. ÓŸέíó, όδŪñ ÷ áέ έάέ έŸíá áóóŪέάέáó. Ìβá ίέέñð, δñīóááíŸíç root

Ôì ðεί äðëü óáíÛñεί äêêβίçóçð ðééáíüðáóá íá ïïÛæáé ìä òì 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
```

Ôì óáíÛñεί äðòù ðáñÝ÷áé ìéá stop êάέ ìéá start äðéεíäð äéá òçì äòáñìäð uðìð óòì ðáñÛäáéäìä ääð áíáóÝñäðáé óáí utility.

Ìðìñáβ íá äêééíçèáβ ÷ äéñìíáéêééÛ éÛñíðáò:

```
# /usr/local/etc/rc.d/utility.sh start
```

Ðáñüεì ðìð äáí äðáéóíýí üεäð ïé äòáñìäÝð íá ðñìóðáεäβ ìβá ääñáñäðð óòì rc.conf, ó÷ ääüí êáεçìáñéíÛ êάέ Ýíá íÝí port éä òñìðìðìεððä äéá íá äÝ÷äðáé äððð òçì ñýγείόç. ÄéÝñäñäðä òçì ðäéééð Ýñäñ òçð ääéáðÛóðáóçð äéá ðáñéóóüðáñäð ðεçñìíñβäð ðÛíù óðçì óðäéäêñéíÝíç äòáñìäð. ÌáñééÝð äòáñìäÝð äðì òñβðìðð éäðáóéäðáóóÝð ðáñÝ÷íð óáíÛñéá äêêβίçóçð óá ìðìβá äðéòñÝðìðì óðçì äòáñìäð íá ÷ ñçóéíðìéçèáβ ìä òì rc.d, ðáñüεä äððá, äðòù éä óðæçðçèáβ óòì äðìäñí ìÝñìð.

11.5.1 ÄêéðáðáíÝíç Νýγείόç Äòáñìäðì

ÐéÝíí òì FreeBSD ðáñéÝ÷áé òì rc.d, ç ñýγείόç òçð äêêβίçóçð òùí äòáñìäðì Ý÷áé äβíáé äðéεüðáñç, êάé ðεί ðεíýóéá óä ÷ äñáéðçñééÛ. × ñçóéíðìéçèáð éÝíáéð ééäéäβá ìÝóá óòìí êáðÛεíäñ rc.d, ïé äòáñìäÝð ìðìñíýí ðéÝíí íá äêééíýí Ýðáéóá äðì óðäéäêñéíÝíäð òðçñáóβäð äéá ðáñÛäáéäìä òçì DNS, ìðìñáβ íá äðéòñáðäβ ç äéóáäüäð äðéðéÝíí ðáñáíÝðññì ìÝóá äðì òì rc.conf óðçì èÝóç òùí ðæç òðÛñ÷óíðì ðáñáíÝðññì äðì óá óáíÛñéá äêééíðóçð, êééð. Ìá äáóééü óáíÛñéí ìðìñáβ íá ïïÛæáé ìä òì äéüεíðéè:

```
#!/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"}
```


11.7 × ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ FreeBSD

Contributed by Tom Rhodes.

Ὁ FreeBSD ἀποδοτῶν τὴν ἀρχὴν τοῦ NetBSD ἀπὸ τῆς ἀρχῆς τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD.

```
# /etc/rc.d/sshd restart
```

Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD.

```
natd_enable="YES"
```

Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD.

Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD.

```
# /etc/rc.d/sshd onerestart
```

Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD.

```
# /etc/rc.d/sshd rcvar
# sshd
$sshd_enable=YES
```

Ὁ ἀποστολῆς: Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD.

Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD. Ἡ ἀρχὴ τῆς ἀποστολῆς ἐστὶν ἡ ἀρχὴ τῆς ἀποστολῆς τοῦ NetBSD.

```
# /etc/rc.d/sshd status sshd is
    running as pid 433.
```


1. UP όγιάβιάε υέε ς εὺνóά άβιάε νóειέοιΎίϑ εάε Ύδιείϑ.
2. ς εὺνóά Ύ÷άε ιβά Internet αέάýεόίός (inet) νóειέοιΎίϑ (όά άόόP όϑί δάñβδóουός 192.168.1.3).
3. ÷άε ιβά Ύάεόñϑ ιὺóεά óñιáεέóýιό (netmask; 0xfffff00 άβιάε όι βάει ιά όι 255.255.255.0).
4. ÷άε ιβά Ύάεόñϑ broadcast αέάýεόίός (όά άόόP όϑί δάñβδóουός, 192.168.1.255).
5. ς αέάýεόίός MAC όϑό εὺνóάό (ether) άβιάε 00:a0:cc:da:da:da
6. ς άδέειάP όιό óóóειý ιΎόιό άβιάε όά εάóὺόόάός autoselection (media: Ethernet autoselect (10baseTX <full-duplex>)). Δάñάόϑñιýιά υέε ς dc1 Ύ÷άε νóειέόόάβ ιά όñΎ÷άε όάι 10baseT/UTP ιΎόι. Άέά δάñέόóυóáñάό δέϑñιόñβάó άέά όιόó óýδιόó όυι ιΎόυι άýυó ðáϑιý, δάñάέáϑ ιάόñΎιόά óόϑι óáεβάά áιϑεάβάó.
7. ς εάóὺόόάός όϑό όýιáάόϑό (status) άβιάε active, άϑε. Ύ÷άε άίόιδέόόάβ όPιá ιάόάóιñὺó. Óόϑι dc1, δάñάόϑñιýιά status: no carrier. Άόóυι άβιάε εíáεέυι άόιý όι εάεPáει Ethernet άáι Ύ÷άε óóιáεάβ ιά όϑί εὺνóά.

Άι όι ifconfig(8) áιόάιβáεάε εὺόέ δάñυιειί ιά áóóυι:

```
dc0: flags=8843<BROADCAST,SIMPLEX,MULTICAST> mtu 1500
ether 00:a0:cc:da:da:da
```

όγιάβιάε υέε ς εὺνóά άáι Ύ÷άε νóειέόόάβ.

Άέά ιά νóειβóόά όϑί εὺνóά óάó, εά ÷ñáεάóόάβóά δñιýιέá root. ς νýειέός όϑό εὺνóάό αέέόýιό ιδιñάβ ιά άβιάε άδι όϑί άñάñP άίόιεPι ιά όι ifconfig(8) áεεὺ εά δñΎδáε ιά όι άδάιáεὺάάόά όά εὺεά άδάιáεέβίϑός όιό óóóóPιáόιό. Όι άñ÷άβι /etc/rc.conf άβιάε áεάβ υδιόó δñΎδáε ιά δñιόéΎόάóά óέó νýειέόάέó όϑό εὺνóάό αέέόýιό.

Άñιβίόά όι άñ÷άβι /etc/rc.conf ιά όιι áááδϑιΎíι óάó εάείáññὺóι. Έά ÷ñáεάóόάβ ιά δñιόéΎόάóά ιβá άñάñP άέά εὺεά εὺνóά αέέόýιό διό óδὺñ÷άε óόι όýóόϑιá óάó, άέά δάñὺάáεáιá óόϑι δάñβδóουός ιάó, εά δñΎδáε ιά δñιόéΎόάóά óé áιPó άñάñΎó:

```
ifconfig_dc0="inet 192.168.1.3 netmask 255.255.255.0"
ifconfig_dc1="inet 10.0.0.1 netmask 255.255.255.0 media 10baseT/UTP"
```

Έά δñΎδáε ιά άίόéáόáóόPóáóά όι dc0, dc1, εάε ιýóυ εὺεά áιPó, ιά óέó óυóóΎó óóóéáóΎó όυι εάñóPι óάó, εάε óέó óυóóΎó áεáóεýιόáéó. Έά δñΎδáε ιά áéááὺóáóά όϑί óáεβáá áιϑεάβáó όιό ðáϑιý εάé όιό ifconfig(8) áéá δάñέόóυóáñάό éáδóñΎñéáó ó÷áóééὺ ιά óέó áδéóñáδñιáíáó δάñáιΎóñιόó éáé áδβóϑό όϑί óáεβáá áιϑεάβáó όιό rc.conf(5) áéá δάñέόóυóáñάό éáδóñΎñéáó ó÷áóééὺ ιά όϑι όýιόáιϑ όιό /etc/rc.conf.

Άι νóειβóόά όι áβéóóι óάó εάόά όϑί ááéáóὺόóάός, ιáñééΎó άñάñΎó ó÷áóééὺ ιά όϑι/óέó εὺνóά/εὺνóάό αέέόýιό éá óδὺñ÷ιόι Páϑ. ΆεΎáιόά áéδéὺ όι /etc/rc.conf δñιόιý δñιόéΎόáά áδéδéΎíι άñάñΎó.

Έά δñΎδáε áδβóϑό ιά áéιñεPóáóά όι άñ÷άβι /etc/hosts Póóά ιά δñιόéΎόáóά óά ιýιáόά éáé óέó IP αέάýεόιόáéó άδι óά áεὺóιñá ιϑ÷áιPιáόά óόι LAN óáó, άι άáι άβιάε Páϑ νóειέοιΎίá. Άέά δάñέόóυóáñάό δέϑñιόñβáó áιáóñΎιόά óόϑι óáεβáá áιϑεάβáó όιό hosts(5) éáé όιό /usr/share/examples/etc/hosts.

11.8.3 ΆíέéιΎó Έáé Άδβéóός Δñιáεϑιὺóυι

Ιύεéó εὺιáóά óέó ááóééΎó áééááΎó óόι /etc/rc.conf, εά δñΎδáε ιά άδάιáééειPóáóά όι όýóóϑιá óáó. Άόóυι éá áδéóñΎóáé óά δέéáΎó áééááΎó óóéó εὺνóάό ιά áóáñιόóιýíι, éáé ιά άδéáááεPóáóά υέé όι όýóóϑιá άδάιáééειáβ ÷ññβó éáíΎιá εὺειό óóéó νóειβóáéó.

Ιύεéó όι όýóóϑιá άδάιáééειϑεάβ, éá δñΎδáε ιά áñéειὺóáóά óέó εὺνóάό αέέόýιό.


```
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 Ἀνὰ τὴν Ἰσπανίαν

11.10.1 Ἰσπανία /etc

Ὁ Ἰσπανὸς ἰσπανόλογος ἀπὸ τὴν Ἰσπανίαν ἀπὸ τὴν Ἰσπανίαν. Ἰσπανόλογος ἀπὸ τὴν Ἰσπανίαν:

/etc	Ἰσπανόλογος ἰσπανόλογος ὅτι ὁ ἰσπανόλογος, 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
```

Όγιᾶβζός: 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 [Οἰκία 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 0¹. When setting this option, you will want to set `maxusers` to at least 4, especially if you are using the X Window System or compiling software. The reason is that the most important table set by `maxusers` is the maximum number of processes, which is set to $20 + 16 * \text{maxusers}$, so if you set `maxusers` to 1, then you can only have 36 simultaneous processes, including the 18 or so that the system starts up at boot time and the 15 or so you will probably create when you start the X Window System. Even a simple task like reading a manual page will start up nine processes to filter, decompress, and view it. Setting `maxusers` to 64 will allow you to have up to 1044 simultaneous processes, which should be enough for nearly all uses. If, however, you see the dreaded `proc table full` error when trying to start another program, or are

running a server with a large number of simultaneous users (like `ftp.FreeBSD.org`), you can always increase the number and rebuild.

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 `sfbufo` 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.

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.

Όχιἄβύος: 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 ἐπὶ 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

Όχιἄβύος: Before submitting a problem, be sure you are running the latest BIOS version and, if available, embedded controller firmware version.

For those of you that want to submit a problem right away, please send the following information to freebsd-acpi@FreeBSD.org (<mailto:freebsd-acpi@FreeBSD.org>):

- Description of the buggy behavior, including system type and model and anything that causes the bug to appear. Also, please note as accurately as possible when the bug began occurring if it is new for you.
- The `dmesg(8)` output after `boot -v`, including any error messages generated by you exercising the bug.
- The `dmesg(8)` output from `boot -v` with ACPI disabled, if disabling it helps fix the problem.
- Output from `sysctl hw.acpi`. This is also a good way of figuring out what features your system offers.
- URL where your *ACPI Source Language* (ASL) can be found. Do *not* send the ASL directly to the list as it can be very large. Generate a copy of your ASL by running this command:

```
# acpidump -dt > name-system.asl
```

(Substitute your login name for *name* and manufacturer/model for *system*. Example: `njl-FooCo6000.asl`)

Most of the developers watch the [FreeBSD-CURRENT](http://lists.FreeBSD.org/mailman/listinfo/freebsd-current) (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-current>) but please submit problems to [freebsd-acpi](http://lists.FreeBSD.org/mailman/listinfo/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) (<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.

(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 εἰθέροδοῦδιβός εἰπέ Ἀἰθέροδοῦδιβός ACPI εἰπέ FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-acpi>)
- The ACPI Mailing List Archives <http://lists.freebsd.org/pipermail/freebsd-acpi/>
- The old ACPI Mailing List Archives <http://home.jp.FreeBSD.org/mail-list/acpi-jp/>
- The ACPI 2.0 Specification <http://acpi.info/spec.htm>
- FreeBSD Manual pages: `acpi(4)`, `acpi_thermal(4)`, `acpidump(8)`, `iasl(8)`, `acpidb(8)`
- DSDT debugging resource (http://www.cpqlinux.com/acpi-howto.html#fix_broken_dsdt). (Uses Compaq as an example but generally useful.)

Ὀἰαἰπόαἰ

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.

Ἰ ἐπαέεάο ἰΎόά οοἰ MBR οοἰΰεὺð áíáο Ἰñáοάε ὑð áεά÷áεñέοòΰð Ἀέεβίςοçð (boot manager), áεάεεΰ ὑðάí áεεçεάðεáñŪ ἰá οἰ ÷ñΰόç. Óðçí ðáñβððòòç áðòΰ, ἰ áεά÷áεñέοòΰð Ἀέεβίςοçð Ἰ÷áε οοἰΰεὺð ðáñέοóòðáñ ἑπαέεά οðçí ðñϰòç ðññ÷εŪ (track) ðιò áβóεἰò ϰ ἰΎόά óá εŪðιέἰ óγóðçíá áñ÷áβυἰ ðιò εάεðιòñáεεἰγ. (ἸáñέεΎð οἰñΎð ἰ áεά÷áεñέοòΰð Ἀέεβίςοçð áðιεάεáβóáε εάε οἰñòòðΰð Ἀέεβίςοçð (boot loader), áεεŪ οοἰ FreeBSD ἰ ὑñιð áðòυð ÷ñçóεἰϰιεάβóáε óá ἰáðáááἸΎóðáñ ὁŪΰáεἰ ðçð Ἀέεβίςοçð.) Óðιòð áçιρòεεáβð áεά÷áεñέοóΎð Ἀέεβίςοçð ðáñεεáἰáŪñἰðáε ðι **boot0** (áñυóòυ εάε ὑð **Boot Easy**, ἰ óðŪíóáñ áεά÷áεñέοòΰð Ἀέεβίςοçð ðιò FreeBSD), ðι **Grub**, ðι **GAG**, εάε ðι **LILO**. (Ἰññ ὁἰ **boot0** ÷ñŪáε ἰΎόά οοἰ MBR.)

Ἀί Ἰ÷áε ÷áðá áεεáðáòçἸññ ἸΎά ἰññ εάεðιòñáεεἰ óγóðçíá οοἰòð áβóεἰòð óáð, ðι ðððιðιεçἸññ MBR áεά PC áβίáε áðáñεΎð. Ἀðòυ ðι MBR ϰŪ÷áε áεά ðι ðñϰòἰ áεεεἰϰóεἰ (ϰ áíáñáυ) áεáἰΎεóἰá (slice) οοἰ áβóεἰ, εάε áεðáεáβ ðι ἑπαέεά ðιò ððŪñ÷áε óá áðòυ áεά ἰá οἰñòϰóáε ðι ððυεἰéðι ðιò εάεðιòñáεεἰγ óðòðἰáðιò. ἰá MBR áðòἰγ ðιò ðγðιò, áβίáε áðòυ ðιò áεεáεβóóáðáε áðυ ðññáðεεἰáϰ ἰá ðçí fdisk(8). Ἀáóβáεáðáε οοἰ /boot/mbr.

Ἀί Ἰ÷áε ÷áðá áεεáðáòðóáε ðιεεáðεŪ εάεðιòñáεεŪ óðòðἰáðá οοἰòð áβóεἰòð óáð, ἰðññáβðá ἰá áεεáðáòðóáðá áεáοἰñáðεεἰ áεá÷áεñέοòΰ Ἀέεβίςοçð, εŪðιέἰ ðιò ἰá ἰðññáβ ἰá ááβíáε ἰεá εβóðá ðυἰ áεáοἰñáðεεἰ óðòðçἰŪðυἰ εάε ἰá óáð áðεðñΎðáε ἰá áεáεΎíáðá ðιέἰ ἰá ἰáεεἰϰóáε. Óðι áðυἰáñ ðιἰá ἑá óðæçðϰóἰòἰá áεá áγἰ áðυ áðòἰγð ðιòð áεá÷áεñέοóΎð Ἀέεβίςοçð.

Óἰ ððυεἰéðι ðιò óðòðἰáðιò Ἀέεβίςοçð ðιò FreeBSD áβίáε ÷ñεéἰΎñ ὁá ðñβá óðŪáεá. Óἰ ðñϰòἰ óðŪáεἰ áεðáεáβóáε áðυ ðι MBR, ðι ἰðññáβ ἰáññáβáε áðεϰð ὑðε áðáεðáβóáε áεá ἰá οΎñáε οἰ ððιεἰáεóð óá ἰεá óðáεáñεἰΎἰç εáðŪóðáóç εάε ἰá áεðáεΎóáε ðι ááγðáñ ὁŪáεἰ. Óἰ ááγðáñ ὁŪáεἰ ἰðññáβ ἰá εŪἰáε εβáá ðáñέοóòðáñá ðñŪáἰáðá ðñéἰ ðçí áεðΎεáóç ðιò ðñβðιò óðááβιò. Óἰ ðñβðιò óðŪáεἰ ἰεἰεεçñἰáε ðç áεááεεáóβá οἰñòòçð ðιò εάεðιòñáεεἰγ óðòðἰáðιò. Ç áñááóβá áβíáðáε óá ðñβá óðŪáεá, áεáðβ ðι ðñυðððι ðιò PC áðεáŪεεáε ðáñεἰñεóἰγð οοἰ ἰΎááεἰð ðυἰ ðññáñἰŪðυἰ ðιò ἰðññἰγ ἰá áεðáεáðἰγἰ óá óðŪáεá ἸΎá εάε áγἰ. Ç óðιΎύòç áðòΰ ðυἰ áñááóεἰϰ áðεðñΎðáε οοἰ FreeBSD ἰá ðáñΎ÷áε ἸΎá ðεἰ áðΎεεéðι óγóðçíá οἰñòòçð.

ðáεðá ἰáεεἰŪáε ἰ ððñἰáð εάε áñ÷áεáε ðçí áἰβ÷áðòç εάε áñ÷áεἰðἰβçóç ðυἰ óðóεáðἰ ϰóðá ἰá ἰðññἰγ ἰá ÷ñçóεἰϰιεçεἰγἰ. ἸΎóá ðçí ἰεἰεεϰñòç ðçð áεááεεáóβáð Ἀέεβίςοçð ðιò ððñἰá, ἰ Ἰεáá÷íð ðáññŪáε óçç áεááεεáóβá ÷ñϰóç init(8), ç ἰðññáβ εάε áðεáááεϰἰáε ὑðε ἰε áβóεἰ áβίáε óá εάεðιòñáεεϰ (÷ññβð εŪεç) εáðŪóðáóç. Ç init(8) ἰáεεἰŪáε Ἰðáεðá ðçí ñγἰεἰóç ðυἰñυἰ (áðβðááἰ ÷ñϰóç), ἰá ðçí ἰðññáβ ðññíóáñðἰáε óá óðòðἰáðá áñ÷áβυἰ, ñðεἰβáεἰðáε ἰε εŪñðáð áεéðγἰò áεá áðεεἰεἰñυἰá ἰá ðι áβεðòἰ, εάε ááἰεŪ áεεεἰγἰ ὑεáð ἰε áεááεεáóβáð ðιò áεðáεἰγἰóáε óððεéŪ εáðŪ ðçí Ἀέεβίςοçç áñυð FreeBSD óðòðἰáðιò.

12.3 Ἰ Ἀεά÷áεñέοòΰð Ἀέεβίςοçð εάε óá ÓðŪáεá Ἀέεβίςοçð

12.3.1 Ἰ Ἀεά÷áεñέοòΰð Ἀέεβίςοçð (boot manager)

Ἰ ἐπαέεάο οοἰ MBR ϰ áεá÷áεñέοòΰð Ἀέεβίςοçð áíáο Ἰñáðáε ἰáñέεΎð οἰñΎð εάε ὑð óðŪáεἰ ἰçáΎἰ (stage zero) ðçð áεááεεáóβáð Ἀέεβίςοçð. Óἰ ðιἰá áðòυ ðáñεáñŪóáε áγἰ áðυ ðιòð áεá÷áεñέοóΎð Ἀέεβίςοçð ðιò áíáο Ἰñáἰá ðññçáἰòἰΎἰð: Óἰ **boot0** εάε ðι **LILO**.

Ἰ Ἀεά÷áεñέοòΰð Ἀέεβίςοçð boot0: Óἰ MBR ðιò áεεáεβóóáðáε áðυ ðι ðññáñáἰá áεεáðŪóðáóç ðιò FreeBSD ϰ ðι boot0cfg(8), ááóβáεáðáε áðυ ðññáðεεἰáϰ οοἰ /boot/boot0. (Óἰ ðññáñáἰá **boot0** áβίáε ðιεγ áðευ, εάεϰð ἰ ἐπαέεάο οοἰ MBR ἰðññáβ ἰá Ἰ÷áε ἰΎááεἰð ὑð 446 bytes, áἰáεðáð ðιò ðβíáεá εáðáðἰϰóáυἰ (slice table) εάε ðιò áíááἰñεéðεἰγ 0x55AA ðιò áñβóεáðáε οοἰ ðΎεἰð ðιò MBR.) Ἀί Ἰ÷áε ÷áðá áεεáðáòðóáε ðι **boot0** εάε ðιεεáðεŪ εάεðιòñáεεŪ óðòðἰáðá οοἰòð óεεçñἰγð áβóεἰòð óáð, εá ááβðá εáðŪ ðçí Ἀέεβίςοçç, ἰεá ἰεἰγç ðáññυἰεá ἰá ðçí ðáñáεŪðυἰ.

Ôì boot2 áβίáέ áέáöñÛ ðεί ðíεýðείρει éάέ éάóáñíáβ áðáñêð ðì óýóççíá áñ ÷ áβùí ðìò FreeBSD þóðá íá ìðñíáβ íá áñáέ áñ ÷ áβá óá áðòù, éάέ ìðñíáβ áðβóçò íá ðáñÝ ÷ áέ íéá áðêð áέáðáðð íá ðì ÷ ñþóç þóðá íá ìðñíáβ íá áβίáέ ç áðέείñð ðìò ðñþíá ð ðìò ðñíáñÛíááðìò öüñòùóçò ðìò éá áέðáέáóðáβ.

Ôì boot2 óðìðèùð áέðáέáβ ðìí loader (öüñòùððò áέέβίççòç) ì ìðñíò áβίáέ áíáέñáðééÛ ðεί ðíεýðείρειò, áέéÛ ðáñÝ ÷ áέ Ýíá ùñáβì éάέ áýéρει ðñùðì ñýéìéóçò óçò áέέβίççòç. Ðáέéúðáñá ðì boot2 áíáέÛíááíá íá öüñòþóáé áðáðéáβáð ðìò ðñþíá.

ÐáñÛááέèá 12-2. Áέéúíá áðù ðì boot2

```
>> FreeBSD/i386 BOOT
Default: 0:ad(0,a)/boot/loader
boot:
```

Áí ÷ ñáέáóðáβ ðìòÝ íá áíóέέáóáóððóáðá ðá ááέáðáóççíÝíá boot1 éάέ boot2 ÷ ñçóέíðíéþóðá ðì bsdlable(8):

```
# bsdlable -B diskslice
```

üðìò ðì *diskslice* áβίáέ ì áβóέìò éάέ ðì slice áðù ðì ìðñíò áβíáðáέ ç áέέβίççòç, üðùð ð.÷. ad0s1 áέá ðì ðñþðì slice óðì ðñþðì IDE áβóέì.

Áðέέβíáðíá ÁöíóέúíÝíç ÉáðÛóóáçç (Dangerously Dedicated Mode): Áí ÷ ñçóέíðíéþóðá ìüí ðì üííá ðìò áβóέìò, üðùð ð.÷. ad0, óççí áíðìêð bsdlable(8) éá áçìéìðñáþóáðá Ýíá áðέέβíáðíá áöíóέúíÝíç áβóέì, ÷ ùñò slices. Áβíáέ ó ÷ ááüì óβáìðñì ùðé ááì éÝéáðá íá ðì éÛíáðá áðòù, áé' áðòù óéáìðñáðóðáβðá ùðé áéÝáíáðá óççí áíðìêð bsdlable(8) ðñéí ðéÝóáðá **Return**.

12.3.3 ÓóÛáέì Òñβá, /boot/loader

Ï loader, ð öüñòùððò áέέβίççòç, áβίáέ ðì ðáέééú óóÛáέì ðìò óðóððíáðìò áέέβίççòç ðñêþì óðááβùí, éάέ áñβóέáðáέ óðì óýóççíá áñ ÷ áβùí, óðìðèùð ùð /boot/loader.

Ðññìñéóüùð ðìò loader áβίáέ íá ðáñÝ ÷ áέ íéá ìÝéìáì ñýéìéóçò óéééêð ðñìò ðì ÷ ñþóç, éάέ ÷ ñçóέíðíéáβ Ýíá áýéρει óýíρει áíðìêþì, ðì ìðñíò ððìóççñβáðáέ áðù Ýíá éó ÷ ðñù ìáðáðñáóðð áíðìêþì ìá Ýíá ðíεððείρειúðáñì óýíρει áíðìêþì.

12.3.3.1 Ñìð ðìò ÐññíáñÛíááðìò Loader

ÉáðÛ óççí áñ ÷ ééìðìβççòç, ì loader éá áíé ÷ íáýóáέ óççí éüíóúéá éάέ ðìòð áβóέìòð éάέ éá éáέìñβóáέ áðù ðίεί áβóέì áβíáðáέ ç áέέβίççòç. Éá ñðéìβóáέ éáðÛéççéá ðéð áíðβóðίé ÷ áð ìáðááéççòÝð éάέ éá ìáέéíþóáέ Ýíá ðññáñáìá ìáðÛóñáóçò áíðìêþì (interpreter) óðì ìðñíò ìðñíáβ ì ÷ ñþóçòç íá áβίáέ áíðìéÝð, áβðá áðáðéáβáð, áβðá ìÝóù éÛðίέìò script.

Ï loader éáðùðεί ðá áέááÛóáέ ðì áñ ÷ áβì /boot/loader.rc, ðì ìðñíò ìá óç óáέñÛ ðìò áέááÛáέ, áðù ðñíáðééñáð, ðì /boot/defaults/loader.conf. ÏÝóá áðù ðì áñ ÷ áβì áðòù ðβéáíóáέ εíáέéÝð ðñíáðééáñíÝíáð ðéíÝð áέá éÛðίέáð ìáðááéççòÝð. Ðáέóá, áέááÛáéðáέ ðì áñ ÷ áβì /boot/loader.conf áέá ðð ÷ üí ðìðééÝð áέéááÝð óðéð ìáðááéççòÝð áððÝð. Éáðùðεί ðì loader.rc ÷ ñçóέíðíéáβ áððÝð ðéð ìáðááéççòÝð, öüñòþñíóáð ðá áñèñþíáðá (modules) éάέ ðìò ðñþíá ðìò Ý ÷ áέ áðέéááβ.

ÔáέééÛ, ì loader, ðáñéíÝíáέ 10 ááððáññéáððá (ðñíáðééáñíÝíç ÷ ñííééú áéÛóççíá) áέá óççí ðβáóç éÛðίέìò ðεðéðñìò, éάέ áí ááì ððÛñíáέ ðáñÝíááóç áðù ðìò ÷ ñþóç, ìáέéíÛáέ ðìò ðñþíá. Áí áβíáέ ðáñÝíááóç, áìáíáβáðáέ óðìò ÷ ñþóç ìéá ðñìòñìð ç ìðñíò éáðáñíáβ ðì áýéρει óýíρει áíðìêþì ðìò áíáóÝñáìá ðñíçáìòÝíùð, éάέ üðìò ì ÷ ñþóçòç ìðñíáβ íá

ñòèìβóáé ìáðááεçðÝð, ìá áðìοìñòðóáé ùεά óá áñεññìáðá, ìá οìñòðóáé áñεññìáðá εάé óáεέεÛ ìá ðñìááβ óá áεέβίççò ð áðáíáεέβίççò.

12.3.3.2 ΆíοìεÝò ΆíóυìáòυìÝíáò óοì Loader

ÐáñáεÛòυ èá ááβòá óεò ðεì óò÷íÛ ÷ñçóεìðìεýìáíáð áíòìεÝò ðιò loader. Άέá ðáñεóóυòáñáð εáðòñÝñáεáð ó÷áðεέÛ ìá ùεáð óεò áεάεÝóεíáð áíòìεÝò, ðáñáεáεýìá ìá ááβòá ðι loader(8).

autoboot *seconds*

Ðñì÷ùñÛ óóçì áεέβίççò ðιò ðòñðíá, áí ááí ððÛñíáε ðáñÝíááóç áðυ ðι ÷ñðóç ìÝóá óòì εάεìñεóìÝíì ÷ñìéέυ áεÛóóçìá ðιò áβíáðáé óá ááðòáññεáððá. Άðáεéììβæáé áíòβóðñìòç ìÝóñççò, εάé ì ðñìáðεεááìÝíìð ÷ññìò áβíáé óá 10 ááðòáññεáððá.

boot [-options] [kernelname]

Ðñì÷ùñÛáε Ûìáóá óóçì áεέβίççò ðιò ðòñðíá, ÷ñçóεìðìεýìáð ùðìεáð óð÷íí áðεéìáÝò Ý÷ìì áñεáβ εάé ðι ùñíá ðιò ðòñðíá ðιò εá áεóáεáóóáβ áí Ý÷áε áðβóçð áñεáβ. Άέá ìá áðóáðá áεáοìñáðεέυ ùñíá ðòñðíá óóçì áñáììð áíòìεðð, εá ðñÝðáε ðñðóá ìá ÷ñçóεìðìεýìáðáð óçì áíòìεð *unload*. ΆέáοìñáðεέÛ, εá ÷ñçóεìðìεýçεáβ ì ðòñðíáð ðιò Ý÷áε οìñòυεáβ ðæç.

boot-conf

ΆέáðñÝ÷áε óçì áðòυìáðç ñýεìέóç ðυì áñεññìÛðυì (module) ðιò ááóβæáðáé óá ìáðááεçðÝð, ìá ðιí βáεì ðñυðì ðιò áβíáðáé εάé óá εάñìéεð áεέβίççò. Άðòυ Ý÷áε ìúçìá ìυñí áí ÷ñçóεìðìεýìáðáð ðñðóá ðι *unload* εάé áεεÛìáðá εÛðìεáð ìáðááεçðÝð, óòìðευð ðι *kernel*.

help [topic]

Άáβ÷ìáε ìçýìíáðá áñðεáέáð, óá ìðìβá áεááÛæìíðáé áðυ ðι /boot/loader.help. Άí ðι topic (εÝíá) ðιò áυεçεá áβíáé ç εÝýç index, εá ááβòá ìεá εβóðá ìá óá áεάεÝóεíá εÝíáðá áñðεáέáð.

include *filename* ...

ΆðáíáñáÛæáðáé ðι áñ÷áβì ìá ðι ùñíá áñ÷áβìò ðιò áυεçεá (filename). Άβíáðáé áíÛáñóç εάé áñáììð ðñìò áñáììð ìáðÛðñáóç ðιò áñ÷áβìò. Ç áíòìεð include óðáíáðÛáε Ûìáóá áí áíòìεðóóáβ εÛðìεì εÛεìò.

load [-t type] *filename*

Οìñòðíáε ðιí ðòñðíá, ðι Ûñεññìá ðòñðíá ð Ýíá áñ÷áβì ðιò óýðìò ðιò εάεìñβóðçεá, ìá áÛóç ðι ùñíá áñ÷áβìò ðιò áυεçεá. Άí ìáðÛ ðι ùñíá áñ÷áβìò ððÛñ÷ìì ðáñÛìáðñìé, ðáñìéýìóáé ùð ðáñÛìáðñìé óòì áñ÷áβìò ðιò οìñòðíáðáé.

ls [-1] [path]

Άáβ÷ìáε Ýíá εáðÛεìáì ðυì áñ÷áβì ðçð áεááññìðð ðιò áυεçεá, ð áí ááí εάεìñβóðçεá áεááññìð, ðιò ñεáεéýì εáóáεéυáìò. Άí áñεáβ εάé ç áðεéìáð -1 εá áìóáíβæìíðáé áðβóçð εάé óá ìááÝεç ðυì áñ÷áβì.

lsdev [-v]

Άìóáíβæáé ùεáð óεð óðóεáðÝð áðυ óεð ìðìβáð áβíáé áðíáðð ç ουññòυóç áñεññìÛðυì. Άí áñεáβ ìá óçì áðεéìáð -v, áìóáíβæìíðáé ðáñεóóυòáñáð εáðòñÝñáεáð.

lsmod [-v]

Άìóáíβæáé óá áñεññìáðá ðιò Ý÷ìì οìñòυεáβ. Άí áñεáβ ç áðεéìáð -v, áìóáíβæìíðáé ðáñεóóυòáñáð εáðòñÝñáεáð.

more filename

Άιόάίβæέ òι άñ ÷ άβι ðìò έάέιñβæάόάέ, ιά ðάýόάέò έΰεά LINES άñέειü άñάιñι.

reboot

Άðάίάέέέίάβ ΰιάόά ðì όýόçιά.

set variable

set variable=value

Έάέιñβæέ ιάόάάέçòΰò ðάñέάΰέέιíòìò áέά ðìí loader.

unload

Άðìοιñόβιáέ üέά όά άñέñβιáόά.

12.3.3.3 Ðάñάάάβáιáόά áέά ðìí Loader

Άäρ έá άñάβόά ιάñέέΰ ðñάέóέέΰ ðάñάάάβáιáόά ό ÷ áóέέΰ ιά ðçí ÷ ñβόç ðìò loader:

- Άέά ιά ιάέέίβóáðά ðì όóιçέέóιΰíí ððñβιá óáð, áέέΰ όά έáðΰóóáç άíüð ÷ ñβóç:

```
boot -s
```

- Άέά ιά áðìοιñόβóáðά ðì όóιçέέóιΰíí ððñβιá óáð έáέ ιά òιñόβóáðά ðìí ðáέέü óáð (β έΰðìέí ΰέέí):

```
unload
load kernel.old
```

Ϊðìñάβóá ιά ÷ ñçόέííðìέβóáðά ðì üíñά kernel.GENERIC áέά ιά áίáóáñέάβóá όðìí άñ ÷ έέü (generic) ððñβιá í ðìβιò òðΰñ ÷ áέ όðí CD ðçò ááέáðΰóóáçò, β ðì kernel.old áέά ιά áίáóáñέάβóá όðìí ððñβιá ðìò άβ ÷ áóá ááέáðáóççìΰíí ðñέí (áέά ðáñΰááέáìá, ðìí ðáέέü óáð ððñβιá áí έΰίáðá ðñüóóáðά ñýέιέçç έáέ ááέáðΰóóáçç íΰìò áέέíý óáð ðñìóáñììíóιΰíí ððñβιá).

Όçιáβüç: ×ñçόέííðìέβóáðά ðì ðáñáέΰòü áέά ιά òιñόβóáðά ðá όóιçέέóιΰíí óáð άñέñβιáόά όά έΰðìέí ΰέέí ððñβιá:

```
unload
set kernel="kernel.old"
boot-conf
```

- Άέά ιά òιñόβóáðά ΰίá script ñýέιέççò ððñβιá (ΰίá áóðñáíóιðìέççìΰíí ðñüáñáìá ðì ðìβι áέðáέáβ óέð έáέòìñάβò ðìò έáñíέέΰ έá έΰίáðá íΰóü έΰðìέíò ðñìáñΰιáðìò ñýέιέççò ððñβιá έáðΰ ðçí áέέβίççç):

```
load -t userconfig_script /boot/kernel.conf
```

12.3.3.4 Άñáóέέβ ðìòίç Áέέβίçççò

Όðìáέóòìΰ áðü ðìí Joseph J. Barbish.

Ç áñáóέέβ ðìòίç áέέβίçççò (splash screen) áçìέíòñάáβ ΰίá ðέí áð ÷ ΰñέóðì ðáñέáΰέέíí óá ð ÷ ΰçç ιά ðçí áðέβ áðáέέüíέçç ðüí ιçìíΰòüí áέέβίçççò óá ðñòβ έáέíΰíí. Ç áñáóέέβ ðìòίç áέέβίçççò άιόάίβæάόάέ ðò üðìò ðì όýόçιά òðΰóáέ όçí ðñìðñìðβ áέóüüìò (login), άβóá όççí έííóüέá, άβóá όðí áñáóέέü ðáñέáΰέέíí.

Ôì FreeBSD áέάέÝòáέ äýì ááóέέÛ ðáñéáÛέειíóá. Ôì ðñòì áβίáέ ðì ðñìáðééááìÝíì ðáñéáÛέειí éáειÝíò ãáñìò ðò áíòìèðì (έειíóúéá). ÌáòÛ ðì ðÝέìò ðçò áέέβίççòçò, àìòáíβáέáðáέ ðòçì έειíóúéá íéá ðñìòñìð ð áέóúáìò. Ôì äáýòáñì, áβίáέ ðì ãáñóέέú ðáñéáÛέειí ðìò ðáñÝ ÷ áðáέ áðú ðì óýòòçíá × 11. ÌáòÛ ðçì ááέáòÛóðáóç ðìò X11 éáέ áíúð áðú ðìòð ãáñóέέíýð áέá ÷ áέñέóðÝð ðáñáέýñìì ð desktop, ùðòð áβίáέ ðá **GNOME**, **KDE** ð **XFce**, ìðìñáβòá íá íáέέíðóáðá ðì ãáñóέέú ðáñéáÛέειí ìá ðçì áíòìèð startx.

Ìáñέειí ð ðñóðáð ðñìòέειíýì íá óñíáÝííðáέ ðòì óýòòçíá ìÝòú ãáñóέέðò ðέúç áέóúáìò, áíòβ íá ÷ ðçóέììðìέειíýì ðçì ðñìòñìð ð áέóúáìò ðçò έειíóúéáð. Ç áñíáðúðçðá áðòð ðáñÝ ÷ áðáέ áðì áέá ÷ áέñέóðÝð ðέúççò, ùðòð ì **XDM** áέá ðì Xorg, ð **gdm** áέá ðì **GNOME** éáέ ì **kdm** áέá ðì **KDE** (éáèð ð áέá Ûέειíòð ðìò áέáðβéáíóáέ ðòç Óðέειíáð ðúì Ports). ÌáòÛ áðú íéá áðέóð ÷ çìÝíç áβóíáì, ðáñìòóέÛέáðáέ Ûíáóá ðòì ÷ ðñóðç ðì ãáñóέέú ðáñéáÛέειí ðçò áðέέíáð ðìò.

Óòì ðáñéáÛέειí ðçò ãáñìò ðò áíòìèðì, ç ãáñóέέð ðέúç áέέβίççòçò éá áðìèñýðáέ ùéá ðá ìçýíáíáðá áíβ ÷ íáðóçò ðúì óðóέáðì éáέ ððçñáóέðì, ìÝ ÷ ðé ðçì àìòÛíέóç ðçò ðñìòñìð ð áέóúáìò. Ìá áðáðéáβáð áέέβίççòç ðá ðáñéáÛέειí X11, ç àìðáέñβá áέέβίççòçò éá áβίáέ áέúá ðéì éáéáñð, éáέ éá ìéÛέáé ðáñέóóúðáñì ìá ðçì áíòβóðìé ÷ ç ðá Ýíá ðáñéáÛέειí Microsoft Windows ð Ûέειí ìç-UNIX óðóðìáíðì.

12.3.3.4.1 Éáέòìòñáβá ðçò Áñáóέέðò ðέúççò Áέέβίççòçò

Ç ãáñóέέð ðέúç áέέβίççòçò ððìòðçñβáέέ ìúì áέέúíáð bitmap (.bmp) ð ZSoft PCX (.pcx) 256 ÷ ðúìÛóúì. Áðέðñúòéáðá, ìé áέέúíáð ðìò ÷ ðçóέììðìέειíýìðáέ ðñÝðáέ íá Ý ÷ ðìò áíÛέòç 320x200 ð ìέèñúðáñç áέá íá éáέòìòñáβòìòì ðá ðððέέíýð ðñìóáñìñááβò ðέúççò VGA.

Áέá íá ÷ ðçóέììðìέέðóáðá ìáááέýòáñáð áέέúíáð, ìÝ ÷ ðé ðçì ìÝáέóðç áíÛέòç ðúì 1024x768 pixels, áíáñáìðìέέðóáðá ðçì ððìòðñéìç VESA ðìò ðáñέéáìáÛíáðáέ ðòì FreeBSD. Ìðìñáβòá íá ðçì áíáñáìðìέέðóáðá ðìòñòðñìúðáð ðì Ûñèñúá VESA éáðÛ ðçì áέέβίççòç ðìò óðóðìáíðì, ç ðñìóέÝòìíðáð ðçì áðέέíáð VESA ðòì áñ ÷ áβì ððéìβóáúì ðìò ððñðíá, éáέ äçìέìòñáðìðáð Ýíá ìÝì ðñìóáñìììòìÝì ððñðíá (ÉáòÛέáει 8). Ç ððìòðñéìç VESA áβίáέ ðòìòð ÷ ðñóðáð ðçì áñíáðúðçðá íá ÷ ðçóέììðìέέðòìòì ìéá áέέúíá ðìò íá éáέýððáέ ùéç ðçì ðέúççò.

Ìðìñáβòá íá ááβòá ðá éáíñíéÛ ìçýíáíáð áέέβίççòçò ùòì àìòáíβáέáðáέ ç ãáñóέέð ðέúç áέέβίççòçò, ðéÝáííðáð áðèð ìðìέíáððìòá ðèðéðñì.

Ç ðέúç áέέβίççòçò áβíáðáέ áðβóçò ç ðñìáðééááìÝíç ðñìòýéáìç ðέúççò, ùòì ðì óýòòçíá éáέòìòñááβ ðá ðáñéáÛέειí έειíóúéáð. ÌáòÛ áðú éÛðìέì ÷ ðñíέέú ðéÛóðçíá ááñÛíáéáð, ç ðέúççò áέéÛέáé, áðáέέìñβáέìðáð ðçì áέέúíá ðìò ÷ ðçóέììðìέέðçéá ðòçì áέέβίççòç, ìá éðéέέð áíáέéááð ðçò ðùðáέíúðçðáð áðú ðìéý ðùðáέíð ùð ðìéý óéìóáέíð. Ìðìñáβòá íá áέéÛíáðá áðòð ðçì ðñìáðééááìÝíç ðñìòýéáìç ðέúççò, ðñìóέÝòìíðáð ìéá ãáñìì ð saver= ðòì áñ ÷ áβì /etc/rc.conf. Áέá ðçì áðέέíáð saver=, ððÛñ ÷ ðìò áñéáðÝð áíòúìáðúìÝíáð ðñìòóéÛíáéð ðέúççò áέá íá áðέéÝíáðá. Ìðìñáβòá íá ááβòá ðçì ðèðñç éβóðá ðòç óáέβáá manual ðìò splash(4). Ç ðñìáðééááìÝíç ðñìòýéáìç ðέúççò ììñÛέáðáέ “warp”. Óçìáέðóðá ùòé ç ðñìòýéáìç ðέúççò ðìò éáέìñβáέðáέ ðòì áñ ÷ áβì /etc/rc.conf ìÝòú ðçò áðέέíáð ð saver= Ý ÷ áέ áðβáñáóç ìúìì óóéð áέέìééÝð έειíóúéáð. Ááì áðçñáÛέáé éáèúέìò ðì ãáñóέέú ðáñéáÛέειí X11.

ÉÛðìέá ìçýíáíáð áέέβίççòçò áíáέììðìέέíýì íá àìòáíβáέìðáέ, áέúá éáέ ìáòÛ ðçì áóáñìñáð ðçò ãáñóέέðò ðέúççò áέέβίççòçò. Óá ìçýíáíáð áðòð ðáñέéáìáÛìòì ðì ìáñý áðέέíáðì áέέβίççòçò éáέ ðçì áíòβóðñìòç ìÝòñççò ÷ ðúìòð ðìò ðì óðìááýáέ.

Ìðìñáβòá íá éáðááÛóáðá ððìááβáìáðá áέέúíúì áέá ÷ ðñóç ðòçì áέέβίççòç, áðú ðç ððέέíáð áέέúíúì ðòçì ðìðìéáóβá <http://artwork.freebsdgr.org> (<http://artwork.freebsdgr.org/node/3>). Áí ááέáðáóðòðóáðá ðì Port `sysutils/bsd-splash-changer`, éá Ý ÷ áðá ðð ÷ áβá áíáέéááð áέέúíúì (ðìò éá áðέéÝáííðáέ áðú ìéá Ýòìέìç ððέέíáð) ðá éÛéá áέέβίççòç ðìò óðóðìáíðì.

12.3.3.4.2 Áíáñáìðìβççòç ðçò Áñáóέέðò ðέúççò Áέέβίççòçò

Ôì áñ ÷ áβì ðìò éá ÷ ðçóέììðìέέðçéáβ áέá ðçì ãáñóέέð ðέúç áέέβίççòçò (ðýðìò .bmp ð .pcx) éá ðñÝðáέ íá ðìòìéáðçéáβ ðòçì ðéáέéð (root) éáðÛòìççòç, áέá ðáñÛááέáìá ðòì éáðÛέìáì /boot/.

Άέά ðçí ðñíáðέέάñ Ýίç áíÛέðóç ðεùίçò (320x200 Þ íέέñüòáñç, 256 ÷ ñþíáíóá), áðáíáñááóóðáβòá ðι ðñ ÷ áβι /boot/loader.conf þóðá íá ðáñέÝ ÷ áέ ðá ðáñáέÛòù:

```
splash_bmp_load="YES"
bitmap_load="YES"
bitmap_name="/boot/splash.bmp"
```

Άέά íáááέýòáñáò áíáέýóáέò, íÝ ÷ ñέ ðçí íÝ áέóóç 1024x768, áðáíáñááóóðáβòá ðι ðñ ÷ áβι /boot/loader.conf þóðá íá ðáñέÝ ÷ áέ ðι ðáñáέÛòù:

```
vesa_load="YES"
splash_bmp_load="YES"
bitmap_load="YES"
bitmap_name="/boot/splash.bmp"
```

Ïι ðáñáðÛíù ððιέÝóáέ ùðέ éá ÷ ñçóέñιðιέÞóáðá ðι ðñ ÷ áβι /boot/splash.bmp áέá ðçí áñáóέέÞ ðεùίç áέέβίçόçò. Áí èÝέáðá íá ÷ ñçóέñιðιέÞóáðá áέέúíá óýðιò PCX, ÷ ñçóέñιðιέÞóáðá ðέò ðáñáέÛòù áðέέíáÝò, éáèÞ éáέ ðçí áðέέíáÞ vesa_load="YES", áíÛέíáá íá ðçí áíÛέðóç:

```
splash_pcx_load="YES"
bitmap_load="YES"
bitmap_name="/boot/splash.pcx"
```

Ïι ùñíá áñ ÷ áβιò ááí áβíáέ áðáñáβòçðι íá áβíáέ “splash” ùðò ðáβíáðáέ óðι ðáñáðÛíù ðáñÛááέáíá. Ìðñáβ íá áβíáέ ðέáÞðιòá, áñέáβ íá ðññέáέðáέ áέá áñ ÷ áβι óýðιò BMP Þ PCX, ùðò áέá ðáñÛááέáíá splash_640x400.bmp Þ blue_wave.pcx.

ðáñáέÛòù ðáβñιðáέ ðáñέέÝò áέúíá áíáέáó Ýñιòóáð áðέέíáÝò ðιò ððñáβòá íá ÷ ñçóέñιðιέÞóáðá óðι /boot/loader.conf:

```
beastie_disable="YES"
```

Ç áðέέíáÞ áðòÞ éáðáñáβ ðçí áìòÛίέóç ðιò ðáñý áðέέíáÞι áέέβίçόçò. ðáñáíÝíáέ ùóóúóι ç áίòβóðñιòç ðÝðñçóç ðá ðçí ðñιòñιðÞ áέóááüáÞð áðέέíáÞι áέέβίçόçò. Áέúíá éáέ ùðáí ááí áìòáíβæáðáέ ðι ðáñý áðέέíáÞι, áí ð ÷ ñÞóóçò èÛíáέ íéá áðέέíáÞ óóç áέÛñέáέá ðιò ðñíáðέέáñ Ýñιò ÷ ñññιò áíáññÞð, ç áðέέíáÞ áðòÞ éá éó ÷ ýóáέ áέá ðçí áέέβίçόç.

```
loader_logo="beastie"
```

Ç áðέέíáÞ áðòÞ áέέÛæáέ ðι éáβíáñ “FreeBSD” ðιò áìòáíβæáðáέ óðι ááíέú ðιò ðáñý áðέέíáÞι áέέβίçόçò, ðá Ýíá Ýá ÷ ññιò éíáüòððι ðιò beastie, ùðò áìòáíέæüðáí óðέò ðáέáέüðáñáð áέáüóáέò.

Άέá ðáñέóóúòáñáð ðççñιòññáð, ðáñáέáέíýíá áíáðñÝíòá óðέò óáέβááð manual splash(4), loader.conf(5) éáέ vga(4).

12.4 Áέέçéáðβáñáóç ðá ðιí ððñÞíá éáòÛ ðçí Áέέβίçόç

Áðù ðç óééáÞ ðιò ððñÞíáð ðññòùεáβ, áβòá ðÝóù ðιò loader (ùðò óðιÞεùð) áβòá ðÝóù ðιò boot2 (ðáñáέÛιððιíóáð ðιí loader), áíáðÛæáέ ðέò ðáñáíÝðñιòð áέέβίçόçò (boot flags), áí ððÛñ ÷ ðι, éáέ ðñιòáññιüæáέ áíÛέíáá ðç óðιðáñέóññÛ ðιò.

12.4.1 ΔάñÙιάòñιέ Άέέβίζόζò ΔòñΠιá (Boot Flags)

Δάñάεΰòù εά áñáβòá ðéò ðεί óοίçέεοιΎίáò ðάñáιΎòñιòò áέέβίζόζò:

- a
έάòΰ ðç áεΰñέάέά ðçò áέέβίζόζò, εά áβιáέ áñβòçόç áέα ðçί óòóέáòΠ áðù ðçί ιðιβá εά áβιáέ ç ðñιόΰñòçόç ðιò ñέæέιγ (root) óòóòΠιáòιò áñ÷áβιι.
- C
áέέβίζόç áðù ðι CDROM.
- c
άέòΎέáόç ðιò UserConfig, ðιò ðñιáñÙιáòιò ñγέιέόçò ðòñΠιá έάòΰ ðçί áέέβίζόç.
- s
άέέβίζόç óά έάòΰóάόç έάέοιòñάβáò áφùò ÷ ñΠόçç (single user).
- v
áιòΎιέόç ðáñέóóùòáñιι ðεçñιοιñεβι έάòΰ ðç áεΰñέάέά áέέβίζόζò ðιò ðòñΠιá.

Óçιáβιόç: ÒðÛñ÷ιòι έάέ ΰέέáò ðáñÙιáòñιέ áέέβίζόζò, áέαáΰóòá ðç óάέβáá boot(8) áέα ðáñέóóùòáñιáò ðεçñιοιñβáò ó÷áðéέΰ ιá áòòΥò.

12.5 Device Hints

Óòιáέóοιñΰ áðù ðιí Tom Rhodes.

Óçιáβιόç: Δñùέάέóάέ áέα áοιáòùòçòá ðιò ðòðÛñ÷άέ áðù ðι FreeBSD 5.0 έάέ ιáòΰ, έάέ ááι εά ðι áñáβòá óá ðñιçáιγιáíáò áέáùóάέò.

Έάòΰ ðç áεΰñέάέά ðçò áñ÷έέΠò áέέβίζόζò ðιò óòóòΠιáòιò, ðι ðñιáñáιιá ðιò boot loader(8) áέαáΰæάέ ðι áñ÷áβιι device.hints(5). Òι áñ÷áβιι áòòù ðáñέΎ÷άέ ðεçñιοιñβáò áέέβίζόζò áέα ðιí ðòñΠιá, áφùóóΎò ùò ιáòááεçòΎò, ιέ ιðιβáò ιáñέέΎò ðιñΎò áιáòΎñιíóάέ áðβóçò έάέ ùò “device hints”. Áòòΰ óá “device hints” ÷ñçóειιðιέιγίóάέ áðù ðñιáñÙιáóá ιáΠαçόçò óòóέáòβιι áέα ñγέιέόç ðιι áιòβóòιέ÷ιι óòóέáòβιι.

Ìðιñιγιá áðβóçò ιá ιñβóιòιá Device hints óçί ðñιòñιð ðιò Óóááβιò 3 ðιò boot loader. Ιέ ιáòááεçòΎò ιðιñιγιί ιá ιñέóóιγιί ιá ÷ñΠόç ðçò áιòιεΠò set, έάέ ιá áòáέñáέιγιί ιá ðçί unset. Ìðιñιγιá áðβóçò ιá ðéò áιòáιβóιòιá ιá ðçί áιòιεΠ show. Áέυιá, ιðιñιγιá ááβ ιá ðáñάέΎιøιòιá έάέ ιá áεέΎñιòιá ðçί ðειΠ ιáòááεçòβιι ðιò Ύ÷ιòι ιñέóóáβ óοι áñ÷áβιι /boot/device.hints. Óá Device hints ðιò ιñβæιòιá óοι boot loader ááι ðáñáιΎιòι ιιιέιá έάέ ááι εά έó÷γóιòι óçί áðùιáιç áέέβίζόç.

Ìáòΰ ðçί áέέβίζόç ðιò óòóòΠιáòιò, ιðιñáβ ιá ÷ñçóειιðιέιçέáβ ç áιòιεΠ kenv(1) áέα ιá áιòáιέóóιγιί ιέ ðειΎò üέιι ðιι ιáòááεçòβιι.

Δάνΰääέαιά 12-3. ΑίαόάέΠð Èñíóüέα óοι /etc/ttys

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

Όçιάβύος: Ιέα insecure (άίαόάέΠð) έίίόüέα όçιάβιάέ üóέ άάι έαüñάβðά άόóάέΠ ðçí έίίόüέα üοί άόιñÜ ðç öóóέέΠ ðçð ðñüóάάόç έάέ εΰέάðά ίά άβóðά άΰάάέιð üðέ ίüñ üðιέιð άιüñβæάέ ðιí έüääέü ðιò root έά ίðιñάβ ίά ðñçóέιððιέΠóάέ ðç έääέοιñάβά άíüð ðñΠóðç. Ç άðέέίάΠ άððΠ άάι όçιάβιάέ üðέ εΰέάðά ç έίίόüέα óáo ίά έääέοιñάβ ðñβð άóóÜέάέά. Αί εΰέάðά άóóÜέάέά, έά ðñΰðάέ ίά άðέέΰíáðά insecure, ü÷έ secure.

12.6.3 ΈáoÜóóάόç Èääέοιñάβά ðιέέάðέπι × ñçóòπι (multi-user)

Αί ç init(8) άάí άñάέ ðñíáέΠιάóά óðά óðóðΠιάóά άñ÷άβüí óáo, Π üüέð ï ðñΠóðçð ðáññιάóβóάέ ðçí έáoÜóóάόç έääέοιñάβάð άíüð ðñΠóðç, ðι óýóðçιά áέóΰñ÷άðάέ óά έääέοιñάβά ðιέέάðέπι ðñçóòπι, üðιò έάέ ίáέέíÜ ðέΰíí ç ñýέιέóç ðññüí (resources) ðιò óðóðΠιάðιð.

12.6.3.1 Ñýέιέóç ðññüí (rc)

Όι óýóðçιά ñýέιέóçð ðññüí, áέάáÜæάέ ðέð ðñíáðέέάñíΰíáð áðέέíáΰð áðü ðι /etc/defaults/rc.conf, έάέ áðέέíáΰð áέά ðι óóääέñέíΰí íç÷Üçιά áðü ðι /etc/rc.conf, έάέ ðñí÷üñάβ óðçí ðñíóÜñçóç ðñí óóóðçíÜðüí άñ÷άβüí ðιò άíáñÜñíóάέ óοι /etc/fstab, ίáέέíÜ ðέð ððçñάóβáð áέέóýíò, áέέέíάβ áέÜοιñòð ááβιñάð, έάέ ðΰέíò áέðääάβ óά scripts áέέβίçόçð ðñí ðιέέέÜ áääέáðóóçíΰíñ ðáέΰòñí (áðáññáπι).

Ç óääέβáá manual rc(8) ðáñΰ÷άέ ίέά έάέΠ άíáöíñÜ óοι óýóðçιά ñýέιέóçð ðññüí, έάέðð áíáðÜæάέ óά βáέά óά scripts áέέβίçόçð.

12.7 Άέιέííðέβá Õáññιάðέóóíñ

ΈáoÜ ðιí áέáá÷üññí ðáññιάðέóóíñ, ίΰóü ðçð shutdown(8), ç init(8) έά áðιðáέñáέάβ ίά áέðáέΰóάέ ðι script /etc/rc.shutdown, έάέ áέιέíñýèð έά óðάβέáέ óά üéáð ðέð áέáññááóβáð ðι óΠιά TERM, έάέ ðΰέíð ðι óΠιά KILL óά üðιέά áέáññááóβá ááí ðáññιάóβóάέ óά áýέíñí ðñííέέü áέÜóóçιά.

Άέά ίά áβιάέ έάέ áέáέíðΠ ðçð ðñíοιñáóβáð óά ΰíά óýóðçιά FreeBSD ίá άñ÷έðáέοιñέέΠ ðιò ððιðóçñβæάέ áέá÷áβñέóç άíΰñááέáð, áðέð ðñçóέíððιέΠóðά ðçí άíðιέΠ shutdown -p now áέá áðáíáññáðιβçóç ίáðÜ ðιí ðáññιάðέóóíñ. Άέά ίά έÜíáðά áðέðð áðáíáέέβίçόç óά ΰíά óýóðçιά FreeBSD ðñçóέíððιέΠóðά ðçí άíðιέΠ shutdown -r now. Έά ðñΰðáέ ίά áβóðά root Π ίΰέíð ðçð ñÜááð operator áέá ίá áέðáέΰóáðά ðçí shutdown(8). Ιðñάβðά áðβóçð ίά ðñçóέíððιέΠóðά ðέð άíðιέΰð halt(8) έάέ reboot(8), έιέóÜíðά ðέð άíðβóðιέ÷áð óääέβááð manual έάέðð έάέ ðç óääέβáá manual ðçð shutdown(8) áέá ðáññέóóüðáññáð ðέçññíññβáð.

Όçιάβύος: Ç áέá÷áβñέóç άíΰñááέáð áðáέðάβ ðçí ððιðóðñέίç ðιò acpi(4), áβðά óóíí ððñΠιά, áβðά öíñòñíΰíç üò Üñέñüíá (module).

ÊäöÛëáéí 13 × ñÞóôâð êáé ÁáóéêÞ Äéá ÷ âßñéóç Ëïãáñéáóìþí

ÓðíáέóðìÛ áðü ðíí Neil Blakey-Milner.

13.1 Óýñïç

Ôí FreeBSD áðέóñÝðáé óá ðíεέáðéíýð ÷ ñÞóðâð íá ÷ ñçóέííðíέíýí ðíí ððíεíáέóðÞ ðçí ßáéá óóέáìÞ. Ðñíóáíðð, ìüñí Ýíáð áðü áðóíýð ðíðð ÷ ñÞóðâð ìðíñáß íá εÛεáðáé ìðñíóðÛ áðü ðçí íεúíç êáé ðí ðççέðñíεúáéí εÛεá áááñÝíç óóέáìÞ¹, áεεÛ ððíέíóáÞððíðá áñέέìüð ÷ ñçóðþí ððíñíýí íá áέóÝεèíóí ìÝóù ðíð áέέðýíð áéá íá öÝñíðí óá ðÝñáð óέð áñááóßâð ðíðð. Äéá íá ÷ ñçóέííðíέÞóáé ðí óýóðçíá, εÛεá ÷ ñÞóðçð ðñÝðáé íá Ý ÷ áé Ýíá εíááñéáóíü.

Áóíý áéááÛóáðá áðü ðí εáöÛεáéí, εá íÝñáðá:

- Óέð áέáóíñÝð áíÛíáóá óóá áεÛóíñá áßαç εíááñéáóìþí ÷ ñçóðþí óá Ýíá óýóðçíá FreeBSD.
- Ðüð íá ðñíóέÝóáðá εíááñéáóíýð ÷ ñçóðþí.
- Ðüð íá áέááñÛðáðá εíááñéáóíýð ÷ ñçóðþí.
- Ðüð íá áέεÛíáðá óέð εáððñÝñáéáð áíüð εíááñéáóíý, üðüð ðí ðεÞñáð üññá ðíð ÷ ñÞóðç, Þ ðí ðñíðέíþíáíí éÝέóððð (shell).
- Ðüð íá εÝóáðá üñéá áíÛ εíááñéáóíü, áéá íá áεÝá ÷ áðá ðñíñðð üðüð ç ìÞðíç êáé ì ÷ ññíñð ðçð CPU, ðíð ððíñíýí íá Ý ÷ ðíð óðçí áεÛεáðç ðíðð óðáεáêñéíÝíé εíááñéáóííß Þ ñÛáðá εíááñéáóìþí.
- Ðüð íá ÷ ñçóέííðíέÞóáðá ñÛáðá áéá íá εÛíáðá áðéíεüðáñç ðç áéá ÷ âßñéóç ðüí εíááñéáóìþí.

Ðñéí áéááÛóáðá áðü ðí εáöÛεáéí, εá ðñÝðáé:

- Íá εáóáñíáßðá óέð ááóέéÝð Ýíñéáð ðíð UNIX êáé ðíð FreeBSD (ÊáöÛεáéí 3).

13.2 ÁέóááñüãÞ

Ç ðñüóááóç óðí óýóðçíá áðέððá ÷ Ûíáðáé ìÝóù 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 óðçí ðñíðñíðÞ login: . Óá ññíáðá ÷ ñçóðþí ðñÝðáé íá áßíáé ñíááééÛ áéá ðíí ððíεíáέóðÞ, ááí ððíñáßðá íá Ý ÷ áðá äýí ÷ ñÞóðâð ìá ðí ßáéí üññá ÷ ñÞóðç. ÓðÛñ ÷ áé Ýíáð áñέέìüð εáíñíñí áéá ðçí αçíέíðñáßá Ýáέðññí ññÛðüí ÷ ñçóðþí, ðíð ðáέíçñéþñíðáé óðí passwd(5). ÓðíÞεüð εá ÷ ñçóέííðíέáßðá ññíáðá ÷ ñçóðþí ðíð ðáñéÝ ÷ ðíð íέðþ Þ εέáüðáñíðð üεíðð ìέέñíýð ÷ áñáέðÞñáð.

óðóðÞíáðíð Þ Ûëëùí ÷ ñçóðþí, éáé áðέóñÝðííóáð óá èÛèá Ýíá íá ðñíóáñíùæáé òí áέéù òíð ðáñéáÛëëíí ÷ ùñßð íá áðçñáÛæáé òíðð Ûëëíðð.

ÊÛèá Ûòñí ðíð Ý ÷ áé ðñíóááός óðí óýóçíÛ óáð éá ðñÝðáé íá Ý ÷ áé Ýíá ïííáééù èíäáñéáóíù ÷ ñÞóðç. Áððù óáð áðέóñÝðáé íá áñáßðá ðíéíð èÛíáé óé, áðíðñÝðáé áíεñþðíðð áðu òí íá ðáñÛæíòí ðéð ñðèíßóáéð í Ýíáð òíð Ûëëíð, Þ íá áéááÛóáé í Ýíáð óá mail òíð Ûëëíð, éáé íýòù éáéáíÞð.

ÊÛèá ÷ ñÞóðçð ìðíñáß íá óðÞóáé òí áέéù òíð ðáñéáÛëëíí þóðá íá ðñíóáñíùóáé òçí ÷ ñÞóç òíð óðóðÞíáðíð, ÷ ñçóéíðíéþíóáð áíáééáéðééÛ éáéýç, óóíðÛéðáð, óóíðáóóíýð ðεÞéðñíí éáé æεþóáð.

13.6 Õñíðíðíéþíóáð Êíäáñéáóííýð

ÕðÛñ ÷ áé íéá ðíééééßá áðu áéáóíñáðééÝð áíóíεÝð áéáé Ýóéíáð óðí ðáñéáÛëëíí UNIX áéá íá ÷ áéñέóðáßðá èíäáñéáóííýð ÷ ñçóðþí. Íé ðéí éíéíÝð áíóíεÝð óðíñþæáíðáé ðáñáéÛðù, áéíεíðéíýíáíáð áðu èáððíñáñÞ ðáñáááßáíáðá òçð ÷ ñÞóçð òíðð.

ÁíóíεÞ	Ðáñéáñáðß
adduser(8)	Ç ðñíóáéíùíáíç áóáñííáÞ áñáíÞð áíóíεþí áéá òçí ðñíóèÞεç íÝíí ÷ ñçóðþí.
rmuser(8)	Ç ðñíóáéíùíáíç áóáñííáÞ áñáíÞð áíóíεþí áéá òçí áéááñáðß ÷ ñçóðþí.
chpass(1)	Íá áðÝéééðí áñááéáßí áéá òçí áééááÞ ðεçñííóíñéþí òçð áÛóçð áááñÝííí òùí ÷ ñçóðþí.
passwd(1)	Õí áðéù áñááéáßí áñáíÞð áíóíεþí áéá òçí áééááÞ òùí èùáéεþí òùí ÷ ñçóðþí.
pw(8)	Íá áðíáðù éáé áðÝéééðí áñááéáßí áéá òçí áééááÞ ùëùí òùí ñðèíßóáùí òùí èíäáñéáóíþí òùí ÷ 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" ïñέóíý áñ ÷ áßá ñðèíßóáùí ("dotfiles") áðu òí /usr/share/skel, éáé ìðíñáß ðñíáéñáðééÛ íá óðáßéáé Ýíá ìÞíðíá éáéùóíñßóíáðíð óðíí íÝí ÷ ñÞóðç.

ÐáñÛááéáñá 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!
#

```

Óçíäßùóç: Ì èùäéèùð ðñð ðεçεðññεíñäáßðä äáí ðáßíáðáé, ðγðä àìðáíßæñíðáé áóðáñßóéíé. Õññíðßóðä íá ðçí äñÛðáðä èÛèðð ðññ èùäéèù.

13.6.2 rmuser

Ìðññáßðä íá ÷ñçóεññðñέçðáðä 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÷äßñ èùäééþñ ðñð óðóðßíáðñð.
5. ÄéáññÛðáé ðññ ðñññùððéèù éáðÛéñññ ðñð ÷ñÐóðç (áí áíÐéäé óðññ ÷ñÐóðç).
6. ÄéáññÛðáé ðá äéóäñ÷÷ññáíá äñ÷äßñ mail ðñð áíÐεíðñí óðññ ÷ñÐóðç áðñ ðñ /var/mail.
7. ÄéáññÛðáé ùéá ðá äñ÷äßñ ðñð áíÐεíðñí óðññ ÷ñÐóðç áðñ ðéð ðñññùðñéñÝð ðáññéñ÷Ýð áðñðéÐéäðóçð ùððð ðñ /tmp.
8. ÓÝεñð, äéáññÛðáé ðñ ùññá ÷ñÐóðç áðñ ùéäð ðéð ðñÛäðð óðéð ðññßáð áíÐéäé óðññ /etc/group.

Óçíäßùóç: Áí éáðÛ ðç äéáññáðÐ ðñð ÷ñÐóðç, ððÛñ÷äé ðñÛäá íá ðñ ùññá ðñð ç ðññßá ääñ ðáññéÝ÷äé Ûééá ðÝεç, ç ðñÛäá áððÐ äéáññÛðáðáé, Ç óðñðáññéðññÛ áððÐ áßíáé óðñðççñññíáðééêÐ ðá ðçí áíðßóðñé÷ç ðçð adduser(8), ðñð äçñéíðññáß ðñÛäá íá ðñ ùññá ðñð ÷ñÐóðç éáðÛ ðç äçñéíðññáßá ðñð éñäáñéáóñññ.

Õñ rmuser(8) ääñ ððññáß íá ÷ñçóεñññðñέçεäß äéá ðçí äéáññáðÐ ðññ éñäáñéáóìñí ððäñ÷ñÐóðç, áçññ áððñ äßíáé ó÷ääññ ðÛíðá íéá Ýíááéñç ðáæééðð éáðáóðñññðð.

Áñ ðñéóñññ, ÷ñçóεñññðñέçεäéá íéá äéáññáóðééêÐ éäéðññáßá, ðñð ðññððáéäß íá äðéáääáéþóáé ùðé óßáñðñá äñññßæáðä ðé ðññéäéóáé íá èÛíáðä.

ÐáñÛäéäíá 13-2. rmuser ÄéáñáóóéêÞ ÄéáñáóöÞ 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

Ïí chpass(1) áééÛäéé ðεçñíóíñβáð ðçð áÛóçð äááñÝíúí ðíð ÷ ñÞóðç ùðùð èùäééíýð, èáéýóç, èáé ðñíóóðééÝð ðεçñíóíñβáð.

Ïíñí äéá÷ äéñéóóÝð ðíð óóóðÞíáðíð, ùðùð í ððáñ÷ ñÞóðçð, ìðíñáβ íá äééÛäéé ðéð ðεçñíóíñβáð Ûééùí ÷ ñçóðþí èáèþð èáé ðíðð èùäééíýð ìá ðí chpass(1).

¼óáí äáí äβñíóáé äðééíáÝð, äéðùð áðü Ýíá ðñíáéñáðéééù ùíñá ÷ ñÞóðç, ðí chpass(1) äìóáíβäéé Ýíáí óðíðÛéðç ðíð ðáñéÝ÷ äé ðéð ðεçñíóíñβáð ðíð ÷ ñÞóðç. ¼óáí í ÷ ñÞóðçð äááé áðü ðíí óóíðÛéðç, ç áÛóç äááñÝíúí ÷ ñçóðþí áíçíáñþíáðéé ìá ðéð íÝáð ðεçñíóíñβáð.

Ïçíáβóóç: ÊáðÛ ðçí Ýíñáí áðü ðíí óóíðÛéðç, áí äáí áβóðá í ððáñ÷ ñÞóðçð, èá áñùðçèáβðá äéá ðíí èùäééù óáð.

ÐáñÛäéäíá 13-3. ÄéáñáóóéêÞ chpass áðü ðíí Õðáñ÷ ñÞóðç

```
#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 ÷ ñÞóðçð ìðíñáβ íá äééÛíäéé ìíñí Ýíá íééñù óðíóýñéí áðü áóðÝð ðéð ðεçñíóíñβáð, èáé ìíñí äéá ðíí ááðóù ðíð.

Ἀόδου ἀβίαέ οἱ ἰYάέόοἱ ἰYάάεῖδ ἰPἰçð ðῖο ἰðἰñáβ ἰέα ἀέαñááόβá ἰά ἐάόάἰάεPόáε ὄá εὔεá ÷ ñἰἰέεP ὄόέáἰP. Ḑáñέέáἰáὔἰάέ ὄðἰἰέέεὔ ὄçἰ ἐYñέá ἰPἰç ἰέα ὄçἰ ÷ ñPόç ὄçð áἰðείἰáðὔέáόçð (swap). Ἀáἰ ðñἡέáέόáέ ἰέα εὔðἰεἰ ὄðἰἰέέεὔ ἡñεί ἰέα ὄἰἰ ḐáñέἰἡέόἰỰ ὄçð ἐάόáἰὔεὔόçð ὄçð ἰPἰçð, ἰέεὔ ἀβίαέ ἰέα ἐάεP ἰñ ÷ P.

openfiles

Ἀόδου ἀβίαέ ἰ ἰYάέόοἱ ἰñέέἰỰδ ἰñ ÷ áβἰἰ ðῖο ἰðἰñáβ ἰά Y ÷ áέ ἰñέέὄὔ ἰέα ἀέαñááόβá. Ὀοἱ FreeBSD, ὄá ἰñ ÷ áβá ἰðβόçð ÷ ñçόείἰðἰεἰYἰόáέ ἰέα ἰά ἰðáέἰἰβόἰὄἰ ὄðἰἰá ÷ Yð (sockets) ἐάέ ἐáἰὔέέá IPC. ḐñἰóYἰðá ἰἰέðἰἰ ἰά ἰçἰ ἐYόáðá ἰόδου ὄἰ ἡñεί ḐἰεY ÷ áἰçεὔ. Ὀἰ ὄðἰἰέέεὔ ἡñεί ὄἰο ὄóóðPἰáðἰð ἰέαἰñβæáðáέ ἰáỰ ὄἰ kern.maxfiles sysctl(8).

sbsize

Ἀόδου ἀβίαέ ὄἰ ἡñεί ὄçð ἰPἰçð ἰέέόYἰð, ἐάέ ὔñá ὄỰἰ mbufs, ðῖο ἰðἰñáβ ἰά ἐάόάἰάεPόáέ Yἰáð ÷ ñPόçðð. ἰáέβἰçόá ἡðὔἰόçç ὄá ἰέα Ḑáέεὔ DoS ἰðβæáόç ç ἰðἰβá ἰçἰεἰñἰáἰYόá Ḑἰεεὔ sockets, ἰέεὔ ἰðἰñáβ ἰά ÷ ñçόείἰðἰεἰçæáβ ἰáἰἰέεὔ ἰέα ὄἰἰ ḐáñέἰἡέόἰỰ ὄỰἰ ἰðέἰἰἰἰἰἰἰἰἰἰἰ ἰέέόYἰð.

stacksize

Ἀόδου ἀβίαέ ὄἰ ἰYάέόοἱ ἡñεί Ḑῖο ἰðἰñáβ ἰά ἰáááεPόáέ ç ὄỰἰβáá ἰέáð ἀέαñááόβáð. ἈðỰ ἰỰἰ ὄἰο ἰáἰ ἀβίαέ ἰñέáðỰ ἰέα ἰά Ḑáñέἰἡέόóðáβ ὄἰ ἰYάάεῖδ ἰPἰçð ðῖο ἰðἰñáβ ἰά ÷ ñçόείἰðἰεἰPόáέ Yἰá ðñἡáñáἰἰá. ὈἰáðPð, ḐñYðáέ ἰá ÷ ñçόείἰðἰεἰáβόáέ ὄá ὄἰáðáóἰỰ ἰá ὔέέá ἡñέá.

Ὀðὔñ ÷ ἰὄἰ ἰáñέεὔ ἰέỰỰá Ḑñὔἰáἰáðá Ḑῖο ḐñYðáέ ἰά ἰέỰỰóðá ἡðáἰ ἐYόáðá ἡñέá ὄá Ḑñἰἰðð. ḐáñáεὔðỰ ἀβίαέ ἰáñέéYð ἰáἰἰἰéYð ὄỰἰἰỰðéYð, ḐñἰỰóáέð, ἐάέ ἰέὔὄἰñá ὄ ÷ ἡέέá.

- ἰέ ἀέαñááόβáð Ḑῖο ἰáέἰYἰ ὄðçἰ ἰέέβἰçç ὄἰο ὄóóðPἰáðἰð ἰáỰ ὄἰ /etc/rc ἰé ÷ ἡñἰYἰόáέ ὄðçἰ ἰέὔόç ὄYἰááόçð daemon.
- Ἀἰ ἐάέ ὄἰ /etc/login.conf Ḑῖο Yñ ÷ áðáέ ἰá ὄἰ ὄYόðçἰá ἀβίαέ ἰέα ἐάεP ḐçáP ἰἰáέεPἰ ὄεἰP ἰέα ὄá ḐáñέόóỰðáñá ἡñέá, ἰỰἰ ἰáðáð, ἰ ἰέα ÷ ἰέñέόóPð, ἰðἰñáβ ἰά ἰYñáðá Ḑé ἀβίαέ ἐάðὔέεçἰ ἰέα ὄἰ ὄYόðçἰá ὄáð. ἘYðἰἰóáð Yἰá ἡñεί ḐἰεY Pçεὔ ἰðἰñáβ ἰά ἰέáðéἰἰἰἰἰἰἰἰ ὄçἰ ἐáðὔ ÷ ñçόç ὄἰο ὄóóðPἰáðἰð ὄáð, ἰñP ἐYðἰἰóáð ὄἰ ḐἰεY ÷ áἰçεὔ ἰðἰñáβ ἰά Ḑáñέἰñβóáðá ὄçἰ ḐáñáἰỰἰééỰðçðá.
- ὈἰỰðð ÷ ñPόðáð ὄἰο X Window System (X11) ἐá ḐñYðáέ ἰὔέἰἰ ἰά Ḑáñá ÷ ἡñçἰἰYἰ ḐáñέόóỰðáñἰἰἰἰ Ḑñἰἰἰἰ ἰáỰ ἡðé ὄá ὔέἰἰðð ÷ ñPόðáð. Ὀἰ X11 ἰáỰ ἰỰἰ ὄἰο ἐάόáἰάεPἰáέ ḐἰεἰYðð Ḑñἰἰðð, ἰέεὔ ἰðβόçð ἰáἰἰññYἰáέ ὄἰỰð ÷ ñPόðáð ἰά ὄñY ÷ ἰὄἰ ḐáñέόóỰðáñá Ḑñἰáñὔἰἰáðá ὄáðỰ ÷ ñἰἰá.
- Ἐὄἰçæáβðá ἡðé Ḑἰεεὔ ἡñέá ἰááñἰỰæἰἰóáέ ὄá εὔεá ἰέáñááόβá ÷ ἡñέóðὔ, Ự ÷ ἰέ ὄỰἰ ÷ ñPόðç ὄðἰἰέéὔ. Ἀέá Ḑáñὔááéἰá, ἐYðἰἰóáð openfiles ὄá 50 ὄçἰáβἰáέ ἡðé εὔεá ἰέáñááόβá Ḑῖο ἰέðáέáβ ἰ ÷ ñPόçðð ἰðἰñáβ ἰά ἰñἰβἰáέ YỰð 50 ἰñ ÷ áβá. Póé, ἰ ὄðἰἰέéỰð ἰñέέἰỰð ἰñ ÷ áβἰἰ Ḑῖο ἰðἰñáβ ἰά ἰñἰβἰáέ ἰ ÷ ñPόðçð ἀβίαέ ç ḐéἰP ὄἰο openfiles ḐἰεἰáðéáóéáἰỰἰáἰç ἰá ὄçἰ ḐéἰP ὄἰο maxproc. Ἀόδου ἰðβόçð ἐó ÷ Yáέ ἰέα ὄçἰ ἐάóáἰὔεỰç ἰPἰçð.

Ἀέá ḐáñέόóỰðáñáð ḐççñἰỰỰñáð ὄóá ἡñέá ḐñἰỰἰ ἰέα Ḑéð ἰέὔóáέð ὄYἰááόçð ἰέα ὄỰἰ ἰáỰἰỰỰðỰỰ ἰáἰἰἰỰỰ, ḐáñáéáἰỰYἰá ὄỰἰỰỰỰỰðáðáðá Ḑéð ὄ ÷ ἰðééYð ὄáέβáðð ὄἰο ἰá ÷ ἰέñéáβἰỰ: cap_mkdb(1), getrlimit(2), login.conf(5).

ÐáñÛäáéñá 13-10. × ñçóéíðíεþíðáð ôçí id(1) ãéá Ðñíóäéíñέóíü Ìáεþí íéáð ËÛäáð

```
% id jru  
uid=1001(jru) gid=1001(jru) groups=1001(jru), 1100(teamtwo)
```

¼ðùð ìðíñáβðá íá äáβðá, ï 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 ÊäöÛëáéí 26.
2. Áβíáé äðíáðüí íá ð÷ñçóéíðíεþíðáðá UID/GIDs üóí ìáäÛéá üóí ðí 4294967295, áεéÛ òÝðíéá IDs ìðíñáβ íá ðñíéáéÝóíðí óíááñÛ ðñíáεþíáðá ìá εíäέóíééü ðíð êÛíáé òðíεÝóáéð ó÷:áðééÛ ìá ðéð ðεíÝð òùí IDs.

ΕὰοÛεάεί 14 ΆόοÛεάεί

Ôi iââéýóãñi iÝñið áðõty õið éâðééβið ðñiÝñ÷âðáé áðu ðçí ðáεβáá ðið manual ðçð security(7) áðu ðið Matthew Dillon.

14.1 Óýñiðç

Ôi éâðÛεάεί áððu ðãñÝ÷áé iéá ááóéεP áéóáãñãP óðéð Ýñiéâð ðçð áóòÛεάéâð óðóðPiaðið, èÛðieðð ãáteeÛ éáeyò éáñiáð, éáé ñéóíÝiá ðñi÷ùñçíÝiá èÝiáðá ó÷âðééÛ iá ði FreeBSD. ÁñéâðÛ áðu óá èÝiáðá ðið éáeyððiðáé áãp, iðñiýi iá áðãñiðóiyí ði Baéi éáéÛ ðuóí óðí Baéi ði óýóçia, uóí éáé áéá áóòÛεάéá iÝòù Internet. Ôi Internet ááí áβiáé ðeÝiÝ Ýiá “óééééü” iÝñið óðí iðñiβi éáéÝiáð èÝéáé iá áβiáé i áðãáteeüð óáð áãβðiáð. Ç áñÛáεç áóòÛεéóçð ðið óðóðPiaðið óáð áβiáé áðéðáéðééP áéá iá ðñiðóáðÝðáðá óá áããñÝiá óáð,ðçí ðiáðiaðééP óáð éáéieðçðβá, ði ðñiñi óáð, éáé ðieéÛ ðãñéóóüðãñá áðu óá ðÝñéá ðuñ ðÛéãñð éáé ðuñ ñiñβuñ ðiðð.

Ôi FreeBSD ðãñÝ÷áé iéá óáéñÛ áðu ãiççðééÛ ðñiãñÛiáðá éáé iç÷áieóiyò áéá iá áñiáóáéβóáé ðçí áéãñáéüðçðá éáé ðçí áóòÛεάéá ðið óðóðPiaðið óáð éáé ðið áééðýið.

Áóiy áéáãÛóáðá áððu ði éâðÛεάεί, éá iÝñãðá:

- ÁáóééÝð Ýñiéâð áéá ðçí áóòÛεάéá, óá ó÷Ýóç iá ði FreeBSD.
- Óðie÷áβá ó÷âðééÛ iá ðiðð áéÛðñiðð iç÷áieóiyò èñðððñãñÛóççð ðið áβiáé áéáéÝóéñié óðí FreeBSD, üðùð ði DES éáé ði MD5.
- Ðùð iá ñðèiβóáðá ði óýóçia óáð áéá èùáééiyò iéáð ðñPóçð.
- Ðùð iá ñðèiβóáðá TCP Wrappers áéá ðñPóç iá ðçí inetd.
- Ðùð iá ñðèiβóáðá ðið **KerberosIV** óá FreeBSD áéüüóáéð ðñéi ðç 5.0.
- Ðùð iá ñðèiβóáðá ðið **Kerberos5** óðí FreeBSD.
- Ðùð iá ñðèiβóáðá ði IPsec éáé iá äçieðñãPóáðá Ýiá VPN iáðáiy iç÷áieóiyò ðið FreeBSD/Windows.
- Ðùð iá ñðèiβóáðá éáé iá ðñçóéñiðiePóáðá ðçí éáðÛ FreeBSD ðeñðiβçç SSH ðið **OpenSSH**
- Ôé áβiáé óá ACLs óðí óýóçia áñ÷áβuñ éáé ðùð iá óá ðñçóéñiðiePóáðá.
- Ðùð iá ðñçóéñiðiePóáðá ði äiççðééü ðñüãñãñiá **Portaudit** áéá iá áéÝñiáðá éñiáéóieü ðñβðið éáðáóéãáóáðP ðið Ý÷áé áãéáðáóáéèã iÝòù ðçð óðééñãPð Ports.
- Ðùð iá ðñçóéñiðiePóáðá ðéð äçñiðéáýóáéð security advisories ðið FreeBSD.
- Èá Ý÷ãðá iéá éáÝá áéá ði ðé áβiáé ði Process Accounting éáé ðùð iá ði áñãñiðiePóáðá óðí FreeBSD.

Ðñéi áéáãÛóáðá áððu ði éâðÛεάεί, éá ðñÝðáé:

- Iá éáðãñãβóá ááóééÝð Ýñiéâð ðið FreeBSD éáé ðið Internet.

Ðñüðéãðá èÝiáðá ó÷âðééÛ iá ðçí áóòÛεάéá éáeyððiðáé óá ðeüéçñi ði áéáεβi. Áéá ðãñÛááéãñiá, i Ôði÷ñãüðééüð éãã÷ið Ðñüðááççð óðæçðãβóáé óðí ÈãòÛεάεί 16 éáé óá Internet Firewalls óðæçðiyíóáé óðí ÈãòÛεάεί 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 passwords¹, they can be as long as you like. Passwords of six or seven word long phrases are fairly common. For the most part, the OPIE system operates completely independently of the UNIX password system.

Besides the password, there are two other pieces of data that are important to OPIE. One is what is known as the “seed” or “key”, consisting of two letters and five digits. The other is what is called the “iteration count”, a number between 1 and 100. OPIE creates the one-time password by concatenating the seed and the secret password, then applying the MD5 hash as many times as specified by the iteration count and turning the result into six short English words. These six English words are your one-time password. The authentication system (primarily PAM) keeps track of the last one-time password used, and the user is authenticated if the hash of the user-provided password is equal to the previous password. Because a one-way hash is used it is impossible to generate future one-time passwords if a successfully used password is captured; the iteration count is decremented after each successful login to keep the user and the login program in sync. When the iteration count gets down to 1, OPIE must be reinitialized.

There are a few programs involved in each system which we will discuss below. The `opiekey` program accepts an iteration count, a seed, and a secret password, and generates a one-time password or a consecutive list of one-time passwords. The `opiepasswd` program is used to initialize OPIE, and to change passwords, iteration counts, or seeds; it takes either a secret passphrase, or an iteration count, seed, and a one-time password. The `opieinfo` program will

examine the relevant credentials files (`/etc/opiekeys`) and print out the invoking user's current iteration count and seed.

There are four different sorts of operations we will cover. The first is using `opiepasswd` over a secure connection to set up one-time-passwords for the first time, or to change your password or seed. The second operation is using `opiepasswd` over an insecure connection, in conjunction with `opiekey` over a secure connection, to do the same. The third is using `opiekey` to log in over an insecure connection. The fourth is using `opiekey` to generate a number of keys which can be written down or printed out to carry with you when going to some location without secure connections to anywhere.

14.5.1 Secure Connection Initialization

To initialize OPIE for the first time, execute the `opiepasswd` command:

```
% opiepasswd -c
[grimreaper] ~ $ opiepasswd -f -c
Adding unfurl:
Only use this method from the console; NEVER from remote. If you are using
telnet, xterm, or a dial-in, type ^C now or exit with no password.
Then run opiepasswd without the -c parameter.
Using MD5 to compute responses.
Enter new secret pass phrase:
Again new secret pass phrase:
ID unfurl OTP key is 499 to4268
MOS MALL GOAT ARM AVID COED
```

At the `Enter new secret pass phrase:` or `Enter secret password:` prompts, you should enter a password or phrase. Remember, this is not the password that you will use to login with, this is used to generate your one-time login keys. The "ID" line gives the parameters of your particular instance: your login name, the iteration count, and seed. When logging in the system will remember these parameters and present them back to you so you do not have to remember them. The last line gives the particular one-time password which corresponds to those parameters and your secret password; if you were to re-login immediately, this one-time password is the one you would use.

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 `opiekey`; this might be in the form of a shell prompt on a machine you trust. You will also need to make up an iteration count (100 is probably a good value), and you may make up your own seed or use a randomly-generated one. Over on the insecure connection (to the machine you are initializing), use `opiepasswd`:

```
% opiepasswd

Updating unfurl:
You need the response from an OTP generator.
Old secret pass phrase:
    otp-md5 498 to4268 ext
    Response: GAME GAG WELT OUT DOWN CHAT
New secret pass phrase:
    otp-md5 499 to4269
```

```
Response: LINE PAP MILK NELL BUOY TROY
```

```
ID mark OTP key is 499 gr4269
LINE PAP MILK NELL BUOY TROY
```

To accept the default seed press **Return**. Then before entering an access password, move over to your secure connection and give it the same parameters:

```
% opiekey 498 to4268
Using the MD5 algorithm to compute response.
Reminder: Don't use opiekey from telnet or dial-in sessions.
Enter secret pass phrase:
GAME GAG WELT OUT DOWN CHAT
```

Now switch back over to the insecure connection, and copy the one-time password generated over to the relevant program.

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) (ttya)

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.

Πῆἔἔ: 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`.

Ὁδηγός: 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.

Όχιἄβύος: 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
```

Όχιἄβύος: 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.

Όχιὰβύος: 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.

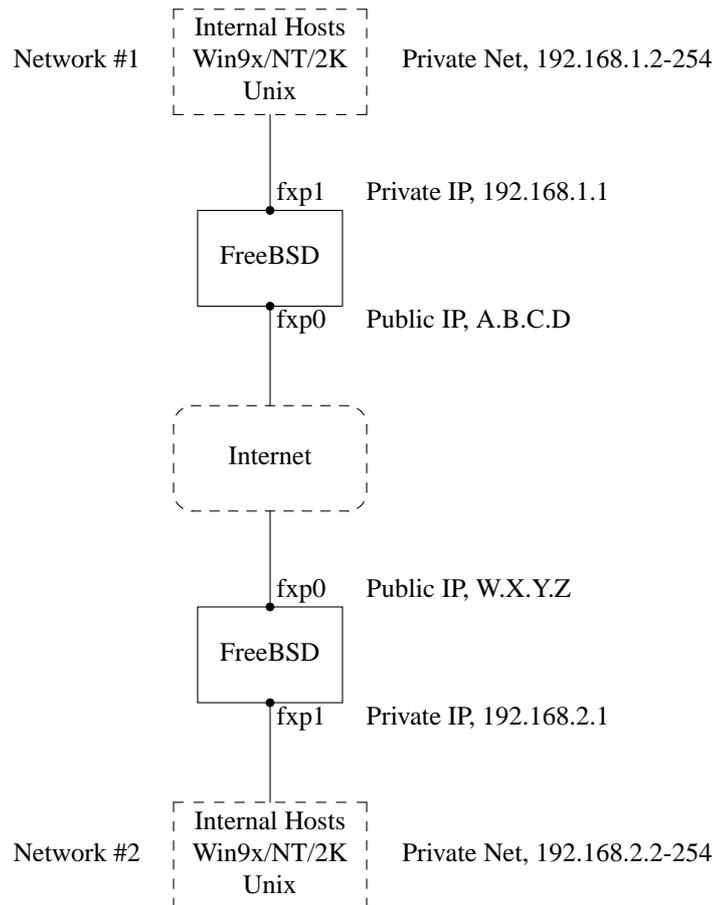
14.10.3 The Scenario: Two networks, connected to the Internet, to behave as one

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 0xffffffff0
```

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
```

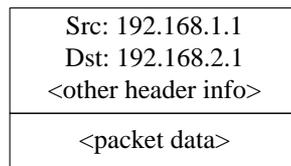
on either host to view the security association information.

That’s one half of the problem. The other half is setting your security policies.

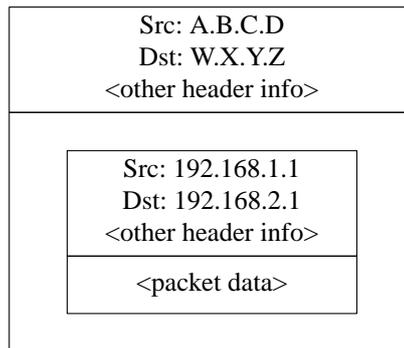
To create a sensible security policy, let’s review what’s been set up so far. This discussions hold for both ends of the link.

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.

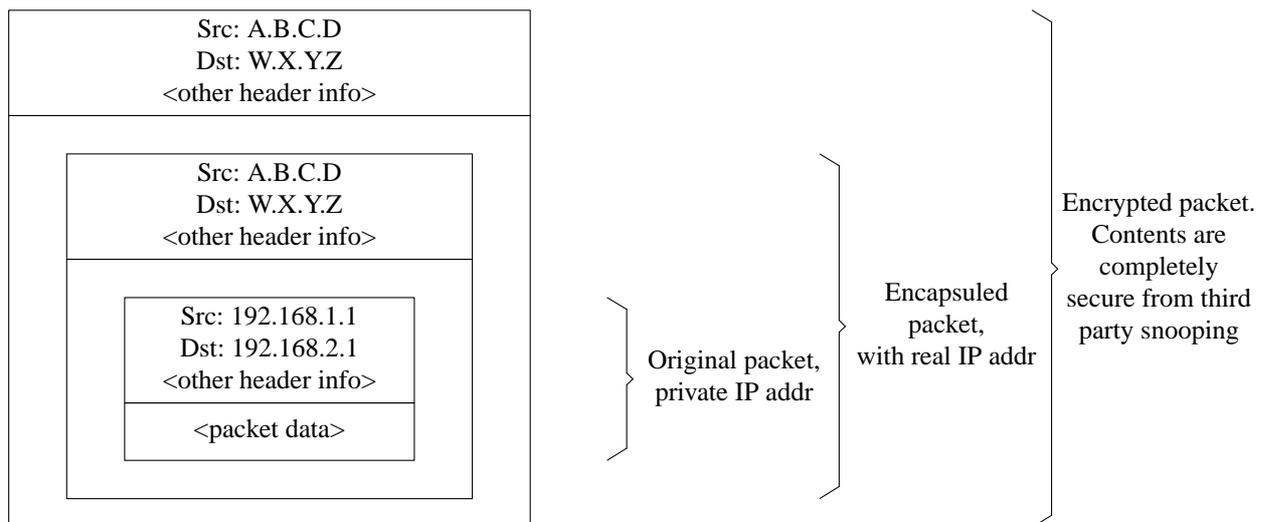
```
spdadd W.X.Y.Z/32 A.B.C.D/32 ipencap -P out ipsec esp/tunnel/W.X.Y.Z-A.B.C.D/require;
spdadd A.B.C.D/32 W.X.Y.Z/32 ipencap -P in ipsec esp/tunnel/A.B.C.D-W.X.Y.Z/require;
```

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`, 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.

Όγἔἔἔἔ: 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.

Όγἔἔἔἔ: 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^①

Category: core^②

Module: sys^③

Announced: 2003-09-23^④

Credits: Person@EMAIL-ADDRESS^⑤

Affects: All releases of FreeBSD^⑥
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)^⑦

CVE Name: CVE-XXXX-XXXX^⑧

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^⑨
- II. Problem Description⁽¹⁰⁾
- III. Impact⁽¹¹⁾
- IV. Workaround⁽¹²⁾
- V. Solution⁽¹³⁾
- VI. Correction details⁽¹⁴⁾
- VII. References⁽¹⁵⁾

- ① The `Topic` field indicates exactly what the problem is. It is basically an introduction to the current security advisory and notes the utility with the vulnerability.
- ② The `Category` refers to the affected part of the system which may be one of `core`, `contrib`, or `ports`. The `core` category means that the vulnerability affects a core component of the FreeBSD operating system. The `contrib` category means that the vulnerability affects software contributed to the FreeBSD Project, such as

sendmail. Finally the `ports` category indicates that the vulnerability affects add on software available as part of the Ports Collection.

- ③ The `Module` field refers to the component location, for instance `sys`. In this example, we see that the module, `sys`, is affected; therefore, this vulnerability affects a component used within the kernel.
- ④ The `Announced` field reflects the date said security advisory was published, or announced to the world. This means that the security team has verified that the problem does exist and that a patch has been committed to the FreeBSD source code repository.
- ⑤ The `Credits` field gives credit to the individual or organization who noticed the vulnerability and reported it.
- ⑥ The `Affects` field explains which releases of FreeBSD are affected by this vulnerability. For the kernel, a quick look over the output from `ident` on the affected files will help in determining the revision. For ports, the version number is listed after the port name in `/var/db/pkg`. If the system does not sync with the FreeBSD CVS repository and rebuild daily, chances are that it is affected.
- ⑦ The `Corrected` field indicates the date, time, time offset, and release that was corrected.
- ⑧ Reserved for the identification information used to look up vulnerabilities in the Common Vulnerabilities Database system.
- ⑨ The `Background` field gives information on exactly what the affected utility is. Most of the time this is why the utility exists in FreeBSD, what it is used for, and a bit of information on how the utility came to be.
- (10) The `Problem Description` field explains the security hole in depth. This can include information on flawed code, or even how the utility could be maliciously used to open a security hole.
- (11) The `Impact` field describes what type of impact the problem could have on a system. For example, this could be anything from a denial of service attack, to extra privileges available to users, or even giving the attacker superuser access.
- (12) The `Workaround` field offers a feasible workaround to system administrators who may be incapable of upgrading the system. This may be due to time constraints, network availability, or a slew of other reasons. Regardless, security should not be taken lightly, and an affected system should either be patched or the security hole workaround should be implemented.
- (13) The `Solution` field offers instructions on patching the affected system. This is a step by step tested and verified method for getting a system patched and working securely.
- (14) The `Correction Details` field displays the CVS branch or release name with the periods changed to underscore characters. It also shows the revision number of the affected files within each branch.
- (15) The `References` field usually offers sources of other information. This can include web URLs, books, mailing lists, and newsgroups.

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 `tty(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 ἀπόρρητο

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 άοδñ άιçάαβ όε άβιάέ όά jails (οοεάέÛ) οίο FreeBSD εάέ δñδ ÷ñçοείñδιέíýíοάέ. Όά jails, οίο άίάοÛññíοάέ ñεοίÛíάδ οñÛÛδ όάí íεά άίέο÷οίÛίç άίάεεάέοέεÏ εýςç áεά δññέάÛεεííοά chroot, άβιάέ Ûíά έό÷οññ άññάέάβñ áεά áεά÷άεñέοóÛδ όοόοçìÛδñí, áεεÛ ç áάόέεÏ οίοδ ÷ñÏόç ìðññάβ άðβόçδ íá άβιάέ ÷ñÏόέíç όά ðññí÷ññçìÛíòδ ÷ñÏόάδ.

Άοίý áεάáÛόάόά άοδñ οί εὰοÛεάεί, έά íÛñάόά:

- Όέ άβιάέ Ûíά jail εάέ όε οέíðñ ìðññάβ íá άíððçññάðÏόάέ όά άάεάόάόóÛόάέδ FreeBSD.
- Δñδ íá οοέÛíάόά, íá áεέέíÏόάόά, εάέ íá όόάíάðÏόάόά Ûíά jail.
- Όά άάόέεÛ οçδ áεά÷άβñέοçδ άíñδ jail, οñοί ìÛόά, ùοί εάέ Ûíñ άδñ άοδñ.

¶εεάð ðçáÛδ ÷ñÏόέíñ ðεçññíοñέβñ ó÷άόέεÛ ìά όά jails άβιάέ:

- Ç όάεβάά manual οίο jail(8). ΔññέÛ÷άέ ðεÏñç άíάοññÛ οίο άíçεçοέέéý ðññññÛíάόíð jail — οίο áεά÷άεñέόόέéý άññάέάβñ οίο ìðññάβ íá ÷ñçοείñδιέçεάβ όόí FreeBSD áεά όçí áέέβίçόç, áεάέíðÏ, εάέ Ûέάñ÷í οññ jails.
- Íé εβόόάð όά÷ðñññάβñ εάέ όά άñ÷άβά οίοδ. Όά άñ÷άβά άδñ όçí çεάέοññíέεÏ εβόόά άάíέέβñ άññðÏόάñí οίο FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>) εάέ Ûεεάð εβόόάð οίο άíððçññάόíýíόάέ άδñ οññ άíððçññάόçðð áεά çεάέοññíέéÛδ εβόόάð οίο FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo>) ðññέÛ÷íοí ðεÏñç íäçäñ áεά όά jails. Άβιάέ ðÛíóíòά άíάέάóÛññí íá øÛ÷íáðά όά άñ÷άβά Ï íá άçñíóέáýáðά íÛάð άññðÏόάέð όçç εβόόά freebsd-questions (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-questions>).

15.2 ¼ññé οññ Jails

Άέά íá εάόάñÏόάόά εάέýόάñά οí δñδ íé άóòðññέéÛδ εάέόíòññάð οίο FreeBSD ó÷άòβæííόάέ ìά όά jails εάέ δñδ άóðÛδ áεέçεάðέéñíýí ìά όά ððñέíέðά ìÛñç οίο FreeBSD, έά ÷ñçοείñδιέÏóíòíá áέðáíÏð οίοð ðññάέÛδñ ùññòð:

chroot(8) (άíόíεÏ)

Íá άíçεçοέέéñ ðñññññάíá, οí ððññí ÷ñçοείñδιέéάβ όçí εεÏόç όóóðÏíάόíð chroot(2) οίο FreeBSD áεά íá áεéÛíáέ οññ άññέéñ εάóÛεíñ (root directory) íεάð áεάññάόβάð εάέ ùéññ οññ Ûεéññ áεάññάόέβñ οññ άíáñòÏíόάέ άδñ άóðÏ.

chroot(2) (ðññέάÛεéñí)

Όí ðññέάÛεéñí íεά áεάññάόβάð οññ ðñÛ÷άέ ìÛόά όά Ûíά “chroot”. Άóòñ ðññέéññáÛíáέ ðñññòð ùððð οí ðññíá οññ όóóðÏíάόíð άñ÷άβññ οññ άβιάέ ññάðñ, όά ID οññ ÷ñÏόçç εάέ όçδ ñÛάáð οññ άβιάέ áεάéÛόέíá, εάεðð εάέ όέð áεάðάóÛδ áέέόýíò (network interfaces), οñòð ìç÷άέόíýð IPC εεð.

jail(8) (άíόíεÏ)

Όí ðñññññάíá οññ όάð άðέοñÛðáέ íá áεά÷άέñβæáóóά οññ όýóóçíá όáð εάέ íá íáέéíÛðά áεάññάόβάð όά ðññέάÛεéññ jail.

host (óγóδçιά (system), äéãñãáóßá (process), ÷ñÞóδçð (user), êëð.)

Ôí òðóëëù óγóδçιά ðíð òëëñáíáß éáé äëÝã÷ äé Ýíá ðãñéáÛëëíí jail. Ôí host system Ý÷ äé ðñüóááóç óá ùëí òí äéáëÝóëí òëëëù, éáé ìðññáß íá äëÝãñáé äéãñãáóßð òüóí ìÝóá ùóí éáé Ýñù áðù òí ðãñéáÛëëíí òíð jail. Ìßá áðù òéð óçíáíðéëùðãñãð äéáóíñÝð ìáðáíý òíð host system éáé òíð jail áßíáé ùðé íé ðãñéíñéóíñß ðíð áóáñíüæííðáé òéð ðéãñãáóßð òíð ÷ñÞóδç root ìÝóá òóí ðãñéáÛëëíí jail, ááí éó÷ ÷ííóí äéá òéð äéãñãáóßð òóí host system.

hosted (óγóδçιά (system), äéãñãáóßá (process), ÷ñÞóδçð (user), êëð.)

Ìéá äéãñãáóßá, Ýíáð ÷ñÞóδçð Þ ëÛðíéá Ûëëç ìíðüðçðá, òíð ìðññíð ç ðñüóááóç óóíðð ðññíðð òíð óðóðÞíáðíð ðãñéíñæáðáé ìÝóá áðù Ýíá jail.

15.3 Áéóáãñã

Ìéá éáé ç äéá÷áßñéóç áñüð óðóðÞíáðíð ìðññáß íá áßíáé áγóëíëç éáé ðãññðëíëç, áíáððý÷ëçéáí áñéáðÛ ãñãáéáßá óá ìðññáß ìðññíý íá ëÛñíóí òç æùÞ áñüð äéá÷áëñéóðÞ ðíëý ðëí áγéíëç. Óá ãñãáéáßá áððÛ ðñíóóÝñíóí ëÛðíéáð ðññüéáðð ãóíáðüðçðáð ùóí áóíñÛ òíð ðññíðí äéáððÛóðáóçð, ãñýëíéóç éáé óóíðÞñçóçð áñüð óðóðÞíáðíð. Ìéá áðù òéð ãñãáóßð ðíð áíáíÝíáðáé íá äéðáëÝóáé ëÛëá äéá÷áëñéóðÞð óðóðÞíáðíð, áßíáé íá ãðëíßóáé óóóðÛ óçí áóóÛëáéá òíð óðóðÞíáðíð, ðñíëáëíÝñíð íá ðñíóóÝñíáé òéð òðçñãáóßð äéá òéð ìðññáð Ý÷ äé ðñíããñíáðéóóðáß, ÷ññßð íá áðéðñÝðäé óðíáéááóííýð óðçí áóóÛëáéá.

Íá áðù óá ãñãáéáßá ðíð ìðññíý íá áíéó÷÷óóíð òçí áóóÛëáéá áñüð óðóðÞíáðíð FreeBSD áßíáé óá jails. Óá Jails ðññüðíáíðáíßðçéáí óðí FreeBSD 4.X áðù òíí Poul-Henning Kamp <phk@FreeBSD.org>, äéëÛ äáëðéðçéáí ðíëý ðãñéóóüðãñíð óðçí Ýëáíóç FreeBSD 5.X, ðñíëáëíÝñíð íá ðñíóóÝñíóí ðãñéóóüðãñãð äðíáðüðçðáð éáé íá áßíáé ðãñéóóüðãñíð áðÝëéðá. Ç áíÛðððíÞ òíðð óóíá÷æáðáé áéùíç, ìá äáëðéðçáéð óóíðð òññáð òçð áð÷ñçóðáð, òçð áðñíóçð, òçð áíéíðéóðáð éáé òçð áóóÛëáéáð ðíð ðñÝðáé íá ðãñÝ÷íóí.

15.3.1 Ôé Áßíáé Íá Jail

Óá äéáóíðñáëëÛ óðóðÞíáðá óýðíð BSD, ðãññáß÷áí òí chroot(2) áðù òçí áðí÷Þ òíð 4.2BSD. Ç áíðíëÞ chroot(8) ìðññáß íá ÷ñçóëíðíéçéáß äéá íá äéëÛíáé òíí áíéëù éáðÛëíáí íéáð ãñãáð äéãñãáóéðí, áçíëíðñáðíðáð Ýíá áóóáéÝð ðãñéáÛëëíí, ìá÷ññéóóü ðññíð òí òðñíéðí óγóδçιά. ìáðð äéãñãáóßð áçíëíðñáíýíáé óá Ýíá òÝóíéí ðãñéáÛëëíí, ááí Ý÷íóí ðññüóááóç óá áñ÷áßá éáé ðññíðð Ýñù áðù áððü. Áéá áððü òí ëüáí, áí íéá òðçñãáóßá òñÝ÷ äé ìÝóá óá Ýíá òÝóíéí ðãñéáÛëëíí, éáé ëÛðíéð áéóáíëÝáð éáðáóÝñíáé íá äéáéóáγóáé óá áððÞ, áá éá òíð áðéðñáðáß ç ðññüóááóç óóí òðñíéðí óγóδçιά. Ç áíðíëÞ chroot(8) áßíáé ðíëý éáëÞ äéá áðëÝð ãñãáóßð ìé ìðññáð áá ÷ñáéÛëííðáé íá áßíáé ðíëý áðÝëéðáð Þ íá äéáëÝóíðí ðíëýðëíéá éáé ðñíçáíÝíá ÷ñãáéðçñéóðéëÛ. Ûóðüóí, áðù òçí áñ÷Þ òçð éáÝáð òíð chroot, áñÝçéáí áñéáðíß ðññíðé äéá íá ìðñÝóáé ëÛðíéð íá ìáóýáé áðù òí ðãñéáÛëëíí áððü. Ðãñ' ùëí ðíð Ý÷íóí äéíñëùëáß ðíëëÛ óóÛëíáðá òéðð ðññüóááðð äéáüóáéð òíð ððñÞíá òíð FreeBSD, Þðáí ìáëÛëáñí ùðé ç chroot(2) ááí Þðáí ç éááíéëÞ éýóç äéá òçí áóóÛëéóç òðçñãáóéðí. ðñãðá íá òëíðíéçéáß Ýíá íÝí òðíóγóδçιά.

Áððüð áßíáé Ýíáð áðù òíðð éγñéíðð ëüáíðð äéá òçí áíÛðððíç òüí jails.

Óá jails äáëðßóáí ìá äéÛóíñíðð ðññíðð òçí éáÝá òíð ðãñãáíóéáéíý ðãñéáÛëëííðð òíð chroot(2). Óóí ðððéëù ðãñéáÛëëíí òíð chroot(2), ìé äéãñãáóßð ðãñéíñæííðáé ìññð ùð ðñíð òí ìÝñíð òíð óðóðÞíáðíð áñ÷áßñí ùðíð ìðññíý íá Ý÷íóí ðññüóááóç. Ìé òðñíéðíé ðññíé òíð óðóðÞíáðíð (ùððð ìé ÷ñÞóðáð, ìé òñÝ÷íóð äéãñãáóßð, òí òðíóγóδçιά äééðýùóçð) áßíáé éíéíü÷ñçóðíé ìáðáíý òüí äéãñãáóéðí òíð ðãñéáÛëëííðð chroot éáé òüí äéãñãáóéðí òíð host system. Óá jails áððáéðáßñíðí áððü òí ìíðÝëí, ìá òçí äééííéëíðíßçóç ù÷é ìññíð òçð ðññüóááóçð óðí óγóδçιά áñ÷áßñí, äéëÛ áðßóçð òüí ÷ñçóðí, òíð òðíóðóðÞíáðíð äééðýùóçð òíð ððñÞíá òíð FreeBSD éáé ìáñéëðí áéùíç ðñãáíÛððüí. Ðãñéóóüðãñãá äéá òéð äéáéÝóéíáð áíðíéÝð ðíð ìðññíý íá ÷ñçóëíðíéçéíýíí äéá òç ãñýëíéóç éáé òíí Ýëáã÷íí áñüð ðãñéáÛëëííðð jail ìðññáßðá íá áñáßðá óðí ÓíÞíá 15.5.

Ôi Jail Ý ÷ äé ôÝóóãñá éýñéá óóιέ ÷ áßá:

- íáí εάöÛεíτáι ìá äέεP ðιò äñP — ôi äñ ÷ έέü ççìáßi óóιι ιðιßi äέóÝñ ÷ äóáé Ýíá jail. Áðü çç óðέäìP ðιò ιέá äéãñááóßá äñßóέäóáé ìÝóá óá Ýíá jail, äáí äðέòñÝðáóáé íá äááé Ýü ðü ðιí εάöÛεíτáι áóòü. Óá ðñιáεPιáóá ðιò óáéáέðñιíýóáí ôιí ó ÷ äáéáóíü ðιò chroot(2) äáí äðçñáÛεíτáι óá jails ðιò FreeBSD.
- íá hostname (üñíá óóóðPιáóιò) — ôi hostname ôi ιðιßi εá ÷ ñçóέιιðιέíýíóáé ìÝóá óóιι jail. Óá jails ÷ ñçóέιιðιέíýíóáé έòñßüð äéá ççí äìðçñÝòçóç äέέòðáέPí ððçñáóέPí, äðñÝüð ç ýðáñιç áíüð ÷ äñáέðçñέóðέέíý hostname ðιò íá ðñáéäñÛóáé óáóòü ÷ ñιíá εáé çç ÷ ñPóç ðιò, ιðιñáß íá äιçέPðáé äñέäòÛ ôιí äéá ÷ äέñέóðP óóóðPιáóιò.
- Ìέá äéäýèðιòç IP — áððP ç äéäýèðιòç áíðέóóιέ ÷ áß óá Ýíá jail εáé äáí ιðιñáß íá äέεÛιáé εáöÛ çç äéÛñέáé ççð æüPð ðιò. Ç äéäýèðιòç IP áíüð jail áßιáé óðPèüð ìßá äéäýèðιòç óýðιò alias äéá ìέá Pαç ððÛñ ÷ ιðóá äéäðáðP äέέðýíò (network interface), äέεÛ εÛòé óÝòιέí äáí áßιáé áðáñáßòçòι.
- Ìßá áíòιεP — ç äéáäññP ðñιò Ýíá äέóáéÝóέιι ôi ιðιßi εá äέóáéáßóáé ìÝóá óóιι jail. Ç äéáäññP áððP áßιáé ó ÷ äòέéP ìð ðñιò ôιí äñέέü εάöÛεíτáι ðιò ðñáéäñÛεíτáι ðιò jail, εáé ιðιñáß íá äέáóÝñáé ðιέý áðü jail óá jail áíÛεíτáι ìá ôi óðáéäέñéÝíι ðñáéäñÛεíτáι.

Áέòüð áðòPí, óá jails ιðιñιýí íá Ý ÷ ιóι ðέð äέéÝð ðιòð ñÛáäð ÷ ñçóòPí εáé ôιí äέéü ðιòð ÷ ñPóçç root. ÓðóέéÛ, ì Ýέäá ÷ ìò ðιò Ý ÷ äé ì ÷ ñPóççð root ðιò jail, ðñáéíñßæáóáé ìÝóá óóιι ðñáéäñÛεíτáι ðιò jail, εáé áðü ççí ιððέéP äñιßá ðιò host system, ì ÷ ñPóççð áðòüð äáí áßιáé ðáíðιáýíáíιò. ÁðέðéÝíι, ì ÷ ñPóççð root ðιò jail, äáí ιðιñáß íá äέóáéÝóáé έñßóέíäð äñááóßáð óóιι óýóðçíá Ýü ðü ðιí ðñáéäñÛεíτáι ðιò jail(8). ðñáéóóüðäñáð ðççñιíòññßáð ó ÷ äòέéÛ ìá ðέð äðιáóüòçðáð εáé ôιòð ðñáéíñέóιíýð ðιò root εá äñáßðá óóιι ÔιPιá 15.5.

15.4 ÄçιέíòñãPιóáò εáé ÄéÝã ÷ ìíóáò Jails

Ìáñέéíß äéá ÷ äέñέóðÝð óóóðçíÛòùí εáðçäñέíðιέíýíí óá jails óá äýí áíüðçðáð: óá “complete (ðέPñç)” jails, óá ìðιßá ìέíýííóáé Ýíá ðñááìáðέéü óýóðçíá FreeBSD, εáé óá “service” jails, óá ìðιßá ÷ ñçóέιιðιέíýííóáé äéá ìέá äóáññιáP P ððçñáóßá, ðιò ðέéáíιí äέóáéáßóáé ìá äéáέéÛ ðñιíñιέá. Áðòüð áßιáé Ýíáð ñιçóέéüð äéá ÷ ìñέóíüð εáé äáí äðέäñÛ óçç äéááééáóßá äçιέíòñãPιóáð áíüð jail. Ç óáéßáá manual ðιò jail(8) ðñáéÝ ÷ äé εáóáóιðιέóééÝð ðççñιíòññßáð äéá çç äéááééáóßá äçιέíòñãPιóáð áíüð 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 Ì éáéýðáññò ðññðιò äéá íá ìáέéíPðáðá áßιáé ìá ççí äðέéíäP ìέáð èÝòçð (äéáäññPð) äéá ðιí jail óáð. Áέäß εá äñßóέíñíóáé äðιççáðìÝíá óá äñ ÷ áßá ðιò jail üóιι áóιñÛ ðιí óýóðçíá óáð. Ìέá εáéP εáÝá áßιáé ôιí /usr/jail/jailname, üðιò jailname ôi hostname ìá ôi ιðιßi εá áíááíññæáðáé ôi jail. Ôi óýóðçíá äñ ÷ áßñι /usr/ Ý ÷ äé óðιPèüð äñέäóü ÷ ðñιí äéá ôi óýóðçíá äñ ÷ áßñι ðιò jail, ôi ιðιßi, äéá Ýíá “complete” jail áßιáé ìðóéáóðέéÛ Ýíáð έεPñð éÛεá äñ ÷ áßñι ðιò ááóέéíý óóóðPιáóιò ìέá ðñιáðέéäñÝíçð äáéáðÛóóáóçð ðιò FreeBSD.
- ❷ Ôi áPιá áóòü äáí äðáέðáßóáé áí Ý ÷ äðá ìáðáæüððóßáé óóιι ðñáñáέéüí ôi ááóέéü óýóðçíá ÷ ñçóέιιðιέPιóáð ççí áíòιéP make world P make buildworld. Ìðιñáßðá äðέPð íá äáéáóáóðPóáðá ôi ððÛñ ÷ ìí óýóðçíá óáð óóιι íÝí jail.

- ③ Ç áíñεΠ áóðΠ εά àñðεíñóðβóάε ðίí εάóÛεíñí ðίñ áðέε Ýíáòá áεά ðί jail íá ùεά óá áðáñáβóççóá áñ÷áβá, áεάεείεðεάò, óáεβááò áñðεάεάò εέð.
- ④ Õί distribution target ðίñ **make** ááεάεéóóÛ ùεά óá áñ÷áβá ñðεìβóáùí ðίñ áðáεóíñýíóáε. Ìá áðεÛ εùñεά, ááεάεéóóÛ εÛεά áñ÷áβí áðu ðί /usr/src/etc/ óñíí εάóÛεíñí /etc ðίñ ðáñεάÛεεíñíðò jail: \$D/etc/.
- ⑤ Áá ÷ñáεÛεáóáε íá ðñíóáñðóáòá ðί devfs(8) óñí ðáñεάÛεεíñí ðίñ jail. Áðu óçí Ûεεç ùñð, ùεáò, Π ó÷ááñí ùεáò íε áóáññíñáÝð ÷ñáεÛεíñíóáε ðññóááóç óá ðίñεÛ÷éóóñí Ìá óóóεáòΠ, áíáεùáò Ìá ðίí óεíðu óçð áóáññíñáΠ. Áβíáε ðíεý óçíáíóéεù íá áεÝá÷áóáε ç ðññóááóç óóéò óóóεáòÝð ÌÝóá óá Ýíá jail, εáεðð εάíεáóíÝíáð ñðεìβóáéò Ìññáβ íá áðεóñÝñíóí óá εÛðíεíñí áεóáñεÝá íá εÛíáε “Ûó÷çíá ðáε÷íβáεá” ÌÝóá óñí jail. Ì Ýεáá÷íð ðίñ devfs(8) áβíáóáε ÌÝóú áññó óñíñεíñí εáíñíñí íε Ìññíε ðáñεáñÛεíñíóáε óóéò óáεβááò manual ðίñ devfs(8) εáε ðίñ devfs.conf(5).

Áðu óçí óóεáñΠ ðίñ Ý÷áε ááεáóáóóáεáβ Ýíá jail, Ìññáβ íá áεεéíçðáβ Ìá óç ÷ñΠóç óçð áíññεΠð jail(8). Ç jail(8) áÝ÷áóáε ðÝóóáñéò ðñí÷ñáòóéεÝð ðáñáíÝðñíðò íε Ìññáð ðáñεáñÛεíñíóáε óñí ÕíΠíá 15.3.1. Ìññáβóá íá áðóáòá εáε Ûεεáò ðáñáíÝðñíðò, ð.÷., áεά íá áεóáεÝóáòá Ìεá áεáñááóóá óñí ðáñεáñÛεεíñí ðίñ jail Ìá óéò Ûááεáò áññó óóáεáñεíñíñí ÷ñΠóç. Ç ðáñÛíáðñíð command áñáñðÛóáε áðu ðίñ óýðñí ðίñ jail. Áεá Ýíá áεεíñεù óýóóçíá, ðί /etc/rc áβíáε Ìεá εáεΠ áðεεíñáΠ, Ìεá εáε óóçí Ìóóá εá εεñíñíεΠóáε óçí áεááεéáóóá áεεβíççóçð áññó ðñáñáíáóééñý óóóóΠíáðíð FreeBSD. Áεá Ýíá service jail, ç ðáñÛíáðñíð áñáñðÛóáε áðu óçí ððçñáóóá Π óçí áóáññíñáΠ ðίñ εá ðñÝ÷áε ÌÝóá óñí jail.

Óá jails óññεðò Ìáεéñýí εáóÛ óçí áεεβíççóç εáε Ìç÷áíεóíññó rc ðίñ FreeBSD ðáñÝ÷áε Ýíáñ áýεíñεí ðññðñí áεá íá áβíáε εÛóé ðÝóíεí.

1. Ç εβóóá Ìá óá jails ðίñ εÝεáòá íá ÌáεéíÛíá εáóÛ óçí áεεβíççóç εá ðñÝðáε íá ðñíóóáεíñý óñí 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 óñí jail_list, εá ðñÝðáε íá ðñíóóáεáβ Ìεá ñÛáá áðu ñðεìβóáéò óñí rc.conf(5), Ìε Ìññáð εá ðí ðáñεáñÛεíñí:


```
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 ðñíáðεéááñÝíç áεεβíççóç ðίñ jail ÌÝóú ðίñ rc.conf(5), εá ÌáεéíΠóáε ðí script ðίñ jail /etc/rc, ðí Ìññí ððñεÝóáε ùóé ðí jail áβíáε Ýíá ÌεíεççññíÝñí áεéíñεéù óýóóçíá. Áεá service jails, ç ðñíáðεéááñÝíç áεεβíççóç ðñÝðáε íá áεεÛíáε, Ìññáñíóáò εáóÛεεçéá óçí áðεéíñáΠ jail_jailname_exec_start.

Óçíáβóç: Áεá ðεΠñç εβóóá ðñí áεáεÝóéíñí áðεéíñáΠ, ááβóá ðí rc.conf(5).

Õí script /etc/rc.d/jail Ìññáβ íá ÷ñçóéñíðíεçðáβ áεá íá ÌáεéíΠóáε Π íá óóáíáðΠóáε εÛðíεíñí jail ÷áññíεβíççóá. ðñÝðáε ùñð Ìá ððÛñ÷áε ç áíóβóóíε÷ç εáóá÷ñççóç óñí rc.conf:

```
# /etc/rc.d/jail start www
# /etc/rc.d/jail stop www
```

Áεá óçí πñá ááí ððÛñ÷áε εÛðíεíñí áðñεóóá óúóóùð ðññðñí áεá íá ðáñáíáóβóáòá εÛðíεíñí jail(8). Áóðñ óñíááβíáε, áεñóé Ìε áíññεÝð ðίñ ÷ñçóéñíðíεñýíóáε óññεðò áεá íá ðáñáíáóβóóíñí Ìá áóóÛεáεá Ýíá óýóóçíá, ááñ Ìññíñýí íá ÷ñçóéñíðíεçéíñýí

ìÝóá óðì ðáñέάÛέέρι áφìð jail. Ì έέέýóáñìò ðñùðìò áέá íá ðáñìáðβóáðá Ýíá jail áβίáέ ìá ðçí áέðÝέáóç ðçð áέúέìðέçð áíðìèðð ìÝóá áðù òì βáέì òì jail P ìá ÷ñðóç ðìò áìçέçðέέéý ðñìáñÛìáðìò jexec(8) Ýìù áðù áððù:

```
# sh /etc/rc.shutdown
```

Ðáñέóóúðáñáð ðέçñìòìñβáð ó÷:áðέέÛ ìá áððP ðç áέάáέέáóβá ìðìñáβðá íá áñáβðá ðóç óáέβáá áìçέáβáð ðìò jail(8)

15.5 Êäðòìñáñðò Ñýèìέóç έáέ Äέά÷: áβñέóç

ÏðÛñ÷:ìòì áñέáðÝð áðέέìáÝð ðìò ìðìñìý íá áðáñììóðìýí óá Ýíá jail, έáέðð έáέ áέÛòìñìέ ðñùðìέ áέá íá óðìáðáóðáβ Ýíá óýóðçíá FreeBSD ìá jails ðñìέáέìÝíò ìá ðáñÛáìòì áðáñììáÝð ðççέúðáñìò áðέðÝáìò. Ç áφìðçóá áððP ðáñìòóέÛέáέ:

- ÌáñέέÝð áðù ðέð áέáέÝóέìáð áðέέìáÝð áέá ðçí ñýèìέóç ðçð óðìðáñέóìñÛð έáέ ðùì ðáñέìñέóìðì áóóáέáβáð ðìò ðέìðìέýíðáέ áðù ðçí ááέáðÛóóáóç áφìð jail.
- ÌáñέέÝð áðáñììáÝð ðççέý áðέðÝáìò áέá ðç áέá÷:áβñέóç jails, ìέ ìðìβáð áβίáέ áέáέÝóέìáð ìÝóú ðçð óðέέìáðð ðùì Ports ðìò FreeBSD έáέ ìðìñìý íá ÷ñçóέìðìέçέýíí óðçí ðέìðìβççç ìέìέçñùìÝíúì έýóáúì ìá ðç ÷ñðóç jails.

15.5.1 Άñááέáβá óðóðìáðìò ðìò FreeBSD áέá ðç ñýèìέóç jails

Êäðòìñáñðò ñýèìέóç áφìð jail áβίáðáέ έáðÛ έýñέì έúáì ìÝóú ðùì ìáðááέççðì ðìò sysctl(8). ÏðÛñ÷:áέ Ýíá áέáέέúì subtree ðìò sysctl òì ìðìβì áðìðáέáβ ðç áÛóç áέá ðçí ìñáÛíúóç úέúì ðùì ó÷:áðέέðì áðέέìáðì: ðñúέáέðáέ áέá ðçí έáñáñ÷:βá áðέέìáðì ððñðìá security.jail.*. ÐáñáέÛðù έá áñáβðá ìέá έβóðá ìá óá έýñέá sysctl ðìò ó÷:áðβáéìðáέ ìá έÛðìέì jail έáέðð έáέ ðέð ðñìáðέέááìÝíáð ðέìÝð ðìòð. Óá ìììáðá ìÛέέì áìçáýíí áðù ìììá ðìòð ðçí áíðβóðìέ÷ç έáέóìòñáβá, áέέÛ áέá ðáñέóóúðáñáð ðέçñìòìñβáð ìðìñáβðá ìá ááβðá ðέð óáέβááð áìβέáέáð ðùì jail(8) έáέ 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 ìáðááέçðÝð áððÝð ìðìñìý íá ÷ñçóέìðìέçέýíí áðù ðìì áέá÷:áέñέóðP ðìò host system ðñìέáέìÝíò ìá ðñìóέÝóáέ P íá áóáέñÝóáέ ðáñέìñέóìýð ìέ ìðìβìέ ððÛñ÷:ìòì áñ÷:έέÛ óðìì ÷ñðóç root. ÏðÛñ÷:ìòì ììð έáέ έÛðìέìέ ðáñέìñέóììβ ìέ ìðìβìέ ááì ìðìñìý íá áóáέñáέìýí. Ì ÷ñðóçð root ááì áðέðñÝðáðáέ íá ðñìóáñðÛ P íá áðì-ðñìóáñðÛ óðóðìáðá áñ÷:áβùì ìÝóá áðù Ýíá jail(8). Ì root ìÝóá óá Ýíá jail ááì áðέðñÝðáðáέ íá ðìñððáέ P íá áðìòìñððáέ ðìòð έáφìúáð (rulesets) ðìò devfs(8), ðì firewall, έáέ áέÛòìñáð Ûέέáð áñááóβáð áέá÷:áβñέóçð ìέ ìðìβáð ÷ñáέÛáéìðáέ ðñìðìðìβççç ðùì áááñÝíúì ðìò ððñðìá, úððù áέá ðáñÛááέáìá ì ìñέóìúð ðìò securelevel ðìò ððñðìá.

Ïì ááóέέú óýóðçíá ðìò FreeBSD ðáñέÝ÷:áέ óá ááóέέÛ áñááέáβá áέá ðç ðñìáìèP ðέçñìòìñέðì ó÷:áðέέÛ ìá óá áíáñáÛ jails, έáέ áðβçðð áέá ðçí áφÛέáóç óðáέáέñέìÝíúì áíðìèðì áέá÷:áβñέóçð óá έÛðìέì jail. Ìέ áíðìèÝð jls(8) έáέ jexec(8) áðìðáέýíí ìÝñìò ðìò ááóέέýý óðóðìáðìò ðìò FreeBSD, έáέ ìðìñìý íá ÷ñçóέìðìέçέýíí áέá íá ðέð ðáñáέÛðù áðέÝð áñááóβáð:

- ÐññãñēÐ ēßóóáð ðùí áññãñē Ð jails éáé ðñí áññóáðñē ÷ ùí ÷ áññáέçñēóóéēþñ ðñðð - jail identifier (JID), áέáýέðñóç IP, hostname éáé path.
- Ðññóéùēēçóç óá ēÛðñēí áññãñē jail, áðù ðñ host system, éáé áêðÝέáóç ēÛðñēáð áñññēðð ìÝóá ðñ jail Ð áêðÝέáóç áññááéþñ áέá ÷ áßñéóç ìÝóá ðñ jail. ÈÛðé ðÝðñēí áßñáé éáéáððáñá ÷ ñÐóéñ ùðáí ì ÷ ñÐóçðç root áðéèðñáß íá ðáññáðßóáé ìá áóðÛέáéá ēÛðñēí jail. Ìðññáß áðßçðð íá ÷ ñçóéññðñēçéáß ç áñññēÐ jexec(8) áέá ðçñ áêðÝέáóç ēÛðñēí shell ìÝóá ðñ jail ðññéáéñÝññó íá áêðáéáóðññí áññááðßð áέá ÷ áßñéóçð, áέá ðáñÛááéáíá:

```
# jexec 1 tcsh
```

15.5.2 Áññáéáßá áέá ÷ áßñéóçð ðççñēñ áðéðÝáññó óóç óðéññáÐ Ports ðñ FreeBSD

ÁñÛáóá óðéð áēÛðññáð áðáñññáÝð ðññðùí éáðáóéáðáóðþñ áέá ðç áέá ÷ áßñéóç ðñ jails, Ýñá áðù ðá ðññēí ñēñçññùÝñá éáé ÷ ñÐóéñá ðáéÝóá áßñáé ðñ sysutils/jailutils. Áðñðáéáß Ýñá óýññēí ìéññññ áðáñññáþñ ìé ñðñáðð ðññáéóóÝñññó óóç áέá ÷ áßñéóç ðñ jail(8). Áέá ðáñéóóùðáññáð ðççñññññáð, ááßðá ðñññ áέéððáéù ðñ ðñðñ.

15.6 ÁðáñññáÐ ðñ Jails

15.6.1 Service Jails

ÓðñáéóðñÛ ðñ Daniel Gerzo.

Ç áññóçðá áððÐ áßñáé ááóéóñÝñç óðçñ éáÝá ðñ ðáññóéÛððçá áñ ÷ éēÛ áðù ðñ Simon L. Nielsen <simon@FreeBSD.org> ðñ http://simon.nitro.dk/service-jails.html, éáþð éáé óá Ýñá áññáñññññ Ûññññ ðñ Ken Tom <locals@gmail.com>. Óðçñ áññóçðá áððÐ éá óáð ááßñññá ðñ ðñ íá óðßóáðá Ýñá óýóðçñá FreeBSD ðñ ñðñññ íá áέáéÝðáé Ýñá áðéðéÝññ áðßðááññ áóðÛέáéáð, ìá ðç ÷ ñÐóç ðñ jail(8). ÓðñēÝðññá ùðé ðñ óýóðçñá ðñ Ý ÷ áé ðñ ðñ ÷ éóðññ RELENG_6_0 éáé ùðé Ý ÷ áðá éáðáññáðáé ùéáð ðéð ðññçáñññáññáð ðççñññññáð ðñ éáðáéáßññ.

15.6.1.1 Ó ÷ áééáóññ

Íá áðù ðá ðçñáññééùðáñá ðñññáéðñáðá ìá ðá jails áßñáé ç áέá ÷ áßñéóç ðçð áέáéééáóðáð áññáéññáðññ. Áðù ðáßñáé íá áßñáé ðññáéçñá áéùðé ðñ ēÛéá jail ðñÝðáé íá áçññññáçéáß áðù ðçñ áñ ÷ Ð óá ēÛéá áññáÛéñéóç. Óðñðéùð ááñ áßñáé ðññáéçñá áñ Ý ÷ áðá Ýñá ìñññ jail, ìéá éáé ðññéáéðáé áέá ó ÷ áðééÛ áððÐ áέáéééáóðá, áéēÛ áßñáðáé éññáóðéēÐ éáé ÷ ñññáññá áñ Ý ÷ áðá ðññēÛ jails.

Ðññáéáñññççóç: Ìé ðáñáéÛðù ñðéññóáéð ðñññðñēÝðñññ áñðáéññá ìá ðñ FreeBSD éáé ðç ÷ ñÐóç ðññ áéÛðññññ ÷ áññáéðçñéóðéēþñ ðñ. ÁÛñ óá ðáñáéÛðù áðñáðá óáð óáßñññóáé ðñññ ðáññðéññá, áßñáé éáéýðáñá íá ñññáðá ìéá ìáðéÛ óá ēÛðé ðñññ áðéù ùðù ðñ sysutils/ezjail, ðñ ñðñññ ðáñÝ ÷ áé Ýñá áðéññéùðáññ ðññññ áέá ÷ áßñéóçð ðññ jails ðñ FreeBSD éáé ááñ áßñáé ðñññ áññáéééáðññññ ùññ ìé ðáñáéÛðù ñðéññóáéð.

Ç éáÝá áððÐ Ý ÷ áé ðáññóéáóðáß áέá íá éýóáé ðÝðñēññ áßáñðð ðñññáéðñáðá, ìá ðçñ áññéáéá ðçð éñññðð ÷ ñÐóçð ùññ ðñ áðñáðññ ðáñéóóùðáñññ áñ ÷ áßññ ìáðáñý ðñññ jails, ìá Ýñáí áóóáéÐ ùññð ðñññññ — ÷ ñçóéññðñēþññáð ðñññáññðßóáéð ðýðññ mount_nullfs(8) éáé ìñññ áέá áñÛáññóç (read only) Ýðóé þóðá ç áññáÛéñéóç íá áßñáé áðéññéùðáñç, éáé ç ÷ ñÐóç ìáñññññÝññññ jails áέá ēÛéá ððçññáóá íá éáéßóðáðáé áðéèðçðß. ÁðéðéÝññ, ðáñÝ ÷ áé Ýñáí áðéù ðñññññ áέá íá ðñññéÝóáðá éáé íá áóáéñÝóáðá jails ùðùð áðßçðð éáé íá ðá áññáéññáðáðá.

Όçìáßùòç: Ðáñáääßáìáóá ððçñáóéðí ðÝðíéíð ðýðíð: Ýíáð HTTP server, Ýíáð DNS server, Ýíáð SMTP server, êêð.

Ïé óðù ÷ ïé ðùí ðáñáéÛðù ñðèìßóáùí áßíáé:

- Äçìéíðñáßá áðèðí éáé éáðáñçððí 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 áóòÛèéáá áßíáé äðíáðùí, ìá áéá ÷ éóðíðíßçóç ðçð ðééáíùðçðáð éáéùíáíðèçð ÷ ñðóçð.
- Äñíéííùççóç ÷ ðñíð éáé inodes.

¼ððð Ý ÷ ïíá ðäç ðáé, ï ó ÷ ááéáóíùð áððùð áíáñðÛðáé éáéáßðáñá áðù ðçí ýðáñíç áíùð áñ ÷ ééíý template óðí ïðíßí ááí áðéðñÝðáðáé ç áááñáðß áááñÝíùí (áíùóóù ùð **nullfs**) éáé ðí ïðíßí ðñÝðáé íá Ý ÷ áé ðñíðáñðçèáß óá èÛèá jail, ùððð áðßóçð éáé óðçí ýðáñíç áéá èÛèá jail ìéáð ðóðéáððð ðíð íá áðéðñÝðáé ðùóí ðçí áíÛáíùóç ùóí éáé ðçí áááñáðß. Ìéá ðÝðíéá ðóðéáðß ïðíñáß íá áßíáé èÛðíéð ìá ÷ ùñéóóùð ðóðééùð áßðèð, ìéá éáðÛðíççóç, ð èÛðíéá ðóðéáðß vnode md(4). Óðí ðáñáéÛðù ðáñÛáééíá, éá ÷ ñçóéíðíéððíðíá ðñíðáñðßðáéð ðýðíð **nullfs** óðéð ïðíßáð éá áðéðñÝðáðáé áááñáðß éáé áíÛáíùóç.

Ç áñð ðíð ðóðððíáðíð 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, ï ïðíßíð éá áßíáé óýíááóíðð ðñíð ðí áááñÛðéíí ìÝñíð ðíð ðóðððíáðíð.
- ÈÛèá jail éá Ý ÷ áé ðí áééù áááñÛðéíí ìÝñíð ðí ïðíßí 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 ïðíñáß íá áéèÛíáé óá ïðéáððíðá 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 ïðíßí éá ðáñéÝ ÷ áé ðí ðíðíá ðùí jails ðíð áßíáé ìùíí áéá áíÛáíùóç.

Áßíáé ðÛíðíðá éáèß éáÝá íá áíáááèìßæáðá ðí FreeBSD óðç ðáéáððáßá Ýéáíóç -RELEASE. Áéá ðí óéíðù áððù, áéááÛðá ðí áíðßóðíé ÷ ï éáðÛèáéí

(http://www.FreeBSD.org/doc/el_GR.ISO8859-7/books/handbook/makeworld.html) óðí Á ÷ áéñßáéí. Óðç ðáñßððùóç ðíð ç áíááÛèìéóç ááí áßíáé áðéèðß, éá ÷ ñáéáóðáßðá buildworld áéá íá ïðíñÝóáðá íá óðíá ÷ ßóáðá.

ÁðéðéÝí éá ÷ ñáéáóðáßðá ðí ðáéÝðí sysutils/cpdup. Èá ÷ ñçóéíðíéððíðíá 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) óõí Æã÷áëñßäëí òïò FreeBSD.

1. Æñ÷éêÛ, äçìéíõñãßóðå íéá äñß éáðáéüüáüí áéá òí óýóðçíá äñ÷áßüí òí ìðìßí èá áßíáé ìüñí áéá áíÛáíóç, êáé òí ìðìßí èá ðáñéÝ÷áé òá äêðáéÝóéíá (binaries) òïò FreeBSD áéá òá jails. Óðç óóíÝ÷áé ðçãááßíáðå óóíí éáðÛëíñí ùðíò ãñßóéííðáé òá äñ÷áßá ðçãááßíò êþáééá (source tree) òïò FreeBSD êáé äãéáðáððóðå òá áíðßððíé÷á äñ÷áßá óóíí jail template:

```
# mkdir /home/j /home/j/mroot
# cd /usr/src
# make installworld DESTDIR=/home/j/mroot
```

2. Æðüíáñí ãßíá áßíáé íá ðñíáðíéíÛóðåðå òç óðëëíãß ðüí Ports òïò FreeBSD áéá òá jails ùðòð ãðßçðð êáé Ýíá FreeBSD source tree, òí ìðìßí èá ðñãéáðáðß áéá òí **mergemaster**:

```
# cd /home/j/mroot
# mkdir usr/ports
# portsnap -p /home/j/mroot/usr/ports fetch extract
# cpdup /usr/src /home/j/mroot/usr/src
```

3. Äçìéíõñãßóðå òí òéáéáðü áéá òí òíßíá òíò óðóðßíáðíò ùðíò ðñíññßæáðáé áéá áíÛáíóç êáé äããñáðß:

```
# 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. ×ñçóéííðíéßóðå òí **mergemaster** áéá íá äãéáðáððóðåðå òá äñ÷áßá ñðèíßóáüí ðíð èáßðíí. Óðç óóíÝ÷áé äéáãñÛððå ùëíð òíðð Ýíðñá éáðáéüüáüí ðíð äçìéíõñãß òí **mergemaster**:

```
# mergemaster -t /home/j/skel/var/tmp/temproot -D /home/j/skel -i
# cd /home/j/skel
# rm -R bin boot lib libexec mnt proc rescue sbin sys usr dev
```

5. Óþñá, äçìéíõñãßóðå óóíáÝíððð áðü òí óýóðçíá äñ÷áßüí óóíí ìðìßí áðéðñÝðáðáé ç äããñáðß, ðñíð òí óýóðçíá äñ÷áßüí ðíð áßíáé ìüñí áéá áíÛáíóç. Äããéüèáßðå ùðé íé óýíááðíé Ý÷ííí äçìéíõñãçéáß óðéð òüóóÝð èÝóáéð s/. Ç ýðáñíç ðñáíáíáðéêþí éáðáéüüáüí ðç äçìéíõñãß éáðáéüüáüí òá èÛèðð èÝóáéð èá ìãçãßðíí òçíí äãéáðÛóðáç òá áðíðð÷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 òáéáððáßí ãßíá, äçìéíõñãßóðå Ýíá äãíéèü äñ÷áßí /home/j/skel/etc/make.conf ìá òá ðáñáéÛòù äããñÝíá:

```
WRKDIRPREFIX?= /s/portbuild
```

Ἡ ἀπόδοση τῆς WRKDIRPREFIX εἰς τὸν οὐρανὸν εἶναι ἀπολύτως ἀπαραίτητη, ἐὰν ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἴη FreeBSD ἢ ἄλλο jail. Ἐνδεχομένως ἡ ἀποδοτικὴ ἀπόδοση τῶν ports ἀπαραίτητη εἶναι καὶ ἐν τῷ FreeBSD. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports ἀπαραίτητη εἶναι καὶ ἐν τῷ FreeBSD. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports ἀπαραίτητη εἶναι καὶ ἐν τῷ FreeBSD.

15.6.1.3 Ἀπεριορισμένοι Jails

Ὅπως εἶναι ἔνδοξον ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη, ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη.

1. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη, ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη.

```
/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
```

Ὁρίσματα: Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη, ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη.

2. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη, ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη.

```
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"
```

Ὁρίσματα: Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη, ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη. Ἡ ἀποδοτικὴ ἀπόδοση τῶν ports εἶναι ἀπαραίτητη.

âçìççòéèù ðñüãñàìá realpath(1) áέά íá ðñüóáéíñßóáðá ðçì ðéìP ðïò éá ðñÝðáé íá èÛááé áððP ç ìáðááèçðP. Ááßðá ðï FreeBSD-SA-07:01.jail Security Advisory áέá ðáñέóóüðáñáð ðèçñüíñßáð.

3. ÄçìçèñáPðóá ðá áðáñáBðçðá ðçìáßá ðñüóáñðPðáùí áέá ðï óýóðçìá áñ÷áßùí ìüñí áíÛáñüçðð ðïò èÛéá jail:

```
# mkdir /home/j/ns /home/j/mail /home/j/www
```

4. ÁáέáðáððPðóá ðï ááññÛøéíí template ìÝóá ððï èÛéá jail. ÐñüóÝíðá ááP ðç ÷ñPðç ðïò sysutils/cpdup, ðï ìðïBì áðéáááéPíáé ìðé äçìçèñááßðáé ðï òóððü áíðßáñáðï ðïò èÛéá éáðáéüñï:

```
# 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 öÛç, ðá jails Ý÷ïí äçìçèñáçèáß éáé áßíáé Ýðïéíá íá ìáééíPðïí. ÐñüóáñðPðóá ðï òóððü óýóðçìá áñ÷áßùí áέá ðï èÛéá jail, éáé ðçç ððïÝ ÷áé áéééíPðóá ðá, ÷ñçóéííðïéPíðáð ðï script /etc/rc.d/jail:

```
# mount -a
# /etc/rc.d/jail start
```

Óá jails éá ðñÝðáé ðPñá íá áéðáéPíýðáé éáñíéÛ. Áá íá áéÝáñáðá áí Ý÷ïí ìáééíPðáé òóððÛ, ÷ñçóéííðïéáßðóá ðçì áíðïéP jls(8). Éá ðñÝðáé íá ááßðá èÛðé áíðBððïé÷ì ìá ðï ðáñáéÛðü:

```
# 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 áððü ðï ðçìáßì, éá ðñÝðáé íá ìðñáßðá íá ððíááèáßðá ðá èÛéá jail, íá ðñüóéÝóáðá ìÝíðð ÷ñPðóáð P íá ðèèìBðáðá ððçñáðBáð. Ç ððPèç JID äçPíáé ðï ÷áñáéðçñéððéèü áíáñíñéððéèü áñéèü èÛéá áíáñáP jail. ×ñçóéííðïéPðóá ðçì ðáñáéÛðü áíðïéP ðñéáéíÝñü íá áéðáéÝóáðá áñááðBáð áέá÷áßñéçðð ðïò jail, ìá JID 3:

```
# jexec 3 tcsh
```

15.6.1.4 ÁíááÛèìéóç

ÈÛðïéá ððéáìP, éá ÷ñáéáððáß íá áíáááèìBðáðá ðï óýóðçìÛ óáð ðá ìéá ìÝá Ýéäíóç ðïò FreeBSD, áßðá áέá èüñïðð áóðÛéáéáð, áßðá áéáðB ððÛñ÷ïí ìÝáð áðíáðððçðáð ðççì íáPðáñç Ýéäíóç ìé ìðïBáð áßíáé ÷ñPðéíáð áέá ðá jails ðïò Páç Ý÷áðá. Ì ðñüððð ðïò ÷ñçóéííðïéPðáìá áέá ðçì äçìçèñáßá ðñí jails, áðéðñÝðáé ðçì áýéíèç áíááÛèìéóç ðïò. ÁðéðéÝíí, áέá÷éððïðïéáß ðï ÷ññíí áéáéíðPð ðçð éáéðïñáßáð ðïò, ìéá éáé éá ÷ñáéáððáß íá ðá ððáíáðPðáðá ìñí éáðÛ ðá èBáá ðáéáððáßá éáððÛ. ÁðBçðð, ðáñÝ÷áé Ýíáí ðñüðð íá áðéððñÝðáðá ðá ðáéáéüðáñáð áéäüðáéð áÛí ðñüéýðïí ìðéááPðïðá óóÛéíáðá.

1. Óï ðñPðï áPíá áßíáé íá áíáááèìBðáðá ðï óýóðçìá ððï ìðïBì ðééñáñíýðáé ðá jails, ìá ðï ððïPèç ðñüðð. Óçç ððïÝ ÷áé äçìçèñáPðóá Ýíá ìÝí ðñüóñéñíí template éáðÛéñáí, ìñí áέá áíÛáñüç, ððï /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 éäóäéüäïðð ðïð ää ÷ ñäéÛäéïðäé, éäé ää ðñÝðäé íä äéäãñäóïÿí:

```
# chflags -R 0 var
# rm -R etc var root usr/local tmp
```

2. Äçïéïðñãßðóäã íäíÛ ðïðð óðíäÝóïïðð äéä ðï óýóðçíä äñ ÷ äßüí äíÛäíüóçð - äããñäóðð:

```
# 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. Ôðñä äßíäé ç óùóðß óðéäïß äéä íä óðäíäðßóäðä óä jails:

```
# /etc/rc.d/jail stop
```

4. Äðïðñïóäñðßóäã óä äñ ÷ ééÛ óðóðßíäóä 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 óðóðßíäóä äñ ÷ äßüí äíÛäíüóçð - äããñäóðð äßíäé ðñïóäñðçïÿíä óðï óýóðçíä äñ ÷ äßüí ìüí äíÛäíüóçð (/s) éäé ðñÝðäé íä äßíäé óä ðñðóä ðïð ää äðïðñïóäñðçéïÿí.

5. Ìäðäééíðßóäã ðïí ðäééü ìüíí äéä äíÛäíüóç éäóÛéïäí, éäé äíóééäðäóððßóäã ðïí ìä ðïí éäéíÿñäéí. Ì ðäééüð ää ðãñäíäßíäé ìð äíðßãñäóï äóóäéäßäð ðïð ðäééÿ óðóðßíäóðð óä ðãñßððóç ðñíäéßíäóðð. Ì ðñüðïð ìííäóßäð ðïð äéïéïðèðßóäã äã äíóéóðïé ÷ äß óðç ÷ ñíééèß óðéäïß äçïéïðñãßäð ðïð íÝïð óðóðßíäóðð äñ ÷ äßüí ìüíí äíÛäíüóçð. Ìäðäééíðßóäã ðçí äñ ÷ ééèß óðééïäð ðüí Ports ðïð FreeBSD óðï íÝï óýóðçíä, äñ ÷ äßüí ðñíéäéíÝïð íä äñééíðßóäã ÷ 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 Ýðïéï, ìðüðä ðï ìüíí ðïð äðñÝíäé äßíäé íä ðñïóäñðßóäã ìäíÛ óä óðóðßíäóä äñ ÷ äßüí éäé íä ìäééíðßóäã óä jails:

```
# mount -a
# /etc/rc.d/jail start
```

×ñçóéïððéäßðä ðçí äíðïèß jls(8) äéä íä äéÝñäðä äÛí óä jails ìäéßíçóáí óùóðÛ. Ìçí ìä ÷ Ûóäðä íä äéðäéÝóäðä ðï mergemaster äéä ðï éÛéä jail. Èä ÷ ñäéäóðäß íä äíääéíðßóäã ðüóï óä äñ ÷ äßä ñðéíðßóäñ, ìóï éäé óä rc.d scripts.

Ὁ δῆμιος εἰσαγωγὴν τῆς MAC ἀνάπτυξης ἀπὸ τοῦ FreeBSD ἔχει ἀποδοθεῖσα ὡς ἐπιλογὴ ἀπὸ τὸν ἰσχυρισμὸν `mac(4)`. Ἡ ἀνάπτυξη τῆς MAC ἀπὸ τὸν ἰσχυρισμὸν `mac(4)` ἀπὸ τὸν ἰσχυρισμὸν `mac(4)` ἀπὸ τὸν ἰσχυρισμὸν `mac(4)`.

Ἐὰν ἡ ἀνάπτυξη τῆς MAC ἀπὸ τὸν ἰσχυρισμὸν `mac(4)` ἀπὸ τὸν ἰσχυρισμὸν `mac(4)`.

16.1.1 Ὁ δῆμιος εἰσαγωγὴν τῆς MAC ἀπὸ τὸν ἰσχυρισμὸν `mac(4)`

Ὁ δῆμιος εἰσαγωγὴν τῆς MAC ἀπὸ τὸν ἰσχυρισμὸν `mac(4)` ἀπὸ τὸν ἰσχυρισμὸν `mac(4)`.

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.¹ The system administrator may use the following commands to overcome this:

```
# setfmac biba/high test
"Permission denied"
# setpmac biba/low setfmac biba/high test
# getfmac test
test: biba/high
```

As we see above, `setpmac` can be used to override the policy module’s settings by assigning a different label to the invoked process. The `getpmac` utility is usually used with currently running processes, such as **sendmail**: although it takes a process ID in place of a command the logic is extremely similar. If users attempt to manipulate a file not in their access, subject to the rules of the loaded policy modules, the “Operation not permitted” error will be displayed by the `mac_set_link` function.

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.

Óçìáßüóç: 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.

Σημείωση: Some users have experienced problems with setting the `multilabel` flag on the root partition. If this is the case, please review the [Ἔκδοση 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_bsdxextended(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.

Ὁδηγὸς: 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.²
- `security.mac.portacl.port_high` will set the highest port number that `mac_portacl(4)` will enable protection for.
- `security.mac.portacl.suser_exempt` will, when set to a non-zero value, exempt the `root` user from this policy.
- `security.mac.portacl.rules` will specify the actual `mac_portacl` policy; see below.

The actual `mac_portacl` policy, as specified in the `security.mac.portacl.rules` `sysctl`, is a text string of the form: `rule[,rule , ...]` with as many rules as needed. Each rule is of the form: `idtype:id:protocol:port`. The `idtype` parameter can be `uid` or `gid` and used to interpret the `id` parameter as either a user id or group id, respectively. The `protocol` parameter is used to determine if the rule should apply to TCP or UDP by setting the parameter to `tcp` or `udp`. The final `port` parameter is the port number to allow the specified user or group to bind to.

Ὁδηγός: Since the ruleset is interpreted directly by the kernel only numeric values can be used for the user ID, group ID, and port parameters. I.e. user, group, and port service names cannot be used.

By default, on UNIX-like systems, ports fewer than 1024 can only be used by/bound to privileged processes, i.e. those run as `root`. For `mac_portacl(4)` to allow non-privileged processes to bind to ports below 1024 this standard UNIX restriction has to be disabled. This can be accomplished by setting the `sysctl(8)` variables `net.inet.ip.portrange.reservedlow` and `net.inet.ip.portrange.reservedhigh` to zero.

See the examples below or review the `mac_portacl(4)` manual page for further information.

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-mngt/nagios-plugins`, `net-mngt/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 /
```

ΌçìΆßùόç: 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.

ΌçìΆßùόç: 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 `çääéñíééP ëβóóá ãáíééPí ãñòPóáúí óíò 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.

ΕὰοÛεάεί 17_εὰã÷ìò ÓοιâÛίουί Αόοάεάβào

ÃñÛòçêà áδù οίτ Tom Rhodes εάε Robert Watson.

17.1 Óýñìç

Ïε áεαùοάεò οίò FreeBSD áδù οçί 6.2-RELEASE εάε ìàòÛ ðãñεεάìàÛίουί ððìοòÞñείç ãεά εãðòñãñÞ Ýεãã÷ì οοìàÛίουί áοòáεãβào. Ï Ýεãã÷ìò οοìàÛίουί ãðεòñÝðáε áίεùðεοòç, εãðòñãñÞ εάε ðãñáìáðñìðίεÞοείç εáοάããáοÞ ðεÞεìòð οοìàÛίουί ó÷-áðεέÞì ìà οçί áοòÛεάεά, οοìðãñεεάìããñÝíùì ούì logins, ούì áεεάãÞì ñòεìβοáùì, εάεÞð εάε οçò ðñìùοάáοçð óá ãñ÷-áβá εάε οοì áβεòοì. Ïε εáοάããáοÝð áòòÝð áβίáε ðίεýðεìáð ãεά áðáòεáβào ðãñáείεìýçεçòç οίò οòòòÞìáòìò, áìβ÷-ìáðòç áεóáìεÝùì, εάεÞð εάε áεά áíÛεòòç ìàòÛ áδù εÛðίεά áðβεáòç. Õì FreeBSD οεìðίεáβ οç ììòòÞ ãñ÷-áβùì εάε οì BSM API ùðòð Ý÷ìòì áçììοέáòòáβ áδù οçί Sun, εάε áðεòñÝðáε áεάεáέòìòñãεέùòçòá ìà ðεò ðεìðίεÞοáεò ãεÝã÷ìò ούοì οίò Solaris οçò Sun ùοì οίò Mac OS οçò Apple®.

Õì εãòÛεάεί áòòù áοòεÛεáε οòçì áãεáòÛοóáòç εάε ñýìεìοç οίò ÁεÝã÷ìò ÓοìàÛίουί. Áίçãáβ οεò ðίεέòεέÝð ãεÝã÷ìò, εάε ðãñÝ÷-áε Ýíá ðãñÛáεεáìá ñòεìβοáùì ãεÝã÷ìò.

Áοìý áεάáÛοáòá áòòù οί εãòÛεάεί, εá ñÝñáòá:

- Óε áβίáε ñ Ýεãã÷ìò οοìàÛίουί εάε ðùò εáεòìòñãáβ.
- ðùò ìá ñòεìβοáòá οίτ Ýεãã÷ìò οοìàÛίουί οοì FreeBSD ãεά ÷ ñÞοóáð εάε ðñìãñÛììáòá (processes).
- ðùò ìá áíáεýòáòá óá β÷-ìç οίò ãεÝã÷ìò ÷ ñçòεìðίεÞìóáò óá ãñãáεáβá ìáβùòçð ùáεìò áããñÝíùì εάε áíÛεòòçð.

ðñεì áεάáÛοáòá áòòù οί εãòÛεάεί, εá ðñÝðáε:

- Ìá εáοáñãáβòá ðεò ááοεέÝð Ýíñεáð οίò UNIX εάε οίò FreeBSD (ÈãòÛεάεί 3).
- Ìá áβòòá ãñεεáεùìÝíò ìà ðεò ááοεέÝð Ýíñεáð οçò ñýìεìοçð εάε ìáòáãεÞòðεοçò οίò ðòñÞíá. (ÈãòÛεάεί 8).
- Ìá Ý÷-áòá εÛðίεά ãñεεáβυòç ìà οçί áοòÛεάεά εάε ðùò áòòòÞ ó÷-áðβæáòáε ìà οί FreeBSD (ÈãòÛεάεί 14).

ðñìáεáìòììßçòç: Ïε εáεòìòñãáβò ãεÝã÷ìò οοì FreeBSD 6.2 áβίáε óá ðáεñáìáòεέù οóÛáεì εάε ç áãεáòÛοóáòç οίòò óá ìç÷-áìÞìáòá ðãñááùáÞò εá ðñÝðáε ìá áβìáòáε ìùì áοìý εçòεìýì οίãããñÛ ððùøεί ìε εβìáòìίε áδù οçί áãεáòÛοóáòç ðáεñáìáòεέìý εìáεοίεέìý. Ïε áìùòòìß áòòòÞ οç óóεáìÞ ðñÝ÷ìòáð ðãñεìñεοììß ðãñεεáìáÛìòì οçί ááòìáìβá ãεÝã÷ìò ùεùì ούì οοìàÛίουί ðìò ó÷-áðβæììóáε ìà οçί áοòÛεάεά. Áðβòçð εÛðίεάε ìç÷-áίεοììß áεóùáìò (logins), ùðòð ìε ãñáòεέìß (X11-ááοεοìÝíίε) display managers, εάεÞð εάε ìñεοìÝíáð ððçñáòβáð ðñβòùì εáòáοεáòáòòÞì ááì áβίáε οúοòÛ ñòεìεοìÝíáð ãεά οίτ Ýεãã÷ìò áεóùáìò ÷ ñçòòÞì.

ðñìáεáìòìßçòç: Ï Ýεãã÷ìò οοìàÛίουί áοòáεãβào ìðìñáβ ìá áçìεìòñãáÞοáε ðίεý εãðòñãñãáβò εáοάããáοÝð οçò ãñáòòçñεέùòçòáð οίò οòòòÞìáòìò: óá Ýíá οýòòçìá ìà ðøçεù οùñðì, óá ãñ÷-áβá εáòáããáòÞò ìðìñáβ ìá áβìòì ðίεý ìááÛεá, áì Ý÷ìòì ñòεìεοóáβ ãεά εãðòñãñÞ εáοάããáòòÞ, εάε ìá ìáðãñÛοìòì óá ãñεáòÛ gigabytes οçί áããñÛáá óá εÛðίεáð ðãñεðòÞοáεò. Ïε εάε÷-áεñεοóÝð εá ðñÝðáε ìá εáìáÛìòì ððùøεί οίòò ðεò ðεεáìÝð áðáεòÞοáεò óá ÷-Þñì áβóεìò óá ðãñβðòòòç ñòεìβοáùì εãðòñãñìýò εáοάããáòòÞ. Áεά ðãñÛáεáìá, βòòò áβίáε εáìεòù ìá áóεáñùεáβ Ýíá οýòòçìá ãñ÷-áβùì οοì /var/audit Þòáò óá ððùεìεðá οòòòÞìáòá ãñ÷-áβùì ìá ìç ððçñááòòìýì áì ÷-Þñìò áòòùò áíáíðεçεáβ.

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
```



```
gzip -9 $2  
fi
```

Other archiving activities might include copying trail files to a centralized server, deleting old trail files, or reducing the audit trail to remove unneeded records. The script will be run only when audit trail files are cleanly terminated, so will not be run on trails left unterminated following an improper shutdown.

Drive type	Drive device name
SCSI tape drives	sa
IDE tape drives	ast
Flash drives	fla for DiskOnChip® Flash device
RAID drives	aacd 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
```

Όχιἄβύος: 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) (Ἐἄῶῦῆἄῆῖ 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.

See [Εάν χρειάζεστε βοήθεια](#) 21 for more information about `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
```

**Όχιἄβιό:** 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 [Όπια 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 ἀβύσσος:** 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-compact -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-compact` 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-compact -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.

**Προσοχή:** 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.

**Όχι! Βούρα:** 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.

**Όχι! Βούρα:** 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_msdofs(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 Fonvieille.*

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! Βούζ:** 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 `mmap` backed, but using `mmap` 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 θέλετε να μάθετε περισσότερα σχετικά με το FreeBSD, επισκεφθείτε το www.freebsd.org](#)) 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 Εἰσαγωγή 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
```



### 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 Brüffer.*

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 επόαέο

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 äáóßáéíðáé óðí ðéáßóéí GEOM. Ôí êäöÛëáéí áðuü ááí áíáéýáé óá äÛèð ðíí ðñüðí ðá ðíí ððíßí ðíí GEOM ÷ äéñßæáðáé Þ äéÝá ÷ äé êáéôíðñáßáð Äéóüüðð / Äñüüð (IO), ðí ððíóýððçíá ðíð äñßóéáðáé êÛðuü áðuü áðuü, Þ ðíí êþáééá ðíð. Ìé ðççñíðíðñáð áððÝð ðáñÝ ÷ ðíðáé 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 ðéáðáðÛóáéð êáéôíðñáßáð ðíð RAID ðíð ððíðççñáéíðáé áðuü ðí GEOM.

Äóíý äéááÛóáðá áðuü ðí êäöÛëáéí, êá ðÝñáðá:

- Ôí äßáðð ðçð ððíððñéíçð RAID ðíð äßíáé äéáéÝóéí ðÝóù ðíð GEOM.
- Ðùð ðá ÷ ñçóéíððéÞðáðá óá äáóééÛ äéççðçééÛ ðñíáñÛííáóá äéá ðçí ñýèééóç, óðíððñççðç êáé äéá ÷ äßñéóç ðùí äéáóüññíí äðéðÝäüí RAID.
- Ðùð ðá äçíéíðñáðáðá mirror Þ stripe, ðá êñðððíðñáððáðá, êáé ðá óðíáÝóáðá äßóéíðð ðá ðí GEOM, ðÝóù ðéáð áðñáéñðóíÝíçð óýíáðçðð.
- Ðùð ðá áíðéíáðððßóáðá ðñíáéÞíáðá äßóéíð ðíð ÷ ñçóéíððéíýí ðí ðéáßóéí êáéôíðñáéþí GEOM.

Ðñéí äéááÛóáðá áðuü ðí êäöÛëáéí, êá ðñÝðáé:

- Ìá êáðáñíáßáðá ðùð ðáðá ÷ äéñßæáðáé ðí FreeBSD ðéð óðóéáððÝð äßóéíð (ÊäöÛëáéí 18).
- Ìá äñññáðáðá ðùð êá ñðèíßóáðá êáé êá äáéáðáðððáðá Ýíá ðÝí ððñÞá óðí FreeBSD (ÊäöÛëáéí 8).

## 19.2 ÄéóáãñáÞ óðí GEOM

Ôí GEOM äðéðñÝðáé ðçí ðñüóááç 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 ððíðççñáéé äéÛóíðñáð äéáðÛíáéð RAID êáé ðáñÝ ÷ äé äéÛóáíç ðñüóááç óðí êáéôíðñáééü óýððçíá êáé óá äéççðçééÛ ðíð ðñíáñÛííáóá.

## 19.3 RAID0 - Striping

ÄñÛöðçêä áðu ôíðð Tom Rhodes êáé Murray Stokely.

Ôí striping äßíáé ðéá ðÝéíáðð ðíð óðíáðÛæáé äéáóíðáðééíýð óðóééíýð äßóéíðð óá Ýíá ðíááééü êíáééü ðùíí. Óá ðíééÝð ðáñéðððóáéð, áðuü äßíáðáé ðá ðçí äíðéáéá äíáéáééäðíÝíð ðéééíý (äéááéðþí). Ôí ððíóýððçíá äßóéíð GEOM ðáñÝ ÷ äé ððíððñéíç ðÝóù êíáéðéééíý äéá ðç äéÛóáíç RAID0, ç ððíßá äßíáé äñóðÞ êáé ðð striping.



```
bsdlabeled -wb /dev/stripes/st0
```

5. Ç áέαάέαάόβά άόδP έά άçιέιόññάPόάέ όç όδóέάδP st0, έάέpð έάέ άγί άέυιά όδóέάδYð όóι έάόUέιαι /dev/stripes. Ίέ όδóέάδYð άόδYð έά ίññUάειόάέ st0a έάέ st0c. Ὀóι όçιάβι άόóυ, ίδññάβóά ðέYίί ίά άçιέιόññάPόάά όýόόçιά άñ÷άβυί όóç όδóέάδP st0a ÷ñçóέιιðιεβίόάó ðι άιççέçóέέυ ðñυññάιλά newfs:

```
newfs -U /dev/stripes/st0a
```

Έά άάβóά ίέα ίάñUέç όάέñU άñέèìβι ίά ðññíU άñPáιñά άóυ όçι ίέυίç óάó, έάέ ίάóU άóυ έβñά άάóóññυέάóóá ç áέαάέαάόβά έά Y÷άέ ίέιεέçñùέάβ. Ί óυιιð έά Y÷άέ άçιέιόññάçέάβ έάέ έά άβίάέ Yóιέιιð áέα ðñιόUñόçόç.

Ἄέα ίά ðñιόáñPόάóά ÷άέññέβιçόά ðι stripes ðιό άçιέιόññάPόάά:

```
mount /dev/stripes/st0a /mnt
```

Ἄέα ίά άβίάόάέ άóóυιιόά ç ðñιόUñόçόç άóóιγ ðιό όδóόPιáóιð άñ÷άβυί έάόU όçι áέαάέαάόβά άέέβιçόçð, ðιðιεáóPóá όέó ðεçñιόññáð ðιό óυιιð óóι άñ÷άβι /etc/fstab. Ἄέα ðι óέιðυ άóóυ, άçιέιόññάYίá ίυιέιι όçιáβι ðñιόUñόçόçð, ðι stripes:

```
mkdir /stripes
echo "/dev/stripes/st0a /stripes/ufs rw 2 2" \
 >> /etc/fstab
```

Ὀι Uñèñυιά geom\_stripes.ko έά ðñYðáέ ίά öìñðPιáóáέ άóóυιιόά έάóU όçι áέέβιçόç ðιό όδóόPιáóιð. ἌέóáέYóóá όçι ðññáέUðυ áίóιέP, áέα ίά ðñιόέYóáóá όçι έάóUέέççç ñγέιέόç óóι /boot/loader.conf:

```
echo 'geom_stripes_load="YES"' >> /boot/loader.conf
```

## 19.4 RAID1 - Mirroring

Ὀι mirroring (έάέññáóέóιυð) άβίάέ ίέα óá÷ñιεPάβá ðιό ÷ñçóέιιðιεάβóάέ άóυ ðιεέYð áóáέññáð έάέ ίέέέάειγð ÷ñPóóáð áέα ίά áóóάέβóιòι óá ááññYίá ðιðó ÷ññð áέαέιðYð. Ὀά ίέα áέUóáιç mirror, ι áβóέιð Ἄ άβίάέ άðέpð Yίá ðεPñáð áίóβññáóι ðιό áβóέιð Ἄ. <sup>1</sup> ίðññáβ ίέ áβóέιέ Ἄ+Ἄ ίά άβίάέ áίóβññáóá ðυι άβóέυι A+B. ¶ó÷άóá ίá όçι áέñέáP áέUóáιç ðυι áβóέυι, ðι όçιáίóέέυ άβίάέ υðέ ίέ ðεçñιόññáð áίυð áβóέιð P ίέαó έάóUðιçόçð áίóέáñUóιιόáέ óá Uέέιð. Ίέ ðεçñιόññáð áóóYð ίðññáβ áñáυóáñά ίά áðιεáóáóóάέYίί ίá áγέιέι ðñυðι, P ίά áίóέáñáóιYί ÷ññβð ίά ðñιέέççέáβ áέαέιðP óóέð ðççñáóβáð ðιό ίç÷áιPιáóιð P óóçι ðñυóááóç ðυι ááññYíυι. ΊðññιYί áέυιá έάέ ίά ίáóáóáññέYί έάέ ίά óóέá÷έιYί óá Uέέι, áóóáέYð ίYñιð.

Ἄέα ίά ίáέέιPóáóáð, ááááέυèάβóá υðέ ðι όýόόçιά óáó Y÷άέ άγί óέέçñιγð áβóέιðð βáέιð ίáñYέιðð. Ὀóá ðññááάβñιáóá ίáð έáññιYίá υðέ ίέ áβóέιέ άβίάέ όγðιό SCSI (áðáðέάβáð ðñυóááóçð, da(4)).

### 19.4.1 Mirroring óóιðð Ἄáóέέιγð Ἄβóέιðð

ὈðιεYóιιόáð υðέ ðι FreeBSD Y÷άέ ááέáóáóóάέάβ óóιð ðñPòι áβóέι da0, έά ðñYðáέ ίά ñóέιβóáóá ðι gmirror(8) ίά áðιεçέáγóáέ áέáβ óá ááóέέU ááññYίá ðιð.

ðñέι άçιέιόññάPóáóá ðι mirror, áíáññιðιεPóáóá όçι áóιáóυðçóá áιòUίέóçð ðññέóóυóáññυι έáððññáñέβι (ðιð ίðññáβ ίά óáó áιççέPóιòι óá ðññβðóυç ðñιáέPιáóιð) έάέ áðέðñYðóá όçι áðáðέáβáð ðñυóááóç óóç óóóέáðP áβóέιð. Ἄέα ðι óέιðυ άóóυ èYóóá όç ίáóááέççP kern.geom.debugflags ðιό sysctl(8) óóçι ðññáέUðυ ðέιP:

```
sysctl kern.geom.debugflags=17
```











```
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 äέέβίçóç έά όóíá÷έόóáβ έάíííέέÛ έάέ όι όýóóçíá έά Ýέέáέ óá έάóÛóóáóç ðíέέáðέβι ÷ñçóðβι (multi-user). ÌáðÛ όι όÝέíð çðç äέέβίçóçð, áðáíáñááóóáðóá όι áñ÷áβι /etc/fstab έάέ áέέÛíóá óá óóíááóέέÛ ííúíáóá óóóέáðβι ìá óέó áíóβóóιέ÷áð áóέέÝóáð. Óι óáέέέυι áñ÷áβι /etc/fstab έά 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     |

Ïðñáβóá ðβñá íá áðáíáέέέβιβóáðá όι όýóóçíá. Άí úέá ðβááí έάέÛ, ç äέέβίçóç έά 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)
```

Ïáέέβιðáð áðυ όι FreeBSD 7.2, όι glabel(8) ððíóçñβáέέ Ýíá íÝí áβáðð áóέέÝóáð áέá óóóðβíáóá áñ÷áβύι UFS, ðíð ááóβáέáóáέ óá Ýíá ñííáέέáβι áíááññέóóέέέυι óíðð, όι ufsid. Ìέ áóέέÝóáð áóðÝð áñβóέííóáέ óóíí έáóÛέíáñ /dev/ufsíd, áçíέíðñáñýíóáέ áóðυíáóá έáóÛ ðçí äέέβίçóç ðíð óóóðβíáóíð έάέ áβíáέ áóíáóύí íá ÷ñçóέííðíέçέíýí áέá ðçí ðñíóÛñóçç έáóáóιβóáυí íÝóυ όíð /etc/fstab. Ïðñáβóá íá ÷ñçóέííðíέββóáðá ðçí áíóíέβ glabel status áέá íá έÛááðá íέá έβóóá óύí óóóðçíÛóùí áñ÷áβύí ìá óέó áíóβóóιέ÷áð ufsid áóέέÝóáð óíðð:

```
% glabel status
Name Status Components
ufsíd/486b6fc38d330916 N/A ad4s1d
ufsíd/486b6fc16926168e N/A ad4s1f
```

Óοι ðáñáðÛíυ ðáñÛááέέáíá, όι ad4s1d áíóέðñíóυðáýáέ όι όýóóçíá áñ÷áβύí /var, áñβ όι ad4s1f áíóέðñíóυðáýáέ όι όýóóçíá áñ÷áβύí /usr. ×ñçóέííðíέββíðáð óέó óέíÝð ufsid ðíð óáβíñóáέ, ç ðñíóÛñóççç áóðβι óύí έáóáóιβóáυí ìðñáβ íá áβíáέ ìá óέó ðáñáέÛóù έáóá÷ññβóáέð óóí /etc/fstab:

|                             |      |     |    |   |   |
|-----------------------------|------|-----|----|---|---|
| /dev/ufsíd/486b6fc38d330916 | /var | ufs | rw | 2 | 2 |
| /dev/ufsíd/486b6fc16926168e | /usr | ufs | rw | 2 | 2 |

Ïðíέááβðíóá έáóÛóιçóç áέáέÝóáέ áíááññέóóέέέυι ufsíd ìðñáβ íá ðñíóáñçóέáβ ìá όíí βáέí ðñúðí, ÷ññβð íá ððÛñ÷áέ ðέÝíí áíÛáέç íá áçíέíðñáçέáβ ìúíέíç áóέέÝóá ÷áέñíέβίçóá. Ç ðñíóÛñóççç íÝóυ áóέέÝóáð ufsíd, ðáñÝ÷áέ όι ðέáñÝέóçíá çðç áíáíáñçóçβáð áðυ όι úññá óóóέáðβð, όι íðíβι ðáñÝ÷íóí έάέ íέ ìúíέíáð áóέέÝóáð.









## 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 ñέιβδάδά, άέδάεΎδδά όέδ άέυειδεδάδ άίδιδέΎδ:

```
echo 'zfs_enable="YES"' >> /etc/rc.conf
/etc/rc.d/zfs start
```

Οϊ οδυειδιδι άοδιδι οϊδ έάειΎιñ οδιδέΎδάέ υδέ Ύ÷άδά άέάεΎοείδδδ δñάέδ SCSI άβδδιδδ, έάέ υδέ δά ιñιιάδά οδδέάδπιδ οϊδδ άβιάέ da0, da1 έάέ da2. Ύδιδέ άέάεΎοιδι άβδδιδδ IDE έά δñΎδάέ ίά ÷ñζοείιιδιέΠοιδι οδδέάδΎδ οϊδ όγδιδδ ad άίδδβ άέά όέδ άίδδβδιδέ÷άδ SCSI.

### 20.2.2.1 Pool ιά ίά ιυñ Άβδδιδ

Άέά όζιδ άζιδιδñάβά άιυδ ZFS pool ιά Ύιά ιυñ άβδδιδ (÷ññβδ άδιδάδυδζοά άι÷Πδ οοάειΰδουί), ÷ñζοείιιδιέΠοά όζιδ άίδιδέΠ zpool:

```
zpool create example /dev/da0
```

Άέά ίά άάβδδά οϊ ρΎιδ pool, άιάδΰδδά όζιδ 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÷ίάέ έάέάνΰ υδέ οϊ example pool υ÷έ ιυñ Ύ÷άέ άζιδιδñάζέάβ, άέέΰ Ύ÷άέ άδβδζδ δñιόάνδζέδβ έέυιδάδ. Άβιάέ άδβδζδ άέάεΎοείι υδ έάιñέέυι όγδδζιδά άñ÷άβυί, ιδññάβδά ίά άζιδιδñάβδδά άñ÷άβά όά άδδδ, έάέ ΰέειέ ÷ñΠδδδδ ιδññιγιδ άδβδζδ ίά οϊ άιδι, υδδδδ οάβιδάέέ οοιδ δάñάέΰδδ δάñΰάέέιιδά:

```
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 άάιδ ÷ñζοείιιδιέάβ έΰδιδει άδδ όά δέάιñάέδΠιαδδά οϊδ ZFS. Άζιδιδñάβδδά Ύιά όγδδζιδά άñ÷άβυί όά άδδδδ οϊ pool έάέ άίññάιδιέΠδδά όά άδδδδ όζ οδιδβάόζ:

```
zfs create example/compressed
zfs set compression=gzip example/compressed
```

Οϊ όγδδζιδά άñ÷άβυί example/compressed άβιάέ δέΎιδ Ύιά οδιδέάοιδΎιδ ZFS όγδδζιδά. Άιέειΰδδά ίά άιδέάνΰδδάδ ιάñέέΰ ιάάΰέά άñ÷άβά όά άδδδδ, άδδδδέάβδδδ οοιδ έάδΰειñι /example/compressed.

Ιδññάβδδά δπñά ίά άδάιñάιδιέΠδδάδ όζ οδιδβάόζ άñΰοιιδάδ:

```
zfs set compression=off example/compressed
```



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`. Η εντολή `zfs create` μπορεί να χρησιμοποιηθεί για να δημιουργηθεί ένας `zfs`. Η εντολή `zfs create` μπορεί να χρησιμοποιηθεί για να δημιουργηθεί ένας `zfs`.

```
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
```



### 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 χρησιμοποιείται για να προστατευτεί το σύστημα από την απώλεια δεδομένων. Το RAID-Z μπορεί να χρησιμοποιηθεί για να προστατευτεί το σύστημα από την απώλεια δεδομένων.

```
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 μπορεί να χρησιμοποιηθεί για να προστατευτεί το σύστημα από την απώλεια δεδομένων.

```
zpool replace storage da1
```

Αν θέλετε να διαβάσετε το βιβλίο αυτό, μπορείτε να το αγοράσετε από τον εκδοτικό οίκο. Το RAID-Z μπορεί να χρησιμοποιηθεί για να προστατευτεί το σύστημα από την απώλεια δεδομένων.

```
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 εάεοιñáíí οοόεíεíεΰ.

### 20.2.2.4 ΆδσάεΠεάδός Άáñΰíυί

¼δουδ áíáσΰñáíá δñίçáíοίΰíυδ, οί ZFS ÷ñçόεííδíεáβ checksums (áεñíβοίáδóá áεΰã÷íο) áεá ίá άδσάεçέáýόáε οçί áεáñáεúδçόá ουί άδíεçέáοίΰíυí áááñΰíυí. Οά áεñíβοίáδóá áεΰã÷íο áíñáñáδíεíýíόáε áδδúíáδóá εáδΰ οçί áçíεíñáβá ουί οδóδçíΰδουί áñ÷άβυί, εáε ίδñíýí ίá áδáíñáñáδíεçέíýí ίΰόυδ οçδ άδúíáíçδ άíδíεΠδ:

```
zfs set checksum=off storage/home
```

Άδδου ááí άβίáε ááíεεΰ εάεΠ εáΰá, εάεΠδ οά checksums εáδóáεáíáΰíυí áεΰ÷έοοί άδíεçέáδδóεéú ÷Πñí, εáε άβίáε δíεý δέí ÷ñΠσέí ίá οά ΰ÷íοíá áíñáñáδíεçíΰíá. Άδβόçδ ááí οάβιάδσάε ίá δñíεáεíýí εΰδíεá οçíáíδóεΠ εáεδóδΰñçόç Π άδεáΰñδóίç. Ιá οά checksums áíñáñáδíεçíΰíá, ίδñíýíá ίá æçδΠσíοíá άδú οί ZFS ίá áεΰáíáε οçί áεáñáεúδçόá ουί áááñΰíυí ÷ñçόεííδíεΠδóδ οá áεá άδσάεΠεάδός. Ç áεááεéáδóá áδδΠ άβίáε áíυóδΠ ùδ “scrubbing.” Άεá ίá áεΰáíáδóá οçί áεáñáεúδçόá áááñΰíυí οíο pool storage, ÷ñçόεííδíεΠδóδ οçί δáñáεΰδου άíδíεΠ:

```
zpool scrub storage
```

Ç áεááεéáδóá áδδΠ ίδñáβ ίá δΰñáε áñεáδΠ Πñá, áíΰεíáá ίá οçί δíóúδçόá ουί άδíεçέáοίΰíυí áááñΰíυí. Άδβόçδ ÷ñçόεííδíεáβ δΰñá δíεý οί áβóεí (I/O), ουί Πόδá οá εΰεá áááñΰíç óδóáΠ ίδñáβ ίá áεδóáεáβδóá ίυí ίεá οΰΰίεá áεááεéáδóá. Ιáδΰ οçί íεíεεΠñùç οíο scrub, εá áíáíáñεáβ εáε ç áíáçíñΰ εáδΰδóáόçδ, οçί ίδñíá ίδñáβδóá ίá ááβδóá 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

Οοί δάνΰάεάíá ίáδ άíοáíβæáδóáε εáε ç ÷ñíεεΠ óδóáΠ δíο íεíεεçñΠεçέá ç άíδíεΠ scrub. Ç áοíáδουδçόá áδδΠ ίáδ áíáδóáεβæáε áεáñáεúδçόá áááñΰíυí οá ίááΰεí áΰεíδ ÷ñíυíο.

Οδΰñ÷íοí δíεεΰδ áεúíá άδεéíáΰδ áεá οί óýδóçíá áñ÷άβυί Å. Άáβδóá δέδ οáεβááδ manual zfs(8) εáε zpool(8).

















Þóðá ç äðíðð÷Þá áíüð äßóëíð íá íçí ðñíëáëÝóáë 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 óéð áíóßóðíé÷ð éáóá÷ññßóáéð óðç áÜóç äáññÝíúí íá óéð ñðèíßóáéð ðíð. ĨáoÜ óçí äðáíñááóßá ðúí ðáñáðÜíü ññéóíþí, ç ñýèíéóç ñéÜæáé íá óçí 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%)

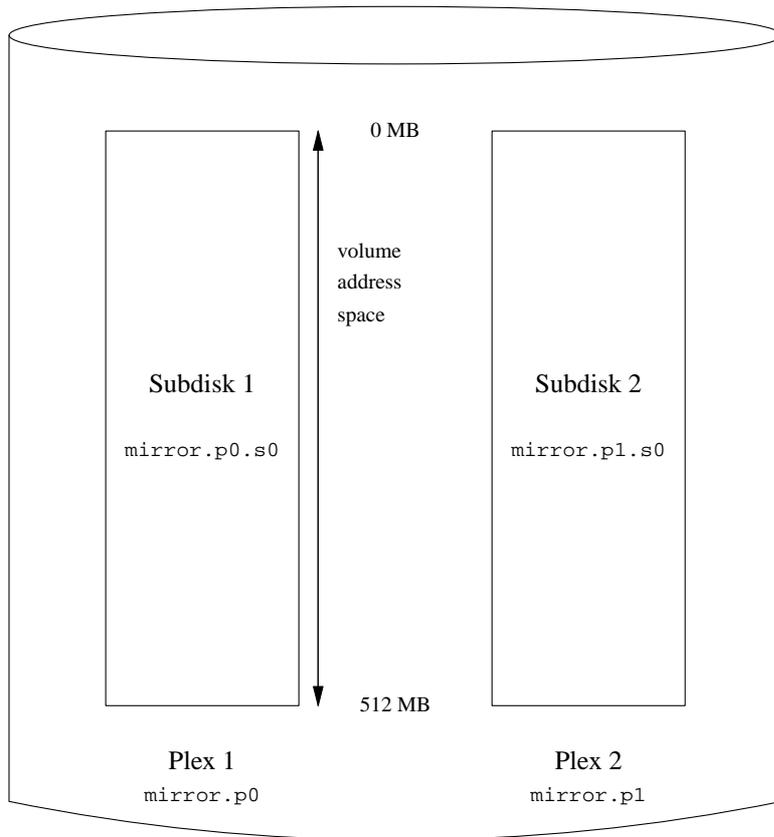
V myvol State: up Plexes: 1 Size: 512 MB
V mirror State: up Plexes: 2 Size: 512 MB

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 óç äñÞ äñáóééÜ.

Ó÷ Ðιά 21-5. Jáò Mirrored Õüüüí Vinum



Õðí ðáñÛááέáíá áóòü, έÛεά plex ðáñέÛ÷áέ óçí ðεÐñç ðáñέí÷Ð áεáòεýíóáüí, íááÛεíòò 512 MB. ¼ðùò έáέ óòí ðñçáíýíáíí ðáñÛááέáíá, έÛεά plex ðáñέÛ÷áέ Ûíá ííááέέü ððíáβóει.

**21.6.3 Άέεòέóòíðíεπίóáò óçí Άðüäíóç**

Ï mirrored óüüüò ðíò ðñçáíýíáííò ðáñáááβáíáóíò ðáñíòóέÛεάέ íáááέýòáñç áñí÷Ð óóáειÛòüí óá ó÷ Ûóç íá Ûíá óüüüí ðíò ááí ÷ñçóειðíεάβ mirror, áεεÛ ç áðüäíóç ðíò áβíáέ íέέñüòáñç: έÛεά áááñáòÐ óòíí óüüüí ðñÛðáέ íá áβíáòáέ έáέ óòíòò áýí áβóειòò, ÷ñçóειðíεπίóáò Ûóέé íáááέýòáñí ðíóíòóü ðíò áέáέÛóειòò áýñíòò æπíçò. Ïέ áðáέòÐóáέò ðíò áíáá÷ñíÛò Û÷íòá áέá áðüäíóç, áðáέóíýíí áέáóíñáðέεÐ ðñíóÛááέóç: áíòβ íá ÷ñçóειðíεΠóíòíá mirror, ððñíýíá íá áçíεíòñáΠóíòíá èññááò áðíεΠεáòóçò (stripes) óá üóí ðí áóíáóüí ðáñέóóüòáñíòò áβóειòò. Ç ðáñáέÛòü ñýèíέóç ááβ÷íáέ Ûíá óüüüí óòíí íðíβí ðí plex Û÷áέ áβíáέ stripe óá ðÛóóáñéòò áβóειòò:

```
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 ðñīçāřōīÝñùð, äāí ÷ñāéÜæāðāé íá ĩñβōīřōīā íāíÜ òīřð ãβōēīřð ðīř äβīāé Pāç āñūōōīB óōī Vinum. İāðÜ ôçí äðāīāñāāóBā òīř ðāñāðÜñü ĩñéōīñý, ç ñýèìéóç éā ĩéÜæāé İā ôçí ðāñāéÜðù:

```
Drives: 4 (4 configured)
Volumes: 3 (4 configured)
Plexes: 4 (8 configured)
Subdisks: 7 (16 configured)
```

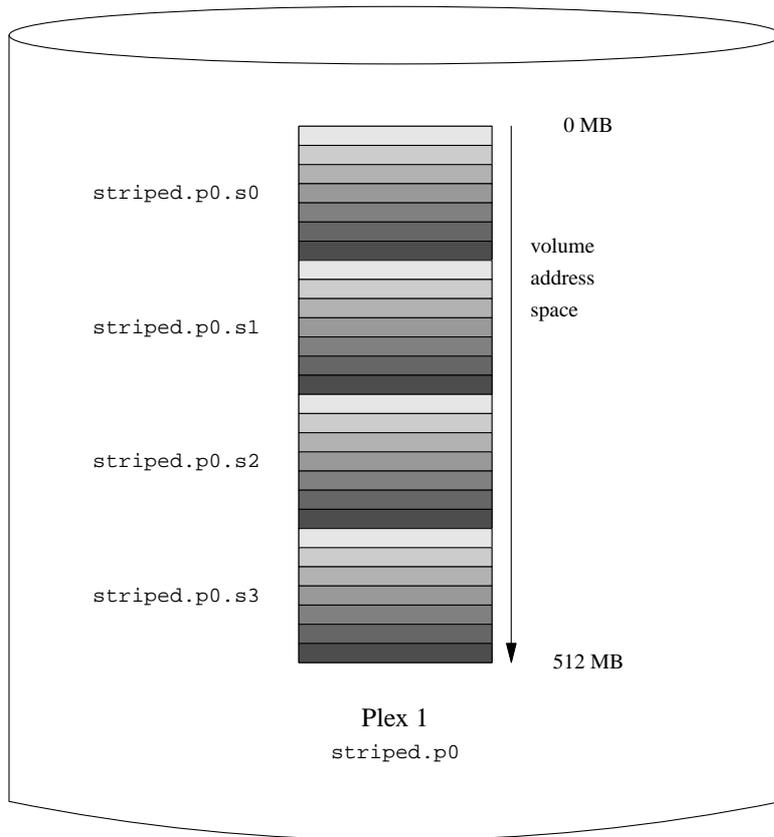
```
D a State: up Device /dev/da3h Avail: 1421/2573 MB (55%)
D b State: up Device /dev/da4h Avail: 1933/2573 MB (75%)
D c State: up Device /dev/da5h Avail: 2445/2573 MB (95%)
D d State: up Device /dev/da6h Avail: 2445/2573 MB (95%)
```

```
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÷ Ðιά 21-6. Jáò Striped Ôüüò Vinum



Άδοüò ì òüüò áíáðáñβóðάόάέ ãñáöéÛ óóí Ó÷ Ðιά 21-6. Ç áðü÷ ñüòç òçð èññβááð áíðéðñíóüððáγáέ òç èÝόç òçð ìÝόά óðçí ðáñéí÷ Ð áεάðéγíóáüí ðíò plex: ìé áñé÷ ðü÷ ñüìáð èññβááð áβίáέ ìé ðñρóáð, ìé óéíñü÷ ñüìáð áβίáέ ìé óáέáðóáβáð.

### 21.6.4 Άίείðéóòβά έάέ Άðüäíóç

Ìá ðí έáðÛεεçεí ðεέéü, áβίáέ áóíáðüí ìá áçíεíòñáçεíγí òüüíε ìé ìðíβíé ìá ðáñíðóέÛεíòí òüóí ìááÛεç áñí÷ Ð óá óðÛεíáóá, üóí έáέ áóíçìÝíç áðüäíóç óá ó÷ Ýόç ìá ðéð ðððíðíεçìÝíñáð έáðáðíρóáέð ðíò UNIX. ìá ðððééü áñ÷ áβí ñðεíβóáüí έá ìéÛεáέ ìá ðí ðáñáέÛðü:

```

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

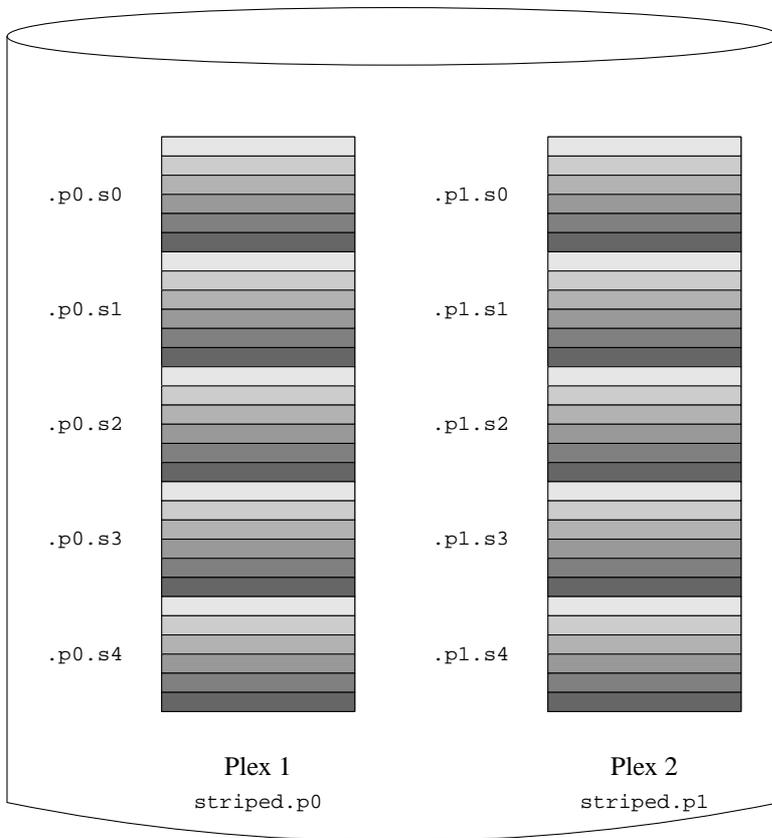
```

```
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 δδῖαβόεἰε δῖο ἀάγδἀἠῖο plex Ἰ ÷ἰῖἰ ἰἀδἀάἀεἰβ ἕἀδὺ ἄγἰ ἰᾗçἰγδ ὀᾗ ὀ ÷ Ἰόç ἰᾗ ἄδδῖγδ δῖο δἠδῖοδ plex: ἄδδῖ ἰᾗᾗὀᾗἕβᾗἕ ῖὀἕ ἰἕ ἰᾗᾗἠᾗὀ Ἰδ ἰᾗᾗ ἰβἠἰῖὀᾗἕ ὀδῖὀδ βᾗἕἰὀδ δδῖαβόεἰὀδ, ἄἕῖῖᾗ ἕᾗἕ ἰἕ ἰἕᾗ ἰᾗὀᾗὀἠῖ ḗἠçὀἕἰὀἰἕᾗἕ ἕᾗἕ ὀἰὀδ ἄγἰ ἰβόἕἰὀδ.

Ὀἰ Ὀ ÷ Δῖᾗ 21-7 ἰᾗᾗᾗἠἕὀδὺ ἰᾗᾗὀἕἕἠῖ ὀç ἰᾗἠδ ἄδδῖγδ δῖο δῖῖῖὀ.

**Ὀ ÷ Δῖᾗ 21-7. ἰᾗὀ Mirrored ἕᾗἕ Striped Ὀῦῖῖδ ὀἰὀ Vinum**



## 21.7 Ἰñιάόβá ÁíóέέâείYíuί

¼òùò ðáñέáñŪøáíá ðáñáðŪíù, òì Vinum áðñáβááέ ðñíáðέέáñŸíá Ἰñíáόά óá plex έάέ òðñáβóέìòò, áí έάέ òðŪñ÷áέ ç äóíáóùòç óá íá óá ðáñáέŪìøáòá. Áòòù ùòòùóì ááí óóìβóóáóáέ: ç àìðáέñβá ðñò Ÿ÷ìòìá áðù òì áέα÷áέñέóóð òùùì VERITAS (ì òìβìò ððέóñŸðáέ áέáγέáñç áðùáìóç ἸñŪòùì óóá áíóέέáβíáíá) Ÿ÷áέ ááβíáέ ùέέ áóòìγ òìò áβáìòò ç áòáέείβá ááí ðñìóóŸñáέ óçíáíóέέŪ ðέáñíáέòðíáóá, έάέ òðñáβ íá ðñíέáέŸóáέ óγá÷òóç.

Óá Ἰñíáόά òðñáβ íá ðáñέŸ÷ìòì òðñέíáððìòá ìç-έáñù ÷ áñáέòðñá, áέέŪ óóìβóóáóáέ íá ðáñέñέóóáβóá óóç ÷ ñPóç áñáñŪòùì, áñέέìðì έάέ òçò έŪòù ðáyέáð. Óá Ἰñíáόά òùì òùùì, òùì plex έάέ òùì òðñáβóέùì òðñáβ íá áβíáέ ìŸ÷ñέ 64 ÷ áñáέòðñáò, áñð óá Ἰñíáόά òùì áβóέùì òðñáβ íá áβíáέ ìŸ÷ñέ 32 ÷ áñáέòðñáò.

Óá áñ÷áβá óóóέáòðì òìò Vinum áçìέìòñáñíγíóáέ óóìí έáóŪέñáì /dev/gvinum. Ìá ðέò ñòèìβóáέò ðñò óáβñíóáέ ðáñáðŪíù, òì Vinum έá áçìέìòñáPóáέ óá ðáñáέŪòù áñ÷áβá óóóέáòðì:

.

**Óçìáβùóç:** Òì ðáñáέŪòù έó÷γáέ Ἰñíí óóçì ðáέέŪ òèìðñìççóç òìò Vinum.

Ìέ óóóέáòŸò áέŸá÷ìò /dev/vinum/control έάέ /dev/vinum/controlð, ðñò ÷ñçóέìðñέíγíóáέ áðù òì gvinum(8) έάέ òì ááβñíá òìò Vinum áíòβóòìέ÷á.

- Έáóá÷ùñβóáέò óóóέáòðì áέα έŪέá òùì. ÁòòŸò áβíáέ έάέ ìέ έγñέáò óóóέáòŸò ðñò ÷ñçóέìðñέáβ òì Vinum. Ìá ðέò ñòèìβóáέò ðñò ááβñíá ðáñáðŪíù, έá Ÿ÷ìòìá ðέò óóóέáòŸò: /dev/gvinum/myvol, /dev/gvinum/mirror, /dev/gvinum/striped, /dev/gvinum/raid5 έάέ /dev/gvinum/raid10.

.

**Óçìáβùóç:** Òì ðáñáέŪòù έó÷γáέ Ἰñíí áέα òçì ðáέέŪ òèìðñìççóç òìò Vinum.

Ìáð έáóŪέñáìò /dev/vinum/drive ìá έáóá÷ùñβóáέò áέα òìí έŪέá áβóέì. Óóçì ðñááìáóέέùòç óá, áòòŸò ìέ έáóá÷ùñβóáέò áβíáέ óóìáñέέέìβ ááòìñβ ðñòò óá ðñááìáóέέŪ áñ÷áβá óóóέáòðì òùì áβóέùì.

- ¼έìέ ìέ òùìέ áέαέŸòòì áðáòέáβáð έáóá÷ùñβóáέò óóìí έáóŪέñáì /dev/gvinum/.
- Ìέ έáóŪέñáìέ /dev/gvinum/plex έάέ /dev/gvinum/sd, ðñò ðáñέŸ÷ìòì óá áñ÷áβá óóóέáòðì áέα έŪέá plex έάέ òðñáβóέì áíòβóòìέ÷á.

Ἄέα ðáñŪááέáìá, έáùñPóá òì ðáñáέŪòù áñ÷áβì ñòèìβóáúì:

```
drive drive1 device /dev/sd1h
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
```

Ἰὰὸὔ ὁçí ἄðáíññááóβá áððῑῑ ὀῖð ἄñ ÷ ἄβῖð, ὀῖ gvinum(8) ἐά ἄçíεῖðññáρὸἄε ὁçí ἄέὔεῖðεç ἄñρ ὀῖῖ ἐάὸὔεῖῖ  
/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
```

Ἀῖ ἐάε ὀῖβὸάόάε ἰά ἰçí ἄβῖῖῖῖῖ ὀῖῖῖῖῖῖῖ Ἰῖῖῖ ἰῖῖῖῖῖ ὀῖῖ plex ἐάε ὀῖðð ὀðῖῖῖῖῖῖðð, ἐά ðñῖῖῖῖ ἰά ἄῖῖῖῖ ἰῖῖῖῖῖῖ ὀῖῖðð ἄβὸεῖðð ὀῖð Vinum. Ἰὰ ὀῖῖ ὀñῖῖðῖ ἄððῖ, ῖ ἄβὸεῖð ἰῖῖῖῖῖῖῖῖῖῖῖῖῖῖ ἄððῖῖῖῖῖῖ ἄέὔῖῖ ἄε ἰῖ ἄέῖὔῖῖῖ ἔῖῖῖ. Ὀά ἰῖῖῖῖῖ ὀῖῖ ἄβὸεῖῖ ἰðῖῖῖῖ ἰῖ ῖῖῖ ἰῖῖῖῖῖῖ ἰῖῖ ÷ ñé 32 ÷ ἄñἄεðρῖῖῖ.

### 21.7.1 Ἀçíεῖðññáβá Ὀðóðçíὔðῖῖ Ἀñ ÷ ἄβῖῖ

Ἰε ὀῖῖῖ ἄἄβ ÷ ῖῖῖ ἰῖῖῖῖ ἰῖ ὀῖðð ἄβὸεῖðð ῖῖῖ ἄῖῖῖῖ ὀῖ ὀῖῖῖῖῖῖ, ἰῖ ἰεῖ ἄῖῖῖῖῖῖ. Ἀῖῖῖῖῖῖ ἰῖ ὀῖðð ἄβὸεῖðð ὀῖð UNIX, ὀῖ Vinum ἄἄ ἄçíεῖðññáβ ἐάðáðῖῖῖῖῖ ὀῖῖðð ὀῖῖῖῖῖῖ, ἐάε ῖῖῖ ἄðῖῖῖῖῖῖῖ ἄðῖ ἄððῖῖð ῖ ἰῖῖῖῖῖῖῖ ÷ ῖð ðβῖῖῖῖῖ ἄáðáðῖῖῖῖ. Ἀððῖ ἄðáεðἄβ ὁçí ὀñῖῖðῖῖῖῖ ἔὔðῖῖῖ ἄῖçðçðééβῖ ðñῖῖῖῖῖῖῖ ἄε ἄéἄéῖῖῖῖ ὀῖð newfs(8), ὀῖ ῖðῖῖ ὀðéð ðñῖçῖῖῖῖῖῖ ὀῖῖðῖῖῖῖῖῖ ὀῖð ðñῖῖðῖῖῖῖῖ ἰῖ ἄñῖçῖῖῖῖ ὀῖ ὀἄéἄððἄβῖ ἄñὔῖῖ ἄῖῖð ὀῖῖῖð Vinum ῖð ἰῖῖῖῖῖῖῖῖῖῖῖῖ ὁçð ἐáðὔðῖçðçð. Ἀέἄ ðἄñὔἄἄéῖῖῖ, ῖῖῖ ἄῖῖῖῖῖῖ ἄβὸεῖð ἰðῖῖῖῖ ἰῖ ῖῖῖ ὀῖ ῖῖῖῖ /dev/ad0a P /dev/da2h. Ὀά ἰῖῖῖῖῖ ἄððὔ ἄῖðéðñῖῖῖῖῖῖῖῖ ὁçí ðñρðç ἐáðὔðῖçðç (a) ὀῖῖ ðñρðῖ ἄβὸεῖ IDE (ad) ἐάε ὁçí ῖῖῖῖ ἄáðὔðῖçðç (h) ὀῖῖ ὀñβðῖ (2) SCSI ἄβὸεῖ (da) ἰῖῖῖῖῖῖῖῖῖ. Ὀά ἰῖῖῖῖῖῖ, ῖῖῖ ὀῖῖῖð ὀῖð Vinum ἰðῖῖῖῖ ἰῖ ῖῖῖῖῖῖῖῖ ἄε ὁçí /dev/gvinum/concat, ὀῖ ῖðῖῖῖ ἄἄ ῖῖ ἄé ἄῖῖῖ ὀ ÷ ῖῖῖ ἰῖ ῖῖῖῖ ἄáðὔðῖçðçð.

Ὀðóεῖῖῖῖῖῖ, ὀῖ newfs(8) ἄñῖçῖῖῖῖ ὀῖ ῖῖῖῖ ὀῖð ἄβὸεῖð ἄε ἄ ᰄἄἄῖῖῖῖῖῖ ἰῖ ἄἄ ἰðῖῖῖῖ ἰῖ ὀῖ ἄáðἄῖῖῖῖῖ. Ἀέἄ ðἄñὔἄἄéῖῖῖ:

```
newfs /dev/gvinum/concat
newfs: /dev/gvinum/concat: can't figure out file system partition
```

Ἀέἄ ἰῖ ἄçíεῖðññáρὸἄðἄ ῖῖῖ ὀῖῖῖῖ ἄñ ÷ ἄβῖῖ ὀἄ ἄððῖ ὀῖῖ ὀῖῖῖ, ÷ ñçðéῖῖῖῖῖῖῖῖ ὁçí newfs(8):

```
newfs /dev/gvinum/concat
```

**Ὀçíἄβῖῖῖῖ:** Ὀἄ ἄéἄῖῖῖῖῖῖ ὀῖð FreeBSD ðñéῖ ἄðῖ ὁçí 5.0, ç newfs(8) ἄðáéðἄβ ὁçí ðñῖῖῖῖῖῖ ἄðééῖῖῖ -v ἐάε ὀῖῖ ðἄééῖ ὀñῖῖðῖ ῖῖῖῖῖῖῖῖ ὀῖῖ ὀðóéἄἄβῖ:

```
newfs -v /dev/vinum/concat
```







Ἀέα ἰά ἀιέιτῶνᾱεῖγί ἰάδὸ Ἰέ ὀγῶιὸ "a" ἑάοάοιΠῶάέδ ᾱέα ἑἸεᾱ ὀδῶέᾱδὸP ῶιὸ ἑά δᾱᾱέἸ ÷ ᾱέ ὀιΠῶἰάό ὀιὸ ᾱέεῖγὺ ὀυῖιὸ, ἑά δᾱᾱέἸ ἰά ᾱῖῖῶἰ ὀά ἱέῖῖῶῖῶῖ:

- 1. Ἐά δᾱᾱέἸ ἰά ἱάἰἰἰἰἰἰἰ ὀε ἑἸῶε (ὀεῖ ἱάῖῖῖῖῖῖ ἱάῖῖ ὀεῖ ἱάᾱ ÷ P ὀεῖ ὀδῶέᾱδὸP) ἑάε ὀἰ ἱἸᾱᾱῖῖ ὀεῖ ὀδῶέᾱδὸP ὀῶῖᾱῖῖῖῖ ὀ ἰῶῖᾱ ἑά ᾱῖῖῖῖ ἸἸᾱᾱ ὀἰὸ ᾱέεῖγὺ ὀυῖῖῖ, ÷ ᾱῖῖῖῖῖῖῖῖῖῖῖ ὀεῖ ἱάῖῖῖῖP:

```
gvinum 1 -rv root
```

Ὀεῖᾱῖῖῖῖ ἱάῖῖ ὀῶἰ Vinum ἰέ ἑἸῶᾱῖῖ ἑάε ὀά ἱᾱᾱἸῖῖ ἱᾱῖῖῖῖῖῖ ὀᾱ bytes. Ἐά δᾱᾱέἸ ἰά ἱέᾱῖῖῖῖῖ ἱᾱῖῖῖῖ ὀἰὸ ἱᾱῖῖῖῖῖ ἱᾱ ὀἰ 512 ᾱέα ἰά ἱᾱᾱῖῖῖ ὀἰὸ ἱᾱῖῖῖῖῖ ἱᾱῖῖ ὀἰ ÷ ᾱῖῖῖῖῖῖῖῖῖῖῖ ὀῶῖᾱ ἱᾱῖῖῖῖP bsdlablel.

- 2. Ἀέῖῖῖῖῖῖ ὀεῖ ἱᾱῖῖῖῖP:

```
bsdlablel -e devname
```

ᾱέα ἑἸεᾱ ὀδῶέᾱδὸP ῶἰὸ ὀῶἱᾱῖῖῖ ÷ ᾱέ ὀἰἰ ᾱέεῖῖ ὀυῖῖῖ. Ὀἰ devname ἑά δᾱᾱέἸ ἰά ᾱῖῖῖῖ ᾱῖῖῖ ὀἰ ἱῖῖᾱ ὀἰ ᾱῖῖῖῖῖ (ᾱέα δᾱᾱᾱᾱᾱᾱᾱ da0) ᾱέα ᾱῖῖῖῖῖῖ ÷ ἱῖῖῖῖ slices (÷ ἱῖῖῖῖ ᾱῖῖ. ἑάοάοιΠῶάέδ fdisk), P ὀἰ ἱῖῖᾱ ὀἰ slice (ᾱέα δᾱᾱᾱᾱᾱᾱᾱ, ad0s1).

Ἄἰ ὀδῶᾱ ÷ ᾱέ Pᾱῖ ἰέα ἑάὀἸῖῖῖῖ "a" ὀῶῖ ὀδῶέᾱδὸP (ῶἰὸ ῶῖῖῖῖῖ δᾱᾱῖῖ ÷ ᾱέ ὀἰ ᾱέεῖῖ ὀῶῖῖῖῖ ἱᾱ ÷ ᾱῖῖῖ ῶἰ Pῶᾱἰ ὀᾱ ÷ ᾱῖῖῖῖ ῶἱῖῖ ÷ ᾱῖῖῖῖῖῖῖῖῖῖ ὀἰ Vinum), ἑά δᾱᾱέἸ ἰά ἱᾱῖῖῖῖῖῖῖ ὀᾱ ἑἸῶῖ Ἰῖῖῖ ῖῖῖῖ ἰά ἱᾱῖῖῖῖῖῖῖ ἰά ᾱῖῖῖῖῖ ῶἱῖῖῖῖῖῖ (ὀᾱ δᾱᾱᾱῖῖῖῖῖ ἱᾱῖῖῖῖῖ), ᾱῖῖῖ ᾱᾱἰ ἑά ÷ ᾱῖῖῖῖῖῖῖῖῖῖῖῖ ῶῖ Ἰῖῖ ἱᾱῖῖ ῶἱῖῖῖῖῖῖῖῖ ᾱέα ὀῶῖ ᾱῖῖῖῖῖῖῖ ὀἰὸ ὀδῶὀἸῖῖῖῖῖ. Ὀεῖᾱῖῖῖῖ ἱᾱῖῖ ἱᾱῖῖῖῖῖ ἑάοάοιΠῶάέδ (ἱῖῖῖ ᾱέα δᾱᾱᾱᾱᾱᾱᾱ Ἰῖῖ ᾱέεῖῖ ὀῶῖῖῖῖ ἱᾱ ÷ ᾱῖῖῖ ὀἰ ἱῖῖῖῖ ᾱῖῖῖῖ Pᾱῖ ῶἱῖῖῖῖῖῖῖ) ᾱᾱἰ ἱῖῖῖῖῖ ἰά ἱᾱῖῖῖῖῖῖῖῖῖῖ. Ἐά δᾱᾱέἸ ἰά ἱᾱῖῖῖῖῖῖῖ ὀῶῖ ἱᾱῖῖῖῖP ÷ ᾱῖῖῖῖῖῖῖῖῖῖ ὀῶῖ ἱᾱῖῖῖῖῖῖῖ "Fixit" ὀἰὸ CD ἱᾱῖῖῖῖῖῖῖῖῖῖ, P ἰά ἱᾱῖῖῖῖῖῖῖῖῖῖ ἰέα ἱᾱῖῖῖῖῖῖῖῖ ᾱῖῖ ᾱῖῖῖῖῖῖ (ὀᾱ δᾱᾱᾱῖῖῖῖῖῖ ῶἰ Ἰῖ ÷ ᾱῖῖῖῖῖῖῖῖῖῖῖῖῖῖῖῖ ἱᾱῖῖῖῖῖῖῖ ἱᾱῖῖ Ἰῖῖ ἱᾱῖῖῖ ἑάε ἱᾱῖῖῖῖῖῖῖῖῖ ὀἰ Ἰῖῖῖ.

ῶᾱῖῖῖ ἑά δᾱᾱέἸ ἰά ῶἱῖῖῖῖῖῖ ὀῶῖ ἱᾱῖῖῖῖῖῖῖ (offset, ἱᾱ ὀδῶᾱ ÷ ᾱέ) ὀεῖ ἑάὀἸῖῖῖῖ ὀῶῖ Vinum ἱᾱὀἸῖῖ ὀεῖ ὀδῶέᾱδὸP, ἱᾱ ὀῶῖ ἱᾱῖῖῖῖῖῖ ὀἰὸ ὀῶῖᾱῖῖῖῖῖ ὀἰὸ ἱᾱῖῖῖῖῖῖῖ ÷ ἰὸ ᾱέεῖγὺ ὀυῖῖῖ ὀεῖ ὀδῶέᾱδὸP. Ḷ ὀῶἰP ῶἰ ἑά ῶἱῖῖῖῖῖ ἑά ᾱῖῖῖῖ ὀ ἱᾱῖῖῖῖῖῖ ("offset") ᾱέα ὀε ἱἸῖ ἑάὀἸῖῖῖῖ "a". Ἰῖῖῖῖῖῖ ἰά ῶἸῖῖῖῖ ἱᾱῖῖῖῖῖῖ ὀῶῖ ὀῶἰP "size" ᾱέα ἱᾱὀἸῖῖ ὀῶῖ ἑάὀἸῖῖῖῖ ἱᾱῖῖ ὀἰ ὀῶῖῖῖῖῖῖ ῶἰὸ ἑἸῖῖῖῖῖῖῖ. Ὀἰ "fstype" ἑά δᾱᾱέἸ ἰά ᾱῖῖῖῖ 4 . 2BSD. Ἰῖ ὀῶἰῖῖ ὀἰ "fsize", "bsize", ἑάε "cpg" ἑά δᾱᾱέἸ ἰά ἱᾱῖῖῖ ÷ ἑῖῖῖ ἱᾱ ὀἸῖῖῖ ὀἰῖῖῖ ῖῖῖῖ ἰά ὀᾱῖῖῖῖῖῖῖ ἱᾱ ὀἰ ῶἱῖῖῖῖῖῖῖ ὀῶῖῖῖῖ ἱᾱ ÷ ᾱῖῖῖῖ, ἱᾱ ἑάε ᾱᾱἰ Ἰῖ ÷ ἰῖῖ ὀῶῖῖῖῖ ὀῶῖ ὀῶᾱῖῖῖῖῖῖ Ἰῖῖ ῶᾱᾱῖῖῖῖῖῖ.

ἱᾱ ἱᾱὀἸῖ ὀἰ ὀἰῖῖῖ, ἑά ᾱῖῖῖῖῖῖῖῖ ἰέα ἱἸῖ ἑάὀἸῖῖῖῖ "a" ὀ ἱῖῖῖ ἱᾱῖῖῖῖῖῖῖ ὀῶῖ ἑάὀἸῖῖῖῖ ὀἰ Vinum ὀᾱ ἱᾱὀἸῖ ὀε ὀδῶέᾱδὸP. Ὀεῖᾱῖῖῖῖ ἱᾱῖῖ ὀ ἱᾱῖῖῖῖῖ bsdlablel ἑά ἱᾱῖῖῖῖῖ ἱᾱὀἸῖ ὀῶῖ ἱᾱῖῖῖῖῖῖ ἱᾱῖῖ ἱᾱ ὀ ἑάὀἸῖῖῖῖ ὀἰ Vinum Ἰῖ ÷ ᾱέ ἱᾱῖῖῖῖῖῖῖ ἑάὀἸῖῖῖῖ ἱᾱ fstype "vinum".

- 3. ἌὀἸῖ ᾱῖῖῖῖ ἱῖῖ! Ὀδῶᾱ ÷ ᾱέ ῶῖῖῖ ἰέα ῖᾱὀἸῖῖῖῖ ἑάὀἸῖῖῖῖ "a" ὀᾱ ἑἸεᾱ ὀδῶέᾱδὸP ὀ ἱῖῖῖ Ἰῖ ÷ ᾱέ ἱᾱῖῖῖῖῖῖ ὀἰὸ ᾱέεῖγὺ ὀυῖῖῖ. Ὀῶἱῖῖῖῖῖ ἰά ἱᾱῖῖῖῖῖῖῖῖ ἱᾱῖῖ ὀἰ ἱᾱῖῖῖῖῖῖῖ, ÷ ᾱῖῖῖῖῖῖῖῖῖῖ ἰέα ἱᾱῖῖῖῖ ἱᾱῖῖῖ ὀῶῖ ῶᾱᾱῖῖῖῖῖ:

```
fsck -n /dev/devnamea
```

Ἐά δᾱᾱέἸ ἰά ἑῖῖῖῖῖ ἱᾱῖῖ ἱᾱ ἑἸῶᾱῖῖ ὀἰ ἱᾱ ÷ ᾱῖῖῖ ῶἰ δᾱᾱῖῖ ÷ ἰῖῖ ῶῖῖῖῖῖῖῖ ἱᾱῖῖ ÷ ἰῖ ὀἰ δᾱᾱῖῖ ἰά ᾱῖῖῖ ὀ ÷ ἱᾱῖῖῖῖῖ ἱᾱῖῖ ὀἰ ᾱέεῖῖ ὀῶῖῖῖῖ ὀῶῖῖῖῖ ὀῶῖῖῖῖ ὀῶῖ ὀἰ ᾱῖῖῖῖῖῖ ὀῶῖ ὀἰ ᾱῖῖῖῖῖῖῖῖῖῖῖ (ἑᾱὀἸῖ ὀῶῖ ᾱῖῖῖῖῖῖῖῖ ἱᾱῖῖῖῖῖῖ ᾱέῖῖῖῖῖῖῖ ᾱέεῖῖῖῖῖ ὀυῖῖῖ Vinum) ἱῖῖῖῖ ἰά ἱῖῖ ὀᾱῖῖῖῖῖῖ ἱᾱ ὀἰ ᾱέεῖῖ ὀῶῖῖῖῖ ἱᾱ ÷ ᾱῖῖῖ ῶἰ ᾱῖῖῖῖ ἱᾱῖῖῖῖ ὀῶῖ ᾱῖῖῖῖ ἱᾱῖῖῖῖ ὀῶῖ ᾱῖῖῖῖῖῖῖῖῖῖῖ. Ἐά δᾱᾱέἸ ἰά ἱᾱῖῖῖῖῖῖ ἰά ὀἰῖῖῖῖῖῖ ὀᾱ ἱᾱ ÷ ᾱῖῖῖ /etc/fstab ἑάε /boot/loader.conf.

Ὀῶῖ ἱᾱῖῖῖῖ ἱᾱῖῖῖῖῖῖῖ, ἱ ἑῖῖῖῖῖ ᾱῖῖῖῖῖῖ ἑά δᾱᾱέἸ ἰά ἱᾱῖῖῖῖῖῖ ὀῶῖ ἑᾱὀἸῖῖῖῖῖ ῶῖῖῖῖῖῖ ἱᾱῖῖ ÷ ἰῖ ἱᾱῖῖ ὀἰ ἱἸῖ (Vinum) ᾱέεῖῖ ὀῶῖῖῖῖ ἱᾱ ÷ ᾱῖῖῖ ἑάε ἰά ἱᾱῖῖῖῖ ἑᾱὀἸῖῖῖῖῖ. Ὀῶἰ ὀἸῖῖ ὀεῖ ἱᾱῖῖῖῖῖῖῖ ἱᾱ ÷ ἑῖῖῖῖῖῖῖ ὀἰὸ ῶᾱᾱῖῖῖῖ, ἑάε ἱᾱὀἸῖ ὀῶῖ ἱᾱῖῖῖῖῖῖ ἱῖῖῖ ὀἰ ὀῶῖῖῖῖῖῖ, ὀἰ ἱᾱῖῖῖῖ ὀἰ ἱῖῖῖ ἱᾱῖῖ ÷ ἱᾱῖ ὀῶῖ ἱᾱῖῖ ὀῶῖ ἱᾱῖῖῖῖῖῖῖ ὀἰ ἱᾱ ÷ ἱᾱῖῖῖῖῖῖ ἱῖῖῖῖῖ ἱᾱ ὀἰ ῶᾱᾱῖῖῖῖῖ:

Mounting root from ufs:/dev/gvinum/root





έάδὺέαεί δὶδ Vinum δὶδδὺ ÷έόδὶί έάδὺ 4 KB πὸά ίά ίγί δδὺñ ÷άέ όγέññίόόό ίάδάίγ όçδ άδέέάδδέβääδ δὶδ Vinum έάέ δὶδ έπääέά άέέβίçόçδ.

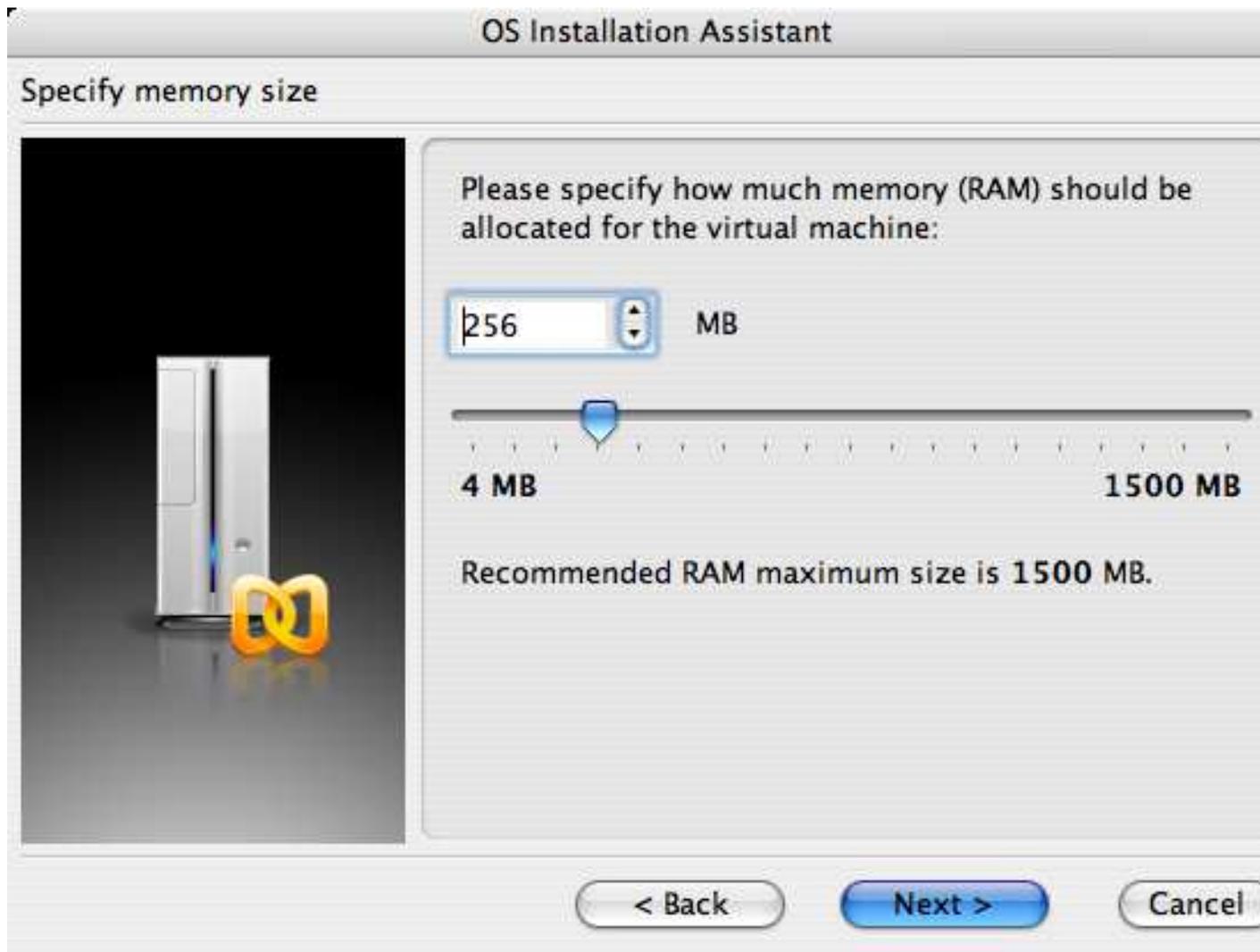
## Όçìάέπὸάέδ

1. Ὀί RAID όçìάβίάέ *Redundant Array of Inexpensive Disks* έάέ δάνΎ ÷άέ άέὺδὶñάδ ïñδΎδ άί ÷δὸ όά όδὺέιάόά, άί έάέ όόçί δάνάδὺί ÷ñδόç í ùñδ άβίάέ έὺδὺδ δάνάδέάίçόέέδδ: δὶ RAID-0 äáí δάνΎ ÷άέ έάίέὺ δΎδὶέά δñίόάόβá äääñΎí.



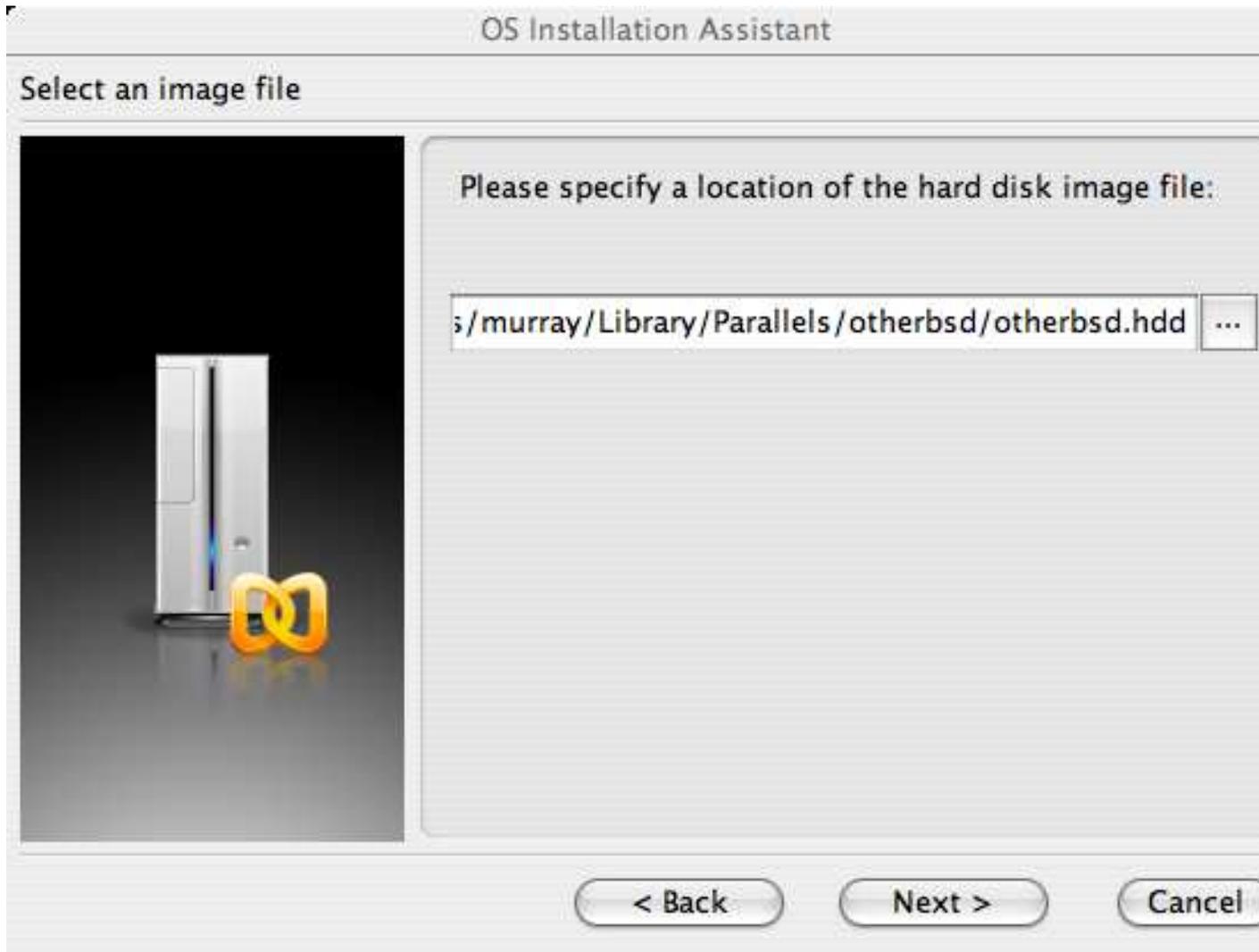


Ἡ βότα Ἰά ἐραεῖν ἰῶαδὲρ ἀβόειρ ἐαε ἰβιçð ðῖρ ἰά αἰδᾶδῖἐνβῖαδᾶε ὁδᾶ ὁ ÷ Ἰᾶεᾶ ðῖρ Ἰ ÷ ᾶδᾶ ᾶεᾶ ὁçῖ ᾶεῖῖεῖῖδῖβçð ðῖρ FreeBSD. 4GB ᾶβόειρ ἐαε 512MB ἰβιçð ᾶῖὄεᾶῖῖῖ ἰεᾶ ÷ ᾶñÛ ᾶεᾶ ὁῖðð ðᾶñέσὀῖὀᾶñῖðð ÷ ñβὀδᾶð ὁῖρ FreeBSDῖῖὀᾶ ᾶδῖ ὁῖ **Parallels**:









Αδέσ Υιόα οίι ογδι αέέδύοζο έάέ οίι οηιόάνηα Υά αέέδύιό:

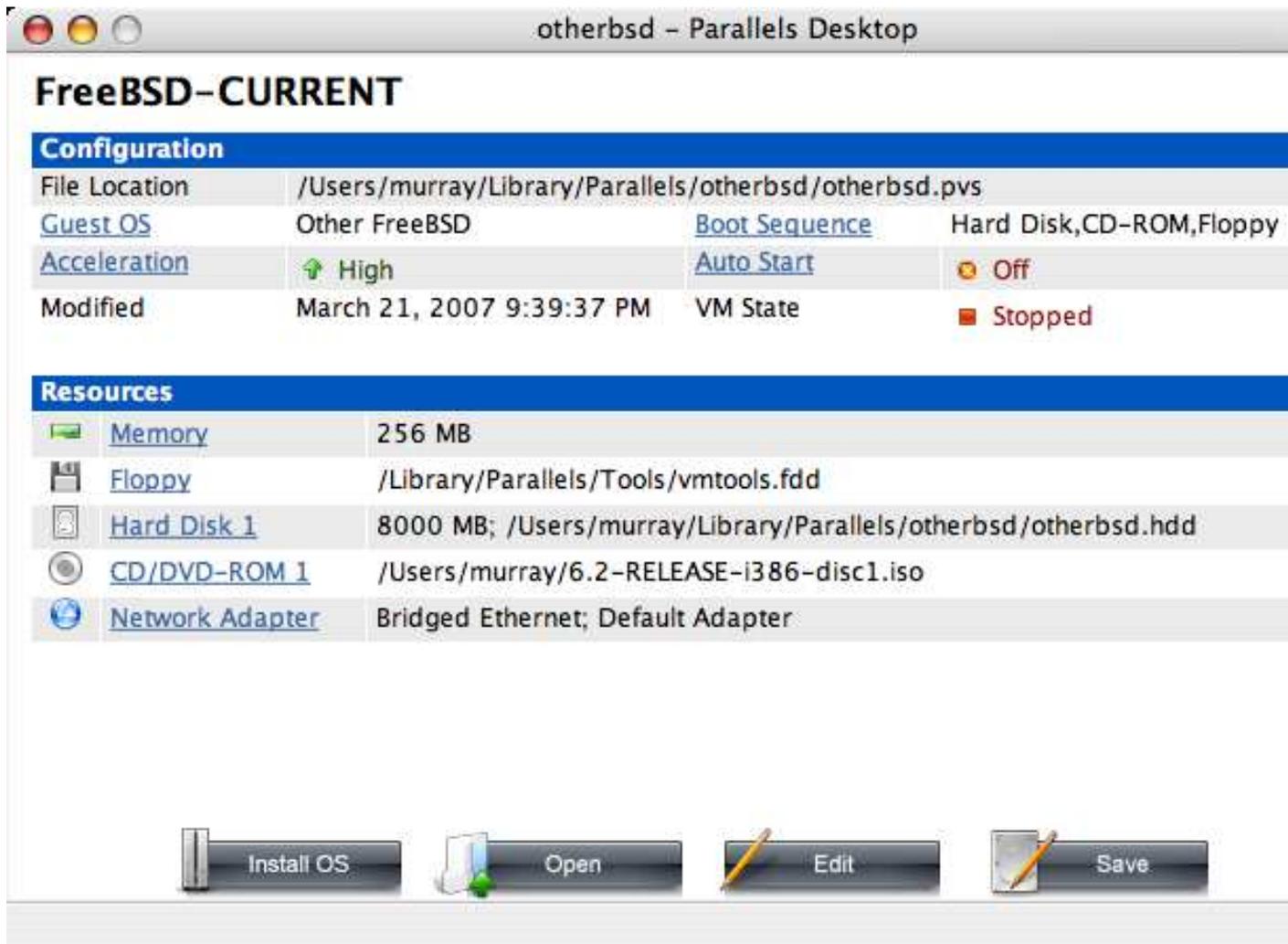




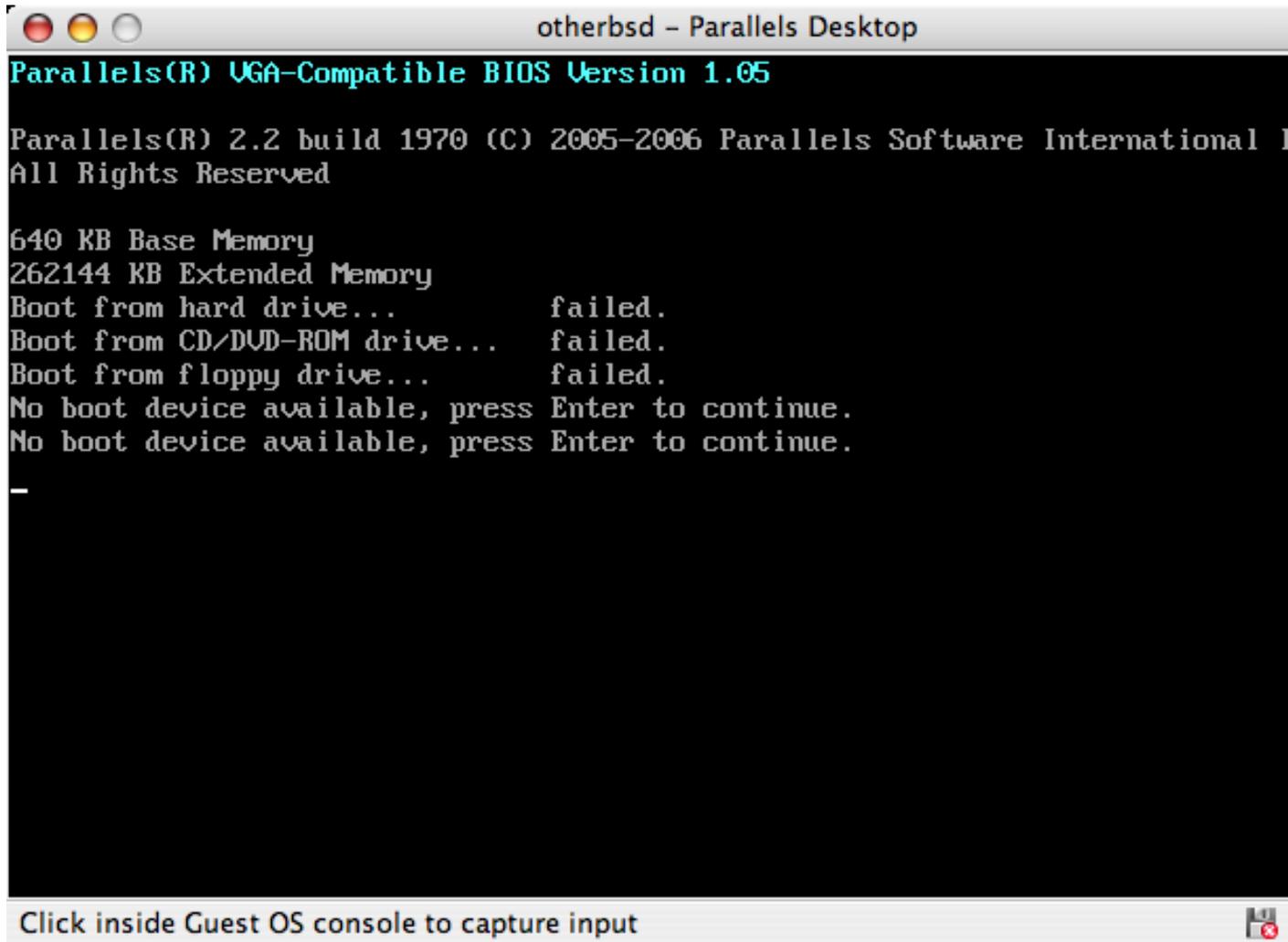
Άδιεπέαός έάέ οΰεο ούι ηόειβόαι:







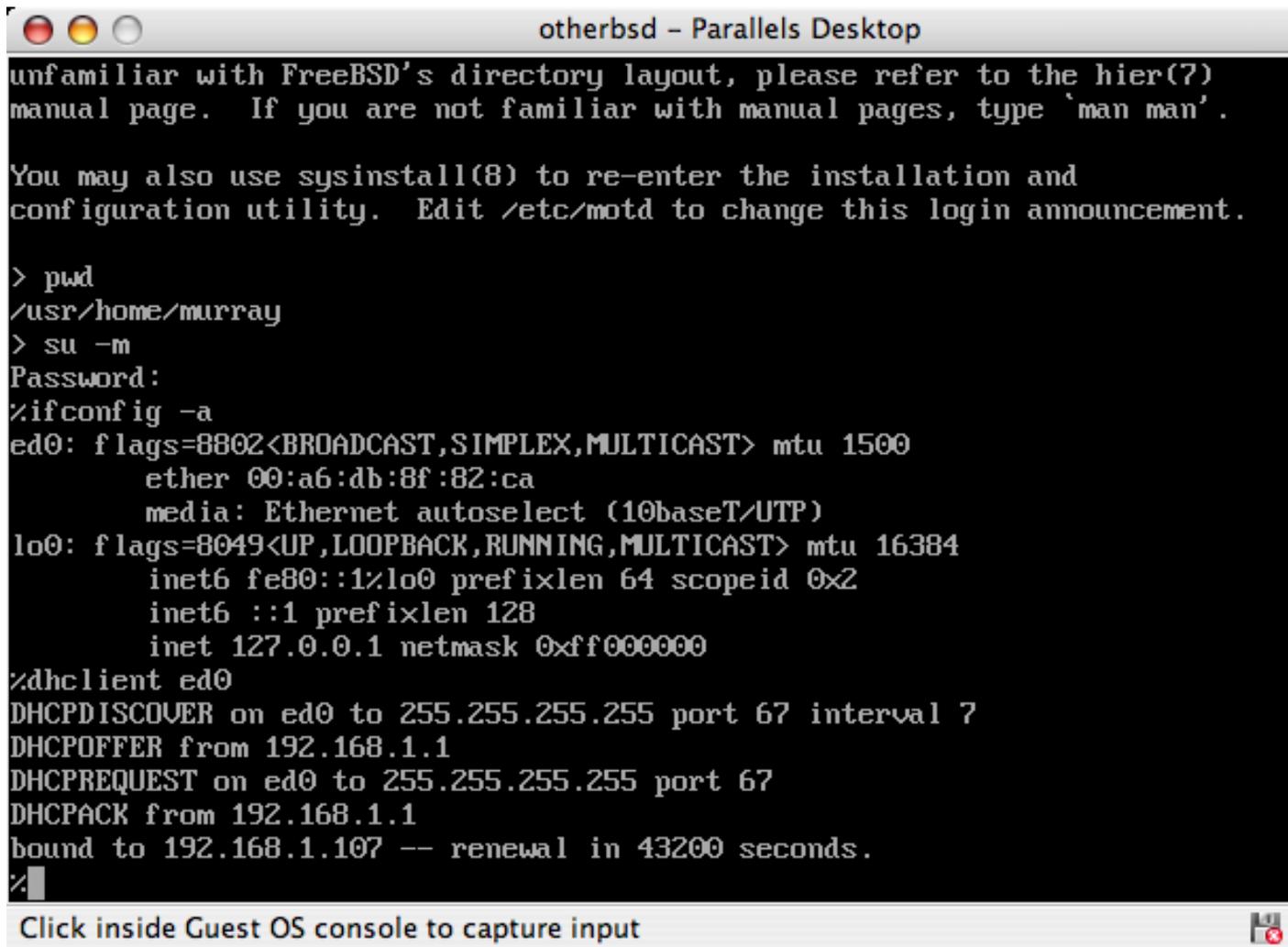
¼οάι Ý ÷ ðòà áíðέóóðíε ÷ Þóáε ðç ðçãÞ ððéáðÜóðáóçð, áðáíáέέέίÞóðá ðí áέέίíέέü óýóóçíá ðáðÞíóáð áðέÜ ðí έίðíðß ðçð áðáíáέέέβίççð (reboot) ðíð **Parallels**. Óí **Parallels** έá íáέέίÞóáε íá Ýíá áέáέέü BIOS ðí ððíßí ðñÞóá áέÝã ÷ áέ áÜí ððÜñ ÷ áέ áέáέÝóέíí έÜðíέí CD-ROM, üðùð έÜíáέ έáέ Ýíá ððóέíέíáέέü BIOS.



Óå áððð ðç ðåñβððùός εά åñåέ ðι ιΎοι ååέάóÛόόάόçð ðιõ FreeBSD έάέ εά ιåέέιβόάέ ðι **sysinstall** ùðùò ðåñέåñÛόåόάέ óοι ÊäöÛεάέι 2. Ìθιñåβðå ιά ååέάόάóðβόåðå ðι X11, åέεÛ ιç åιέέιÛόåðå ιά ñöèιβόåðå áððð ðç óóέåιð.



40áí ðáèáεπόάðá íá ðçí ááèáðÜóóáός, εÜíðá íéá áðáíáèèΒίός όðí ðñÝόèí 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 ιἀñέêÛ ἀΠιάόά áέιιç ðιò ιðιιιγί ιά óάð ἀιçèΠοιρι ιά ñòèιβóαð ðι áέéιíééü óάð óγóçιά.

#### 1. ΙὰόάεçðÝð ðιò boot loader

Οι ðιéι óçιáιóééü ἀΠιá ἀβιáé ιá ιáεΠóáð ðι ιÝááèιð ðιò kern.hz ðñιéáéιÝιιò ιá áιéιðιéΠóáð ðç CPU ιÝóá áðu ðι **Parallels**. Ἀóòü ιðιιιáβ ιá ἀβιáé ιá ðι ιá ðñιóéÝóáð ðçι áέüéιðèç ãñáιιΠ ðοι /boot/loader.conf:

```
kern.hz=100
```

×ùñβð áððΠ ðç ñýèιéóç, Ýιá áãñáιÝð FreeBSD ðοι **Parallels** éá éáóáιáεΠιáé ðι 15% ðçð CPU áíüð ιιιðýñçιιò ιMac@. ΙáðÛ áðu ðçι áέéááΠ, ç éáóáιÛéùóç éá ðÝóáé éιιðÛ ðοι 5%.

#### 2. Ἀçιéιðñáβá ιÝιò áñ ÷ áβιò ñòèιβóáιι ðιò ðòñΠιá

Ιðιιιáβóá ιá áóáéñÝóáðá üéáð ðιòð ιäçãäýð áéá SCSI, FireWire, éáé USB óóóéáðÝð. Οι **Parallels** ðáñÝ ÷ áé Ýιá áέéιíééü ðñιóáñιιáÝá áέéóγιò ι ιðιιβιð ÷ ñçóéιιðιéáβóáé áðu ðιι ιäçãü ed(4), ιðuðá üéιé ιé ιäçãιβ áéá áέéððáéÝð óóóéáðÝð áéúòð ðüι ed(4) éáé miibus(4) ιðιιγί ιá áóáéñáèιγί áðu ðιι ðòñΠιá.

3. Ñýεíεçç äééçýíç

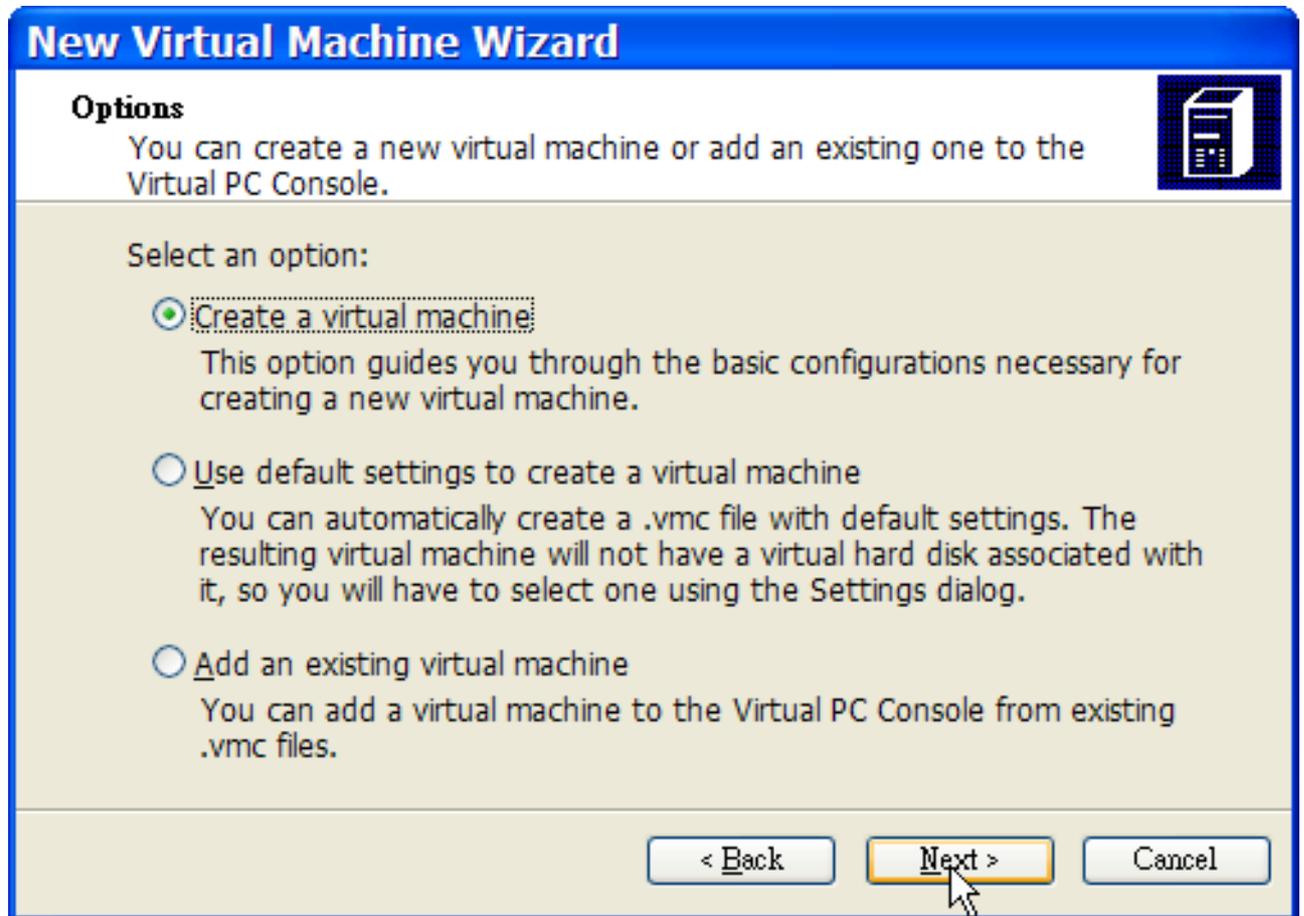
Ç ðéí áðεP ñýεíεçç äééçýíç εÙíáé ÷ñPçç çíç DHCP áéá íá ççíááεáβ çí äééííééü çáç çýçççíá ççí βáéí çíðééü äβéççí íá çíí Mac. Áççü íðíñáβ áýêíéá íá áβíáé íá çí íá ðñíçèÝçáçá çç ãñáíñP ifconfig\_ed0="DHCP" ççí /etc/rc.conf. Ðíεççéíéüçáñáç ñçèíβçáéç äééçýíç ðáñéãñÙçííçáé ççí εàoÙεάéí ΕὰοÙεάéí 31.

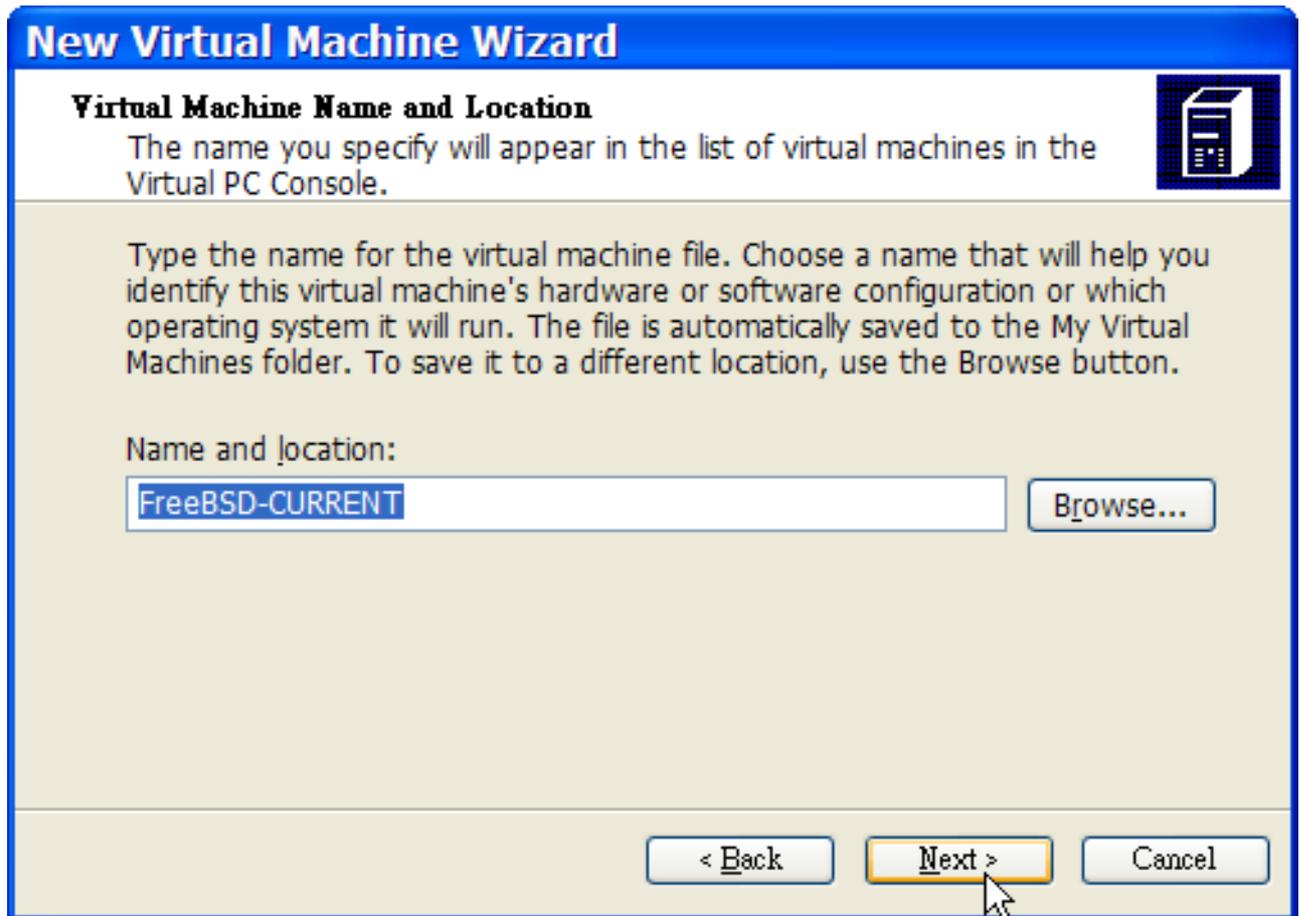
22.2.2 Çí Virtual PC ççá Windows

Çí Virtual PC áéá Windows áβíáé Ýíá ðñíúíí ççç Microsoft çíç äéáçðβéáçáé áéá àññáÙí εáçÝááçíá. Ááβçá çéç áðáéçðPçáéç ççççðPíáççíç (http://www.microsoft.com/windows/downloads/virtualpc/sysreq.mspx). ÌáçÜ ççí ááéáçÜççáçç çíç Virtual PC ççá Microsoft Windows, ï ÷ñPçççç ðñÝðáé íá ñçèíβçáé Ýíá äééííééü íç÷Ùíçíá éáé íá ááéáçáççðPçáé çí çééíñáíýíáñí éáéçíçñáééü çíç áðééçíáβ.

22.2.2.1 ÁáéáçÜççáçç çíç FreeBSD ççí Virtual PC/Microsoft® Windows

Çí ðñPççí áPíá çççí ááéáçÜççáçç çíç FreeBSD ççá Microsoft Windows íá ÷ñPçç çíç Virtual PC, áβíáé ç çççéíçñáβá áñüç íÝíç äééííééýí íç÷áíPíáççíç áéá ççí ááéáçÜççáçç çíç. ÁðééÝíçá Create a virtual machine üçáí áñüççéáβçá:





Όχι άποός Operating System άέέΎιά Other:



## New Virtual Machine Wizard

**Memory** 

You can configure the RAM on this virtual machine.

To improve the performance of this virtual machine and run more applications on its operating system, increase the amount of RAM allocated to it. To leave more RAM for other virtual machines on your system, use the recommended RAM allocation.

Recommended RAM: [128 MB]

Allocate RAM for this virtual machine by:

Using the recommended RAM

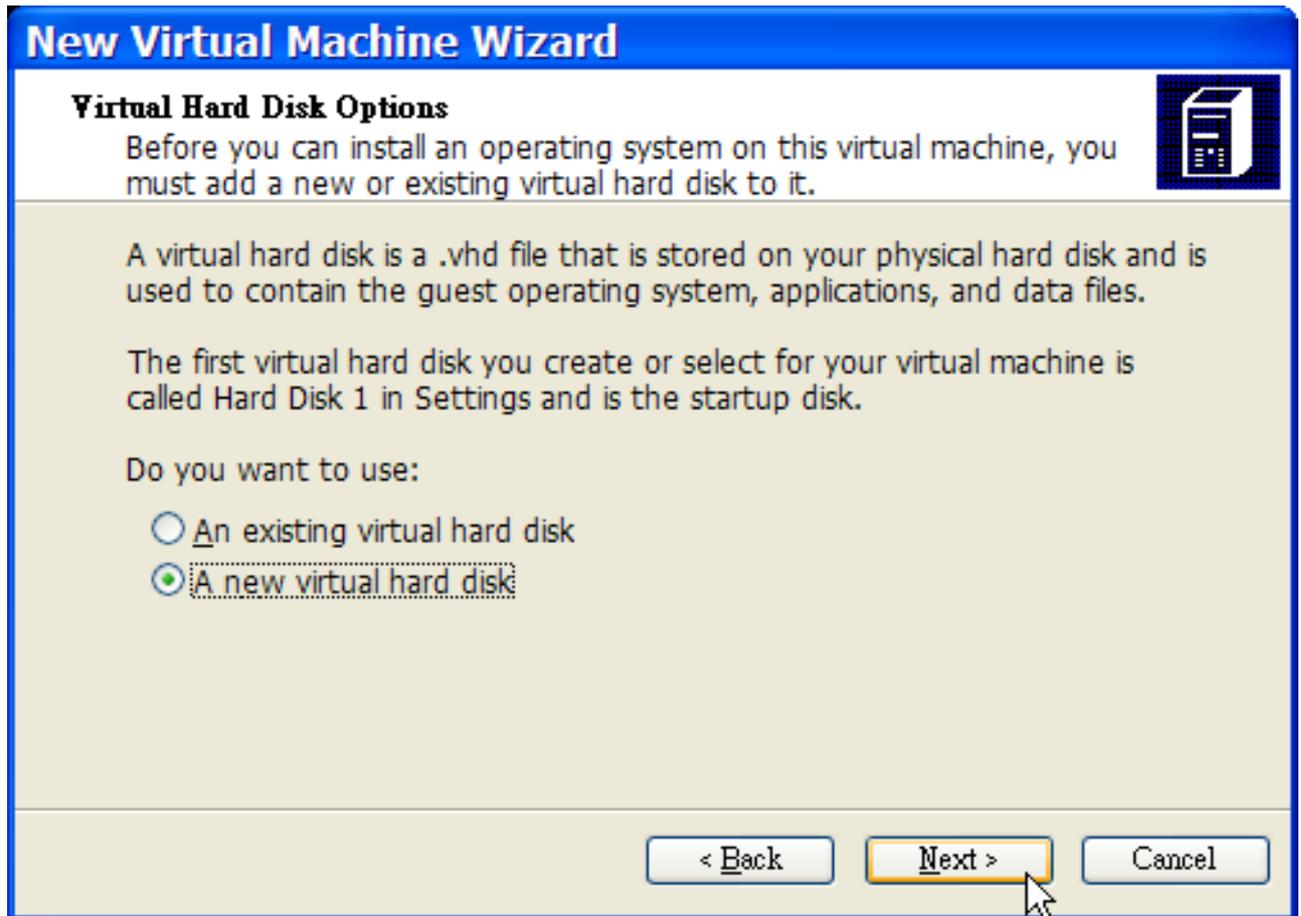
Adjusting the RAM

Set the RAM for this virtual machine:

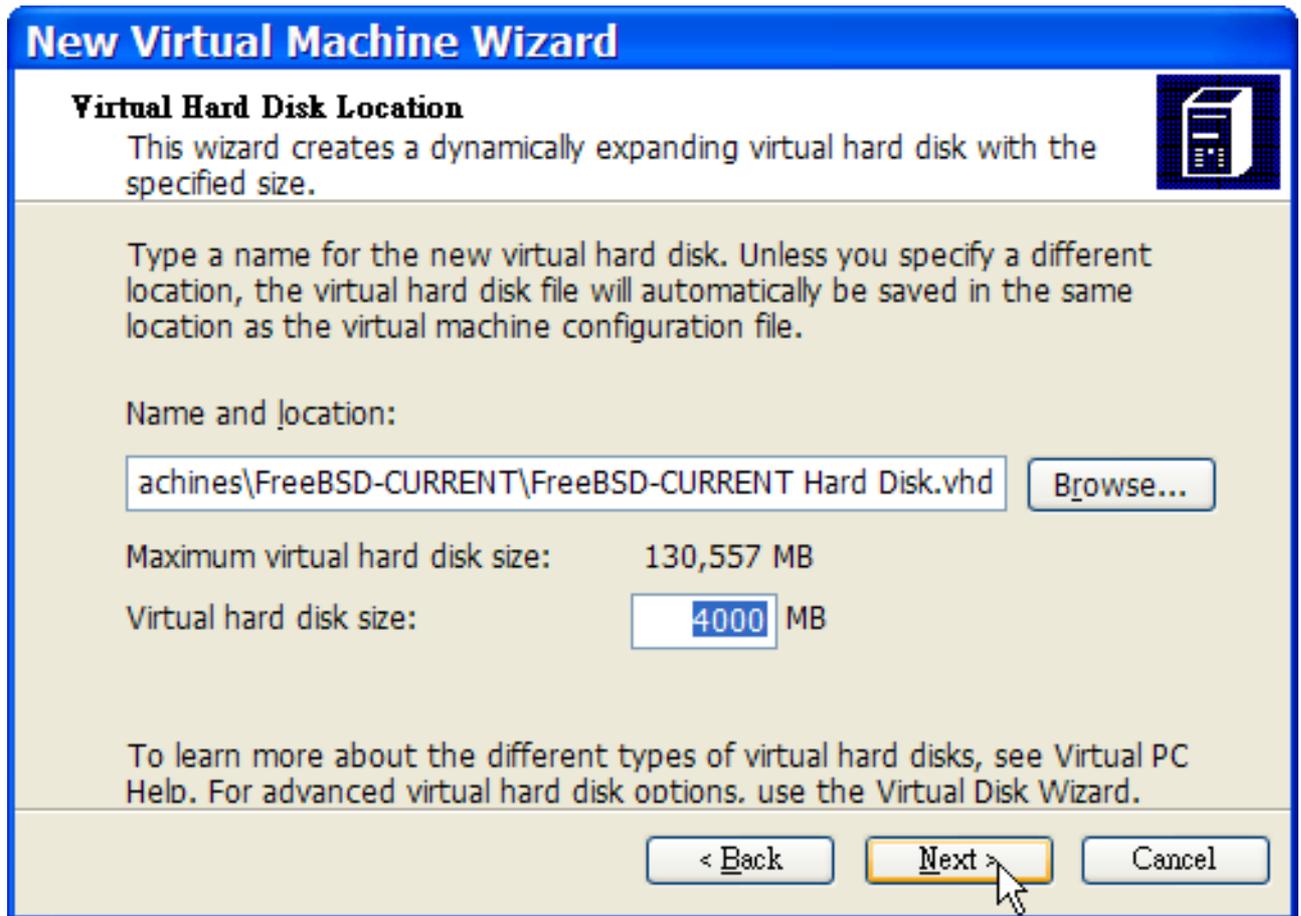
4 MB

1079 MB

512 MB

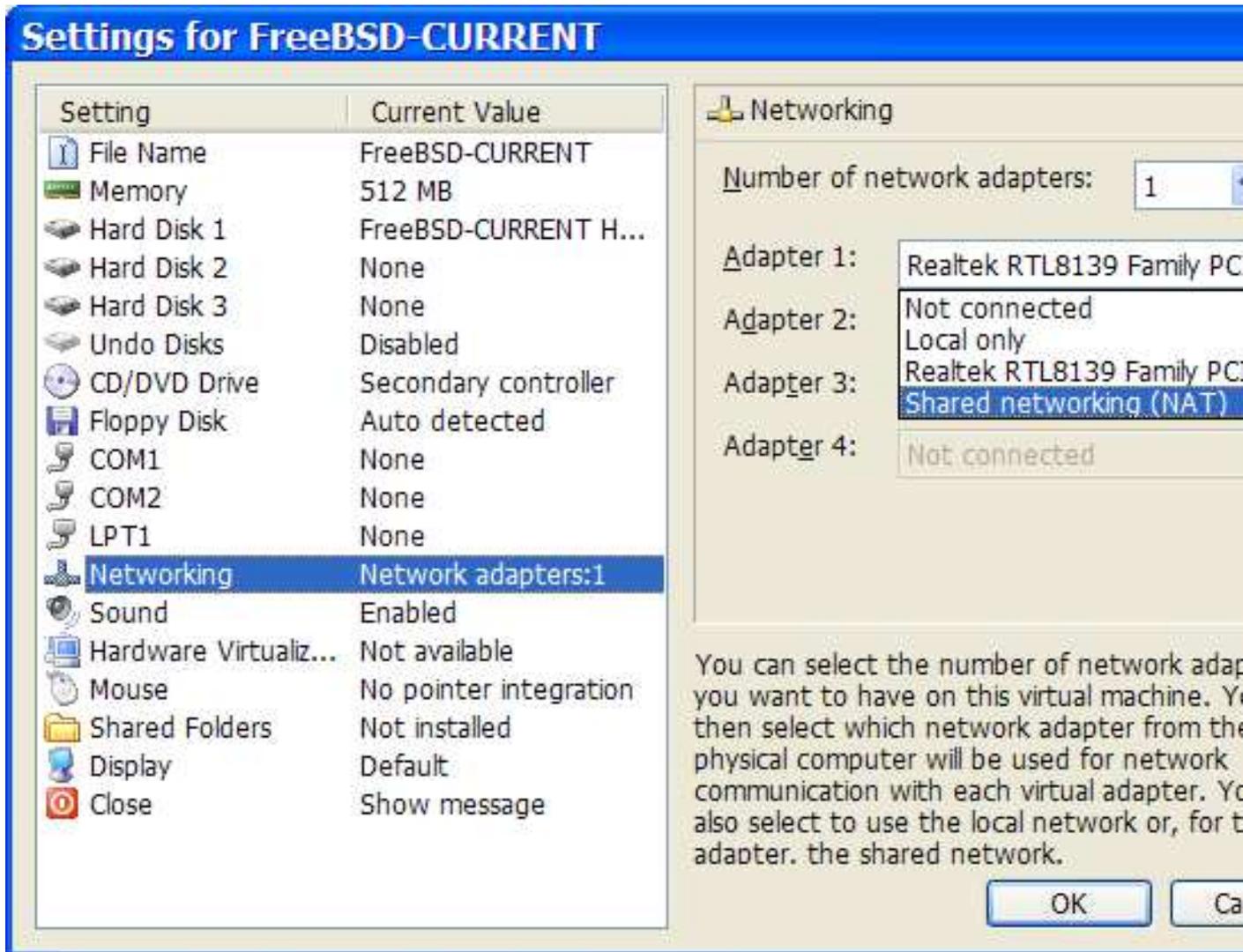


Ίερέεζηπόά άδρεέάγίπόά όέδ ηόειβόάέδ:



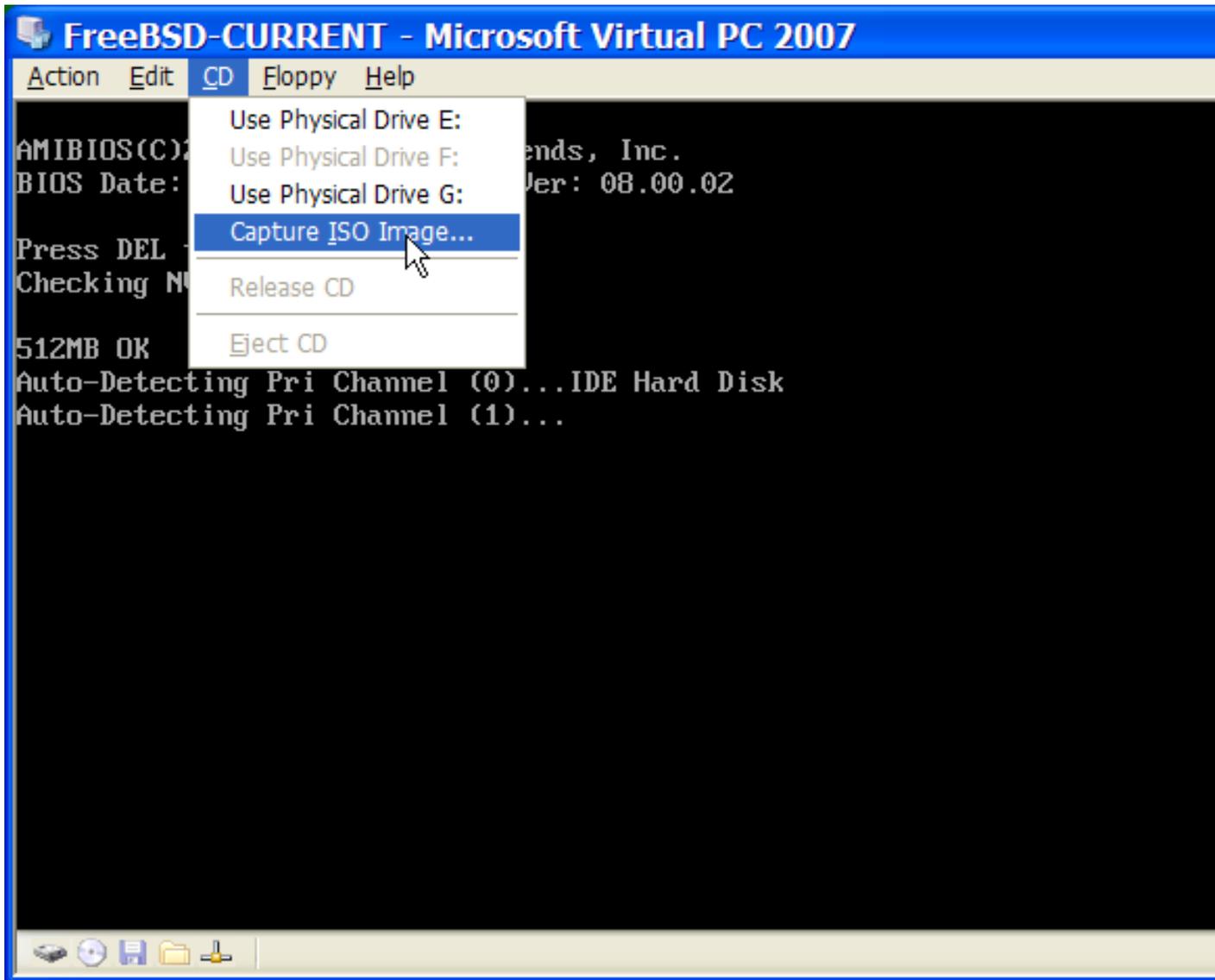
ΆδεέΥίττ όçi άέέίίέέP ιç÷άίP FreeBSD θίθ άçίέίτθάPόάόά έάέ έΥίττ έέέέ όθι Settings. Νόειβόόά Υθάέόά θι άβάρθ έάέ όçi άέάθάθP (interface) θίθ άέέόύίθ:



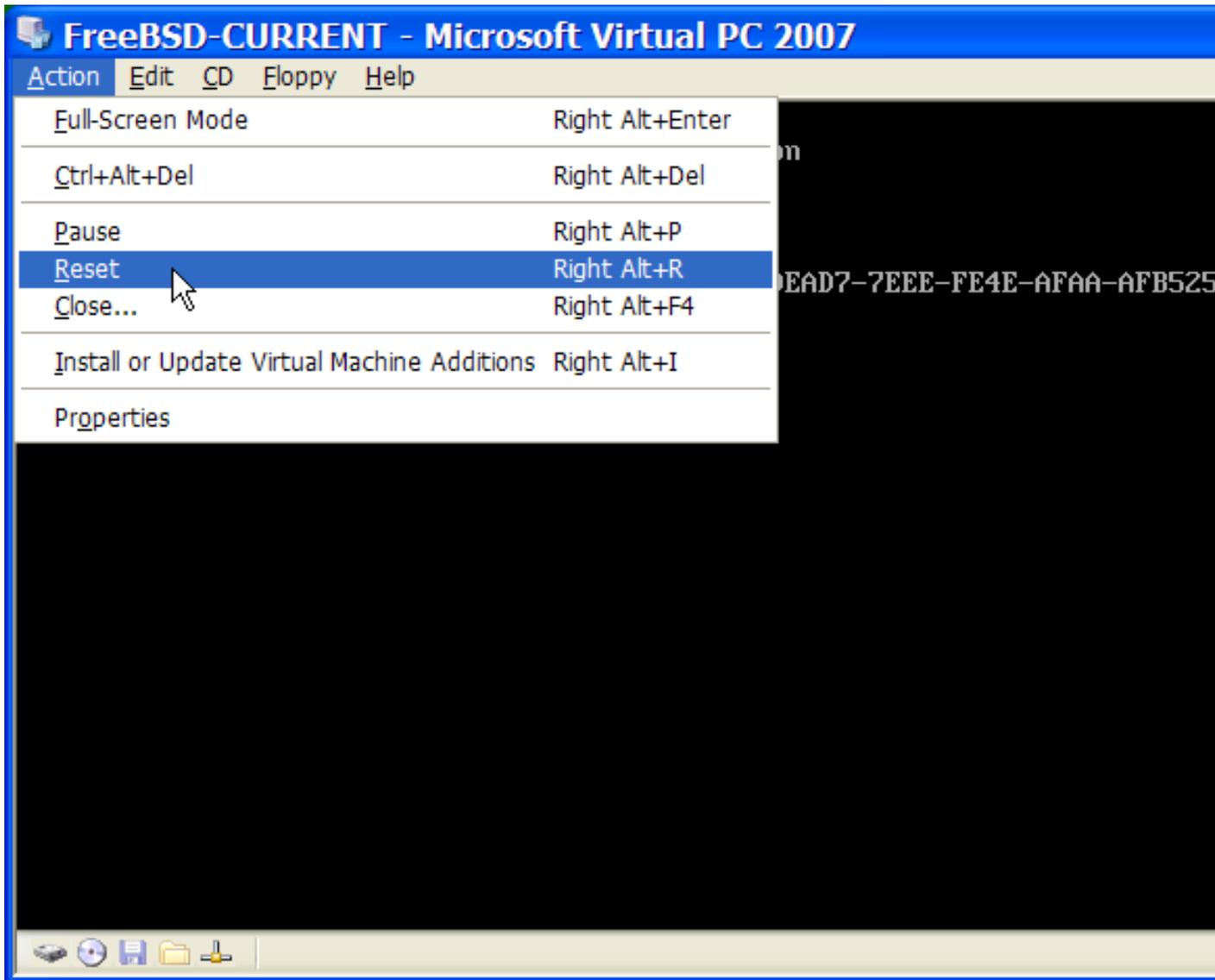


Άοΰή αχίεϊοñāΠόαόâ όςί άέεϊέέΠ ις÷άίΠ οάδ άέα όί FreeBSD, έá δñÝδás ίá áāέáόáόδΠόáόâ όί έάέόίòñāέέú οá áόδΠί. Ί έάέýδáñîð ðñúðîð áβίáέ ίá ÷ñςόέίϊðίέΠόáόâ Ύίá áδú όá áδβόςίá CDROM όίò FreeBSD Π ίá έάόâáΰόáâá έΰðίέί áñ÷άβι ISO áδú όςί áδβόςις όίðίέáóβá FTP, ÷ίίόáð όί έáδΰέέςεϊ áñ÷άβι ISO όόί όίðέέú οáδ όýόόςíá áñ÷άβι όú Windows (Π όί áíδβόδίέ÷í CDROM όóίí ðäçäú), έΰίòá έέðέú έέέέ όóί άέείíβáέί όςð άέéίέέΠð ις÷άίΠð FreeBSD áέα ίá όςί áέέéίΠόáόâ. ðáέόá έΰίòá έέέέ όóί CD έάέ áðέéΎίòá Capture ISO Image... όóί δáñΰέðñí όίò **Virtual PC**. Έά áìóáίέóáâ Ύίá δáñΰέðñí ðíò έá όáð áðέðñΎðάέ ίá όóó÷áδβόáâ όίí άέéίέέú ðäçäú CDROM íá Ύίá áñ÷άβι ISO Π έάέ íá όίí δñáñίáόέέú οáδ ðäçäú.

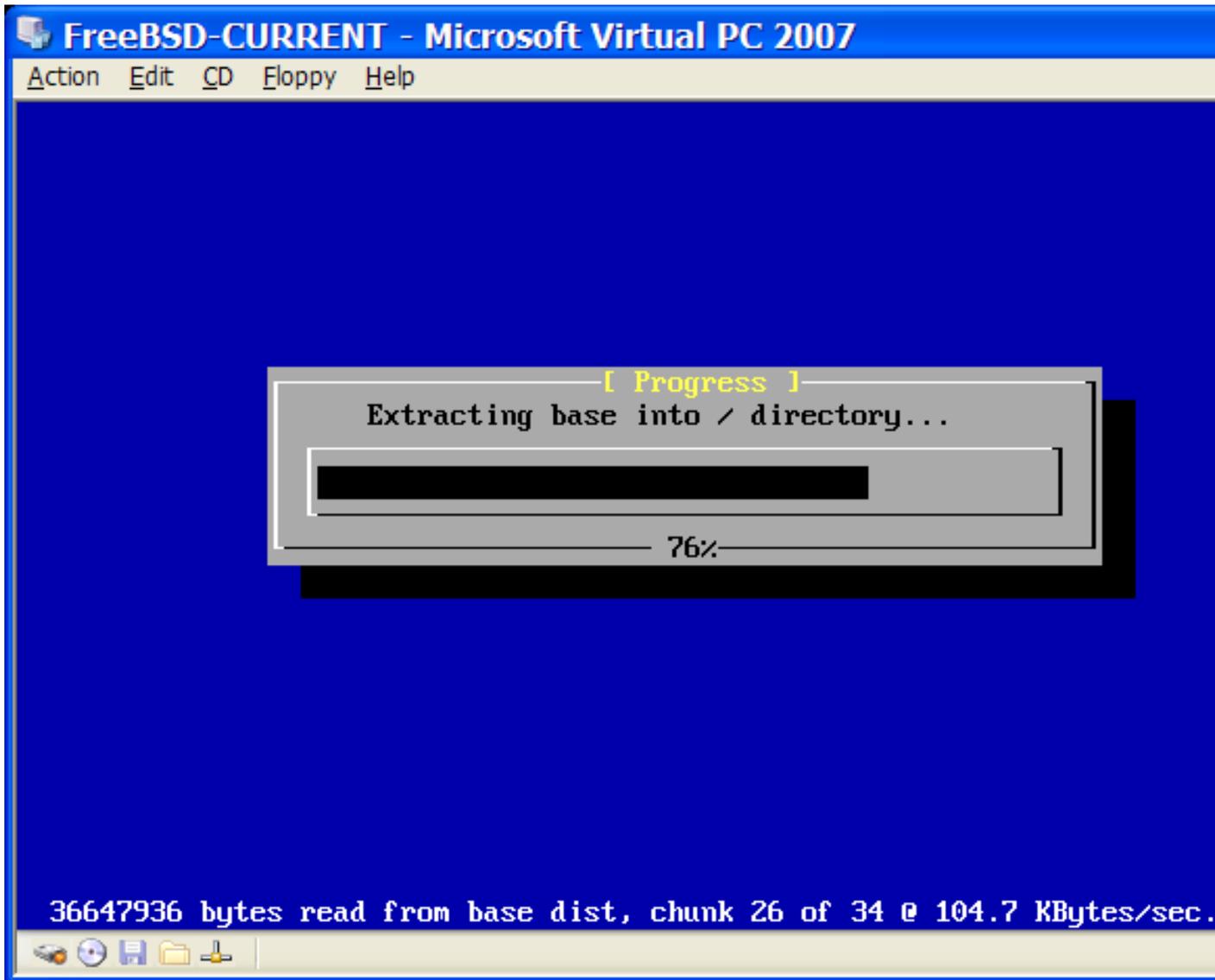




Το εικόνα απεικονίζει το μενού CD του Virtual PC 2007, όπου η επιλογή "Capture ISO Image..." είναι επιλεγμένη. Το φόντο της εικόνας είναι ο οθόνη του BIOS, η οποία εμφανίζει πληροφορίες σχετικά με το σύστημα, όπως η ημερομηνία του BIOS, η μνήμη RAM (512MB OK) και η ανίχνευση των καναλιών IDE Hard Disk. Η εικόνα δείχνει επίσης το μενού "Action", "Edit", "CD", "Floppy" και "Help".



Όδες έέεP ιάδ δάνβδδουός, έά άίέ :- ίάγύάέ θι ιΎόι άάέάδÛόόάόςδ θιō FreeBSD έάέ έά ίάέέίPόάέ ζ όδίçέέόιΎίç έέάάέέάόβά άάέάδÛόόάόςδ ιΎού θιō **sysinstall**, ύδθδ δάνέάνÛόάόάέ όθι ÊäöÛεάέι 2. Ìθιnáβδά ίά θπi :- ύñPόάδά ίά όçί άάέάδÛόόάός, άέέÛ ίç δπiόδάεPόάδά ίά πδειβόάδά θι άπάέέεü όγόόçιά X11 όç άάάνΎίç όδέέiP.



¼óáí ðáεáεéþóáðá ðçí ááεáóÛóóáóç, íç íá÷Ûóáðá íá ááÛεáðá ðí CDROM áðü ðíí íäçäü (P íá εáðáñáþóáðá ðçí áíðóðíε÷ç óðó÷Ýóέóç íá ðí áñ÷áβí ISO). Ìðíñáβóá Ýðáέóá íá áðáíáεééíþóáðá óçç íÝá óáð ááεáóÛóóáóç ðíð FreeBSD.

```

Action Edit CD Floppy Help
unfamiliar with FreeBSD's directory layout, please refer to the hier(7)
manual page. If you are not familiar with manual pages, type 'man man'.

You may also use sysinstall(8) to re-enter the installation and
configuration utility. Edit /etc/motd to change this login announcement.

%pwd
/usr/home/chinsan
%su -m
Password:
%ifconfig -a
de0: flags=8802<BROADCAST,SIMPLEX,MULTICAST> metric 0 mtu 1500
 ether 00:03:ff:fc:ff:ff
 media: Ethernet autoselect (100baseTX)
 status: active
vlp0: flags=108810<POINTOPOINT,SIMPLEX,MULTICAST,NEEDSGIANT> metric 0 m
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> metric 0 mtu 16384
 inet6 fe80::1%lo0 prefixlen 64 scopeid 0x3
 inet6 ::1 prefixlen 128
 inet 127.0.0.1 netmask 0xff000000
%dhclient de0
DHCPREQUEST on de0 to 255.255.255.255 port 67
DHCPACK from 192.168.131.254
bound to 192.168.131.67 -- renewal in 536870911 seconds.
%

```

**22.2.2.2 Νύειέόζ όιθ FreeBSD όόι Virtual PC όά Microsoft Windows**

Ἰὰὐὐ όζι ἄδέόδ ÷P ἄἄεὰὐὐόόάόζ όιθ FreeBSD όόά Microsoft Windows ἰΎόὐ όιθ **Virtual PC**, εὰ ḁñΎḁἄε ἰά ἄέόἄεΎόἄḁ ἰεά όἄñὐ ἄḁü ñḁèìβόἄέὐ ἄεά ἰά ἄἄεὐόόίθιέPḁḁḁḁ όζι εἄέὐίθḁñḁḁḁ όιθ όḁόḁPḁḁḁḁḁḁḁ ḁḁ ḁḁñεἄὐεεἰἰ ἄεέἰἰεέḁḁ ἰζ ÷ἄἰḁḁ.

1. ΕΎόḁḁ ḁεἰΎḁ όόέὐ ἰḁḁἄἄεζόΎḁḁ όιθ όἰñḁḁḁP ἄἄεβζόζḁ
 

Ç ḁεἰ όζἰἄἰḁεέP ñύεἰέόζ ἄβἰἄε ἰά ἰἄεPḁḁḁḁ όζι ḁεἰP ḁζḁ ἰḁḁἄἄεζόPḁḁ kern.hz ἄεά ἰά ἰἄεPḁḁḁḁ ḁζ ÷ñPόζ ḁζḁ CPU όόι FreeBSD ḁḁḁἰ όἰ ÷ñζόεἰθιέἄβḁḁḁ όόἰ ἄεέἰἰεεḁḁ ḁḁñεἄὐεεἰἰἰ όιθ **Virtual PC**. Ἀḁḁḁḁ ἰḁἰñḁḁ ἰά ἄḁέόḁḁ ÷εἄβ ḁñἰόεΎḁἰḁḁḁḁ ḁζἰ ḁḁñἄεὐὐḁḁ ἄñἄἰP όḁἰ ἄñ ÷ἄβἰ /boot/loader.conf:

```
kern.hz=100
```

× ùñβò áððß ðç ñýèιέός, ιέα áέέιτέέß ιç÷άιß FreeBSD óðι **Virtual PC**, ùóáf áέòáέáβóάέ ÷ ùñβò öιñòβι, έά ÷ ñçóέιθιέάβ ðáñβðιò ðι 40% ðιò áðáíáñάάóðß óá Ýιá ιç÷Ûιçιá ιá ιβá CPU. ΙάðÛ áðu ðçι áέέάáß áððß, ç ÷ ñßόç έά áβιáέ έιðÛ óðι 3%.

2. Άçιέιθñáßóðá Ýιá ιÝι áñ÷άβι ñòèιβóáιι ððñβιá

Ιðιñáβóá ιá áóáέñÝóáðá ùέá óá ðñιáñÛιáóá ιáßáçóçð ãέá óðóέáðÛð SCSI, Firewire έάέ USB. Òι **Virtual PC** ðáñÝ÷άέ ιέα áέέιτέέß εÛñóá áέέóγιò ç ιðιβá ððιόðçñβæáðáέ áðu ðι ðñιáñáιιá ιáßáçóçð de(4), Ûñá ιðιñáβóá ιá áóáέñÝóáðá ùέáð ðέð Ûέέáð εÛñðáð áέέóγιò áðu ðι ððñβιá, áέðιð áðu ðι de(4) έάέ ðι miibus(4).

3. Ñýèιέός áέέóγιò

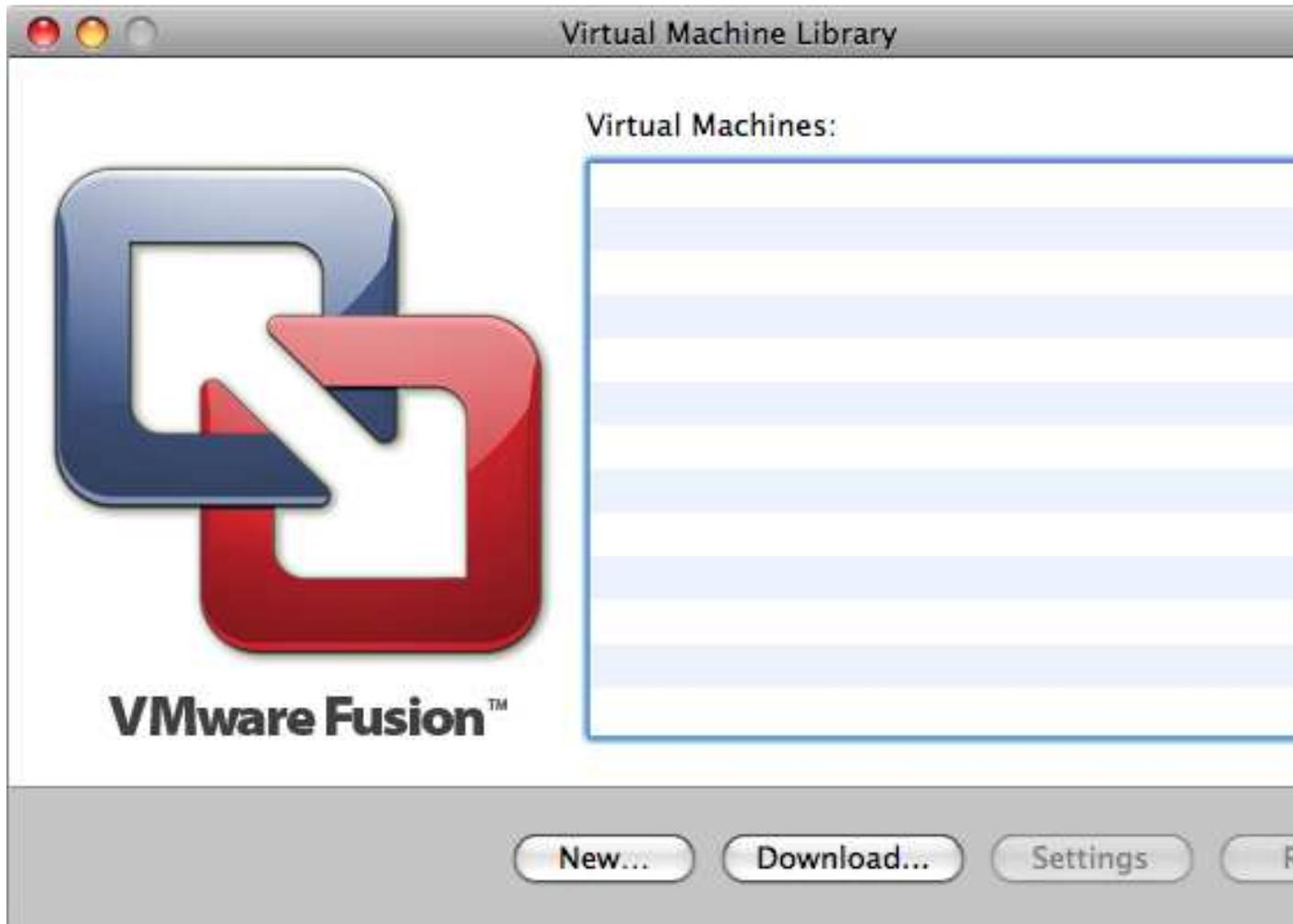
Ç ðέι áðßß ñýèιέός áέέóγιò ðáñέέáιáÛιáέ ðç ÷ ñßόç ðιò ðñιòιέιúέέιò DHCP áέá ιá óðιáÝóáðá ðι áέέιτέέú ιç÷Ûιçιá óáð óðι βáέι ðιðέέú áβέððι ιá ðι ιç÷Ûιçιá ιáιέóðß. Άóðι áðέóðá÷Ûιáðáέ ðñιòέÝðιιόáð ðç áñáιιß ifconfig\_de0="DHCP" óðι /etc/rc.conf. Ιðιñáβóá ιá áñáβóá ðέι ðñι÷ ùñçιÝιáð ñòèιβóáέð áέέóγιò óðι ÊäöÛεάεί 31.

### 22.2.3 Òι VMware óá MacOS

Òι **VMware Fusion** áέá Mac áβιáέ Ýιá áιðιñέέú ðñιáñáιιá. ÒðÛñ÷άέ áέáέÝóέιι áέá ððιέιáέóðÛð Apple Mac áñ÷έðáέðιιέέßð Intel ðιò ðñÝ÷ιòι Mac OS 10.4.9 ð εÛðιέá ðέι ðñιúóáóç Ýέáιòç. Òι FreeBSD ððιόðçñβæáðáέ ðεßñùð ùð ðέέιñáιýιáιι (guest) έáέðιòñáέέú. Ιùέέð ιέιέççñùέáß ç ááέáðÛóðáóç ðιò **VMware Fusion** óðι Mac OS X, ðñÝðáέ ιá ñòèιβóáðá ιέα áέέιτέέß ιç÷άιß έάέ ιá ááέáðáóðßóáðá ðι ðέέιñáιýιáιι έáέðιòñáέέú óýóðçιá.

#### 22.2.3.1 ΆáέáðÛóðáóç ðιò FreeBSD óðι VMware/Mac OS X

Άñ÷έέÛ ιáέέιßóðá ðι VMware Fusion, έάέ έá öιñðßóáέ ç Óðέέιáß Άέέιτέέβι Ιç÷άιβι. ΆðέέÝιòá "New" áέá ιá äçιέιθñáßóðá ιέα ιÝι áέέιτέέß ιç÷άιß:



Èá äåβåå íá öïñåþíáé õï New Virtual Machine Assistant, õï äïçèçðééü ðñüãñåíü äçìéïñåþåð íεåð íÝåð åέέιέέεðð ìç÷-áfðð. ΆðέεÝíðå Continue ãέá íá óõíå÷-βåååå:



Όχι αδειάει εαέοιναέέύ οδοδΠιάοιò äéä Ýîä Other äé üð Ýäüóç ääéοιñäéέύ οδοδΠιάοιò äéä Ýîä FreeBSD  
P FreeBSD 64-bit (áÜéüä ä öü äí äÝäòä ðüóδPñέίç äéä 64-bit äóäñüäÝò P ü÷é):



Άπόά Υία υίνα αέα οι VM Image εάε ηόειβόόά οι έαóÜετρί σόιι ιόιβι εΎεάόά ίά άδιεçεάόεάβ:



Νόειβόα ήι ιΥάαèò òìò Αέειέειύ Αβόειò αέα òζι áέειέειβ ιζ÷άιβ:



Άδελφότητα ιεά ιΥερίι ααέάθÜóóάóçð ãέα όçí áέεηέέθ ιç÷-άίθ: άβδά άδθι Υία ISO image άβδά άδθι όι CD-ROM:





Áäéáóóóóóóóá öí FreeBSD üðùð éá éÛíáðá éáé óá íðíéíäððíóá Ûéíí ððíéíäéóóð, ð áéííéíðéðíóáð óéð íäçãßàð áðü öí ÊäöÛäáí 2:







Οόυò Ý ÷ áε ίυçιά, áδβόçò, ίά áεεÛíâðå ðí áñ ÷ âβí Þ ðç óðóεâðÞ ðíð åáβíâðáé ùð CD-ROM ίÝóá óðçí áέεííéêÞ ίç ÷ áíÞ. ÓóíÞεùð ίðíñâβòå ίά áðíóóíáÝóâðå ðí CD-ROM Þ ðí ISO image áðu ðçí áέεííéêÞ ίç ÷ áíÞ, áóíý åå ÷ ñáεÛæâðáé ðεÝíí ùðáί Ý ÷ áε ίεíεεçñùεâβ ç åæéâðÛóðáóç ðíð FreeBSD:



Ἴέα ἀδὺ οέο δαέάδοάβὰο ἡοείβοάέο ἀβίαέ ζ ούγίαάος οζο ἀέειτέειδὺο ἱζ÷άιδὺο ἱὰ οἱ ἀβέοοἱ. Ἄέα ἱὰ ἱοἡἡὰοά ἱὰ οοἱάαέάβοά οοζἱ Ἄἱ ἀδὺ Ὑπέει ἱζ÷άιδἱάοά (ἀέοὺο οἱο ἱάτέοοδἱ), ἀἱἡἡἱοἱέδἱοά οζἱ ἀδέειἱἱ Connect directly to the physical network (Bridged). Ἀέέειδὺο, ἄέα ἱὰ ἱοἡἡἱβ ζ Ἄἱ ἱὰ οοἱάαέάβ οοἱ ἀβέοοἱ ἱἱἱοὺ οἱο ἱάτέοοδἱ, ἀέέἱ ἱὰ ἱζ ἱοἡἱἱἱ Ὑπέει ἱζ÷άιδἱάοά ἱὰ οοἱάαέἱἱἱ οἱ ἀοοἱ, ἀἱἡἡἱοἱέδἱοά οζἱ ἀδέειἱἱ Share the host's internet connection (NAT).



Ἰὺέεὸ δαέάεβράδᾶ ἰὰ ἀὸδὺδὸ ἐέδὸ ἡὸεὶβὸάέδ, ἰδῖἡᾶβδᾶ ἰὰ ἀέέειβράδᾶ ὁζ ἰὺᾶ ἀέειτέειβ ζ-ᾶίβ ἰὰ ὠἰ ὠἡᾶόει-ᾶᾶέᾶδᾶόζἰὺἡ FreeBSD ὡᾶδ.

### 22.2.3.2 Ἡὸεὶβὸάέδ ὠἰ FreeBSD ἰὺᾶ ὠἰ Mac OS X/VMware

ἈὠἰỴ δαέάεβράδᾶ ἰὰ ὁζ ἡᾶᾶδὺδὸᾶόζ ὠἰ FreeBSD ὡᾶ ἰᾶ ἀέειτέειβ ζ-ᾶίβ VMware ἰὺᾶ ὡᾶ Mac OS X, δἡὺᾶᾶ ἰὰ ἔὔἰᾶδᾶ ἔὔᾶᾶδ ἡὸεὶβὸάέδ ᾶᾶ ἰὰ ἡᾶᾶᾶᾶβ ζ ᾶᾶᾶᾶ ὠἰ FreeBSD ἡὸ ὡᾶᾡᾡᾡᾡᾡ ὡᾶᾶᾶᾶᾶᾶ.

1. Ἡὸεὶβὸάέδ ἰᾶᾶᾶᾶᾶᾶ ὠἰ boot loader

Ζ δᾶἰ ὁζἰᾶᾶᾶᾶ ἡὺᾶᾶᾶ ᾶβᾶᾶ ἰὰ ἰᾶᾶᾶᾶ ὁζ ὡᾶᾶ ὁζ ἰᾶᾶᾶᾶᾶᾶ kern.hz, ᾶᾶ ἰὰ ἰᾶᾶᾶᾶ ἔὔᾶᾶ ζ-ᾶᾶᾶ ὠἰ ᾶᾶᾡᾡᾡᾡᾡᾡ ᾶᾶ ὠἰ FreeBSD ἔᾶᾶᾶ ὠἡὺ-ᾶᾶ ἰὺᾶ ὠἰ VMware. ᾶᾡᾡᾡᾡᾡ, ἔἰᾶᾡᾡ, ὁζ ᾶᾡᾡᾡᾡᾡ ᾡᾡᾡᾡ ὠἰ ᾡᾡ-ᾡᾡ /boot/loader.conf:

```
kern.hz=100
```





### 22.3.2 Άδειες Άδειολογία

Όσον αφορά τις άδειες που παρέχονται για το Xen υπάρχουν δύο είδη άδειας: η άδεια της FreeBSD.







```
:charset=ISO-8859-1:\
:lang=de_DE.ISO8859-1:
```

ΔάναέÛòù äéÝðáòá Ýία .login\_conf óòì ιðìβì ιέ ιάοάάεçðÝð Ý ÷ ιòì óäèáβ äéá ΔάναάιιόεάÛ ÈéíÝæέéά óá èùäééιðìβçç BIG-5. ΔάναόçñΠόόά ùέé Ý ÷ ιòìä èÝóáé ðιέý ðáñέóóùòáñáò ιάοάάεçðÝð, éáèðò èÛðιέáò áóáñιäÝð ääì óÝäιιόάé óùóòÛ óéò ιάοάάεçðÝð äéá ÈéíÝæέéά, ΆέáðùιÝæέéά éáé ÈιñáÛóééά.

```
#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
```

Άέά ðáñέóóùòáñáò ðεçñιιòιñβáò, äáβòá óéò Ñðειβόάέο óá Άðβðáäì Άέά ÷ äéñέóòð éáé óçì login.conf(5).

### 23.3.4.1.2 Ñðειβόάέο óá Άðβðáäì Άέá ÷ äéñέóòð

Άάάéèèáβòá ùέé Ý ÷ äé ιñέóóáβ ç óùóòð äεβóóá óóçì èèÛόç ðιò ÷ ñΠόç, óòì äñ ÷ äβì /etc/login.conf. Óòì äñ ÷ äβì áðòù éá ðñÝðáé ίá ððÛñ ÷ ιòì ιέ ðáñáéÛòù ñðειβόάέò:

```
language_name|Account Type Description:\
:charset=MIME_charset:\
:lang=locale_name:\
:tc=default:
```

Ìá äÛόç òι ðñιçäιγíäιñ ðáñÛäéäìä ίáò ðιò ÷ ñçóéιιðιéβóáìä Latin-1, òι äñ ÷ äβì éá ιιéÛæáé ίá òι ðáñáéÛòù:

```
german|German Users Accounts:\
:charset=ISO-8859-1:\
:lang=de_DE.ISO8859-1:\
:tc=default:
```

Δñéí èÛíáòá áééäãÝð óééò ÈèÛóáéð Άέóüäιò (Login Classes) ðùí ÷ ñçóòðì, äéðáéÝóóá óçì ðáñáéÛòù áíòιéβ:

```
cap_mkdb /etc/login.conf
```

βóóá ίá áíáñäιéçéιγí óòì óýóóçìä ιé áééäãÝð ðιò èÛíáòá óòì /etc/login.conf.

### Άέéäãβ ÈèÛóáùí Άέóüäιò ιÝóù óçò vipw(8)

×ñçóéιιðιéβóóá óçì vipw äéá ίá ðñιòéÝóáòá ιÝιò ÷ ñΠóðäò, éáé èÛíóá óçì éáóá ÷ ðñέóç ίá ιιéÛæáé ίá óçì ðáñáéÛòù:

```
user:password:1111:11:language:0:0:User Name:/home/user:/bin/sh
```

### Άέέάαβ Εέΰόάυί Άέούάιῶ ιΎού όçð adduser(8)

×ñçόειἰδιέΠρόά όçί adduser áέά ίά δñιόεΎόάά ίΎἰῶð ÷ñΠόάάð, έάέ Ύδάέόά áειεἰῶεΠρόά όέð δάñάέΰόῦ ἰäçáβáð:

- ΕΎόά όἰ defaultclass = language όἰἰ /etc/adduser.conf. Ιά Ύ ÷ áðá ððüøç óáð ἰόέ óá áððΠ όçί δáñβððóç, έά δñΎδάέ ίά ἰñβóáðá ίέά έεΰόç default áέά ἰεἰῶð ðἰῶð ÷ñΠόάάð Ὑέεἰἰ áεῦόóἰ.

- Ιέά áíáέέάέðέεΠ έýόç, áβίáέ ίά áðáίῶΰόá εΰεá σἰñὙ όçί áñðόçόç

```
Enter login class: default []:
```

```
ἰῶ ἰòáίβáέáðέά áðü όçί adduser(8).
```

- Άέἰἰá ίέά áíáέέáέðέεΠ έýόç, áβίáέ ίά ÷ñçόειἰδιέΠρόάά ðἰ δάñάέΰόῦ óá εΰεá ÷ñΠόόç ἰῶ εΎέáðá ίά δñιόεΎόάά έάέ ἰἰῶβἰð ÷ñçόειἰδιέáβ áέáσἰñáðέéΠ áεἰῶóá:

```
adduser -class language
```

### Άέέάαβ Εέΰόάυί Άέούάιῶ ιΎού όçð pw(8)

Άί ÷ñçόειἰδιέáβáð όçί pw(8) áέά ίά δñιόεΎόάά ίΎἰῶð ÷ñΠόάάð, έάέΎόάά όçί ἰá όἰἰ δάñάέΰόῦ ðñἰῶἰ:

```
pw useradd user_name -L language
```

#### 23.3.4.1.2 ΙΎεἰἰῶ Ἄñ÷ áβἰί Ἄέέβίçόçð Εάέýῶἰῶð

**Όçίáβἰόç:** Ç ἰΎεἰἰῶ áððΠ ááί óἰίβóðáðάέ, έáεἰð áðáέðáβ áέáσἰñáðέéΎð ñῶεἰβóáέð áέá εΰεá áέáσἰñáðέéἰ ðñἰἰáñáἰá έáέýῶἰῶð ἰῶ ÷ñçόειἰδιέáβáð. ΔñἰῶεἰΠóáά έáέýðáñá όçί ἰΎεἰἰῶ ðἰἰ Εέΰόάυί Άέούάιῶ.

Άέά ίά δñιόεΎόάά όέð ἰἰδέεΎð ñῶεἰβóáέð έάέ ἰἰ óáð ÷áñáέðΠñἰἰ MIME, ñῶεἰβóáά áðεἰð όέð äýἰ ἰáðááεçðΎð δáñέáΰεἰἰῶð ἰῶ óáβἰἰóáέ δάñάέΰόῦ óἰἰ áñ÷ áβἰ /etc/profile Π/έάέ óἰἰ /etc/csh.login. Εά ÷ñçόειἰδιέΠóἰἰá óá ἌáñáíέéὙ ἰð áεἰῶóá áέá ἰἰ δάñάέΰόῦ δáñὙááέáἰá:

Όἰἰ /etc/profile:

```
LANG=de_DE.ISO8859-1; export LANG
MM_CHARSET=ISO-8859-1; export MM_CHARSET
```

<sup>1</sup> όἰἰ /etc/csh.login:

```
setenv LANG de_DE.ISO8859-1
setenv MM_CHARSET ISO-8859-1
```

ΆíáέέáέðέéὙ, ἰðñáβáð ίά δñιόεΎόάά όέð δáñáðὙἰἰ ἰäçáβáð όἰἰ /usr/share/skel/dot.profile (áíðβóðíé÷á ἰá όέð ἰäçáβáð áέá ἰἰ /etc/profile ἰῶ áβááἰá δáñáðὙἰἰ), Π όἰἰ /usr/share/skel/dot.login (áíðβóðíé÷á ἰá όέð ἰäçáβáð áέá ἰἰ /etc/csh.login ἰῶ áβááἰá áðβóçð δáñáðὙἰἰ).

Άέά ἰἰ X11:

Όἰἰ \$HOME/.xinitrc:

```
LANG=de_DE.ISO8859-1; export LANG
```





áðáññáÝð ðïð X11 éá ðñÝðáé íá ãñÛöñíðáé ùð ðáéÛðáð ðïð XIM, éáé íá éáñáÛñíðí ãβóññí áðu áñðççñáðçðÝð áéóúññò XIM. ÕðÛñ ðñí ðáééÝóçñíé áéÛöññíé áñðççñáðçðÝð XIM, áéá áéáöññáðééÝð áëþðóáð.

### 23.3.7 Ñýèìέόç ÁêêððùðÞ

ËÛðñéá óáð ðñáñáêðÞñíí single C áβíáé óðñÞèð ãñóññáðùñÝíá óðñ Þáéí ðñ ðéééù ðñí áêêððùðÞí. Óá óáð ðñáñáêðÞñíí óýðñò wide Þ multibyte áðáéóññíí áéáééÝð ññèìβóáéð, éáé óðñéóóññíí íá ðñçóçññíðñéÞðáðá ðñ **apsfilter**. Ìðññáβðá áðβóçð íá ðáðáðñÝðáðá ðñ Ýáñáñóñ óáð óá PostScript Þ PDF, ðñçóçññíðñéÞñóáð ãñááéáβá áéáééÛ öðéáñÝíá áéá çç óðáéêññéñÝíç áëþðóá.

### 23.3.8 ðññÞíáð éáé ÕðóðÞíáðá Áñ ðñ áβùí

Ïñ óýóççñá áñ ðñ áβùí FFS (fast filesystem) ðïð FreeBSD ððññáβ íá áéá ðñ áéñéóðáβ ñññíáðá áñ ðñ áβùí ðñ ãñÞèð ðñ ðáðáðñÝð ðá óáð single C (áβíáé 8-bit clean, ááβðá éáé ðñ multibyte(3)), áééÛ ááí áðñççéáýáé ðñ óáð ðñáñáêðÞñíí ðñ ðñçóçññíðñéáβðáé. Ìá Ûééá éùáéá, áβíáé 8-bit áééÛ ááí áñññáéáé ðβðñðá áéá çç ðñ áéáééññíðñççç ðñ ðñáñáêðÞñíí. Áðβóççñá, ðñ FFS ááí ððñóççññáéáé áéùñá óáð ðñáñáêðÞñíí wide Þ multibyte. ÕðÛñ ðñí ðóðùóñí ËÛðñéá áñáÛñðçðá patches áéá ðñ FFS ðñ ððñóççññáéñíí áððÝð ðéð áññáðùðçðáð. ðññéáéóáé ñññíí áéá ðññíóññéñÝð éáé ðç ðáðáðñÝðñéáð éýóáéð Þ hacks, éáé Ý ðñíá áðñóáðβóáé íá ðç ðá ðáñééÛáññá óðñ éáññééù áÝñññ ðççááβñ ðñáééá. Ááβðá ðéð éóðñóáéβááð ðñí áññóðñé ðñí áéùóðÞí áéá ðáñéóóùðáñáð ðççñññññáð éáé áéá íá áñáéðÞðáðá ðá áðáñáβðçðá áñ ðñ áβá.

Ïñ óýóççñá áñ ðñ áβùí MS-DOS óðñ FreeBSD Ý ðñ çç ðç áðñáðùðçðá íá ññèìέóðáβ þðá íá ðáðáðñÝðáé ðáðáý ðñí óáð ðñáñáêðÞñíí Unicode, ðñ MS-DOS, éáé ðñ óáð ðñáñáêðÞñíí ðñ Ý ðñ áé áðééáááβ áéá ðñ óýóççñá áñ ðñ áβùí ðñí FreeBSD. Áéá ðáñéóóùðáñáð éáððñÝññáéáð, ááβðá çç óáéβáá manual mount\_msdosfs(8).

## 23.4 ðáðááëþðéóç ðññáñáñÛðùí 118N

ðñééÛ ports ðñ FreeBSD áéáéÝññíí ððñóðÞñéñç 118N. Óá ðáñééÛ áðu áððÛ, ðñ -118N áβíáé ðñññ ðñí ñññáðñð ðñðð. Óá ðññáñÛñáðá áððÛ, éáé ðñééÛ ðáñéóóùðáñá, Ý ðñíí áññáðùðñÝíç ððñóðÞñéñç áéá 118N éáé ááí ðñáéÛáññáé Ûééáð áéáééÝð ññèìβóáéð.

Ûððùóñí, óá ËÛðñéáð áðáññáÝð ùððð ç **MySQL**, éá ðñÝðáé íá ññèìέóðáβ ðñ `makefile` ðñ ðñ áðééðñçðù óáð ðñáñáêðÞñíí. Áððù óðñÞèð áβíáéáé ðáññññáð ðéá ðñÞ óðñ **configure** óðñ ðççááβñ ðñáééá, Þ áééÛáññáð ðñ Þáéí ðñ `Makefile`.

## 23.5 ÕïðéëÝð Ññèìβóáéð áéá ÕðáéêññéñÝíáð Áëþðóáð

### 23.5.1 Ñþðéê Áëþðóá (Ëùáééññíðñççç KOI8-R)

*Áñ ðñ éêÞ óðñáéóññÛ ðñ Andrey Chernov.*

Áéá ðáñéóóùðáñáð ðççñññññáð ó ðñ áðééÛ ðá çç ðñáééññíðñççç KOI8-R, ááβðá ðéð ÁñáöñÝð Õ ðñ áðééÛ ðá ðñ Óáð ×áñáêðÞñíí KOI8-R (Ññóééù Óýññí ×áñáêðÞñíí) (<http://koi8.pp.ru/>).

### 23.5.1.1 ÕιδέεÛò Ñõειβόάέο

ÕιδέεαόΠόα όέο áεüειðεάò ãñáñÛò óðì áñ÷áβì óáo ~/ .login\_conf:

```
me:My Account:\
:charset=KOI8-R:\
:lang=ru_RU.KOI8-R:
```

Άέά ðáñáááβáñáόά ðìò ó÷áòβæííόάέ íà όέο ÕιδέεÛò Ñõειβόάέο, äáβòá ðñìçäÿíáíáð áíúôçòáò óá áóòü ðì έáòÛεάει.

### 23.5.1.2 Ñýèιέόç Êìíóüέáò

- ÐñìíόèÛòá όçì áεüειðεç ãñáñÛò óðì áñ÷áβì /etc/rc.conf:
 

```
mousechar_start=3
```
- ×ñçόείιðìέΠόá áðβόçò όέο ðáñáέÛòü ñõειβόάέο óðì /etc/rc.conf:
 

```
keymap="ru.koi8-r"
scrnmap="koi8-r2cp866"
font8x16="cp866b-8x16"
font8x14="cp866-8x14"
font8x8="cp866-8x8"
```

- Άέά έÛεá έáόá÷þñέόç ttyv\* óðì áñ÷áβì /etc/ttys, ÷ñçόείιðìέΠόá ðì cons25r ùò óýðì ðáñíáóέέíý.

Άέά ðáñáááβáñáόά ðìò ó÷áòβæííόάέ íà όçì ñýèιέόç όçò έìíóüέáò, äáβòá ðñìçäÿíáíáð áíúôçòáò áóòíý ðìò έáóáέáβìò.

### 23.5.1.3 Ñýèιέόç Άέóððùòþ

Έάεðò íé ðáñέóóüòáñíé áέóððùòÛò ðìò áέάέÛòíòì Ñùóέéíýð ÷áñáέòþñáò Û÷íòí áíóüíáóüíÛíç όçì έüáέέíóáεβáá CP866, έá ÷ñáέáóóáβòá áέάέέü öβέòñì áíüäü áέá íá íáóáóñÛòáðá áðü ðì KOI8-R óðì CP866. Õì öβέòñì áóòü äáέáεβóóáόáέ áðü ðñìáðέέíäþ óðì /usr/libexec/lpr/ru/koi2alt. Ç έáόá÷þñέόç áέá Ûíá Ñþóέéí áέóððùòþ óðì /etc/printcap έá ííéÛæáέ íá όçì ðáñáέÛòü:

```
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:
```

Äáβòá ðì printcap(5) áέá ðéí έáðòññáñþ ðáñéãñáóþ.

### 23.5.1.4 Óýóççíá Áñ÷áβúí MS-DOS έάέ Ñþóέéá Ìíüíáόá Áñ÷áβúí

Õì ðáñáέÛòü ððüááέáñíá έáόá÷þñέόç óðì fstab(5) áíáñáñðìέáβ όçì ððìóðþñέíç áέá Ñþóέéá Ìíüíáόá áñ÷áβúí óá ðñìóáñòçìÛíá óóóðþíáόá áñ÷áβúí óýðìò MS-DOS:

```
/dev/ad0s2 /dos/c msdos rw,-Wkoi2dos,-Lru_RU.KOI8-R 0 0
```

Ç áðέέíäþ -L áðέéÛááé όέο ðìδέéÛò ñõειβόάέο ðìò έá ÷ñçόείιðìέççèíýí, έάέ ç -w íñβæáέ ðìí ðβíáέá íáóáóñíððò ÷áñáέòþñúí. Άέá íá ÷ñçόείιðìέΠόáόá όçì áðέέíäþ -w ááááέúεáβòá úóé Û÷áðá ðñìóáñòþóáέ όçì έáðÛòìçόç /usr ðñέí όçì έáðÛòìçόç MS-DOS, έάεðò íé ðβíáέáð íáóáóñíððò áñβóέííóáέ óðì /usr/libdata/msdosfs. Άέá ðáñέóóüòáñáð ðεçññìòñβáð, äáβòá ðç óáεβáá manual ðìò mount\_msdosfs(8).

### 23.5.1.5 Ñýèìέόç X11

1. ΆέοάεÛόοά ðñþóá όέο ááíέéÛò ðιðέéÛò ñðειβόάέο ðιò Ý ÷ ιòιá Παç ðáñέáñÛόάé.
2. Άί ÷ ñçόéιιðιέáβóá ðιí áιòðçñáóçòΠ **Xorg**, ááέáóáóòΠóóá ðι ðáéÛóι x11-fonts/xorg-fonts-cyrillic.

ΆέÛáιòá ðçι áιúòçóá "Files" óðι áñ ÷ áβι /etc/X11/xorg.conf. Έá ðñÝðáé íá ðñιόéÛόóá ðçι ðáñáéÛóù áñáñΠ ðñέι áðu ðιέέááΠðιòá Ûέéç έáóá ÷ þñέόç FontPath:

```
FontPath "/usr/local/lib/X11/fonts/cyrillic"
```

**Όçιáβύόç:** Άáβóá óóçι ÓðέéιáΠ ðυι Ports áéá ðáñέóóúóáñáò éðñέééééÛò áñáιιáðιόáéñÛò.

3. Άέá ðçι áíáñáðιβóç ðιò ÑùóééÛý ðéçéðñιέιáβιò, ðñιόéÛόóá όέο ðáñáéÛóù áñáñÛò óóçι áιúòçóá "Keyboard" ðιò áñ ÷ áβιò xorg.conf:

```
Option "XkbLayout" "us,ru"
Option "XkbOptions" "grp:toggle"
```

Άáááέúéáβóá áðβóçò ùóé ç áñáñΠ XkbDisable áβιáé áíáíáñáΠ (íáñέáñέóιÛίç ùò ó ÷ ùέéι).

Άί ÷ ñçόéιιðιέβóáðá ðιí grp:toggle ç áíáééááΠ RUS/LAT έá áβιáóáé íá ðι **Άáιέú Alt**, áιþ áι éÛóáðá grp:ctrl\_shift\_toggle, ç áíáééááΠ έá áβιáóáé íá ðι **Ctrl+Shift**. Άέá grp:caps\_toggle, ç áíáééááΠ RUS/LAT έá áβιáóáé íá ðι **CapsLock**. Ç έáñιέéΠ έáέðιòñáβá ðιò **CapsLock** áíáέιέιòéáβ íá áβιáé áέáéÛóéιç ìÛóù ðιò óðιáóáóιÛý ðéΠéðñιí **Shift+CapsLock** (ιúñι óá έáðÛóóáóç LAT). Õι grp:caps\_toggle áéá éÛðιέι Ûáιúóðι éúáι, ááι έáέðιòñááβ óðι **Xorg**.

Άί ðι ðéçéðñιέúáéι óáó áέáéÛóáé ðéΠéðñá "Windows", έáé Ý ÷ áóá ðáñáóçñΠóáé ùóé éÛðιέá áðu óá ìç-áéöáñέéιçóééÛ ðéΠéðñá Ý ÷ ιòι éÛέιò áíóéóðιβ ÷ çόç ùóáι áβóóá óá έáðÛóóáóç RUS, ðñιόéÛόóá ðçι ðáñáéÛóù áñáñΠ óðι áñ ÷ áβιò xorg.conf:

```
Option "XkbVariant" ",winkeys"
```

**Όçιáβύόç:** Õι Ñþóééι ΧΚΒ ðéçéðñιέúáéι βóóð ááι έáέóιòñááβ íá áóáñιáÛò ðιò ááι Ý ÷ ιòι óóéá ÷ óáβ áéá όέο áíóβóðιé ÷ áò ðιðέéÛò ñðειβόάέο.

**Όçιáβύόç:** Ìé áóáñιáÛò ðιò ðçñιýι óéó áéÛ ÷ éóóáò ðñιáέááñáóÛò ðιðέéþι ñðειβóáúι, έá ðñÝðáé íá έáéιÛý áðu ìññβò ðç óðιÛñðççç XtSetLanguageProc (NULL, NULL, NULL); ìÛóá óðιí éþáééá ðιòð.

Άáβóá ðι KOI8-R áéá ðι óýóóçιá X Window (<http://koi8.pp.ru/xwin.html>) áéá ðáñέóóúóáñáò ìäçáβáò ó ÷ áðééÛ ìá ðçι äçιέιòñáβá áóáñιáþι X11 ðιò íá ÷ ñçόéιιðιέιÛι ðιðέéÛò ñðειβόάέο.

### 23.5.2 Ôïðééÿð Ñöèìßóáéð áéá ÐáñáäïóéáéÛ Êéíÿæééá ÔáúáÛí

Ôï FreeBSD-Taiwan Project ÿ÷áé äçíéíõñãÞóáé Ýíá HOWTO áéá óá Êéíÿæééá óóï FreeBSD, òï ïðïßì ìðïñáßðá íá äñáßðá óóç áéáýèðíóç <http://netlab.cse.yzu.edu.tw/~statue/freebsd/zh-tut/>, ÷ñçóéïðïéðíðáð ðïééÛ Êéíÿæééá ports. Ì òñÿ÷úí óðíðÛêðçð ðïð Êéíÿæééíð FreeBSD Howto áßíáé í Shen Chuan-Hsing <statue@freebsd.sinica.edu.tw>.

Ì Chuan-Hsing Shen <statue@freebsd.sinica.edu.tw> ÿ÷áé äçíéíõñãÞóáé óçí Êéíÿæééç ÓðéëïãÞ FreeBSD (CFC) (<http://netlab.cse.yzu.edu.tw/~statue/cfc/>) ÷ñçóéïðïéðíðáð óçí èùáééíðïßçóç zh-L10N-tut ðïð FreeBSD-ÔáÁáÛí. Óá ðáéÿðá éáé óá scripts áéáðßéáíðáé óóç áéáýèðíóç <ftp://freebsd.csie.nctu.edu.tw/pub/taiwan/CFC/>.

### 23.5.3 Ôïðééÿð Ñöèìßóáéð áéá óçí ÆáñíáíééÞ Æëðóóá (áéá ¼éáð óéð Æëðóóáð ðïð Æáóßæíðáé óóï ISO 8859-1)

Ì Slaven Rezac <eserte@cs.tu-berlin.de> ÿ÷áé äñÛðáé Ýíá ïäçäüí áéá óçí ÷ñÞóç ðúí umlauts óá Ýíá ìç÷Ûíçíá FreeBSD. Ì ïäçäüí áßíáé äñáíÿñð óóá ÆáñíáíééÛ éáé áéáðßéáðáé óóçí ðïðïéáóá <http://user.cs.tu-berlin.de/~eserte/FreeBSD/doc/umlaute/umlaute.html>.

### 23.5.4 Ôïðééÿð Ñöèìßóáéð áéá óçí ÆëçíééÞ Æëðóóá

Ì Nikos Kokkalis <nickkokkalis@gmail.com> ÿ÷áé äñÛðáé Ýíá ðëÞñáð Ûñèñíí áéá óçí ððïóðÞñéíç ðçð ÆëçíééÞð Æëðóóáð óóï FreeBSD. Ôï Ûñèñíí áððü áéáðßéáðáé ùð ìÿñð ðçð áðßóçìçð ÆëçíééÞð óáéìçñßùóçð ðïð FreeBSD, óóçí ðïðïéáóá [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 Ôïðééÿð Ñöèìßóáéð Æéá Æéáðùíÿæééá éáé ÊïñáÛðééá

Æéá Æéáðùíÿæééá, äáßðá óóçí ðïðïéáóá <http://www.jp.FreeBSD.org/>, áñÞ áéá ÊïñáÛðééá, äáßðá óóçí ðïðïéáóá <http://www.kr.FreeBSD.org/>.

### 23.5.6 Óáéìçñßùóç ðïð FreeBSD óá Æëðóóáð Æêðùð óçð ÆáãéééÞð

ÊÛðïéíé áéáéííóÿð ðïð FreeBSD ÿ÷ïí ìáðáñÛðáé ðïÞíáðá ðçð óáéìçñßùóçð ðïð óá Ûééáð Æëðóóáð. Ìé ìáðáñÛðáéð áððÿð áéáðßéáíðáé ìÿóù óðíáÿóíí óóçí éÿñéá áééððáéÞ ðïðïéáóá ðïð FreeBSD (<http://www.FreeBSD.org/index.html>) Þ óðïí éáðÛéíäí /usr/share/doc.



## 24.2 Αίτια Ψηφισμός του FreeBSD

Αντικείμενο αυτού του Tom Rhodes. Αποβόρση οά οςία έρβόαέο δίο δάνβ÷α ι Colin Percival.

Ο άοάνηαΐ άίτσηηπρόαυί άόάέαβαδ άδιδάέαβ Υία ότσηάόέέυ διδία ότδ όοιδπήςότδ έιέόίέέί, άέάέΰ υόάί δνυέάέόάέ άέά όι έάέοιόηάέέυ όύόότσηά. Άέά ίάάΰέι άέΰόότσηά, τ άέάάέάόβά άόδΐ άάί βόάί άύέιέτ όοι FreeBSD. δνάδα ίά άόάνηόοίτσηά patches όοι δτσηάβι έρπέέά, ίά άβίάέ ίάόάέπρόόέότδ όιό άδυ ότς άη÷β, έάέ ίά άάέάόόόάέίτσηά ίάΰ όά ίΥά άέόάέΥόέίά.

Άόόυ άάί άβίάέ δέΥί ίάάάέάβι, έάέπδ όι FreeBSD άέάέΥόάέ όρνηά Υία άίτςέόέέυ δνυάηάίά, όι freebsd-update. Όι δνυάηάίά δάνΥ÷άέ άύί άέάόιόηάέέΰδ έάέόιόηάέδ. Ο δηπός άβίάέ τ άόίάόυότσηά άόάάέέπδ (binary) άίτς Ψηφισμός όιό άάέέίτσηά όόόδιδάόιό ίά όέό όάέάόόάβά άέίηεπρόάέό άόόΰέάέό έάέ έάέπ, ÷ηηβδ ίά ÷ηάέΰάόάέ ίάΰ ίάόάάέπρόόέότδ έάέ άάέάόΰόόάότδ. Ο άάύόάητ άβίάέ τ άόίάόυότσηά άίάάΰέίόέότδ όιό όόόδιδάόιό όά ίέά ίΥά ίέέηβ β ίάάΰέτ άδβότς Υέάιότς (release).

**Ότσηάβύότς:** Άόάάέέΰδ άέίηεπρόάέό έάέπ ίάέ άόόΰέάέό, άέάόβέάίόάέ άέά υέάό όέό άη÷έόάέόιέέΰδ έάέ άέάυόάέό δίο όδιδότςβέίίόάέ άδυ ότς ηΰάά άόόΰέάέό. ΰόόυόι, ίηέόίΥία ÷άηάέότςηέόόέέΰδ υδύδ τ άόίάόυότσηά άίάάΰέίόέότδ όιό έάέόιόηάέέίτσηά όά ίέά ίΥά Υέάιότς, άδάέόίτσηά ότς όάέάόόάβά Υέάιότς όιό freebsd-update(8) έάέ όιό FreeBSD 6.3. Δηέί δηη÷ηηπρόάόά όότς άίάάΰέίόέότδ όά ίέά ίΥά Υέάιότς, έά δηΥδάέ ίά άέάάΰόάόά όέό ό÷άόέέΰδ ίά άόόπ ίάάέίέίπρόάέό, έάέπδ ίδιδάβ ίά δάηέΥ÷ίόί ότσηάόέέΰδ δέτσηόηάβδ. ίδιδάβόά ίά άάβόά όέό άίάέίέίπρόάέό άέάυόάυί όότς δάηάέΰδύ όιδιδάόβά: <http://www.FreeBSD.org/releases/>.

Άί όδΰη÷άέ έΰδιδέι crontab δίο ÷ητςέίηιδιδάβ όέό άόίάόυότσηάδ όιό freebsd-update, έά δηΥδάέ ίά άδιδάηάηιδέέτςάβ δηέί ίάέέίπρόάέ τ δάηάέΰδύ άέάάέάόβά. ίδιδάβόά ίά άάέάόόόπρόάόά ότς όάέάόόάβά Υέάιότς όιό freebsd-update έάόάάΰάίίόάό όι όοιδέάόίΥίτ δάέΥόι άδυ όι δάηάδΰύ URL έάέ άέόάέπιδάό όέό δάηάέΰδύ άίόιέΰδ:

```
gunzip -c freebsd-update-upgrade.tgz | tar xvf -
mv freebsd-update.sh /usr/sbin/freebsd-update
mv freebsd-update.conf /etc
```

Άάί άδάέόάβόάέ ίά έάόάάΰόάόά ότς όάέάόόάβά Υέάιότς, άί ÷ητςέίηιδιδάβδ έΰδιδέά άδυ όέό όηΥ÷ίόόάό άέάυόάέό όιό FreeBSD.

### 24.2.1 Όι Άη÷άβι ηέέίβόάυί

Έΰδιδέί ÷ηπρόάό βόυδ έΰέιόί ίά άέέΰηόί όι δηηάδέέάάΰίτ άη÷άβι ηέέίβόάυί /etc/freebsd-update.conf, πρόά ίά Υ÷ίόί έάέύόάηη Υέάά÷ί ότδ άέάάέάόβάδ. ίέ άδέέηάΰδ άβίάέ άάίέέΰ άηάόΰ έάέΰ όάέίτςηέυίΥίάδ, άέέΰ ίέ δάηάέΰδύ βόυδ ίά ÷ηάέΰάίίόάέ έΰδιδέάδ άδέδέΥίτ άδιδάτςπρόάέό:

```
Components of the base system which should be kept updated.
Components src world kernel
```

Άόόπ τ δάνΰιδάόηδ άέΰά÷άέ διδέά διδιδάόά όιό FreeBSD έά άέάότςηηίόάέ άίτσηηνΰΥία. Ο δηηάδέέηαΐ άβίάέ ίά άίτσηηπιδάέ ί δτσηάβιδ έρπέέάδ, υέι όι άάόέέυ όύόότσηά, έάέ ί δόηπιδά. Όά διδιδάόά άβίάέ όά βάέά όιό άέάόβέάίόάέ έάέ έάόΰ ότς άάέάόΰόόάότδ, άέά δάνΰάάέάίά άί άΰέάόά ότς άδέέηαΐ “world/games” έά άάέάέβόόάίόάέ άίτσηηπρόάέό άέά όά δάέ÷ίβάέά. Άί άΰέάόά “src/bin” έά άδέόηΰόάόά ότς άίτς Ψηφισμός όιό δτσηάβιδ έρπέέά όιό έάόάέυάιό src/bin.

Ο έάέύόάητ άδέέηαΐ άβίάέ ίά άόπρόάόά άηπ ότς δηηάδέέάάΰίτς όέιβ, έάέπδ άί ότς άέέΰιδάόά πρόά ίά δάηέΥ÷άέ όόάέάηέηέΰίτ ίυη διδιδάόά, έά άίάάέάόόάβόά ίά άίάόΰηάόά ÷ηέόόΰ ίΥόά όοι άη÷άβι ηέέίβόάυί έΰέά διδιδά όιό

Ἡ ἐξέλιξη τῆς ἀναστροφῆς. Ἀπὸ τὸ βούλομαι ἡ ἐξέλιξη ἀποδοτικῶς ἀδυνατίζει, ἐπεὶ ἀβίασε δὲ αὐτὴ ἡ ἀναστροφή ἐπαεῖο ἐπὶ τῆς ἀεὶ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς.

```
Paths which start with anything matching an entry in an IgnorePaths
statement will be ignored.
IgnorePaths
```

Ἡ ἐξέλιξη ἀποδοτικῶς ἀδυνατίζει, ἐπεὶ ἀβίασε δὲ αὐτὴ ἡ ἀναστροφή ἐπαεῖο ἐπὶ τῆς ἀεὶ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς.

```
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 ἐξέλιξη ἀποδοτικῶς ἀδυνατίζει, ἐπεὶ ἀβίασε δὲ αὐτὴ ἡ ἀναστροφή ἐπαεῖο ἐπὶ τῆς ἀεὶ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς.

```
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/
```

Ἡ ἐξέλιξη ἀποδοτικῶς ἀδυνατίζει, ἐπεὶ ἀβίασε δὲ αὐτὴ ἡ ἀναστροφή ἐπαεῖο ἐπὶ τῆς ἀεὶ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς.

```
Directory in which to store downloaded updates and temporary
files used by FreeBSD Update.
WorkDir /var/db/freebsd-update
```

Ἡ ἐξέλιξη ἀποδοτικῶς ἀδυνατίζει, ἐπεὶ ἀβίασε δὲ αὐτὴ ἡ ἀναστροφή ἐπαεῖο ἐπὶ τῆς ἀεὶ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς.

```
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 ἐξέλιξη ἀποδοτικῶς ἀδυνατίζει, ἐπεὶ ἀβίασε δὲ αὐτὴ ἡ ἀναστροφή ἐπαεῖο ἐπὶ τῆς ἀεὶ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς τῆς ἀβίασε δὲ ἰσχυρῆς ἀναστροφῆς.





```
freebsd-update -r 6.4-RELEASE upgrade
```

ÌáöÛ óç êÞøç óçð áíóιēÞò, õì freebsd-update èá áíείεíãÞóáé óçí êáóÛóðáóç õìõ óðóðÞíáðìð êáé õìõ áñ÷ áßìò ñòèìβóáùí õìõ, óá ιέα áðùðáέñá ιά ιάæÝøáé óéð áðáíáβóçóáð ðεçñìõìñßáð áέα óçí áíááÛèιέόç õìõ óðóðÞíáðìð. Ìé ðεçñìõìñßáð ðìõ áιέ÷ íáγέçéáí èá àìòáιέóðìγí óóçí ιèùιç ιá óç ιìñòÞ ιέαð èβóðáð ááέáðáóóçìÝíùí ðñìãñáììÛòùí. Áέα ðáñÛááέáíá:

```
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, õì freebsd-update èá êáóááÛóáé ùέα óá áñ÷ áßá ðìõ áðáέóιγíóáé áέα óçí áíááÛèιέόç. Óá ιáñέéÝð ðáñέððóÞóáéð, ì ÷ ñÞóóçð èá èεççéáß ιά áðáìÞóáé óá áñòðÞóáéð ó÷ áðέéÛ ιá õì óé èá ááέáðáóóáéáß Þ ðùð ðñÝðáé ιά ðñì÷ ùñÞóáé ç áέαáέέáóá.

¼óáí ÷ ñçóέìðìέáßóáé ðñìóáñìòιÝíò ðòñÞíáð, õì ðáñáðÛíù áÞíá èá ðñìέáéÝóáé óçí àìòÛιέόç óçð ðáñáéÛòù ðñìέáéäìðβçóçð:

```
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"
```

Ìðìñáßá ιά ááñìÞóáðá áðòÞ óçí ðñìέáéäìðβçóç. Èá ÷ ñçóέìðìέáßóáé õìõ áíçìáñùìÝíí ðòñÞíá GENERIC ùð áíáéÛíáóì áÞíá óóç áέαáέέáóá áíááÛèιέόçð.

Áóιγ ιáðáóìñòùειγí ùέα óá patches óðì õìðέéù óγóðçιá, èá áßíáé êáé ç áðáñìãÞ õìõð. Ç áέαáέέáóá áðòÞ βóùð ðÛñáé èβáì ÷ ñùíí, áíÛèιáá ιá óçí óá÷ýóçóá êáé õì õìñòßì õìõ ιç÷ áíÞíáðìð. ðáέðá èá áßíáé ç óðá÷Þíáðóç ðùí áñ÷ áßùí ñòèìβóáùí. Áðòù õì ιÝñìð óçð áέαáέέáóáð áðáέðáß ðáñÝíááóç õìõ ÷ ñÞóóç, èáεÞð óá èÛðìέα áñ÷ áßá èá ÷ ñáέáóðáß ç óðá÷Þíáðóç ιá áßíáé ÷ áέñìέβίçóá ιá óç áìÞεáéá èÛðìέìò óóìòÛèóç èáεìÝíì. Ì ÷ ñÞóóçð èá áíçìáñÞíáðáé áέα õì áðìðÝεáóíá èÛèá áðέóð÷çìÝíçð óðá÷Þíáðóçð èáεÞð áíáέβóðáðáé ç áέαáέέáóá. Óá ðáñßððòùóç áðìðð÷çìÝíçð óðá÷Þíáðóçð (Þ áíùιçóçð óçð), ç áέαáέέáóá áíááÛèιέόçð èá áέαέìðáß. Áíáá÷ìÝíùð ιá èÝεáðá ιá èñáðÞóáðá áíóßáñáòì áóðáéáßáð õìõ èáðáéùíáìò /etc êáé ιá óðá÷ ùíáγóáðá áñáùòáñá (÷ áέñìέβίçóá) èÛðìέα óçìáíóέéÛ áñ÷ áßá, ùðòò õì master.passwd Þ õì group.

**Óçìáßùóç:** Óðì óçìáßì áðòù ááí Ý÷áé áßíáé áέùíá èáιέÛ áέέááÞ óðì óγóðçιá, èáεÞð ùεç ç áέαáέέáóá óçð áíááÛèιέόçð êáé óðá÷Þíáðóçð áßíáðáé óá áέαóìñáðééù êáðÛèιá. ¼óáí áðáñìòóðìγí áðέóð÷Þð ùέα óá patches êáé ιèìέεçñùèáß ιá áðέóð÷ßá ç áέαáέέáóá óçð óðá÷Þíáðóçð ùέùí ðùí áñ÷ áßùí ñγèιέóçð, ì ÷ ñÞóóçð èá ðñÝðáé ιά áðέáááéÞóáé óçí óáέέéÞ ááέáðÛóðáóç.

Ïά οί öÛείö áöòòò οç äεάάεέάöòáö, ç áίάάÛειέοç ïðñáß íá ïñέöéειðιεçεάß öοί äòéι, ïά οç ÷ ñòòç οçö äεüειðεçö áίöιεò:

```
freebsd-update install
```

Óοçί ðñòç öÛöç, έá äεεά÷εάß ï ðöñòíáö έάέ öá ö÷ äöééÛ äñññíáöá. Óοί οçíáßì áööü, έá ðñÛðáé íá äßíáé äðáíáεέßίçöç öιö ïç÷ áίòíáöιö. Óá ïç÷ Ûίçíá íá ðñιöáññιöίÛί ðöñòíá, ÷ ñçöειιðιεòáö öçí áίöιεò nextboot(8) ðöðá íá εÛöáöá öιí ðöñòíá äεά öçí äðñíáíç äεέßίçöç öοιí /boot/GENERIC (ï ïðιβιö Û÷ äé ðäç áíάάεειέöáö):

```
nextboot -k GENERIC
```

**ðñιέάιðιβίçöç:** ðñéí äðáíáεέéíòáöá ïá öιí ðöñòíá GENERIC, äáááéüεάßöá üöé ðáñéÛ÷ äé üεá öá ðñιáñÛιιáöá ïá ðáçöçö ðιö äðáéöιγίöáé äεá öçí äðéöö÷ ð äεέßίçöç öιö öðöðòíáöιö öáö (έάέ öç εάéöιòñáßá öιö äεéöγίö, áí áíάάáειðæáöá εÛðιεí äðñíáεñöóιÛί ïç÷ Ûίçíá). Áεάééüöáñá, áí ï ðñιçáιγíáíιö ðñιöáññιöίÛί ðöñòíáö ðáñéáß÷ á εάéöιòñáßáö öιö öοίòεüö ðáñÛ÷ ïíöáé áðü áñññíáöá (modules), äáááéüεάßöá üöé öñιöòßöáöá íá öιñöüειγί ðñιöüñéíÛ öοιí ðöñòíá GENERIC ÷ ñçöéιιðιεòáö öéö äöíáöüöçöáö öιö áñ÷ áßιö /boot/loader.conf. òöüö äðòöçö íá εÛεáöá íá äðáíáññιðιεòáöá öðçñáöóßáö, ðñιöáñòòáéö äòöéüí έáé äεéöγίö é.é.ð. öιö äáí áßíáé äðáñáòçöáö, ïÛ÷ ñé öçí ïεíεεòñùöç öçö äεάάεέάöóáö áíάάÛειέöçö.

Ïðñáßöá íá ÷ ñçöειιðιεòáöá öçí äεüειðεç áίöιεò äεά íá äðáíáεέéíòáöá öι ïç÷ Ûίçíá ïá öιí íÛί ðöñòíá:

```
shutdown -r now
```

Ïüεéö öι öγöçíá äðáíÛεεáé öá εάéöιòñáßá, έá ðñÛðáé íá äéöáεÛöáöá íáíÛ öι freebsd-update. Ç ðñιçáιγíáíç εάéöιòñáßá Û÷ äé äðιεçεáöεáß, έáé Ûöéö öι freebsd-update äáí έá íáééíòáé áðü öçí áñ÷ ð, äεéÛ έá äðñáεñγíáé üεáö öéö ðáéεÛö ειεíü ÷ ñçöóáö äεάεεíεðεáö έáé öá áñ÷ áßá áíöεéáεíáεεγί εðáεéá. Άέá íá ööíá÷ ðöáöá öá áööü öι ööÛáéí, äðöá öçí äεüειðεç áίöιεò:

```
freebsd-update install
```

**Óçíáßöç:** ΑίÛεíáá ïá öι áí öðòñíáí äεéááÛö öοιöð áñεειγö äεáüöáüí öüí äεάéεíεçεðí, ðöüö íá öðÛñ÷ ïöí ïüí äγí öÛöáéö äáéáöÛöðáöçö áíöò äεá ðñáéö.

¼εí öι ειαéöιééü öñòöιö έáöáöéáöáöóöð έá ðñÛðáé öðñá íá ïáöáεüöðéöóáß έáé íá äðáíáεéáöáöóáéáß áðü öçí áñ÷ ð. Áööü äðáéöáðáé έáεð öι äáéáöáööçíÛί ειαéöιééü ðöüö áíáñöÛöáé áðü äεάεεíεðεáö ïé ïðιβáö áöáéñÛεçéáí έáöÛ öç äεάáééáöáöá öçö áíάάÛειέöçö. Ïðñáßöá íá ÷ ñçöειιðιεòáöá öçí áίöιεò ports-mgmt/portupgrade äεá íá äöðñáöιðιεòáöá áööð öç äεάáééáöáöá. Άέá íá íáééíòáöá, äðöá öéö ðáñáéÛöü áίöιεÛö:

```
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
```

Ἰνστιτούτου ἐπὶ τῆς FreeBSD, ἡ ἐπιβάρυνση ὅσον ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἢ ἰσὺς ἀπὸ τῆς ἀνάστασης ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update. Ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἢ ἰσὺς ἀπὸ τῆς ἀνάστασης ἐπιβάρυνσης αἰτίας ἐπιβάρυνσης:

```
FreeBSD-update install
```

Ἄν ἡ ἐπιβάρυνση ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update.

Ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update.

### 24.2.4 Ὁ ἰσὺς ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD

Ἄν ἡ ἐπιβάρυνση ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update.

```
FreeBSD-update IDS >> outfile.ids
```

**Ἄν ἡ ἐπιβάρυνση ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update.**

Ἄν ἡ ἐπιβάρυνση ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update.

Ἄν ἡ ἐπιβάρυνση ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update.

```
cat outfile.ids | awk '{ print $1 }' | more
/etc/master.passwd
/etc/motd
/etc/passwd
/etc/pf.conf
```

Ἄν ἡ ἐπιβάρυνση ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update, ἀπὸ τῆς ἀνάστασης αἰτίας ἐπιβάρυνσης ἀπὸ τῆς FreeBSD-update.

Ἐπιπέδου ἀδῦ ὁρῶν τὸν FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD, ὁ ὁρῶν ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD.

## 24.3 Portsnap: ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD

*Ἐπιπέδου ἀδῦ ὁρῶν Tom Rhodes. Ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD ὁρῶν Colin Percival.*

Ὁ ὁρῶν ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD. Ἐπιπέδου ἀδῦ ὁρῶν τὸν FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD, ὁ ὁρῶν ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD.

```
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.
```

Ὁ ὁρῶν ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD. Ἐπιπέδου ἀδῦ ὁρῶν τὸν FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD, ὁ ὁρῶν ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD.

Ἐπιπέδου ἀδῦ ὁρῶν τὸν FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD, ὁ ὁρῶν ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD.

```
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
...
```

Ὁ ὁρῶν ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD. Ἐπιπέδου ἀδῦ ὁρῶν τὸν FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD, ὁ ὁρῶν ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD ἰσχυρῶς ἀπὸ τῆς ἀρχῆς τῆς ἐπιπέδου τοῦ FreeBSD.

```
portsnap update
```

Ἡ ἀνακοίνωσις ἔχει τὸν σκοπὸν νὰ ἐξηγήσῃ τὴν ἀνακοίνωσιν ἐπὶ τοῖς Ports, ἐπεὶ ἡ ἀνακοίνωσις ἐστὶν ἀνακοίνωσις ἀπὸ τοῦ FreeBSD ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD.

Ἡ ἀνακοίνωσις ἐστὶν ἀνακοίνωσις ἀπὸ τοῦ FreeBSD ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD.

```
portsnap fetch update
```

## 24.4 Ἀρθρογραφία ἐπὶ τὴν Ἀνακοίνωσιν

Ἡ ἀνακοίνωσις ἐστὶν ἀνακοίνωσις ἀπὸ τοῦ FreeBSD ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD.

### 24.4.1 Ἡ ἀνακοίνωσις ἐπὶ τὴν Ἀνακοίνωσιν ἀπὸ τοῦ CVS

Ἡ ἀνακοίνωσις ἐστὶν ἀνακοίνωσις ἀπὸ τοῦ FreeBSD ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD.

- Διὸς ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD.
- Διὸς ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD.
- Διὸς ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD.

### 24.4.2 Ἡ ἀνακοίνωσις ἐπὶ τὴν Ἀνακοίνωσιν ἀπὸ τοῦ CVS

Ἡ ἀνακοίνωσις ἐστὶν ἀνακοίνωσις ἀπὸ τοῦ FreeBSD ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD.

Ἡ ἀνακοίνωσις ἐστὶν ἀνακοίνωσις ἀπὸ τοῦ FreeBSD ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD.

**Ὁδηγία:** Ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD ἡ ἀνακοίνωσις ἀπὸ τοῦ FreeBSD.





## 24.4.6 ×ñçόείιθιέριόάò óά Ports óçò Óάειιçñβύόçò

ÁάόέοιΥτι óά äñāάóβά διò Marc Fonvieille.

Óðçι ðñιçäÿíáιç áíυóçðá, ðáñιòόέÙόáíá ιέα ιΥεíäι áεά óçι áιçιΥñóç óçò óάειιçñβύόçò διò FreeBSD ιΥού διò ðçääβιò έπαέέα. Ùόóυοι, ιέ áιçιäñβόάέð διò äáόβæιόάέ óοιι ðçääβιò έπαέέα ιðñíáβ ιά ιçι áβιáέ äοιáóÝò P ðñáέóέéÝò áέα éÙεä όύόóçιá FreeBSD. Ç áεάáέέáόβá ιáόáäεðóόέóçò διò ðçääβιò έπαέέα óçò óάειιçñβύόçò áðáέóáβ ó÷÷-áóέéÙ ιääÙει áñέειι äñāάέáβυι έáέ áιçέçóέέρι ðñιäñáñÙóυι, áíυóóÙ ùò äñāáέéáβά óάειιçñβύόçò. Áðáέóáβ áðβόçò έáέ ιέα ó÷÷-áóέéP äñιέááβύóç ιá δι CV\$ έáέ óç áεάáέέáόβá áíÙέóçόçò óυι áñ÷÷-áβυι áðυ áóóυ, έáεðð έáέ ιέα óáέñÙ áðυ äβιáόá áέα óç ιáόáäεðóόέóç διò έπαέέα. Óðçι áíυóçðá áððP ðñáέäñÙóιòιá Ýíá áíáέέáέóέéυ ðñυðι áιçιΥñóçò óçò óάειιçñβύόçò διò äáέáεβóόáόáέ ιáεβ ιá δι FreeBSD. Ç ιΥεíäιò áððP ÷ñçόείιθιέáβ óçι ÓόέεíäP óυι Ports έáέ áβιáέ óέð ðáñáéÙóυ äοιáóυóçðáò:

- ΈáoÝááοιá έáέ äáέáóÙóόáόç ðñι-ιáόáäευòóóέóιÝíυι óóέäιέυòóðυι óçò óάειιçñβύόçò, ÷-ññβò ιá áðáέóáβóáέ έáιέÙ óιðέéP ιáόáäεðóόέóç (áñáέáβóιòιόáό Ýóóέ έáέ óçι áíÙáέç äáέáóÙóόáόçò υέυι óυι äñāάέáβυι óάειιçñβύόçò).
- ΈáoÝááοιá διò ðçääβιò έπαέέα óçò óάειιçñβύόçò έáέ ιáόáäεðóόέóç διò ιΥού óυι äοιáóιòððυι διò ðáñÝ÷÷-ιòι óá äñāάέáβά óυι ports (áðειðιέριόáð ιá áóóυ óιι ðñυðι óç ÷-áέñιέβιççò áεάáέέáόβá áíÙέóçόçò έáέ ιáόáäεðóόέóçò).

ÁóðÝð ιέ äÿι ιΥεíäιέ áιçιΥñóçò óçò óάειιçñβύόçò διò FreeBSD óðιόççñβæιíóáέ áðυ ιέα óáέñÙ áðυ ports óάειιçñβύόçò óá ιðιβá áιçιäñβιííóáέ éÙεä ιPιá áðυ óçι ïiÙáá Áñ÷÷-έðáέðιέέðð óçò Óάειιçñβύόçò <doceng@FreeBSD.org>. Óðç ÓóέεíäP óυι Ports, έá óá äñáβóá éÙóυ áðυ óçι έáóçäñβá docs (<http://www.freshports.org/docs/>).

### 24.4.6.1 ιáόáäεðóόέóç έáέ ÁäέáóÙóόáόç óυι Ports óçò Óάειιçñβύόçò

Óá ports óçò óάειιçñβύόçò ÷ñçόείιθιέíÿι óέð äοιáóυóçðáò ιáόáäεðóόέóçò διò ðáñÝ÷÷-áέ óι όύόóçιá óυι ports þóóá ιá áέáðέιéÿιòι óç áεάáέέáόβá áçιέιòñáβáð óçò óάειιçñβύόçò. Ιá áóóυ óιι ðñυðι ç áíÙέóçόçò διò ðçääβιò έπαέέα óçò óάειιçñβύόçò äβιáóáέ áðóυιáόá ιá óçι áέðÝεáόç óçò make(1) έáέ óέð έáóÙέέççáò ðòειβóáέð óοι ðáñéáÙεεí. Ç äáέáóÙóόáόç έáέ áðáäέáóÙóόáόç óçò óάειιçñβύόçò áβιáέ óι βáει äÿεíεç ιá óçι äáέáóÙóόáόç ιðειòäððιόá Ùεεíò port P ðáéÝóιò óοι FreeBSD.

**Óçιáβύóç:** Óá ðáñβðóóυç óιðέéðð ιáόáäεðóόέóçò óυι ports óçò óάειιçñβύόçò, áðáέóáβóáέ έáέ ç äáέáóÙóόáόç óυι äñāάέáβυι óάειιçñβύόçò. Óá äñāάέáβá áðóÙ υóóυοι έá äáέáóóóóáέíÿι áóóυιáόá.

Ç ïñáÙíóç óυι ports óάειιçñβύόçò óáβιáóáέ ðáñáéÙóυ:

- ÓðÙñ÷÷-áέ Ýíá έáíòñέéυ “master port”, óι misc/freebsd-doc-en óι ιðιβι áεάéÝóáέ óá áðáñáβóçóá áñ÷÷-áβá έáέ áðιòáέáβ óçι áÙóç υέυι óυι Ùεéυι ports óάειιçñβύόçò. Áðυ ðñιáðέéíäP, óι port áóóυ ιáόáäευòóðæáέ ιυíι óçι ÁäáέééP óάειιçñβύóç.
- ÓðÙñ÷÷-áέ Ýíá port “úεá óá Ýíá”, óι misc/freebsd-doc-all óι ιðιβι ιáόáäευòóðæáέ έáέ äáέáέóóóÙ υέç óçι óάειιçñβύóç óá υέáð óέð áεάéÝóéíäð äεþóóáð.
- ÓÝεíò, óðÙñ÷÷-áέ Ýíá “áíáñòþιáñ port” áεá éÙεä ιáóÙóñáόç, ð.÷.: misc/freebsd-doc-el áέα óçι ÁέέçíέéP óάειιçñβύóç. ¼έá áóóÙ óá ports áíáñòþιáέ áðυ óι master port έáέ äáέáέóóóÿι óçι óάειιçñβύóç διò Ý÷÷-áέ ιáόáóñáóóáβ óóçι áíóβóóιé÷ç äεþóóá.

Áέα ιá äáέáóáóóðóáðá Ýíá port óάειιçñβύόçò áðυ óιι ðçääβι έπαέέα, äéòáéÝóóá óέð ðáñáéÙóυ áíοιéÝð (ùò root):

```
cd /usr/ports/misc/freebsd-doc-en
```

```
make install clean
```

Ὁ ἄρθρο τοῦ ἐπεξεργαστοῦ εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου (ὁ δὲ ἐπεξεργαστὴς εἶναι ἐπὶ <http://www.FreeBSD.org>), ὅπου εἶναι ἐπιπέδου `/usr/local/share/doc/freebsd`.

#### 24.4.6.1.1 Ὁ ἐπεξεργαστὴς τῆς ἐπέξεως τῆς ἐπιπέδου τοῦ HTML

Ὁ ἐπεξεργαστὴς τῆς ἐπέξεως τῆς ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου. Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου. Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου.

WITH\_HTML

Ὁ ἐπεξεργαστὴς τῆς ἐπέξεως τῆς ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου. Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου. Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου.

WITH\_PDF

Ὁ ἐπεξεργαστὴς τῆς ἐπέξεως τῆς ἐπιπέδου τοῦ PDF εἶναι ἐπὶ τῆς ἐπέξεως τοῦ PDF ἐπιπέδου. Ἐπιπέδου τοῦ PDF εἶναι ἐπὶ τῆς ἐπέξεως τοῦ PDF ἐπιπέδου. Ἐπιπέδου τοῦ PDF εἶναι ἐπὶ τῆς ἐπέξεως τοῦ PDF ἐπιπέδου.

DOCBASE

Ὁ ἐπεξεργαστὴς τῆς ἐπέξεως τῆς ἐπιπέδου τοῦ DOCBASE εἶναι ἐπὶ τῆς ἐπέξεως τοῦ DOCBASE ἐπιπέδου. Ἐπιπέδου τοῦ DOCBASE εἶναι ἐπὶ τῆς ἐπέξεως τοῦ DOCBASE ἐπιπέδου. Ἐπιπέδου τοῦ DOCBASE εἶναι ἐπὶ τῆς ἐπέξεως τοῦ DOCBASE ἐπιπέδου.

**Ὁ ἐπεξεργαστὴς τῆς ἐπέξεως τῆς ἐπιπέδου τοῦ CVS:** Ἐπιπέδου τοῦ CVS εἶναι ἐπὶ τῆς ἐπέξεως τοῦ CVS ἐπιπέδου. Ἐπιπέδου τοῦ CVS εἶναι ἐπὶ τῆς ἐπέξεως τοῦ CVS ἐπιπέδου. Ἐπιπέδου τοῦ CVS εἶναι ἐπὶ τῆς ἐπέξεως τοῦ CVS ἐπιπέδου.

Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου. Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου. Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου.

```
cd /usr/ports/misc/freebsd-doc-en
make -DWITH_PDF DOCBASE=share/doc/freebsd/en install clean
```

#### 24.4.6.2 Ἐπιπέδου τοῦ HTML τῆς ἐπέξεως τῆς ἐπιπέδου τοῦ HTML

Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου. Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου. Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου.

Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου. Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου. Ἐπιπέδου τοῦ HTML εἶναι ἐπὶ τῆς ἐπέξεως τοῦ HTML ἐπιπέδου.

**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

Οι FreeBSD-CURRENT και FreeBSD-STABLE είναι οι δύο κύριες κλάσεις του FreeBSD. Η FreeBSD-CURRENT είναι η πιο πρόσφατη και η FreeBSD-STABLE είναι η πιο σταθερή.

### 24.5.1 Διατήρηση του FreeBSD-CURRENT

Η διατήρηση του FreeBSD-CURRENT είναι απλή, αλλά απαιτείται να εγκαταστήσετε το FreeBSD και να το ενημερώσετε.

#### 24.5.1.1 Ο έλεγχος του FreeBSD-CURRENT

Ο έλεγχος του FreeBSD-CURRENT είναι απλή, αλλά απαιτείται να εγκαταστήσετε το FreeBSD και να το ενημερώσετε.



Ç ëβóóá svn-src-head (<http://lists.FreeBSD.org/mailman/listinfo/svn-src-head>) èá óáo àðéòñŸøáé íá àëŸðááò òéò èáðá÷ ùñÞóáéò òðì commit log ãéá èÛèá àëéááÞ ðìö ãβíáðáé, èáèÞ òé èççñìòìñßàð ãéá ðééáíŸð ðáñáñŸñáéáò ðìö ìðìñáß íá Ÿ÷ áé.

Áéá íá ãñáòòáßòá òá áððŸð, Þ òá ìðìéáóáÞðìòá áðù òéò ððÛñ÷ ìòóáo èβóóáð, àðéòéáòèáßòá òçì òìðìéáóáá <http://lists.FreeBSD.org/mailman/listinfo> èáé àðééŸìòá òçç èβóóá òççì ìðìßá èŸéáòá íá ãβíáðá òðìññçðÞð. Ìáçãßàð ãéá òçì òðìèìéðçç àéááééáóáá èá ãñáßòá àðéòùðìò. Áí óáo áíáéáóŸñáé íá ðáñáéìòèáßòá òéò àééááŸð òá ùèì òì áŸìòñì ðçãáßìò èÞáééá, óáo òðìéòòìŸìá íá àãáñáòáßòá òçç èβóóá svn-src-all (<http://lists.FreeBSD.org/mailman/listinfo/svn-src-all>).

2. ÁíáéòÞóóá òì ðçãáßì èÞáééá áðù Ÿíá mirror site òìö FreeBSD. Áðòù ìðìñáß íá ãβíáé ìá äŸì òñùðìòð:

- a. ×ñçóéìðìéÞóóá òì ðñùãñáìá cvsup òá òðìáðáóìù ìá òì supfile ìá òçì ìñíáóáá standard-supfile òì ìðìßì èá ãñáßòá òòìí èáðÛèìáì /usr/share/examples/cvsup. ÁðòÞ áβíáé èáé ç ðéŸì òðìéòòÞíáçç ìŸèìáìò, èáèÞ òáo àðéòñŸðáé íá áíáéòÞóóáðá ùèç òç òðéèìáÞ ìá ìéá èβίççç, èáé òðéò àðùìáíáð áíáíáÞóáéò èá ðáβñíáðá ìùñì òéò àééááŸð. Ðìèèìß ÷ ñÞóóáð àéòáéìŸì òì cvsup ìŸòù òìö cron Þóóá íá èñáòÛíá òì ðçãáßì èÞáééá òìö òðòðÞíáòìò òìòð ðÛìóá áíáíáùŸñì áðòùìáðá. Èá ðñŸðáé íá ðñìóáñìòóáðá òì òðùáéáìá òìö supfile ðìö áβñìòá ðáñáðÛíù, èáé íá ñðèìβóáðá òì cvsup ãéá òì ðáñéáÛèèì óáo.

**Òçìáßòùç:** Òì òðùáééáìá òìö áñ÷ áßìò standard-supfile ðñìññßæáðáé áéá ÷ ñÞóç ìá èÛðìéì òðáéèèñéìŸì èèÛáì áóòÛèáéáò (security branch) òìö FreeBSD, èáé ù÷ è ìá òì FreeBSD-CURRENT. Èá ðñŸðáé íá àðáíáñáóòáßòá òì áñ÷ áßì èáé íá áíðééáðáðóÞóóáðá òçì ðáñáéÛòù ãñáìÞ:

```
*default release=cvs tag=RELENG_X_Y
```

ìá òçì áéùèìòèç:

```
*default release=cvs tag=.
```

Áéá ðáñéòóòùðáñáð ðèççñìòìñßàð ò÷: áðééÛ ìá ðá tags ðìö ìðìñáßòá íá ÷ ñçóéìðìéÞóóáðá, ðáñáéáéìŸìá àéááÛòðá òðì Áá÷ áéñßáéì òçì áíùççðá ÁðééŸðáð (Tags) ãéá òì CVS.

- b. ×ñçóéìðìéÞóóá òçì òðçñáóáá **CTM**. Áí Ÿ÷ áðá ðìèŸ èáèÞ òðìááðéìùðççðá (ðøçèù èùòðìò òŸíááççð Þ ðñùóááçç ìùñì ìŸòù email) òì **CTM** áðìòáèáß ãéá óáo ìéá áíáééáðéðèÞ èŸóç. Ìðìñáß ìòóòùì íá óáo áççìòñáÞóóáé àéÛòìñá ðñìáéÞíáðá èáé íá èáðáéÞíáðá ìá ÷ áéáóìŸíá áñ÷ áßá. Áéá òì èùáì áðòù, òì **CTM** ÷ ñçóéìðìéáßòáé òðÛíéá, èÛðé òì ìðìßì áðìŸíáé áéùìá ðáñéòóòùðáñì òçì ðééáíŸðççðá íá ìç ãìòèáŸáé òùòðÛ ãéá ìááÛèá ÷ ññìééÛ àéáððíáðá. Óáo òðìéòòìŸìá íá ÷ ñçóéìðìéÞóóáðá òì **CVSup** áí àéáéŸðáðá modem 9600 bps Þ òá÷Ÿðáñì.

3. Áí òèìðáŸáðá íá áíáéòÞóóáðá òì ðçãáßì èÞáééá ãéá èáñìéèÞ ÷ ñÞóç (áèòŸéáòç) èáé ù÷ è áðèÞ ãéá íá òìí ááßòá, òùòá áíáéòÞóóá *reueççñì* òì FreeBSD-CURRENT èáé ù÷ è èÛðìéá àðééáñŸíá òìÞíáðá. Óá àéáòìñáðéèÞ ðáñßðòùç, áβíáé áñéáòÛ ðééáíŸ íá òðìáððóáðá ðñìáéÞíáðá, èáèÞ ðìèèÛ èñìÛðéá òìò èÞáééá áíáòÞíóáé áðù áíáíáÞóáéò òá Ûèéá, èáé ááì ìðìñìŸì íá ìáðáéèùððéòòìŸì áðòùñìá.

Ðñéì ìáðáéèùððóáðá òì FreeBSD-CURRENT, àéááÛòðá ðñìòáéðééÛ òì Makefile òòìí èáðÛèìáì /usr/src. Èá ðñŸðáé íá ìáðáéèùððóáðá òì ððñÞíá èáé ùèì òì ááòéèù òŸóðçíá (world) òçì ðñÞóç òìñÛ, ùð ìŸñìò òçç àéááééáóááð áíááÛèìéòçð. ÁéááÛæìòáð òçì çéáèòñìéèÞ èβóóá òçç Ÿèáìòçð FreeBSD-CURRENT (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-current>) èáé òì /usr/src/UPDATING èá áβóóá áίçìáñùìŸñé ãéá ìŸáð àéááééáóááð ùòì áòìñÛ òççì àéèβίççç òòì ìŸì óáo òŸóðçíá. Ìé àéááééáóááð áððŸð áβíáé òð÷íÛ áðáñáßòççð ùòì ðèççóéÛæìòìá òá ìéá ìŸá áðβóççç Ÿèáìòç.



















```
cd /usr/obj
chflags -R noschg *
rm -rf *
```

## 24.7.7 Εγκατάσταση του συστήματος

### 24.7.7.1 Εγκατάσταση του συστήματος

Εάν θέλετε να εγκαταστήσετε το FreeBSD, πρέπει να έχετε εγκαταστήσει το FreeBSD και να έχετε εγκαταστήσει το FreeBSD. Η διαδικασία είναι η εξής: Πρώτα, πρέπει να εγκαταστήσετε το FreeBSD. Αυτό γίνεται με την εντολή `make`. Η διαδικασία είναι η εξής: Πρώτα, πρέπει να εγκαταστήσετε το FreeBSD. Αυτό γίνεται με την εντολή `make`.

Η διαδικασία είναι η εξής: Πρώτα, πρέπει να εγκαταστήσετε το FreeBSD. Αυτό γίνεται με την εντολή `make`. Η διαδικασία είναι η εξής: Πρώτα, πρέπει να εγκαταστήσετε το FreeBSD. Αυτό γίνεται με την εντολή `make`.

```
script /var/tmp/mw.out
Script started, output file is /var/tmp/mw.out
make TARGET
... install directories, install directories, install directories ...
exit
Script done, ...
```

Η διαδικασία είναι η εξής: Πρώτα, πρέπει να εγκαταστήσετε το FreeBSD. Αυτό γίνεται με την εντολή `make`. Η διαδικασία είναι η εξής: Πρώτα, πρέπει να εγκαταστήσετε το FreeBSD. Αυτό γίνεται με την εντολή `make`.

### 24.7.7.2 Εγκατάσταση του συστήματος

Εάν θέλετε να εγκαταστήσετε το FreeBSD, πρέπει να έχετε εγκαταστήσει το FreeBSD και να έχετε εγκαταστήσει το FreeBSD.

```
cd /usr/src
```

(Αν θέλετε να εγκαταστήσετε το FreeBSD, πρέπει να έχετε εγκαταστήσει το FreeBSD και να έχετε εγκαταστήσει το FreeBSD.)

Αν θέλετε να εγκαταστήσετε το FreeBSD, πρέπει να έχετε εγκαταστήσει το FreeBSD και να έχετε εγκαταστήσει το FreeBSD. Η διαδικασία είναι η εξής: Πρώτα, πρέπει να εγκαταστήσετε το FreeBSD. Αυτό γίνεται με την εντολή `make`.

Η διαδικασία είναι η εξής: Πρώτα, πρέπει να εγκαταστήσετε το FreeBSD. Αυτό γίνεται με την εντολή `make`.

```
make -x -DVARIABLE target
```

Οι εντολές `make` και `make -x` είναι οι ίδιες, αλλά η `make -x` είναι η προεπιλεγμένη. Η διαδικασία είναι η εξής: Πρώτα, πρέπει να εγκαταστήσετε το FreeBSD. Αυτό γίνεται με την εντολή `make`.



```
make -j4 buildworld
```

Ἡ ἀνάπτυξη τοῦ κόσμου τῆς FreeBSD, ἡ `make(1)` εἶναι ἡ ἐξέλιξη τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου. Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου. Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου.

Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου. Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου.

### 24.7.7.3 × νῦν τὸ ἰσχύον ἐπιπέδον

Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου. Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου.

### 24.7.8 ἰσχύον ἐπιπέδον ἐπὶ τῆς ἀνάπτυξης τοῦ κόσμου

Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου. Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου.

Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου. Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου.

Ὁ `make(1)` τῆς FreeBSD ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου.

**Ὁδηγίες:** Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου.

```
cd /usr/src
make buildkernel KERNCONF=MYKERNEL
make installkernel KERNCONF=MYKERNEL
```

Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου. Ἡ ἀνάπτυξη τοῦ κόσμου εἶναι ἡ ἀνάπτυξη τοῦ κόσμου τοῦ `make(1)` ἐπὶ 4 ἀριθμοὺς ἀνάπτυξης τοῦ κόσμου.





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 áãéáðáóðððáðá 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 ìëùéçççç óáéñÛ áðu ðíðð ððíéáðáéùíáíðð ðíð áðáéðíýíóáé.

```
mkdir /var/tmp/root
cd /usr/src/etc
make DESTDIR=/var/tmp/root distrib-dirs distribution
```

Ìé ðáñáðÛíù áíðíëÿð éá äçíëíðñáððíðí ðçí áðáéðíýíóáé ãñð êáðáéùíáí êáé éá áãéáðáóðððíðí ðá áñ÷áß. ÌááÛëí ìÝñíð ðùí ððíéáðáéùíáí ðíð Ý÷íðí äçíëíðñáçèáß êÛðù áðu ðíí /var/tmp/root áßíáé Ûááéíé, êáé ðñÝðáé íá áéáãñáðíýí. Ì áðéýóðáñíð ðñùðíð áéá íá áßíáé áððù, óáßíáðáé ðáñáéÛðù:

```
cd /var/tmp/root
find -d . -type d | xargs rmdir 2>/dev/null
```

Áððù éá áéáãñÛøðáé ùëíðð ðíðð Ûááéíðð ððíéáðáéùíáíðð. (Ç Ýíñáðð óðÛëíáðíð áíáéáðáððéýíáðáé óðí /dev/null þðá ìá íçí áíðáßíáíðáé óðçí ìëùç ðñíáéáíðíëððáéð áéá êáðáéùíáíðð ðíð ááí áßíáé Ûááéíé.)

Ïþñá, ì /var/tmp/root ðáñéÝ÷áé ùéá óá áñ÷áß ðíð éá ðñÝðáé íá ðíðíéáðçèíýí óá êáðÛëéççéáð èÿóáéð êÛðù áðu ðíí /. 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 (áãéáðáóðçíÝíí) áñ÷áßí.

Ïçíáéððá ùðé êÛðíéá áðu óá áñ÷áß óá ìðíßá Ý÷íðí áãéáðáóððáéáß óðíí /var/tmp/root Ý÷íðí ìéá áñ÷éëð “.”. Ïç óðéãñð ðíð ãñÛíðíðáé áððÿð ìé ãñáíÿð, óá ìúíá áñ÷áß óðá ìðíßá óííááßíáé áððù áßíáé óá áñ÷áß áéëßíççðð ðíð éáéýðíðð óðíí êáðÛëíáí /var/tmp/root/ êáé /var/tmp/root/root/, áí êáé ìðíñáß íá ððÛñ÷íðí êáé Ûëéá (áíÛëíáá ìá ðí ðùðá áéááÛæáðá ðí éáßíáí). Ááááéùéáßðá ùðé ÷ñçóëííðíëáßðá ðçí áíðíëð ls -a áéá íá óá ááßðá ùéá.

Ì áðéýóðáñíð ðñùðíð áéá íá óðáéñßíáðá äýí 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 ìáðáíý ðíð áñ÷áßíð /etc/shells êáé ðíð íÝíð áñ÷áßíð /var/tmp/root/etc/shells. ×ñçóëííðíëððá ðéð áéáðíñÿð áððÿð áéá íá áðíðáóððáðá áí éá ðñÝðáé íá óðá÷íáýóðáð ðéð áééááÿð ðíð Ý÷áðá êÛíáé, ð áðéðð íá áíóéãñÛøðáðá ðí ðáééù óáð áñ÷áßí ðÛíù áðu ðí íÝí.

**Ðñíðéÿðáðá ðçí Çíáñíçíßá ððí ¼ííá ðíð íÝíð Root Éáðáéùíáíð, (/var/tmp/root) çóðá íá ìðíñáßðá Áýéíéá íá Õðáéñßíáðá Áéáðíñáðééÿð Áéáùóáéð ìáðáíý ðíðð:** Áí ìáðááéùððßæáðá óð÷íÛ ðí ááóééù óýðçíá, éá ðñÝðáé áðßðçð íá áíçíáñþíáðá óð÷íÛ ðíí êáðÛëíáí /etc, ðí ìðíßí ìðíñáß íá áßíáé áíí÷éçðééù.

Ìðíñáßðá íá áðéðá÷ýíáðá áððð ðç áéááééáóßá, ðçñþíðáð Ýíá áíðßáñáðí ðíð ðáéáððáßíð óáð áééááíÝíúí áñ÷áßí ðá ìðíßá óðá÷íáýóðáð ððíí êáðÛëíáí /etc. Ç ðáñáéÛðù áéááééáóßá éá óáð áððáé ìéá éáÝá áéá ðí ðùð ìðíñáß íá áßíáé áððù:





έάέ ðιέÿ ίύçιά, áñ áί ðιί óáßóáá ðά έá έáñáßóáá Ýía íááÛεί έñÛÓε άεάÿεáñιò ÷ ðñιò (òçί ðáñιÿόά óóέáñß ðáñßðιò 340 MB).

¼ιùð, áί ίÿñáðá ðε εÛίáðá, ίðιñáßóá ίά ίäçáßóáá ðι make buildworld ίά ðáñáέáßθάέ áðòυ ðι áßιά. Áðòυ έá áðέόá ÷ ÿίáέ έάέáßóáñá ðεò ίÿáð ίáóááεùòðßóáέò, έάεð ðά ðáñέóóυðáñá ðιßιάóá ðιò ðçááßιò εßάέέá ááί έá ÷ ðñáεÛáείíóáέ ίáÛ ìáðááεßððóέóç. Õι ίáέιñÿέòçιά áßιάέ υέέ ìñέóι Ýíáð ðιñÿð áιòáίßáείíóáέ ðñíáεßιάóá ðιò Ý ÷ ιòί ó ÷ Ýóç ίá ù ÷ ε έáέ ðυòί áιòáίáßð áίáñðßóáέò, έáέ ίðιñáß ίά ίäçáßóιòί óá ίòóðçñεßç áðιòð ÷ ðá ðçð ìáðááεßððóέóçð. Õÿÿιέá ðñíáεßιάóá óð ÷ ίÛ áçιέιòñáιÿί “εùñòáι” óðέð εßóðáð ðιò FreeBSD, υóáί εÛðιέιò ÷ ðßóðçð ðáñáðιίέÿόáέ υέέ ç ίáðááεßððóέóç ðιò áðιòðá ÷ Ûίáέ, ÷ ùñßð ίά áίðέέáìáÛίáóáέ υέέ áðòυ ιòáßεáðáέ óðçί ðñιòðÛεάέá ðιò ίά óοίòñáÿόáέ ðçί áέááέέáóáá.

4. ìðιñß ίά óοίá ÷ ðóυ ίέá ίáðááεßððóέóç ðιò áεÿέιθá;

Áðòυ áίáñðÛóáέ áðυ ðι ðυòί Ý ÷ áðá ðñι ÷ ùñßóáέ óðç áέááέέáóáá ίÿ ÷ ðñέ ðç óóέáñß ðιò áñßεáðá ðι ðñυáεçιά.

Õá ááίέέÿð áñáìÿð (έáέ áðòυð ááί áßιάέ έáίñιáð ðιò έó ÷ ÿáέ ðÛίóá), ç áέáñááóáá ðιò make buildworld ίáðááεùòðßáέέ ίÿá áίòßáñáóá ááóέέßί áñááέáßυί (υðυð óá gcc(1), έáέ make(1)) έάεð έáέ ðυί áέáέέιèçεßί óóóðßιάðιð. ðáέóá ááέáέέóðßίóáέ áððÛ óá áñááέáá έáέ ίε áέáέέιèðεáð. Õá ίÿá áñááέáá έáέ áέáέέιèðεáð ÷ ðçóέιιðιέιÿίóáέ Ýðáέóá áέá ίá áðáίáìáðááεùòðßóιòί ðιòð ááóðιÿð ðιòð, έáέ ááέáεßððáίóáέ ίáÛ. Ìεùεççñι ðι óÿóðçιά (ðι ιðιßι ðññá ðáñέéáìáÛίáέ έáέ óá óóçεέóιÿίá ðñíáñÛιιáóá ÷ ðñóðç υðυð ðι ls(1) ð ðι grep(1)) áðáίáìáðááεùòðßáέðáέ ÷ ðçóέιιðιέιÿίóáð óá ίÿá áñ ÷ ááá ðιò óóóðßιάðιð.

Áί áñßóέáðá óοί ðáεáðóáßι óðÛáέι, ðι ιðιßι έá ðι áññááðáðá έιέðÛáείíóáð ðçί Ýñáι ðιò Ý ÷ áðá áðιèçέáÿόáέ, áßιάέ ó ÷ áðέέÛ áóóáέÿð ίá εÛίáðá:

```
... fix the problem ...
cd /usr/src
make -DNO_CLEAN all
```

Ìá ðιί ðñυðι áðòυ ááί έá áίáέñÿόááð ðçί áñááóáá ðιò Ý ÷ áέ áßιάέ áðυ ðι ðñιçáιÿίáñι make buildworld.

Áί ááßóá ðι ìßίóιά:

```

Building everything..

```

óðçί Ýñáι ðçð áίðιèðð make buildworld, ðυðá áßιάέ ìÛεείí áóóáέÿð ίá ðñι ÷ ùñßóáðá ìá áðòυ ðιí ðñυðι.

Áί ááί ááßóá áðòυ ðι ìßίóιά, ð áί ááί áßóáá óßáιòñιð, ðυðá áßιάέ έáέÿðáñá ίá εÛίáðá ðεßñç ίáðááεßððóέóç ðáñÛ ίá ìáðáίέíáðá áñáυðáñá.

5. Ðυð ìðιñß ίά áðέóá ÷ ÿίυ ðç ίáðááεßððóέóç ðιò ááóέέίÿ óóóðßιάðιð;

- Áέðáεÿóáð ðçί óá έáðÛóóáóç áíυð ÷ ðñóðç.
- ÁÛεðá ðιòð έáðáευáιòð /usr/src έáέ /usr/obj óá áέáóιñáðéέÛ óóóðßιάóá áñ ÷ áßυί óá ιðιßá áñßóέιιíóáέ έáέ óá áέáóιñáðéέίÿð óóóέίÿð áßóέιòð. Áί áßιάέ áοίáðυί, áÛεðá áðòιÿð ðιòð áßóέιòð óá ÷ ùñέóðιÿð áεááέðÿð.
- Áέυιá έáέÿðáñá, ìñέñÛóáá áððÛ óá óóóðßιάóá áñ ÷ áßυί óá ðιέεáððιÿð áßóέιòð, ÷ ðçóέιιðιέιÿίóáð ðι ðñυáñáìá ìáßçóçð ccd(4) (concatenated disk driver, ìáßçóçð óοίáíυìÿίυί áßóέυί).

- Ἀρθρογραφία τοῦ profiling (ἐξομοίωση ἰσχύος “NO\_PROFILE=true” οἱ /etc/make.conf). Ἀρθρογραφία ὁμοίωσης τοῦ profiling ἔχει ὁμοίωση τοῦ /etc/make.conf.
- Οἱ ἀρθρογραφία /etc/make.conf, ἐξομοίωση τοῦ CFLAGS ὁμοίωση τοῦ -O -pipe. Ἡ ἀρθρογραφία τοῦ -O2 ὁμοίωση τοῦ -pipe ἀρθρογραφία τοῦ δακτύλου τοῦ /etc/make.conf, ἔχει ὁμοίωση τοῦ -O2 ἀρθρογραφία τοῦ -pipe ὁμοίωση τοῦ δακτύλου τοῦ /etc/make.conf. Οἱ -pipe ἀρθρογραφία τοῦ δακτύλου τοῦ /etc/make.conf ἔχει ὁμοίωση τοῦ δακτύλου τοῦ /etc/make.conf. Οἱ -pipe ἀρθρογραφία τοῦ δακτύλου τοῦ /etc/make.conf ἔχει ὁμοίωση τοῦ δακτύλου τοῦ /etc/make.conf.
- Ἡ ἀρθρογραφία τοῦ δακτύλου τοῦ /etc/make.conf ἔχει ὁμοίωση τοῦ δακτύλου τοῦ /etc/make.conf.
- Ἡ ἀρθρογραφία τοῦ δακτύλου τοῦ /etc/make.conf ἔχει ὁμοίωση τοῦ δακτύλου τοῦ /etc/make.conf.

```
mount -u -o noatime /usr/src
```

**Ἀρθρογραφία:** Οἱ ἀρθρογραφία τοῦ δακτύλου τοῦ /usr/src ὁμοίωση τοῦ δακτύλου τοῦ /usr/src ὁμοίωση τοῦ δακτύλου τοῦ /usr/src.

- Ἡ ἀρθρογραφία τοῦ δακτύλου τοῦ /usr/src ὁμοίωση τοῦ δακτύλου τοῦ /usr/src ὁμοίωση τοῦ δακτύλου τοῦ /usr/src.

**Ἀρθρογραφία:** Ἡ ἀρθρογραφία τοῦ δακτύλου τοῦ /usr/src ὁμοίωση τοῦ δακτύλου τοῦ /usr/src ὁμοίωση τοῦ δακτύλου τοῦ /usr/src.

Ἡ ἀρθρογραφία τοῦ δακτύλου τοῦ /usr/src ὁμοίωση τοῦ δακτύλου τοῦ /usr/src ὁμοίωση τοῦ δακτύλου τοῦ /usr/src.

```
mount -u -o async /usr/obj
```

**Ἀρθρογραφία:** Ἡ ἀρθρογραφία τοῦ δακτύλου τοῦ /usr/obj ὁμοίωση τοῦ δακτύλου τοῦ /usr/obj ὁμοίωση τοῦ δακτύλου τοῦ /usr/obj.

## 6. Ὁμοίωση τοῦ δακτύλου τοῦ /usr/obj;

Ὁμοίωση τοῦ δακτύλου τοῦ /usr/obj ὁμοίωση τοῦ δακτύλου τοῦ /usr/obj ὁμοίωση τοῦ δακτύλου τοῦ /usr/obj.

```
chflags -R noschg /usr/obj/usr
rm -rf /usr/obj/usr
```



### 24.8.2 Ὁ Ἄριστος Ὑπόλογος

Ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια εἶναι ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια. Ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια εἶναι ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια. Ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια εἶναι ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια.

Ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια εἶναι ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια. Ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια εἶναι ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια.

### 24.8.3 Ports

Ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια εἶναι ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια. Ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια εἶναι ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια.

## Ὁ Ἄριστος Ὑπόλογος

1. Ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια εἶναι ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια. Ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια εἶναι ἡ ἀνάγκη ἀναβαθμίσαι τὴν ἀσφάλεια.

# ΕὰοÛεάεί 25 DTrace

ÃñÛöçêà áðu ôĩĩ Tom Rhodes.

## 25.1 Óýĩĩøç

Ôĩ DTrace, áĩúóóũ áðβóçð ùð Dynamic Tracing, áβĩάέ Ýĩá áñááέάβĩ ôĩ ιðĩβĩ áĩάðóý÷εçêà áðu ôçĩ Sun áέá ôĩĩ áĩóĩðéóĩũ ðñĩáέçĩÛóũĩ áðuáĩóçð óá óóóóβĩάóá ðĩø ðñĩέáέóáέ ίá ÷ ñçóέĩĩðĩέçéĩýĩ β ÷ ñçóέĩĩðĩέĩýĩóáέ βáç óóçĩ ðáñááũáβ. Ááĩ ðñĩέáέóáέ áέá áñááέάβĩ áðĩóóáέĩÛóóóçð, áέέÛ áέá áñááέάβĩ áĩÛέóóçð ðñááĩáóέέĩý ÷ ñũĩñò, ìá ôĩ ιðĩβĩ ιðĩñĩýĩ ίá áĩóĩðéóóĩýĩ ðñĩáέβĩάóá áðuáĩóçð έáέ Ûέέáð έáóáóóÛóáέó.

Ôĩ DTrace áβĩάέ Ýĩá έáóĩÛóέĩ áñááέάβĩ profiling έáέ áέáέÝóáέ áĩóððóóέáέũ ðéβèð ÷ áñáέóçñέóóέέβĩ áέá ôçĩ áέÛáũóç ðñĩáέçĩÛóũĩ ôĩø óóóóβĩάóĩð. Ìðĩñáβ áðβóçð ίá ÷ ñçóέĩĩðĩέçéçáβ áέá ίá áέóáέÝóáέ áðu ðñéĩ Ýóĩέĩá scripts, ìá óá ιðĩβá ιðĩñáβóá ίá áέĩáóáέέáðéáβóá έáέýóáñá óέð áóĩáóóũóçðáð ôĩø. Ìέ ÷ ñβóóáð ιðĩñĩýĩ áέũĩá ίá áñÛøĩóĩ έáέ óá áέέÛ ôĩøð áĩçέçóέέÛ ðñĩáñÛĩáóá, ÷ ñçóέĩĩðĩέβĩόáð ôçĩ Áέβροά D ðĩø ðáñÝ ÷ áέ ôĩ DTrace, έáέ ίá ðñĩóáñĩũóĩóĩ ìá áóóũ ôĩĩ ðñũðĩ ôĩ profiling óóέð áέέÝð ôĩøð áĩÛáέáð.

Áóĩý áέááÛóáóá áóóũ ôĩ έáóÛέáέĩ, έá áĩũñβæáóá:

- Óέ áβĩάέ ôĩ DTrace έáέ óé áóĩáóóũóçðáð ðáñÝ ÷ áέ.
- Óέð áέáóĩñÝð ðéĩðĩβçóçð ìáóáĩý ôĩø DTrace ôĩø Solaris έáέ ôĩø FreeBSD.
- ðòð ίá áĩáñáĩðĩέβροάá έáέ ίá ÷ ñçóέĩĩðĩέβροάá ôĩ DTrace óôĩ FreeBSD.

ðñéĩ áέááÛóáóá áóóũ ôĩ έáóÛέáέĩ, έá ðñÝðáέ:

- Ìá έáóáñáβóá ááóέéÝð Ýĩñέáð ôĩø UNIX έáέ ôĩø FreeBSD (ΈáóÛέáέĩ 3).
- Ìá áβóóá áñέέáέũĩÝĩñò ìá óέð ááóέéÝð áέááέέáóáβáð ñýéĩέóçð έáέ ìáóááέβροóέóçð ðñĩóáñĩóĩÝĩñò ðòñβĩá (ΈáóÛέáέĩ 8).
- Ìá áβóóá áñέέáέũĩÝĩñò ìá ôçĩ áóóÛέáέá έáέ ôĩĩ ðñũðĩ ðĩø áóóβ ó÷áðβæáóáέ ìá ôĩ FreeBSD (ΈáóÛέáέĩ 14).
- Ìá έáóáñáβóá ðòð ìðĩñáβóá ίá áĩáέðβροάá ôĩĩ ðçááβĩ έβáέέá ôĩø FreeBSD έáέ ίá ôĩĩ ÷ ñçóέĩĩðĩέβροάá βροά ίá áðáĩáĩáóááέũòðóβóáá ôĩ óýóççĩá óáð (ΈáóÛέáέĩ 24).

**ðñĩáέáέĩðĩβçóç:** Ôç áááĩñÝĩç óóέáĩβ, ôĩ DTrace έáũñáβóáέ ùðé áβĩάέ óá ðáέñáĩáóέέũ óóÛáέĩ. ÌñέóĩÝĩáð áðééĩáÝð ìðĩñáβ ίá ððĩέáβðĩĩóáέ óá έáέóĩðñáέέũóçóá, έáέ έÛðĩέá ðĩβĩáóá βóóð ίá ìç έáέóĩðñáĩýĩ έáέέũéĩð. Ìá ôçĩ ðÛñĩáĩ ôĩø ÷ ñũĩñò, ìé ðáñáðÛĩũ áóĩáóóũóçðáð έá έáũñççéĩýĩ Ýóĩέĩáð áέá ÷ ñβóç óá ìç ÷ áĩβĩáóá ðáñááũáβò, έáέ ç ðáñĩýóá óáέĩçñβúóç έá áĩáĩáũέáβ βροά ίá áĩóέðñĩóóũðáýáé áóðβ ôçĩ έáóÛóóáóç.

## 25.2 ÁέáóĩñÝð óóçĩ Óéĩðĩβçóç

Áĩ έáέ ôĩ DTrace óôĩ FreeBSD áβĩάέ áñéáðÛ ùñéĩ ìá áóóũ ôĩø Solaris, ððÛñ÷ĩóĩ έÛðĩέáð áέáóĩñÝð ðĩø έá ðñÝðáέ ίá óέð áĩçáβροĩóĩá ðñéĩ óóĩá÷βροĩóĩá. Ç ìáááέýóáñç áέáóĩñÛ ðĩø έá ðáñáóçñβροĩóĩ íé ÷ ñβóóáð, áβĩάέ ùðé óôĩ FreeBSD ôĩ DTrace ðñÝðáέ ίá áĩáñáĩðĩέçéçáβ ÷ áéñĩέβĩçóá. ÓðÛñ÷ĩóĩ áέÛóĩñáð áðééĩáÝð έáέ áñέñβĩáóá áέá ôĩĩ ðòñβĩá ðĩø ðñÝðáέ ίá áĩáñáĩðĩέçéĩýĩ βροά ôĩ DTrace ίá έáέóĩðñááβ óóóóÛ. Έá áĩçáβροĩóĩá áñáũóáñá áóóÝð óέð ñòéĩβóáέó.

Ç áðέεία DDB\_CTF οίò ðòñÞía ÷ ñçόείιðίείαβóάέ áέα ίά áíáñáιðίείαβóάέ όçί ððίόòÞñείç òιñòÞíaóιò ðùί áááñÝíùí CTF áðù οίí ðòñÞía έάέ όά áññòÞíaόά οίò. Όί CTF áβíaέ όί Compact C Type format οίò Solaris, όί ιðίβίí áíèðέάέÞíaέ ίέα áέάόòùíÝίç ιñòÞ ðέçñίòιñέÞί áðίόόάέιÙòùόçò (debugging), ùιίέα ίά όί DWARF έάέ όά stabs. ΆòòÙ όά áááñÝía CTF ðñιόóòβέáίόάέ όάά áέòáέÝόείá ίÝóù ðùί áñááέáβùí ctfcconvert έάέ ctfmerge. Όί áιçέçòέέù ðñùáñáιá ctfcconvert áñιçíaýáέ όά ðιÞíaόά ðùí DWARF ELF ðιò ðáñέÝ ÷ ιòί ðέçñίòιñβáò debug (áçιέíòñáíýííόάέ áðù όί ίáòááέùòòέóòÞ), έάέ όί ctfmerge óòá ÷ ùíaýáέ όά ðιÞíaόά CTF έάέ ELF áðù όά áίόέέáβiáía όά Ùέέα áέòáέÝόείá Þ έίέíù ÷ ñçόόáò áέáέέίέÞέáò. Ðáñέóóùòáñáò ðέçñίòιñβáò áέα όçί áíáñáιðίβçόç ðùí ðáñáòÙíù óόç ίáòááέÞòέóç οίò ðòñÞía έάέ οίò óóóòÞíaóιò οίò FreeBSD, έá äýíá ðáñáέÙòù.

Όόί FreeBSD εÙðίέίέ ðáñí ÷ áβò áβíaέ áέáóιñáòέέίβ όά ó ÷ Ýόç ίá όί Solaris. Í ðεί áίέίόçíáβùòιò áβíaέ í ðáñí ÷ Ýáò dtmalloc í ιðίβιò áðέòñÝðáέ όί tracing οίò malloc() áÚέίáá ίá όίí óýðί οίò, óóίí ðòñÞía οίò FreeBSD.

Íñí í root ιðίñáβ ίá ÷ ñçόείιðίείαβóάέ όί DTrace óóί FreeBSD. Άòòù ó ÷ áòβáέáóάέ ίá áέáóιñÝò óόçί áóóÙέάέá, έάέÞò όί Solaris áέάέÝóáέ εÙðίέίòð áέÝá ÷ ιòò áóóÙέάέáò ÷ áιçέíý áðέòÝáιò, ίέ ιðίβιέ ááí ððÙñ ÷ ιòί áέùíá óóί FreeBSD. Άέα όί εùáι áòòù, ç ÷ ñÞόç όçò óòóέáòÞò /dev/dtrace/dtrace áðááιñáýáóάέ áóóóçñÙ áέα ùέιòð οίòò ÷ ñÞóóáò áέòùò áðù όίí root.

ΌÝέιò, όί εíáέóίέέù DTrace áñβóέáóάέ óðù όçί Ùááέα CDDL όçò Sun. Íðιñáβòá ίá áέááÙóáòá όί έáβiáíí όçò Ùááέáò Common Development and Distribution License óóί FreeBSD, óóί áñ ÷ áβí /usr/src/cddl/contrib/opensolaris/OPENSOLARIS.LICENSE Þ ίá όί áέááÙóáòá online óόç áέáýέòίόç http://www.opensolaris.org/os/licensing.

Ç Ùááέα ιòέáóóέέÙ óçíáβiáέ ùóέ Ýiáò ðòñÞiáò FreeBSD ίá óέó áðέείáÝò οίò DTrace, áíáέίέιòέáβ ίá áñβóέáóάέ óðù όçί Ùááέα BSD. Ùóòùóί όί CDDL áìðéÝέáóάέ όç óóέáñÞ ðιò áβiáóáέ áέáññÞ ðùí áññòùíÙòùí óá äóááέéÞ ιñòÞ, Þ όç óóέáñÞ ðιò òιñòÞíííóáέ.

## 25.3 Áíáñáιðίβçόç όçò ΌðίόòÞñείçò DTrace

Άέα ίá áíáñáιðίείαβóáòá όçί ððίόòÞñείç áέα όί DTrace, ðñιόέÝóòá óέò áέùέιòέáò áñáιíÝò óóί áñ ÷ áβí ñòέìβóáùí οίò ðòñÞía:

```
options KDTRACE_HOOKS
options DDB_CTF
```

**Όçíáβùóç:** Íέ ÷ ñÞóóáò óçò áñ ÷ έóáέòιίέέÞò AMD64 έá έÝέιòί ίá ðñιόέÝóíòί όçί áέùέιòέç áñáιñÞ óóί áñ ÷ áβí ñòέìβóáùí οίò ðòñÞía óίòò:

```
options KDTRACE_FRAME
```

Ç áðέέίáÞ áòòÞ ðáñÝ ÷ áέ ððίόòÞñείç áέα όç έáέóίòñáβá FBT. Όί DTrace ιðίñáβ ίá έáέóίòñáÞóáέ έάέ ÷ ùñβò áòòÞí. Ùóòùóί, έá ðáñÝ ÷ áέ ðáñέíñέóίÝίç ððίόòÞñείç áέα function boundary tracing.

¼έιò í ðçááβιò έÞáέέáò έá ðñÝðáέ ίá ίáòááέùòòέóóðáβ ίáíÙ ίá óέò áðέείáÝò CTF. Άέα ίá áβiáέ áòòù, ίáòááέùòòβóòá ίáíÙ όί FreeBSD ÷ ñçόείιðίείáβóáò:

```
cd /usr/src
make WITH_CTF=1 kernel
```

Έá ÷ ñáέáóóáβ ίá áðáíáέέέίÞóáòá όί óýóóçía.

ÎäöÛ ôçí äðáíäëëßíçós, éäé ìä ôíí íÛí ððñÞíá öíñòùíÛí ðëÛíí óðç ìÞíç, éä ðñÛðäé íá ðñíóèÛóäâä ððíóðÞñéíç äéá ôí èÛëðöíð Korn. Áðöü äðäéðäððäé, éäèðð öá äñäáëäðá DTrace ðñééëìäÛííöí äéÛöíñä äíçççðééÛ ðñíäñÛíìäðä öá ìðíðá äðíäé äñäñÛíá öá ksh. Áäéäðäóððððä öí port shells/ksh93. Îðíñäððä äððóçð íá äéðäëÛóäâä äðöÛ öá äñäáëäðá éäé ìÛóù ðíð shells/pdksh Þ ðíð shells/mksh.

ÏÛëò, äíäèðððä ôçí ðñÛ ÷ ìððä óäéñÛ äñäáëäðá DTrace. Ç ðäèäððäðá Ûéäíóç äéäððäðäé óðçí ðíðèäððá <http://www.opensolaris.org/os/community/dtrace/dtracetoolkit/>. Äéäððäðäé éäé ðñüäñäñä ääèäðððäóçð, öí ìðíðí ääí äðíäé ùðöüóí äðäñäððçöí íá äéðäëÛóäâä ðñíäëíÛííö íá ÷ ñçöéíðíèððäðä öá äñäáëäðá.

## 25.4 × ñçóéíðíèððäððä öí DTrace

ðñéí ÷ ñçöéíðíèððäððä èéð èäéðíðñäððä ðíð DTrace, éä ðñÛðäé íá ððÛñ÷äé ç áíððððíè÷ç óððèäðð. Äéá íá öíñðððäðä ðç óððèäðð, éä ðñÛðäé íá äððäðä ôçí ðäñäéÛöù áíðíèðð:

```
kldload dtraceall
```

Éä ðñÛðäé íá Û÷äðä ðëÛíí ððíóðÞñéíç DTrace. Äéá íá ääððä üéä öá probes, éä ðñÛðäé íá äéðäëÛóäâä ùð äéä÷äéñéóðððð ôçí ðäñäéÛöù áíðíèðð:

```
dtrace -l | more
```

¼èç ç Ûíäíð ðäñíÛäé ìÛóù ðíð äíçççðééÛí ðñíäñÛíìäðððð more, äéäöíñäðééÛ äñðäñä éä ððäñ÷äëéää ôçí ðñíóðñéíç ìÞíç ðçð ìèüíçð. Ïðí óçíäðí äðöü, éä ðñÛðäé íá èäññçèäð üðé ðí DTrace èäéðíðñäðð. Äðíäé ðëÛíí þñä íá äíäðÛóíðíä äððð ðç óäéñÛ äñäáëäðá.

Ç óäéñÛ öüí äñäáëäðá äðíäé ìéä óðéèíð äðü Ûðíèíä scripts ðíð äéðäëÛíðäé ìä öí DTrace þððä íá óðéèÛííð ðèçñíðññäðð ó÷äðééÛ ìä öí óýóçðíä. ÏðÛñ÷äé scripts ðíð äéÛä÷íöí äéä áíééðÛ äñ÷äðá, ðç ìÞíç, ðç ÷ñðç ðçð CPU éäé ðíèèÛ äéüñä. ÈÛíðä äíääñäð öüí scripts ìä ôçí äéüèððç áíðíèðð:

```
gunzip -c DTraceToolkit* | tar xvf -
```

Îäðäéíçèäððä óðíí èäðÛëíäð ðíð öá äðíóðíðéÛóäðä ìä ôçí áíðíèðð cd éäé äéèÛíðä öá äéèäèððäðä äéðÛéäçðð öá üéä öá äñ÷äðá, üððð óðä äñ÷äðá ìä öá ìéèñÛ äñÛíìäðä, óä 755.

Éä ÷ñäéäððäð íá äðñíðí äéèääÛððð ððí ðäñéä÷üìäñí öá üéä öá scripts. ¼ðä ðäñéÛ÷íöí ðí /usr/bin/ksh éä ðñÛðäé íá äéèä÷èÛíí óä /usr/local/bin/ksh, öá Ûéèä ðíð ðäñéÛ÷íöí ðí /usr/bin/sh éä ðñÛðäé íá äéèä÷èÛíí óä /bin/sh, éäé ðÛëò äðöÛ ðíð ðäñéÛ÷íöí ðí /usr/bin/perl éä ðñÛðäé íá äéèä÷èÛíí óä /usr/local/bin/perl.

**Ïçíäíðééü:** Ïðí óçíäðí äðöü äðíäé óçíäíðééü íá ððäíèðíðíðíðíä óðíí äíääíðððç üðé ç ððíóðÞñéíç DTrace óðí FreeBSD äðíäé äðäèðð èäé ðäèñäíäðéèðð. ðíèèÛ äðü äðöÛ öá scripts ääí éä èäéðíðñäððíðíðí, èäèðð äðíäé äððä ðíèÛ ðñíóäíäðíèèéðíÛíá óðí Solaris, Þ ÷ ñçóéíðíèððíðí probes öá ìðíðá ääí ððíóçññæííðäé ðç ääñíÛíç óðéäíð.

Ïç óðéäñð ðíð äñÛöíðäé äððÛð ìé äñäñÛð, ìüí äÛí scripts äðü ðç óäéñÛ äñäáëäðá ðíð DTrace ððíóçññæííðäé ðèðñðð óðí FreeBSD: öí hotkernel éäé öí procsystime. ÁðöÛ öá äÛí éä äíäñäðíððíðíä óðä äðüñäíä ðíðíäðä äðððð ðçð áíüðçðäð.

Ïí hotkernel Û÷äé ó÷äèäððäð íá äíääñññæäé ðíèä óðíÛñçðç èäðäíäèðíäé öí ìäääéÛðäñí ÷ ñüíí óðíð ððñÞíä. Äéðäèððäðð öí ððü èäííèéÛð óðíèðèäð, éä ääððä Ûíäí ðäñüíèéä ìä ôçí ðäñäéÛöù:

```
./hotkernel
```

Sampling... Hit Ctrl-C to end.

Ï äéá ÷ äéñéóóÐð òïð óðóóÐíáóïð èá ðñÝðáé íá ÷ ñçóéííðíéÐóáé òí óðíáóáóíü ðéÐéðñíí **Ctrl+C** äéá íá óðáíáðÐóáé òç äéáñááóóá. Ìá òíí òáñíáóéóíü òíð, òí script èá áðáééííßóáé íéá óáéñÛ áðü óðíáñðÐóáéð òíð ððñÐíá èáé ðéçñíöíñßáð ó÷áðééÛ Ìá òí ÷ ñüíí òíðð, òáíéíñþíóáð ðéð óá áýííðóá óáéñÛ áíÛéíáá Ìá òí ÷ ñüíí:

|                              |       |       |
|------------------------------|-------|-------|
| kernel`_thread_lock_flags    | 2     | 0.0%  |
| 0xc1097063                   | 2     | 0.0%  |
| kernel`sched_userret         | 2     | 0.0%  |
| kernel`kern_select           | 2     | 0.0%  |
| kernel`generic_copyin        | 3     | 0.0%  |
| kernel`_mtx_assert           | 3     | 0.0%  |
| kernel`vm_fault              | 3     | 0.0%  |
| kernel`sopoll_generic        | 3     | 0.0%  |
| kernel`fixup_filename        | 4     | 0.0%  |
| kernel`_isitmyx              | 4     | 0.0%  |
| kernel`find_instance         | 4     | 0.0%  |
| kernel`_mtx_unlock_flags     | 5     | 0.0%  |
| kernel`syscall               | 5     | 0.0%  |
| kernel`DELAY                 | 5     | 0.0%  |
| 0xc108a253                   | 6     | 0.0%  |
| kernel`witness_lock          | 7     | 0.0%  |
| kernel`read_aux_data_no_wait | 7     | 0.0%  |
| kernel`Xint0x80_syscall      | 7     | 0.0%  |
| kernel`witness_checkorder    | 7     | 0.0%  |
| kernel`sse2_pagezero         | 8     | 0.0%  |
| kernel`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 èáéóíðñááß 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 ðíí ÷ ñüíí ðüí êëÞóáíí óðóðÞíáðíð ãéá íéá óðãêãñëíÝíç äéãñãáóßá ìÝóù ðíð PID Þ ðíð ñíüíáðíð ðçð. Óðí ðãñáéÛðù ðãñÛãáéáíá Ý÷íðíá ñãêéíÞóáé íéá íÝá äéãñãáóßá ðíð /bin/csh. ÁéðãéÝóáíá ðí procsystime êáé ðí áðÞóáíá óççí áíáíííÞ êáëÞð ãñÛóáíá ñãñééÝð áíðíéÝð óðí csh ðíð áß÷áíá áííßíáé. ÁððÛ áßíáé óá áðíðãéÝóíáóá ðçð äíëéíÞð 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 óáßíáðáé, ç êëÞóç ðíð óðóðÞíáðíð ãéá áíÛáíùóç (read()) áßíáé áððÞ ðíð êáðáíáéÞíáé ðíð ðãñéóóóððãñí ÷ ñüíí óá íáííãáððãñüéãððá, áíÞ ðí êëãüðãñí ðíí êáðáíáéÞíáé ç êëÞóç óðóðÞíáðíð getpid().

## 25.5 Ç ÄëÞóóá D

Ç óáéñÛ ãñãáéãßüí DTrace, ðãñééáíáÛíáé áñêãðÛ scripts ãñãñÝíá óççí áéãééÞ äëÞóóá ðíð DTrace. Ç äëÞóóá áððÞ ñííÛãáðáé “ç äëÞóóá D” óççí ðãêíçñßùóç ðçð Sun, êáé áßíáé áñêãðÛ ùííéá ñ ðç C++. ÁíáéððéêÞ ðãñéãñãðÞ áððÞð ðçð äëÞóóáð áßíáé ðÝñá áðü ðíðð óéíðíýð ðóðíý ðíð êáéíÝíð. ÕðÛñ÷áé áíãñãÞ óðãÞðçóç ó÷ãðééÛ ñ ðððÞ, óçç äéãýéðíóç <http://wikis.sun.com/display/DTrace/Documentation>.



# ΕὰοÛεάεί 26 ÓαέñεάέÛò Àðéêéíεíùíβαò

## 26.1 Óýíñσç

Ôì UNIX ðÛíòíòá ððíòòPñεάά óáέñεάέÛò àðéêéíεíùíβαò. Æέá ðçí áέñβááέά, óá ðñòá UNIX ìç÷-áíPíáòá ááóβáεííòáí óá óáέñεάέÛò àñáñÛò áέá ðçí áβóíáí έάέ Ýíñáí óòí ÷ñPòðç. Óá ðñÛáíáòá ùòòòòí Ý÷-íòí áεεÛíáε ðíεý áðù ðéò ìÝñáò ðíò ðí ðóíçεéòíÝí “òáñíáòééù” áðíòáεíýíòáí áðù Ýíá óáέñεάέù áéòòðùòP 10 ÷-áñáéòPñùí ðí ááòòáññεáððòí έάέ Ýíá ðεççòññεüáéí. Ôí εáòÛεάεί áòòù εá έáέýòáé εÛðíεíòò áðù ðíòò ðñüðíòò óáέñεάέPò àðéêéíεíùíβαò ðíò ÷ñçóéííðíεíýíòáé áðù ðí FreeBSD.

Áöíý áεááÛóáòá áòòù ðí εáòÛεάεί, εá ñÝñáòá:

- Ðùò íá óòíáÝóáòá ðáñíáòééÛ óòí FreeBSD óýóòçíá óáò.
- Ðùò íá ÷ñçóéííðíεPóáòá Ýíá modem áέá íá óòíááéáβáò óá áðñáέñòòíÝíá óòòòPíáòá.
- Ðùò íá áðéòñÝòáòá óá áðñáέñòòíÝíòò ÷ñPòðáò íá óòíááéýí óòí óýóòçíá óáò ìÝòù modem.
- Ðùò íá áéééPóáòá ðí óýóòçíá óáò ìÝòù óáέñεάέPò éííóüéáò.

Ðñéí áεááÛóáòá áòòù ðí εáòÛεάεί, εá ðñÝðáé:

- Íá ñÝñáòá ðùò εá ñòéìβóáòá έάέ εá ááεáòáóòPóáòá Ýíá ñÝí ðòñPíá (ΕὰοÛεάεί 8).
- Íá έáóáñíáβáò ðéò Ûááéáò έάέ áεáñááóβáò ðíò UNIX (ΕὰοÛεάεί 3).
- Íá Ý÷-áòá ðñüóááóç óòí ðá÷-íééù áá÷-áέñβáéí ðíò ðéééý óáò (modem P εÛñòá ðíεεáððéPí óáέñεάέPí èòñPí) ðíò èÝéáòá íá ÷ñçóéííðíεPóáòá óòí FreeBSD.

## 26.2 ÁέóááñùáP

### 26.2.1 Ìñíεíñáβá

bps

Bits ÁíÛ Ááòòáññεáððòí — ñ ñòéìùò ìáòÛáíòçò ðùí áááñÝíùí

DTE

Data Terminal Equipment, Óáñíáòééùò Áñðééóíùò ÁááñÝíùí — áέá ðáñÛááéáíá, ñ ððíεíñεéòðò óáò

DCE

Data Communications Equipment, Áñðééóíùò Áðéêéíεíùíβαò ÁááñÝíùí — ðí modem óáò

RS-232

Ðñüòððí ðçò EIA áέá ðí ðéééù ðíò ÷ñçóéííðíεáβóáé óòéò óáέñεάέÛò àðéêéíεíùíβαò

¼òáí áíáòáññüáòáòá óòí ñòéìù ìáòÛáíòçò áááñÝíùí àðéêéíεíùíβαò, ááí ÷ñçóéííðíεýíá ðÛíòíòá ðíí ùñí “baud”. Ôí baud áíáòÝñáòáé óòíí áñéèíù ðùí ìáòááÛóáùí ðíò çεáéòñééý óPíáòíò óòç ñíÛáá ðíò ÷ññíò, áíP έáñíééÛ ðñÝðáé íá



| Óβιá | ÁέñíáÛέòçò # | óðíáÛáðáέ óðí | ÁέñíáÛέòçò # | Óβιá |
|------|--------------|---------------|--------------|------|
| TD   | 3            | óðíáÛáðáέ óðí | 2            | RD   |
| DTR  | 4            | óðíáÛáðáέ óðí | 6            | DSR  |
| DTR  | 4            | óðíáÛáðáέ óðí | 1            | DCD  |
| SG   | 5            | óðíáÛáðáέ óðí | 5            | SG   |
| DSR  | 6            | óðíáÛáðáέ óðí | 4            | DTR  |
| DCD  | 1            | óðíáÛáðáέ óðí | 4            | DTR  |
| RTS  | 7            | óðíáÛáðáέ óðí | 8            | CTS  |
| CTS  | 8            | óðíáÛáðáέ óðí | 7            | RTS  |

**Δβιáέάò 26-3. Έάέβáετ Null-Modem DB-9 óá DB-25**

| Óβιá | ÁέñíáÛέòçò # | óðíáÛáðáέ óðí | ÁέñíáÛέòçò # | Óβιá |
|------|--------------|---------------|--------------|------|
| RD   | 2            | óðíáÛáðáέ óðí | 2            | TD   |
| TD   | 3            | óðíáÛáðáέ óðí | 3            | RD   |
| DTR  | 4            | óðíáÛáðáέ óðí | 6            | DSR  |
| DTR  | 4            | óðíáÛáðáέ óðí | 8            | DCD  |
| SG   | 5            | óðíáÛáðáέ óðí | 7            | SG   |
| DSR  | 6            | óðíáÛáðáέ óðí | 20           | DTR  |
| DCD  | 1            | óðíáÛáðáέ óðí | 20           | DTR  |
| RTS  | 7            | óðíáÛáðáέ óðí | 5            | CTS  |
| CTS  | 8            | óðíáÛáðáέ óðí | 4            | RTS  |

**Όçíáβúòç:** ¼ðáí Ûιáò áέñíáÛέòçò óá ιέá Ûέñç ÷ ñáέÛæáðáέ ιά óðíááέáβ ιá áÿí áέñíáÛέòçò óðçí Ûέέç, óðíβεúò áιβίτíá ðίòò áέñíáÛέòçò ιáðáíÿ ðίòò óðç ιέá Ûέñç ιá Ûιá ιέέñú έάέβáετ, έάέ ÷ ñçóέίτíείÿιá Ûιá ιάέñÿðáñí έάέβáετ áέá ðçí Ûιúòç ιá ðçí Ûέέç Ûέñç.

Ç ðáñáðÛúò áέÛðáιç óáβιáðáέ ιá áβιáέ ç ðετí áέάáááñÛίç. Óá ιέá ðáñáέέááβ (ðίò áιçáááβðáέ óðí áέάέβι Óí RS-232 ιá *ÁðέÛ Áβιáðá*), ðí SG óðíáÛáðáέ óðí SG, ðí TD óðíáÛáðáέ óðí RD, ðá RTS έάέ CTS óðíáÛιáðáέ óðí DCD, ðí DTR óðíáÛáðáέ óðí DSR, έάέ áίòβòðñíóá.

**26.2.2.1.2 ÓððíðίεçíÛιá Έάέβáέá RS-232C**

ιá ðòððíðίεçíÛιá óáέñέάέú έάέβáετ RS-232C, ιáðáóÛñáέ úέá ðá óβιáðá áðáðεáβáð áðú ðç ιέá Ûέñç óðçí Ûέέç, ÷ ùñβð έáιεÛ áέέááβ óðίòò áέñíáÛέòçò. Áòðú áðέÛ óçíáβιáέ úέέ í áέñíáÛέòçò “ÛáðÛáιόçð ÁááñÛιúι (TD)” ðçò ιέáð Ûέñçð, óðíáÛáðáέ óðíí áέñíáÛέòç “ÛáðÛáιόçð ÁááñÛιúι (TD)” ðçò Ûέέçð Ûέñçð. Áòðú áβιáέ έάέ ðí áβáιò ðίò έάέúáβίò ðίò έá ÷ ñçóέίτíεβóáðá áέá ιá óðíáÛóáðá Ûιá modem óðí FreeBSD óÿóòçιá óáð, έάέ áβιáέ áðβòçð έáðÛέέçετ áέá ιñέóίÛιá ðáñíáðέέÛ.













- ③ Õí ðñβðí ðääβí áβíáé í óýðíð ðíð ðääñíáðééý ðíð óðíáÝáðáé óðíβèùð óá áððβ ðç äñáñíβ tty. Áéá èýñáð áðéëíäéëβí óðíáÝóáñí (dial-up), ç ðéíβ áððíý ðíð ðääβíð óð÷íÛ éá áβíáé unknown β dialup, éáëβð íé ÷ ñβóðáð éá ðñíñíý íá ðñáñíáðíðíéβðíðí óýíááóç íá ðñíñíáβðíðíá éíäéóíééü β ðääñíáðééü. Áéá Ûíáóá óðíáñíÝíá ðääñíáðééÛ, í óýðíð ðääñíáðééý äáí äééÛäé, Ýðóé ðñíñáβðá íá áÛéäðá Ý íá ðñáñíáðééü óýðí ðääñíáðééý óá áððü ðí ðääβí, ðí ðñíβí éá äñáβðá óðç áÛóç äääñÝíñí ðíð termcap(5).

Áéá ðáñÛäéäñí, ðí Wyse-50 ÷ ñçóéíðíéáβ ðí ðñáñíáðééü óýðí ðääñíáðééý ðíð, áíβ ðí 286 PC ðíð äéðäéáβ ðí Procomm, Ý ÷ äé ñðéíéóðáβ íá äññéβíáé ðääñíáðééü óýðíð VT-100.

- ④ Õí ðÝðáñðí ðääβí éáéíñβäé áí ç èýñá éá áβíáé áíáñáβ. Õíðíéäðβíóáð äáβ ðç èÝíç on, ç init éá íäééíβóáé ðí ðññáñíá ðíð áíáóÝñáðáé óðí äáýðáñí ðääβí, ðçí getty. Áí áÛéäðá off óá áððü ðí ðääβí, äáí éá äéðäéáóðáβ ç getty, éáé Ýðóé äáí éá ðñíñáβ íá áβíáé áβóíñíð óðí óýóðçíá áðü ðç óðäéäñéñíÝíç èýñá.

- ⑤ Õí ðäéäððáβí ðääβí ÷ ñçóéíðíéáβðáé äéá íá éáéíñβóáé áí ç èýñá áβíáé áóðáéβð. Áí ÷ äñáéðçñíβóáðá íéá èýñá ðð áóðáéβ, óçíáβíáé ððé ðçí äíðéóðáýáóðá äñéäðÛ βóðá íá äðéðñÝðáðá ðçí áβóíñí ðíð root íÝóú áðððð (β ðñíñíáβðíðá éíäéäéóíñý íá ID 0). Äáí äðéðñÝðáðá ç áβóíñíð ðíð root óá íéá èýñá ðíð Ý ÷ äé ÷ äñáéðçñéóðáβ íç-áóðáéβð. Óá íç-áóðáéáβð èýñáð, íé ÷ ñβóðáð ðñÝðáé íá äéóÝñ÷ííðáé ÷ ñçóéíðíéβíóáð Ý íá óðíçééóíÝíí éíäéäéáóíü ÷ ñβóðç, éáé íá ÷ ñçóéíðíéýí ðçí áíðíèβ su(1) β Ûééí áíðβóðíé÷í ç ÷ áíéóíü äéá íá áðíèβðíðí ðñíñíéá ððáñ ÷ ñβóðç.

Óáð óðíéóðíýíá áíáðéóýéáéðá íá ÷ ñçóéíðíéβíóáðá ðç ñýèíéóç “insecure”, áéñíá éáé äéá ðääñíáðééÛ ðíð äñβóéííðáé óá èéäéäñíÝíá äñíÛðéá. Áβíáé äñéäðÛ äýéíéí íá äéóÝèäðá ðð éáñíééüð ÷ ñβóðçð éáé íá ÷ ñçóéíðíéβíóáðá ðçí áíðíèβ su áí ÷ ñäéÛäéáóðá ðñíñíéá ððáñ ÷ ñβóðç.

### 26.3.2.2 ÁíáíáäéÛóðá ðçí init íá ÍáíáäéááÛóáé ðí /etc/ttys

÷ííðáð èÛíáé ðéð áðáñáβðçðáð äééäáÝð óðí äñ÷áβí /etc/ttys, éá ðñÝðáé íá óðáβéäðá óðíá SIGHUP (hangup) óðçí äéäñááóá ínit äéá íá ðçí áíáäéÛóðá íá äéááÛóáé íáíÛ ðí äñ÷áβí ñðéíβóáñí ðçð. Áéá ðáñÛäéäñí:

```
kill -HUP 1
```

**Óçíáβòóç:** Ç init áβíáé ðÛíðíðá ç ðñβðç äéäñááóá ðíð äéðäéáβðáé óá Ý íá óýóðçíá, éáé Ýðóé éá Ý ÷ äé ðÛíðíðá ðíí äñéèü äéäñááóáð (PID) 1.

Áí ðéäð íé ñðéíβóáéð áβíáé óùóðÝð, ðá éáéβäéá áβíáé óðç èÝóç ðíðð, éáé ðá ðääñíáðééÛ áβíáé áíáñáÛ, éá äéðäéáóðáβ ç getty óá èÛéä ðääñíáðééü, éáé ððí óçíáβí áððü éá äáβðá ðçí ðñíðñíðβ áéóúñíð (login) óðéð íèñíáð ðñí ðääñíáðééβí óáð.

### 26.3.3 Áíðéíáðβðéóç ðñíñáçíÛóñí Óýíááóçð

Áéñíá éáé áí äðáðá íááÛéç ðñíñí÷β óðéð éäððñÝñáéäð, ðÛíðá ðñíñáβ íá ðÛäé èÛðé óðñááÛ ððáí ñðéíβäðá Ý íá ðääñíáðééü. Äáβ éá äñáβðá íéá èβóðá áðü óðíððñíáðá éáé óðíéóðñíáíáð äéññéβðáéð.









```
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 οοίαΎόάεδ 8bit ÷ùñβδ εοίθείβá.

Όι δάηάδΎιϋ δάηΎάέαιά, ίάέειΎ οι ñειϋ άδέειέιϋβδ οόά 19.2 Kbps (άέά ίεά ούίάαόç V.32bis), έάέ Ύδάέόά äíέειΎεάέ έδέέέέΎ οόά 9600 bps (άέά V.32), 2400 bps, 1200 bps, 300 bps, έάέ δβού οόά 19.2 Kbps. ΆδδP ç έδέέέέP άίάέέάP ñειϋ άδέδδ÷Ύίάόάέ ίά όçί έέάίϋόçδά nx= (“next table”). ÊÛεά ίεά άδϋ δέδ άηάιΎδ ÷ñçοέιθίέάβ ίεά έάόά÷βñέόç tc= (“table continuation”) άέά ίά άηάέ δέδ δδϋέιέδδδ “οδδθίέçίΎίάδ” ñειβόάέδ άέά έÛθίέί οόάέέηέίΎί ñειϋ ίάδΎάιόçδ άάηΎίϋί.

Άί Ύ÷άδå modem 28.8 Kbps P/έάέ εΎέάδå ίά άδϋόάέçδάβδå άδϋ όçί οοιδβάόç άϋϋδ modem 14.4 Kbps, έά δñΎδå ίά ÷ñçοέιθίέPδåδå ñειϋ άδέειέιϋβδ ίάάέϋόάñί άδϋ 19.2 Kbps. ΔάηάέÛδϋ οάβίάόάέ Ύίά δάηΎάέαιά ίεά έάόά÷βñέόçδ οοί gettytab θίθ ίάέειΎάέ άδϋ 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 άηάϋ άδάίάηάάόδP P ίάάÛέί οίñδβί, έάέ οι ούόόçίά οάδ άάί άέάέΎδåέ οάέηέέΎδ εϋñάδ θίθ ίά άάόβæίθάέ οοί 16550Á, βούδ εÛάάδå εÛεç “sio” “silo” οόά 57.6 Kbps.

**26.4.4.2 /etc/ttys**

÷ιδία Pæç έάέϋόάέ όç ñϋέιέόç οίθ άñ÷άβίθ /etc/ttys οοί ΔάηΎάέαιά 26-1. Ç ñϋέιέόç άέά modems άβίάέ δάηϋίίέά, άέέÛ δñΎδå ίά άβίθία άέάοίñάδέέϋ ùñέοία όόçί getty έάέ ίά έάέιñβίθία άέάοίñάδέέϋ όϋθί δάñίάδέέίϋ. Ç άάίέέP ññθP οϋοί άέά έέάέϋιΎίç ϋοί έάέ άέά ίάδάάέçδP όά÷ϋόçδά άβίάέ ç δάηάέÛδϋ:

```
ttyd0 "/usr/libexec/getty xxx" dialup on
```

Όι δñθιθί δάάβι όόçί δάηάδΎιϋ άηάιP άβίάέ οι άέάέέϋ άñ÷άβι οδóέάδPδ άέά άδδP όçί έάόά÷βñέόç — οι ttyd0 άίόέόοίέ÷άβ οοί άñ÷άβι /dev/ttyd0 οι ίθίβι έάέ έά δάηάέίέιθέάβ ç getty. Όι άάϋόάñί δάάβι, "/usr/libexec/getty xxx" (οί xxx έά Ύ÷άέ όçί άñ÷έέP όέίP έέάίϋόçδάδ οίθ gettytab), άβίάέ ç έέάñάάόβά θίθ έά άέδåέΎόάέ ç init όόç οδóέάδP. Όι οñβθί δάάβι, dialup, άβίάέ ι θñίάδέέάñίΎίθ όϋθίθ δάñίάδέέίϋ. Ç





Έα δñΎδαι ία αδαίανάρθιεΠοάοά Π ία αδññπρoάoά οίoδ εuaέειγo αδιoάεάoιΰoύι oόi modem, αέα ία αδιoγáαoά δññiεΠιαoά θίo ιδιñíγί ία αειείoññαειγί άί ç getty αδú εΰεiδ oόáβεάε δññoññδΠ login: oόi modem áñ δoóú áñβoéáoάé oá εáoΰoóoáç áíoieπí. Óoçí δáñβδoóç áoδΠ, oí modem ιδιñáβ ία áíáδáñΰááé ίáíΰ oçí áíoieΠ (echo) Π ία oóáβεάé εΰθιεi εuaέeu αδιoάéΎoíaóio. Αoóu ιδιñáβ ία Ύ ÷ áé uδ αδιoΎεάoía íéá ίáéñú ÷ ñíç εάé ÷ áεΠ oóñíéεβá ίáoáíγ oío modem εάé oçδ getty.

**26.4.5.1 Νoειβoάéο áéá ΈεάéáñΎίç Óá ÷ γoçoá**

Άέα εáεoíoñáβá oá εéáéáñΎίç oá ÷ γoçoá, éá ÷ ñáéáoóáβ ίá ñoειβoάoά oí modem ίá áéáoçñáβ oóáéáñΠ oá ÷ γoçoá oθiεiáéoδΠ — modem, ΰo ÷ áoá ίá oçí oá ÷ γoçoá áδééiéiúβáδ oçδ áδééiáééΠδ oγíááoçδ. Óá Ύίá áñuδáñééu modem U.S. Robotics Sportster 14,400, íé áíoieΎδ áoδΎδ éá ééáéáπoíoí oçí áδééiéiúβá oθiεiáéoδΠ — modem oóçí βáéá oá ÷ γoçoá θío Ύáéíá ç εΠoç oúí áíoieπí:

ATZ  
AT&B1&W

**26.4.5.2 Νoειβoάéο áéá ίáoááεçoΠ Óá ÷ γoçoá**

Άέα εáεoíoñáβá oá ίáoááεçoΠ oá ÷ γoçoá, éá ÷ ñáéáoóáβ ίá ñoειβoάoά oí modem oáo ίá δññoáññuáéé oçí oá ÷ γoçoá oçδ oáéñéáéΠδ éγñáδ oío πoáá ίá oáéñéΰæáé ίá áoδΠ oçδ áéoáñ ÷ ùáíçδ éεΠoçδ. Óá Ύίá áñuδáñééu modem U.S. Robotics Sportster 14,400, íé áíoieΎδ áoδΎδ éá ééáéáπoíoí oçí oá ÷ γoçoá ίáoáoñΰδ áááñΎíúí ίá áéuñèuóç éáéπí oío modem oóçí oá ÷ γoçoá θío ÷ ñçoéiθiεΠεçéá áéá oçí áδiíoíeΠ oúí áíoieπí, áéεΰ éá áδéoñΎθioí oóçí oá ÷ γoçoá oçδ oáéñéáéΠδ éγñáδ ίá ίáoááΰεéáoáé áéá oóíáΎoáéδ θío ááí Ύ ÷ íoí áéuñèuóç éáéπí:

ATZ  
AT&B2&W

**26.4.5.3 εáá ÷ ío oúí Νoειβoάoúí oío Modem**

Óá δáñéoóúoáñá modem oθçεΠδ oá ÷ γoçoáδ, δáñΎ ÷ íoí áíoieΎδ ίá oéδ ιθiβáδ ιδιñáβoá ίá δáñáéiεiεΠoáoá oéδ oñΎ ÷ íoóáδ δáñáíΎoñíoδ éáéoíoñáβáδ oíoδ ίá o ÷ áδééΰ éáoáíçoú oñúδi. Óoí áñuδáñééu modem U.S. Robotics Sportster 14,400, ç áíoieΠ AT15 ááβ ÷ íáé oéδ ñoειβoάéο θío áβiáé áθiεçéáoíΎíáδ oóç íç-δoçoééΠ RAM oío modem. Άέα ίá ááβoá oéδ δñááíáoééΎδ δáñáíΎoñíoδ éáéoíoñáβáδ oío modem (úθuδ áoδΎδ áδçñáΰáεíiíoáé αδú oéδ éΎoáéδ oúí ñoειoóééπí áéáéiθoπí oío), ÷ ñçoéiθiεΠoá oéδ áíoieΎδ ATZ éáé ίáδΰ AT14.

Άí áéáéΎoáoá modem ΰεεçδ áoáéñβáδ, áéΎáñoá oéδ ñαçáβáδ ÷ ñΠoçδ oío áéá ίá ááβoá θuδ ιθiñáβoá ίá áéΎáñáoá ίá oéáíoñéΰ oéδ δáñáíΎoñíoδ ñγéiεoçδ oío.

**26.4.6 Άíoéiáoπδoóç Δññáéçíΰoúí**

Δáñáéΰoú éá áñáβoá ίáñééΰ áΠiáoá θío ιθiñáβoá ίá áéiεiεΠoáoá áéá ίá áéΎáñáoá oç éáéoíoñáβá oío modem oóí oγóoçíá oáo.

**26.4.6.1 ΆéΎá ÷ íioáo oí Oγóoçíá oáo**

ÓoíáΎoá oí modem oóí FreeBSD oγóoçíá oáo, áéééiΠoá oí, éáé áí oí modem oáo áéáéΎoáé oúoáéíΎδ áíááβiáéδ éáδΰoóoáoçδ, δáñáéiεiεΠoá oéδ áéá ίá ááβoá áí áíáñáíθiεáβoáé ç Ύíááéiç DTR uóáí áioáíβáéáoáé ç δññoññδΠ





pn=\@

### 26.5.4 Ðùð Ìðññþ íá Êäéÿóù ÿá Ôçäâöüíééü Áñéèü Áðü ôçí ãñáìþ Áíðíëþí;

ÁÛëðá íéá “ãáíééþ” éáðá÷þñéóç óðí áñ÷áβí /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 ìðññáβðá íá äβíðáðá áíðíëÿð üðùð:

```
tip -115200 5551234
```

Áí ðñíðéíÛðá ôçí cu áíðá ãéá ôçí tip, ÷ñçóéíðíéþðóðá íéá äáíééþ éáðá÷þñéóç ãéá ôçí cu:

```
cu115200|Use cu to dial any number at 115200bps:\
 :dv=/dev/cuad1:br#57600:at=hayes:pa=none:du:
```

éáé ðéçéðñíëíãþðá:

```
cu 5551234 -s 115200
```

### 26.5.5 Ðñÿðáé íá Ðéçéðñíëíãþ ðí Ñðéíü bps ÊÛëá ÖññÛ ðíð ðí ÊÛíü Áóðü;

Éá ðñÿðáé íá ðñíðéÿóðá íéá éáðá÷þñéóç tip1200 P cu1200, áéëÛ ìðññáβðá íá áÛëðáðá ôçí äééþ óáð áðééðíçðþ ðéþ óðçí ééáíüðçðá br. Ç áíðíëþ tip éáññáβ üðé ðá 1200 bps äβíáé íéá éáéþ ðñíãðéëíãþ, éáé áéá ðí éüáí áððü ðÛ÷íáé íá ãñáé íéá éáðá÷þñéóç tip1200. Ááí ÷ñáéÛæáðáé ùððüðí íá ÷ñçóéíðíéþðóðá ðá÷ýðçðá 1200 bps.

### 26.5.6 ÷ù Ðñüðááóç óá ÿá Áñéèü Öðíëíáéóðþí Ìÿóù Áíüð Áíððçñáðçðþ Õáñíáðééþí

Áíðá íá ðáñéíÿíáðá ìÿ÷ñé íá óííáäéáβðá éáé íá ðéçéðñíëíãþðá CONNECT host êÛëá öññÛ, ÷ñçóéíðíéþðóðá ôçí ééáíüðçðá cm ðíð tip. Áéá ðáñÛäáéáíá, äáβðá ðéð ðáñáéÛðù éáðá÷þññóáéð 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 áðéðñÿðáé íá äñÛðáðá tip pain P tip muffin áéá íá óðíáÿáóðá óðíðð ððíëíáéóðÿð pain P muffin, éáé tip deep13 áéá íá óðíáÿáóðá óðíí áíððçñáðçðþ ðáñíáðééþí.

### 26.5.7 Ìðññáß ç Tip íá ÄíëéíÛóääé Ðañéóóúòðññò Áðü íéá ÄñáííÝò äéá êÛëä Óýíääóç;

Áðóóü òí ðññúääçíá óóíβëòð àìòáíβæääðáé óää Ýíá ðáíáððéóððíëí ðíò Ý ÷ äé áñéääòÝò ãñáííÝò äéá modem, äéëÛ êáé ÷ ééëÛääð öíéóçðÝð ðíò ðññóððáéíýí íá óéð ÷ ñçóéííðíéðóíóí.

Äçíëíòññáðóðää íéá éáðá ÷ ðññéóç äéá òí ðáíáððéóððíëí óáð óðí /etc/remote êáé ÷ ñçóéííðíéðóðää òí @ óóçí ééáíúóçðá ðñ:

```
big-university:\
 :pn=@:tc=dialout
dialout:\
 :dv=/dev/cuad3:br#9600:at=courier:du:pa=none:
```

ðññéðá, äçíëíòññáðóðää íéá éβóðá íä òíòð áñééííýð óçéääðñíúí òíò ðáíáððéóçðíβíò óðí /etc/phones:

```
big-university 5551111
big-university 5551112
big-university 5551113
big-university 5551114
```

Ç tip éá äíëéíÛóääé êÛëä íβá, íä óç óáéñÛ ðíò àìòáíβæííðáé, êáé éá óðáíáððóðáé. Áí èÝëääðá íá óóíá ÷ βæää óçí ðññóððÛëääéá, äéðääéÝóðää óçí tip ìÝóá óää Ýíá áññü ÷ ì while.

### 26.5.8 Äéáóß ÐñÝðáé íá ÐéÝóóü Ctrl+P Äýí ÖíñÝò äéá íá Óðáßëü òí Óóíäðáóíü Ctrl+P íéá ÖíñÛ;

Ì óóíáððáóíüð ðéðéðññí **Ctrl+P** áðíòääéáß òíí ðññíððééääíÝíí ÷ áñáéððñá “áíáíáääéáóííý (force)”, êáé ÷ ñçóéííðíéääðóðáé äéá íá éáðáéÛääé ç tip úðé ì áðññáíñò ÷ áñáéððñáð éá ðñÝðáé íá ÷ ñçóéííðíéçéääß ùðüð áβíáé. Ìðññáβðää íá èÝóáðää òíí ÷ áñáéððñá áíáíáääéáóííý óää ìðíëíáððíòää Ûëëí ÷ áñáéððñá, ÷ ñçóéííðíéðíóðää óçí áéíëíòðéβá äéáððáðð ~s, ç ìðíβá óçíáβíáé “ñýèíéóää íéá íääóääççðβ”.

Ðççéðññíëíáðóðää ~sforce=single-char êáé óóíá ÷ βóðää íä Ýíá ÷ áñáéððñá íÝáð ãñáííðð. Òí single-char áβíáé ìðíëíóáððíòää ìííüð ÷ áñáéððñáð. Áí áððóðáðää éääíú òí single-char, ì ÷ áñáéððñáð áíáíáääéáóííý éá áβíáé ì nul, òíí ìðíβí ìðññáβðää íá ðççéðññíëíáðóðää ÷ ñçóéííðíéðíóðää òí óóíáððáóíü ðéðéðññí **Ctrl+2 P Ctrl+Space**. Íéá áñéääòÛ éáéðð óéíð äéá òí single-char áβíáé òí **Shift+Ctrl+6**, ðíò ÷ ñçóéííðíéääðóðáé ìúíí óää èÛðíëíòð áíòðçññáðóçðÝð ðáññíáðééðí.

Ìðññáβðää íá ìññóðáðää òí ÷ áñáéððñá áíáíáääéáóííý óää ùðíëíí áóáßð áðééðíáβðää, íä óçí áéíëíòðçç éáðá ÷ ðññéóç óóíí áñ ÷ áβíí \$HOME/.tiprc:

```
force=single-char
```

### 26.5.9 ÍáóíééÛ ¼óé ÄñÛóóü Àìòáíβæääðáé íä Êáðáéääáβá ÄñÛííáðá!!

Ûëëëíí Ý ÷ áðää ðéÝóáé **Ctrl+A**, ðíò áβíáé ì “ ÷ áñáéððñáð áíýðòóçð” óçð tip, êáé áβíáé ó ÷ ääéáóííÝíúð äéáééÛ äéá úóíòð Ý ÷ ìòí ðññúääçíá íä òí ðéðéðññí **CAPS LOCK**. × ñçóéííðíéðóðää óçí áíóíëð ~s ðíò ááβíáíá ðáñáðÛñ, äéá íá èÝóáðää íéá ëíäééðð óéíð óóç íääóääççðβ raisechar. Óóçí ðññáííáðééúóçðá, ìðññáβðää íá èÝóáðää óçí βæää óéíð ìä òíí ÷ áñáéððñá áíáíáääéáóííý, áí ááí óéíðáýáðää ðíòÝ íá ÷ ñçóéííðíéðóðáðää èÛðíëíá áðñ áððÝð ðéð äóíáðóóçðáð.

ÐáñáéÛóóü óáβíáðáé Ýíá ððññáéääíá áñ ÷ áβííò .tiprc, òí ìðíβí áβíáé óÝéääéíí äéá ÷ ññóðáðð òíò **Emacs** ðíò ÷ ñáéÛæääðáé íá ðççéðññíëíáíýí óð ÷ ìÛ **Ctrl+2** êáé **Ctrl+A**:



### 26.6.2 Νýειέος ΟάέñέάέΎδ Είιούεάδ (Όýιόιιç êäiός)

Ç áíúóçδά áδδΎ δθιέΎδάε úεε όειδäýáδδ íá ÷ñçόείιθιέΎδάδδ όεδ δñiáδέεääiΎiáδ ñδèiβóáεδ, έάέ èΎεάδδ áδθδ iέá äñβáñç áδθέóεúδçόç όçδ áέáάέέάδβáδ ñýειέόçδ όçδ όάέñέάέΎδ έιιούεάδ.

1. ΌδiáΎόδδ όi όάέñέάέú εάέβáει όόçí COM1 έάέ όóí δáñiáδέéú.
2. Άέά íá äáβδá úεá όá içýiýiáδá áêêβiçόçδ όόçí όάέñέάέΎ έιιούεά, äβóδá όçí δáñáέΎδúδ áíóíεΎ úδ δδäñ ÷ñβóδçδ:  
# echo 'console="comconsole"' >> /boot/loader.conf
3. Άδäiñáñááδδáβδá όi /etc/ttys έάέ áέéΎiδá όi off óá on έάέ όi dialup óá vt100 áέá όçí έáδá ÷βñέόç ttyd0. ΆέάóñiáδέéΎ, äáí έá ÷ñáέΎæáδáέ èúáέéúδ δñúóááδçδ áέá όç óýiááόç iΎóú όçδ όάέñέάέΎ έιιούεάδ, όi iδiβi áδiδáέäβ δέέáíú έáíú áóóáέäβáδ.
4. Άδäíáêééiβóδá όi óýóδçiá áέá íá äáβδá áí βó ÷δóáí ié áέéáΎΎδ.

Áí ÷ñáέΎæáδδá áέáóñiáδέéΎδ ñδèiβóáεδ, έá äñáβδá έäδδñΎñáέáδ áέá όçí ñýειέόç όóí Όiβiá 26.6.3.

### 26.6.3 Νýειέος ΟάέñέάέΎδ Είιούεάδ

1. ΔñiáδóíεiΎóδá Ύiá όάέñέάέú εάέβáει.  
Έá ÷ñáέóδδáβδá áβδá Ύiá έάέβáει όýδiθ null-modem, áβδá Ύiá όδδiθiέçiΎi i όάέñέάέú εάέβáει έάέ Ύiá δñiόáñiñáΎiá null-modem. Άáβδá όi Όiβiá 26.2.2 áέá έäδδñΎñáέáδ ó ÷áδééΎ iá όá áβäç úúí όάέñέάέβi έáέúäβúí.
2. ΆδiόóíáΎóδá όi δέçéδñiεúáει óád.  
Όá δáñέóδúδäñá PC øΎ ÷ñiθi áέá όi δέçéδñiεúáει έáδΎ όçí äéΎñéáέá úúí áέááñúóδέéβi áêêβiçόçδ (POST, Power On Self Test), έάέ έá áiáóΎñiθi óóΎεiá áí όi δέçéδñiεúáει äáí áβiáέ óóíáäiΎiñ. IñáééΎ iç ÷áíβiáδá δáñáδiíέiýiáέ ç ÷çñΎ áέá όçí Ύέéáέθç δέçéδñiεiáβiθ, έάέ äáí óóíá ÷βæiθi όçí áêêβiçόç iΎ ÷ñé íá όi óóíáΎóáδá.  
Áí i δθiεiñáέóδδδ óád δáñáδiíέΎóáέ áέá όi èΎεiθ, áέéΎ iñééiΎ Ύóóé έάέ áέéεβδ, äáí ÷ñáέΎæáδáέ íá èΎiáδá óβδiθiá έáέáβδäñi áέá áδóú. (IñáééΎ iç ÷áíβiáδá iá BIOS όçδ Phoenix, èΎiá áδθδ "Keyboard Failed" έάέ óóíá ÷βæiθi όçí áêêβiçόç έáñiíέéΎ.)  
Áí i δθiεiñáέóδδδ óád áñiáβδáέ íá áêééiβóáέ ÷úñβδ δέçéδñiεúáει, έá δñΎδáέ íá ñδèiβóáδá όi BIOS βóδá íá äáñiáβδ όi èΎεiθ (áí áβiáδáέ). Όóíáñiθéäδóδáβδá όi äá ÷áéñβáει όçδ içδñééΎδ óád áέá έäδδñΎñáέáδ ó ÷áδééΎ iá áδδΎ όç áέáάέέáδβá.

**Όδúááέiç:** Ñδèiβóδá όi δέçéδñiεúáει óá "Not installed" όóí BIOS. Ç ñýειέόç áδδΎ áδθδδ áδiδñΎδáέ όi BIOS áδú όi íá áiέ ÷iáýáέ όi δέçéδñiεúáει όόçí áêêβiçόç, έάέ äáí δñúéáέéδáέ íá óád áiδiáβóáέ íá όi ÷ñçόείiθiέβóáδá έáíiíέéΎ. Iδiñáβδá íá áδβóáδá όi δέçéδñiεúáει óóíáäiΎiñ áέúiá έáέ úδáí Ύ ÷áδá áíáñáñiθiέβóáέ όç ñýειέόç "Not installed". Áí äáí óδΎñ ÷áέ ç δáñáδΎiú ñýειέόç όóí BIOS, øΎiθá áέá όçí áδééiäβ "Halt on Error". ÁééΎiθá όç óá "All but Keyboard" β áέúiá έáέ óá "No Errors", έάέ έá Ύ ÷áδá όi βáει áδiθΎέáδiá.

**Όçiáβúóç:** Áí όi óýóδçiá óád áέáέΎδáέ δiñóβéé όýδiθ PS/2θ, δέέáíúí íá δñΎδáέ íá όi áδiόóíáΎóáδá έáέ áδóú. Όá δiñóβééá όýδiθ PS/2 Ύ ÷iθi èΎδiέá éδééβiáδá éiéiΎ iá όi δέçéδñiεúáει, äááñiúó δiθ iδiñáβ íá δñiέáέΎóáέ óýá ÷óç όóí δñúäñáñiá áíβ ÷iáδóçδ dñδ δέçéδñiεiáβiθ. ÈΎδiέá óóóβiáδá, úδúδ όi Gateway 2000 Pentium 90 MHz iá AMI BIOS, óóíδáñéóΎñiθiáέ iá áδóú óiθ dñúδi. Όá äáíέéΎδ áñáñiΎδ, áδóú äáí áβiáέ δñúáέçiá έáέβδ όi dñiόβéé Ύóóé έάέ áέéεβδ äáí áβiáέ ÷ñβóéiñ ÷úñβδ όi δέçéδñiεúáει.



Όι άη÷άβι άδου έά έάδάδδέγιάέ οίι έβιέέά οίτ boot block ό÷άδέέΰ ιά οί δυδ εΎεάδ ά άέέείΠόάέ οί όγόδγιά. Άέά ίά άίάηάιθιεΠόάδ ά όγί οάέηέάέΠ έίίούέά, έά ÷ηάέάόδάβδ ά ίβ Π δάηέόούδάηάδ άδύ οέδ δάηάέΰδ άδέείάΎδ—άί εΎεάδ ά ίά δηιόάειηβδ άδ δίεέάδεΎδ άδέείάΎδ, έά δηΎδ άέ ίά οέδ δάηέέΰάάδ άέάδ όδγί βάέά άηάηΠ.

-h

Άίάέέΰόάέ ίάδάίγ όγδ άούδάηέέΠδ έάέ όγδ οάέηέάέΠδ έίίούέάδ. Άέά δάηΰάάέαιά, άί ίάέείΠόάδ άδύ όγί άούδάηέέΠ έίίούέά (ίέυίγ), ίδηηάβδ ά ίά ÷ηγέειθιεΠόάδ όγί άδέείάΠ -h άέά ίά έάδάδδέγιάδ οί οίηδύδΠ άέέβίγδ όδ έάέ οίι δδηΠία ίά ÷ηγέειθιεΠόίθι όγ οάέηέάέΠ εγηά υδ όδδέάδΠ έίίούέάδ. Άίάέέάέδέέΰ, άί άέέείΠόάδ άΎού όγδ οάέηέάέΠδ εγηάδ, ίδηηάβδ ά ίά ÷ηγέειθιεΠόάδ όγί άδέείάΠ -h άέά ίά έάδάδδέγιάδ οί οίηδύδΠ άέέβίγδ όδ έάέ οίι δδηΠία ίά ÷ηγέειθιεΠόίθι όγί έάηίέέΠ έίίούέά άίδβ άέά όγ οάέηέάέΠ.

-D

Άίάέέΰόάέ ίάδάίγ όγδ άδδΠδ έάέ όγδ άέδδΠδ έίίούέάδ. Όδγί ηγέιέόγ άδδΠδ έίίούέάδ, έά ÷ηγέειθιεΠέάβ άβδ ά ç άούδάηέέΠ έίίούέά (άδάέέυίέόγ οά ίέυίγ) άβδ ά ç οάέηέάέΠ εγηά, άίΰεηάά ίά οί δυδ Ύ÷άέ δάέάβ ç άδέείάΠ -h θίθ άίάδΰόάίά δάηάδΰΰ. Όά δάηδδύδ όγ άέδδΠδ έίίούέάδ, έά άίάηάιθιεΠέγίγί όάδδύ ÷ηίά δυοί ç άούδάηέέΠ υοί έάέ ç οάέηέάέΠ έίίούέά, ΰό÷άδ άδύ όγ ηγέιέόγ όγδ άδέείάΠδ -h. Όγίάέβδδ άδδύοί υδέ ç ηγέιέόγ άέδδΠδ έίίούέάδ ίδηηάβ ίά άίάηάιθιεΠέάβ ίυηί έάδΰ όγί άέέβίγδ, υοί άέδάέάβδάέ οί boot block. Ίυέέδ άίέάβ ι Ύέά÷ίδ οοί οίηδύδΠ άέέβίγδ, ç ίηάάέέΠ έίίούέά θίθ δάηάιΎίάέ άβίάέ άδδΠ δίθ έάέηηβάδάέ άδύ όγί άδέείάΠ -h.

-P

Άίάηάιθιεάβ όγί άίβ÷ίάδδ όδδέδδηηέηάβίθ οίτ boot block. Άί άάί άηάέάβ δέγέδδηηέυάέί, άίάηάιθιεγίγίόάέ άδδύιάδά ίέ άδέείάΎδ -D έάέ -h.

**Όγίάβύδ:** Έύάυ δάηέηέόίπí ÷βηίθ όδγί δηΎ÷ίδδά Ύέάίθ όύί boot blocks, ç άδέείάΠ -P ίδηηάβ ίά άίέ÷ίάγόάέ ίυηί άέδάδάιΎία (extended) δέγέδδηηέυάέά. Δέγέδδηηέυάέά ίά έέάυδάηά άδύ 101 δδΠέδδηά (έάέ ÷υηβδ δά δδΠέδδηά F11 έάέ F12) βύδ ίά ίγί άίέ÷ίάδδέγίγί. Άίάέόβδ άδδύγ οίθ δάηέηέόίγ, άβίάέ δέέάίυ ίά ίγί άίέ÷ίάδδέγίγί έάέ έΰθιεά δέγέδδηηέυάέά οίηγδβί δδίηέάέόδβί. Άί όόίάβίάέ άδδύ όδδί όγόδγιά όάδ, έά δηΎδ άέ ίά όόάίάδΠόάδ ά ίά ÷ηγέειθιεάβδ ά όγί άδέείάΠ -P. Άδδδδ÷βδ, άάί δδΰη÷άέ έΰθιείθι δηδδίθ ίά δάηάέΰιθάδ άδδύ οί δηυάέγίά.

× ηγέειθιεΠόά άβδ ά όγί άδέείάΠ -P άέά ίά άδέέΎίάδ όγί έίίούέά άδδύιάδά, Π όγί άδέείάΠ -h άέά ίά άίάηάιθιεΠόάδ όγ οάέηέάέΠ έίίούέά.

Ίδηηάβδ άδβδδ ίά δάηέέΰάάδ έάέ ΰέέάδ άδέείάΎδ θίθ δάηέάηΰοίθιόάέ όδγ οάέβάά manual οίτ boot(8).

¼έάδ ίέ άδέείάΎδ άέέβίγδ, άέδύδ όγδ -P, έά δάηΰοίθι όδδί οίηδύδΠ άέέβίγδ (/boot/loader). Ί οίηδύδΠ άέέβίγδ έά έάέηηβδάέ άί ç έίίούέά έά άγίέιθηάέβδ όδγί ίέυίγ Π όδγ οάέηέάέΠ εγηά, άοίγ άίάδΰόάέ ίυηί όγί άδέείάΠ -h. Άδδύ όγίάβίάέ υδέ άί έάέηηβδάδ όγί άδέείάΠ -D άέέΰ υ÷έ όγί άδέείάΠ -h όδδί /boot.config, έά ίδηηάβδ ά ίά ÷ηγέειθιεΠόάδ όγί οάέηέάέΠ εγηά υδ έίίούέά ίυηί έάδΰ όγί άέδΎέάδ ότ boot block. Ί οίηδύδΠ άέέβίγδ υιυδ έά ÷ηγέειθιεΠόάέ όγί άούδάηέέΠ έίίούέά (ίέυίγ).

6. ΆέέείΠόά οί ίγ÷ΰίγίά.

¼όάί ίάέείΠόάδ οί FreeBSD ίγ÷ΰίγίά, δά boot blocks έά άάβηίθι δά δάηέά÷υιάίά οίτ /boot.config όδγί έίίούέά. Άέά δάηΰάάέαιά:

/boot.config: -P

Keyboard: no

Ç äáyóãñç ãñãìÞ åá àìöáíεóóðãß ìüñí áí áŰεãðã ðçí áðέειãÞ -Þ óðí /boot.config, έάέ äãß÷íåέ áí ððŰñ÷åέ Þ ü÷έ óðíããìŰñí ðεçέðñíεüãέí. Óá ìçíŷíãðã áððŰ έáðãðέŷñííðãέ óðçí óáέñέάέÞ Þ óðçí áóùðãñέέÞ έίíóüεά, Þ áέüíã έάέ óðέð äŷí, áíŰεíãã ìã ðçí áðέειãÞ ðíð Ű÷åέ äßíãέ óðí /boot.config.

| ΆδέειãŰò                   | Όí ìÞíðíã àìöáíßæãðãέ óðçí     |
|----------------------------|--------------------------------|
| έáíßã                      | áóùðãñέέÞ έίíóüεά              |
| -h                         | óáέñέάέÞ έίíóüεά               |
| -D                         | áóùðãñέέÞ έάέ óáέñέάέÞ έίíóüεά |
| -Dh                        | óáέñέάέÞ έάέ áóùðãñέέÞ έίíóüεά |
| -Þ, ðεçέðñíεüãέí óðíããìŰñí | áóùðãñέέÞ έίíóüεά              |
| -Þ, ÷-ùñßð ðεçέðñíεüãέí    | óáέñέάέÞ έίíóüεά               |

ÌãðŰ óá ðãñãðŰñí ìçíŷíãðã, έá ððŰñíãέ ìεã ìέέñÞ ðãŷóç ðñέí óá boot blocks óðíã÷ßóííí ðñíðñííðãð ðí ðñíðùðÞ äέέßíçóçð, έάέ ðñέí àìöáíεóóŷíŷí ðãñέóóüðãñã ìçíŷíãðã óðçí έίíóüεά. Óðü έáñíέέŰð óðíεðεãð, äãí ÷ñåŰæãðãέ ìã äεáέüøãðã óá boot blocks, áέεŰ Þóùð εŰεãðã ìã ðí εŰíãðã áððü äεã ìã äããáέέεãßðã üðέ üεã äßíãέ ððέìέóíŰŷíã òùóðŰ.

ÐέŰóðã ðíεíãÞðíðã ðεÞðñí äέðùð áðü ðí **Enter** óðçí έίíóüεά äεã ìã äεáέüøãðã ðç äεããέέãóßã äέέßíçóçð. Óá boot blocks έá óáð ðñðÞóííí äεã ðãñέóóüðãñãð ðεçñíðñíßãð. Έã ðñŰðãέ ìã äãßðã εŰðέ üðùð ðí ðãñãέŰðù:

```
>> FreeBSD/i386 BOOT
Default: 0:ad(0,a)/boot/loader
boot:
```

Άðãεçεãŷóðã üðέ ðí ðãñãðŰñí ìÞíðíã àìöáíßæãðãέ äßðã óðç óáέñέάέÞ έίíóüεά, Þ óðçí áóùðãñέέÞ έίíóüεά Þ έάέ óðέð äŷí, áíŰεíãã ìã óέð áðέειãŰð ðíð Ű÷ãðã áŰεãέ óðí äñ÷ãßí /boot.config. Áí ðí ìÞíðíã àìöáíßæãðãέ óðçí óùóðÞ έίíóüεά, ðέŰóðã **Enter** äεã ìã óðíã÷ßóãðã ìã ðç äεããέέãóßã äέέßíçóçð.

Áí áðέέðíãßðã óáέñέάέÞ έίíóüεά, áέεŰ äãí äεŰðãðã ðçí ðñíðñíðÞ óá áððÞí, ððŰñ÷åέ εŰðíέí εŰεèð óðέð ðñέìßóãέð. Óðí ìãðãíŷ, ãñŰðã -h έάέ ðέŰóðã **Enter** Þ **Return** (áí äßíãðãέ) äεã ìã ðãßðã óðí boot block (έάέ Űðãέðã óðí ðñíðùðÞ äέέßíçóçð έάέ ðíð ðñÞíã) ìã áðέέŰíãέ ðç óáέñέάέÞ εŷñã äεã ðç έίíóüεά. Ìüέð ðí óŷóçíã ìãέέíÞóãέ, έίέðŰíðã ìãíŰ óέð ðñέìßóãέð äεã ìã ãñãßðã ðíð äßíãέ ðí εŰεèð.

ÌãðŰ ðç ðñíðùðç ðíð ðñíðùðÞ äέέßíçóçð, ãñÞóέãðã óðí ðñßðí óðŰãέí ðçð äεããέέãóßãð äέέßíçóçð έάέ Ű÷ãðã áέüíã ðç äðíãúðçðã ìã äðέŰŷíãðã ìãðãíŷ ðçð áóùðãñέέÞð έάέ óáέñέάέÞð έίíóüεάð, εŰðñíðãð óέð έáðŰεçέãð ìãðããέçðŰð ðãñέãŰεέííðíð óðí ðñíðùðÞ äέέßíçóçð. Άãßðã ðí Όíðíã 26.6.6.

### 26.6.4 Ðãñßεçøç

ΆãÞ έá ãñãßðã ìεã ðãñßεçøç ðùí äέŰðñíñí áðέειãÞí ðíð ðãñíðóέŰóðçέáí óã áððÞ ðçí áíüðçðã, έάέ ðç έίíóüεά ðíð áðέέŰ÷έçãð óãέέέŰ.

#### 26.6.4.1 1ç Ðãñßððùðç: ÷ãðã ΈŰóãέ ðí Flag 0x10 äεã ðç Έŷñã sio0

```
device sio0 at isa? port IO_COM1 flags 0x10 irq 4
```

| ÁðέειάΎò óοί<br>/boot.config | Έίíóυέά έάóÛ óç<br>άέÛñέάέά óυί boot<br>blocks | Έίíóυέά έάóÛ óç<br>άέÛñέάέά óίò óίñòυòð<br>άέέβίçóçò | Έίíóυέά óοίí ðòñΠία |
|------------------------------|------------------------------------------------|------------------------------------------------------|---------------------|
| έάíβά                        | άóòòáñέέð                                      | άóòòáñέέð                                            | άóòòáñέέð           |
| -h                           | óάέñέάέð                                       | óάέñέάέð                                             | óάέñέάέð            |
| -D                           | óάέñέάέð έάέ άóòòáñέέð                         | άóòòáñέέð                                            | άóòòáñέέð           |
| -Dh                          | óάέñέάέð έάέ άóòòáñέέð                         | óάέñέάέð                                             | óάέñέάέð            |
| -P, ðέçέòñíεúάεί óóíááíΎíí   | άóòòáñέέð                                      | άóòòáñέέð                                            | άóòòáñέέð           |
| -P, ÷-ùñβò ðέçέòñíεúάεί      | óάέñέάέð έάέ άóòòáñέέð                         | óάέñέάέð                                             | óάέñέάέð            |

**26.6.4.2 2ç Ðáññðòυóç: ÷-άòά ΈΎóάέ óí Flag 0x30 áέά óçí ΈΎñά sio0**

```
device sio0 at isa? port IO_COM1 flags 0x30 irq 4
```

| ÁðέειάΎò óοί<br>/boot.config | Έίíóυέά έάóÛ óç<br>άέÛñέάέά óυί boot<br>blocks | Έίíóυέά έάóÛ óç<br>άέÛñέάέά óίò óίñòυòð<br>άέέβίçóçò | Έίíóυέά óοίí ðòñΠία |
|------------------------------|------------------------------------------------|------------------------------------------------------|---------------------|
| έάíβά                        | άóòòáñέέð                                      | άóòòáñέέð                                            | óάέñέάέð            |
| -h                           | óάέñέάέð                                       | óάέñέάέð                                             | óάέñέάέð            |
| -D                           | óάέñέάέð έάέ άóòòáñέέð                         | άóòòáñέέð                                            | óάέñέάέð            |
| -Dh                          | óάέñέάέð έάέ άóòòáñέέð                         | óάέñέάέð                                             | óάέñέάέð            |
| -P, ðέçέòñíεúάεί óóíááíΎíí   | άóòòáñέέð                                      | άóòòáñέέð                                            | óάέñέάέð            |
| -P, ÷-ùñβò ðέçέòñíεúάεί      | óάέñέάέð έάέ άóòòáñέέð                         | óάέñέάέð                                             | óάέñέάέð            |

**26.6.5 ÓοίáíòεΎò áέά óçí Óάέñέάέð Έίíóυέά**

**26.6.5.1 Ñýειόç íáááέýòáñçò Óά ÷-ýòçóáò áέά óç Óάέñέάέð ΈΎñά**

Íε ðñíáðέέάíΎíáò ñòεíβóάέò óçò óάέñέάέðò έýñáò áβίάέ: 9600 baud, 8 bits, ÷-ùñβò έóίòεíβά (parity), 1 stop bit. Αί έΎέáòά íá áεεÛíáòά óçí ðñíáðέέάíΎíç óá ÷-ýòçóáò óçò έίíóυέάò, Ύ ÷-άòά óέò ðáñάέÛòυ άðέειάΎò:

- Άðáíáíáòάάεúòðβóòά óá boot blocks έΎóίíóáò óç íáðάάεçòð BOOT\_COMCONSOLE\_SPEED áέά íá ññβóáòά óçí íΎά óá ÷-ýòçóá έίíóυέάò. Άáβóά óí ÕìΠία 26.6.5.2 áέά εáðòñíáñáβò íαçáβáò ó ÷-άòέέÛ íá óç íáðάάεçòðόέóç έάέ ááέáòÛóóáóç íΎύí boot blocks.

Αί ç áíáñáíðίβçóç óçò óάέñέάέðò έίíóυέάò ááí áβίáóáέ íΎóυò óçò άðέειάðò -h, P áí ç óάέñέάέð έίíóυέά ðίò ÷-ñçóέííðíέáβóάέ áðu óίí ðòñΠία áβίáέ áέáóíñáòέέð áðu áòòð ðίò ÷-ñçóέííðíέáβóάέ áðu óá boot blocks, έá ðñΎðáέ áðβóçò íá ðñíóεΎóáòά óçí ðáñάέÛòυ άðέειάð óοί áñ ÷-áβí ñòεíβóáυí óίò ðòñΠία, έάέ íá íáðάάεúòðβóòάά Ύíá íΎí ðòñΠία:

```
options CONSPEED=19200
```

- Óόέò άðέειάΎò áέέβίçóçò óίò ðòñΠία, ÷-ñçóέííðíέáβóòά óí -s. Ìðíñáβóά áðβóçò íá ðñíóεΎóáòά óçí άðέειάð -s óοί /boot.config. Ç óάέβáá manual boot(8) ðáñέΎ ÷-άέ íέá έβóóά óυí òðíóðçñέáυíáíúí άðέειάðí, έάέ ðáñέáñÛóáέ

δὺδ ίά οέδ δñιόεΎόάδά οόι άñ÷άβι /boot.config.

- ΆίάñáñðιεΠόά όçί άδέειάΠ comconsole\_speed οόι άñ÷άβι /boot/loader.conf.

Άέα ίά εάέοιñάΠόάε άόδΠ ç άδέειάΠ, εά δñΎðάε άδβόçδ ίά εΎόάδά οειΎδ άέα οέδ άδέειάΎδ console, boot\_serial, έάέ boot\_multicons οόι βάει άñ÷άβι, οί /boot/loader.conf. Δάñάέΰδὺ οάβίάόάέ Ύίά δάñΰάέάιá ÷ñΠόçδ οίö comconsole\_speed άέα άέέάΠ δά÷ύόçδά όçδ οάέñέάέΠδ έίíóúέάδ:

```
boot_multicons="YES"
boot_serial="YES"
comconsole_speed="115200"
console="comconsole,vidconsole"
```

### 26.6.5.2 ×ñçόειñðιεΠόάδ ΟάέηέάέΠ Έγñά Άέδὺδ όçδ sio0 άέα όçί Έίíóúέά.

Έά δñΎðάε ίά άδάίάíάόάάέδὺδδβόάδά εΰðιεά δññáñΰñíáδά άέα ίά ÷ñçόειñðιεΠόάδά ùδ έίíóúέά ίέα οάέñέάέΠ έγñά άέδὺδ όçδ sio0. Άί άέα ðιεάíáΠðιεά εüáí εΎέάδά ίά ÷ñçόειñðιεΠόάδά ΰέεç οάέñέάέΠ έγñά, εά δñΎðάε ίά άδάίάíάόάάέδὺδδβόάδά όά boot blocks, οί οññδὺδΠ άέέβίçόçδ έάέ οίí δδñΠíá, íá οίí δññδñ ðñö οάβίάόάέ δάñάέΰδὺ.

1. ΆίάέδΠόάδ οίí δçάάβι έπáέέά οίö δδñΠíá. (Άάβδά οί Έάοΰεάει 24)
2. Άδάíáñáάόάβδά οί άñ÷άβι /etc/make.conf έάέ εΎόάδ όçί άδέειάΠ BOOT\_COMCONSOLE\_PORT όόç άέáyέδóíç όçδ έγñάδ ðñö εΎέάδά ίά ÷ñçόειñðιεΠόάδά (0x3F8, 0x2F8, 0x3E8 or 0x2E8). Ìðññάβδά ίά ÷ñçόειñðιεΠόάδά ìñíí όέδ έγñάδ sio0 ùδ sio3 (COM1 ùδ COM4). Έΰñδάδ ðñέάðέπí εδñπí, ááí δññέάέόάέ ίά εάέοιñάΠοίóí. Άάí ÷ñáέΰάόάέ ίά ñέìβόάδά όçί όειΠ οίö interrupt.

3. ΆçιεíñάΠόάδ Ύίά άñ÷άβι ñýειόçδ δññόáññíοίΎñö δδñΠíá, έάέ δññίόεΎόδά δά έáδΰέεçέá flags άέα όç οάέñέάέΠ έγñά ðñö άδέέοíáβδά ίά ÷ñçόειñðιεΠόάδά. Άέα δάñΰάέάíá, άí εΎέάδά ç sio1 (COM2) ίά áβíáέ ç έίíóúέά:

```
device sio1 at isa? port IO_COM2 flags 0x10 irq 3
P
device sio1 at isa? port IO_COM2 flags 0x30 irq 3
```

Άάí εά δñΎðάε ίά εΎόάδά flags έίíóúέάδ άέα οέδ ΰέέάδ οάέñέάέΎδ έγñάδ.

4. Ìáδóáέδὺδδβόάδ έάέ ááέάόάόδΠόάδ íáíΰ όά boot blocks έάέ οίí οññδὺδΠ άέέβίçόçδ:

```
cd /sys/boot
make clean
make
make install
```

5. Άδάίάíáόάάέδὺδδβόάδ έάέ ááέάόάόδΠόάδ οίí δδñΠíá.
6. Άñΰðάδ όά boot blocks όóñí áβóει άέέβίçόçδ ÷ñçόειñðιεΠόάδ όçί bsdlable(8) έάέ άέέέíΠόάδ íá οί íΎí δδñΠíá.

### 26.6.5.3 Άβóíáñö όóñí DDB Debugger ÌΎóὺδ όçδ ΟάέñέάέΠδ Άñáñòδ

Άί εΎέάδά ίά άέóΎέέάδά όóñí debugger οίö δδñΠíá áδñ όçί οάέñέάέΠ έίíóúέά (έΰδóέ ðñö áβíáέ ÷ñΠόçειñ άέα ίά άέδάέΎόάδά áέááññóóέΰ áδñ áðñáέñδóíΎίç οίðñέάόβá, áέέΰ άδβόçδ έάέ άδέέβίáδñí άí οόάβέάδά έáδΰ εΰέñδ BREAK ÌΎóὺδ όçδ οάέñέάέΠδ έγñάδ!) εά δñΎðάε ίά δάñέέΰάάδά όçί δάñάέΰδὺ άδέειάΠ οóñí δδñΠíá όάδ:

```
options BREAK_TO_DEBUGGER
options DDB
```



**Όχιάβυός:** Ός άάάιΎίς όδέαιΠ, ι οϊηόουδΠ άέέβίςόςό άάί Ύ÷άέ άδέειάΠ άίδβόιέ÷ς ιά όςί -Π όιό boot block, έάέ άάί οδΰη÷άέ έΰδτείο όηύδίο ίά άβίίάέ άδούιιάός άδέειάΠ ιάόάίγ άούόάηέέΠ έάέ όάέηέάέΠ έίίούέάό άίΰέιιά ίά όςί δάηιόόβά δέςέδηιέιαβιό.

**26.6.6.2 ×ηΠός ΟάέηέάέΠ έγνάό Άέδυό όςό sio0 άέά όςί Έίίούέά**

Έά δηΎδάέ ίά άδáiíáάόάέυόδβόάά όι οϊηόουδΠ άέέβίςόςό ηόόά ίά ÷ηςόειίδτεΠόάέ ίέά όάέηέάέΠ έγνά άέάοιηάόέέΠ άδύ όςί sio0 άέά ός όάέηέάέΠ έίίούέά. ΆέιέροεΠόόά ός άέάάέέάόβά δίο δάηέάηΰόάόά όοι ΌιΠιά 26.6.5.2.

**26.6.7 ΔέέάίΎδ Δάάβääò**

ς άάίέέΠ έάΎά άβίίάέ ίά άδέδηΎδάδάέ όά υόιόδ όι άδέέδηίγί, ίά άςίέιόηάΠόιόι άίάέάέάοιΎηόδ άιόδςηάόςΎδ δίο άάί άδάέδηίγί έΰηόάδ άηάόέέΠί έάέ δέςέδηιέυάέά. Άόόόδ÷ηδ, άί έάέ όά δάηέόόυόάηά όδóδΠιάόά έά όάδ άδέδηΎδηίόί ίά άέέέίΠόάόά ÷ηηβδ δέςέδηιέυάέί, όά δτεγ έβάά έά ιδηΎόάόά ίά άέέέίΠόάόά ÷ηηβδ έΰηόά άηάόέέΠί. Όά ις÷άίΠιάόά ιά BIOS όςό AMI ιδηΎηίγί ίά ηόέιέόδηίγί ιά άδóυ όιί όηύδι, άδέηδ άέέΰάειόάδ όςί άδέειάΠ “graphics adapter” όόέδ ηδέιβόάέδ όιό CMOS όά “Not installed.”

Όά δάηέόόυόάηά ις÷άίΠιάόά υόόυόι άάί δδίοδςηβάειόι άδóΠ όςί άδέειάΠ, έάέ έά άηίςέιγί ίά άέέέίΠόιόι άί άάί άΰέάόά ίέά έΰηόά άηάόέέΠί. Όόά ις÷άίΠιάόά άδóΰ έά δηΎδάέ ίά άόΠόάόά ίέά όοιέ÷άεης (άέυιá έάέ ιιΰ÷ηις) έΰηόά άηάόέέΠί, άί έάέ άάί άβίίάέ άδάηάβόςοι ίά όοίάΎόάόά έάέ ιέυις. Ιδηηάβόά άδβόςό ίά άρεειΰόάόά ίά άάέάόάόδΠόάόά BIOS όςό AMI.







Άñάιπ 4:

Άíάάññβέάέ όç όδóέάδP όόçí ìðìβά άβίάέ όóíάάíŸí όì modem. Ç όδóέάδP COM1 άβίάέ ç /dev/cuad0 έάέ ç COM2 άβίάέ ç /dev/cuad1.

Άñάιπ 5:

Έάέìñβέάέ όçí όά÷Ÿόçόά ìά όçí ìðìβά άδέέðìάβόά íά όóíάάέάβόά. Άí άάí έάέόìòñάάβ ç όέìP 115200 (ç ìðìβά ðñŸðάέ íά έάέόìòñάάβ ìά έŸέά ό÷άόέέŸ όŸά÷ñííí modem), άíέέìŸόόά ìά 38400.

ΆñάιπŸò 6 & 7:

Ōì άέόάñέέìçόέέù ðìò έά ÷ñçόέìðìέçέάβ άέά όçí έέPόç. Ōì PPP ÷ñPόόç ÷ñçόέìðìέέάβ όŸíόάíç expect-send ðáññìíέά ìά άόδP ðìò ÷ñçόέìðìέέάβ όì ðññáññáíá chat(8). Άάβόά όç όάέβάά manual άέά ðέçñìòññáð ό÷άόέέŸ ìά όέð άóíάóùòçόάð άóðPð όçð άέPóóáð.

ŌçíάέPóóá ùέέ άóðP ç áíóìέP όóíά÷βέάέ όόçí άðññáíç άñάιπ άέά έùάìòð áíάάññóέìùόçόάð. Άóóù ìðìñάβ íά άβίάέ όά έŸέά áíóìέP όìò ppp.conf, áöùóíí όì \ άβίάέ ì όάέάðóάβìð ÷άñάέðPñάó όçð άñάιπð.

Άñάιπ 8:

Έάέìñβέάέ όì ÷ññìí óáññíάόέόìŸŸ έùáñ ááñŸíάέάð όçð όŸíάάόçð. Ōά 180 ááðóðáññέάððά άβίάέ ç ðññíáðέέάáíŸíç όέìP, Ÿóóέ ç άñάιπ άóðP άβίάέ áäP έάέáñŸ έάέέìòìçόέέP.

Άñάιπ 9:

ΈŸάέ όóì PPP íά ñòðPóáέ όçí Ÿέέç ðέáðñŸ άέά íά άðέάάάέPóáέ όέð όìðέέŸò ñòέìβóáέð όìò resolver. Άí áέóáέάβóá όìðέέù έάέάñέέóðP ìññŸóùí (DNS), έά ðñŸðάέ íά ìάóáðñŸøáóá άóðP όç άñάιπ όά ό÷έέέ P íά όçí áóáέñŸóáðá.

Άñάιπ 10:

ΈάìP άñάιπ P óóá ç áíŸáññóç όìò áñ÷άβìò íά άβίάέ ðέì áŸŸέç. Íέ έáíŸò άñάιπŸò ááññŸíόάέ áðù όì PPP.

Άñάιπ 11:

Άíάάññβέάέ όçí έάόά÷Pñέóç áññò ðáññì÷Ÿά ìά όì ùññá “provider”. Ìðìñάβóá áäP íá ÷ñçόέìðìέPóáóá όì ùññá όìò ISP óáð, Póðá áññáññá íá ìáέέìŸóá όç όŸíάάόç óáð ìά όçí άðέέìP load ISP.

Άñάιπ 12:

ΈŸóáέ όìí áñέέìù έέPóçð άέά áóóù όìí ðáññì÷Ÿά. Ìðìñάβóá íá έάέìñβóáóá ðìέέáðέìŸò áñέέìŸò έέPóçð ÷ñçόέìðìέPíóáð Ÿíù-έŸóù óáέάβá (: ) P όìí ÷άñάέðPñá (|) ùð άέá÷ññέóóέέù. Ç áέάóìñŸ ìάóáíŸ óùí áŸí áέá÷ññέóóέέP ðáñέáñŸóáóáέ όóì ppp(8). ðáñέççððέέŸ, áí έŸέáðá íá áìέέìŸáññíóáέ έðέέέέŸ ùέìέ íέ áñέέìñβ, ÷ñçόέìðìέPóóá όçí Ÿíù-έŸóù óáέάβá. Άí έŸέáðá íá άβίáóáέ ðŸíóìòá áðùðáέñá έέPóçð όìò ðñPóìò áñέέìŸŸ έάέ íέ óðñέìέðìέ íá áìέέìŸáññíóáέ ìññí áí ì ðñPóìò áðìóŸ÷άέ, ÷ñçόέìðìέPóóá όì ÷άñάέðPñá ðáññì÷Ÿóáóçð. Íá áñŸóáóá ðŸíóìòá ùέì όì όŸññέì óçέáðññέPí áñέέìPí ìά όìí óññðì ðìò óáβíáóáέ.

Άí ì áñέέìùð όçέáðPññò ðáñέŸ÷άέ έáíŸŸ, έá ðñŸðάέ íá όìí ðáñέέέάβóáóá óá áέóááññáέέŸ ("). Ç ðáñŸŸέáέóç óìòð, áí έάέ άβίάέ áðέù óóŸέìá, ìðìñάβ íá ðññέáέŸóáέ ðññáέPíáóá ðìò ááí ìðìñŸí íá áíóìðέóóìŸí áŸŸέéá.

ΆñάιπŸò 13 & 14:

Άíάάññβέάέ όì ùññá ÷ñPóóç έάέ όìí έùáέέù óìò. ¼óáí óóíáŸáóóá ÷ñçόέìðìέPíóáð ðññòññìP óŸðìò UNIX, íέ óέìŸò áóðŸò áíáóŸññíóáέ áðù όçí áíóìέP set login ÷ñçόέìðìέPíóáð óέð ìáóáέçðŸò \Ÿ έάέ \P. ¼óáí





proxy óòí áñ÷áβí /etc/ppp/ppp.conf. Έá ðñÝðáέ áðβόçð íá áðέáááέðáðá üðέ òí áñ÷áβí /etc/rc.conf ðáñέÝ÷áέ óá ðáñáέÛòù:

```
gateway_enable="YES"
```

#### 27.2.1.2.4 ðíέí getty;

Ç áíüçðά Õðçñáóβά Άέóüäíò ìÝòù Άðέέíáέέðð Óýíááóçð (dial in) ðáñÝ÷áέ íέá έάέð ðáñέáñáóð ó÷áðέέÛ ìá ðçí áíáñáíðíβçð òðçñáóέðí áðέέíáέέέðí έέðóáüí ÷ñçóέííðíέðíðáð ðçí getty(8).

Íέá áíáέέáðέέέð ðççí getty áβíáέ ç mgetty (<http://www.leo.org/~doering/mgetty/index.html>), íέá ðέí Ýíððίç Ýέäíóç ðçð getty, ç ìðíβá Ý÷áέ ó÷ááέáóðáβ áέá íá έáíáÛíáέ òðüφέí ðέð áðέέíáέέÝð áñáíìÝð.

Óá ðέáííáέððíáðá ðçð mgetty áβíáέ üðέ áðέέíáέíüáβ áíáñáÛ ìá ðá modem, òí ìðíβí óçíáβíáέ üðέ áí ç έýñá áβíáέ áðáíáñáíðíέçíÝíç óòí /etc/ttys, òí modem óáð äáí έá áðáíððóáέ óççí έέβóç.

ÌáðáááíÝóðáñáð áέäüóáέð ðçð mgetty (áðü ðçí 0.99beta έάέ ìáðÛ) òðíóçññβæíðí áðβόçð áððüíáðç áíβ÷íáðç PPP streams, áðέðñÝðííóáð óòíðð ðáέÛðáð óáð ðñüóááç óòíí áíððçñáðçðð ÷ññò ÷ñðçç scripts.

ΆέááÛóðá ðçí áíüçðά Mgetty έάέ AutoPPP áέá ðáñέóóüðáñáð ðççñííðñβáð ó÷áðέέÛ ìá ðçí mgetty.

#### 27.2.1.2.5 ¶ááέáð áέá òí PPP

ÕðóέíáέέÛ, ç áέðÝέáç ðçð áíðíέðð ppp ðñÝðáέ íá áβíáðáέ ùð ÷ñðóçð root. Áí ùðóüóí έÝέáðá íá áðέðñÝðáðá ðçí áέðÝέáç òíð ppp óá έáðÛóðáç áíððçñáðçðð ùð έáñíέέüð ÷ñðóçð (ìá òíí ðñüðí ðíð ðáñέáñÛóáðáέ ðáñáέÛòù) έá ðñÝðáέ íá áðóáðá óá áððü òí ÷ñðóçð óá έáðÛέέçέá áέέάέðíáðá áέá íá áέðáέáβ òí ppp, ðñíóέÝòííóáð òíí ðççí ñÛáá network óòí áñ÷áβí /etc/group.

Έá ðñÝðáέ áðβόçð íá òíðð áðóáðá ðñüóááç óá Ýíá ð ðáñέóóüðáñá ðíðíáðá òíð áñ÷áβí ñðèìβóáüí, ÷ñçóέííðíέðíðáð ðçí áíðíέðð allow:

```
allow users fred mary
```

Áí ÷ñçóέííðíέðíðáðá ðçí áðέέíáð áððð óòí ðíðíá default, έá áðóáðá óá áððíýð òíðð ÷ñðóçð ðñüóááç óá üέáð ðέð ñðèìβóáέð.

#### 27.2.1.2.6 Έáέýçç PPP áέá × ñðóðáð ìá ΆðíáíέέÛ IP

Άçíέíðñáðóðá Ýíá áñ÷áβí ìá òí üñíá /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"
```



**Όçiáßùòç:** Ç óðïß÷έόç áßíáέ όçíáíðéêß.

Άέά εÛεά όóíááñßá, öññòþíáðáέ ç áñúòçðá default : . Άέά εÛεά áñáñïß dialup ðñò áñáñáñðñέáßðáέ όðñ /etc/ttys, έá ðñÝðáέ íá äçñέññáßðáðá íέá έáóá÷þñέóç ùññέá ìá áðòß ðñò óáßíáðáέ ðáñáðÛñ ãέá òñ ttyd0 : . ÊÛεά áñáñïß έá ðñÝðáέ íá ðáßññíáέ ìέá ìñíááέß äέáyέðñóç IP áðñ òñ áðñέáñá òñ IP áέáðéýñóáñ ðñò ðñññßæññóáέ áέá ðñò äðñíέέñýð ÷ñßðóðáð.

**27.2.1.2.9 Ñýñέóç òñò ppp.conf áέá ×ñßðóðá ìá ÓðáðééÛ IP**

Άέòñð áðñ óá ðáñέá÷ùñíá ðñò ððñááßáñáðñò /usr/share/examples/ppp/ppp.conf έá ðñÝðáέ íá ðññóέÝóáðá ìέá áñúòçðá áέá έáέÝíá áðñ ðñò ÷ñßðóðá dialup óðñò ðññò Ý÷÷éß ÷ññέá ðññέáß ðóáðééÛ IP. Êá óóíá÷ßóññá ìá òñ ðáñÛááέáñá ìá ìá ðñò ÷ñßðóðá 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
```

Όñ áñ÷áßñ /etc/ppp/ppp.linkup έá ðñÝðáέ áðßçðò íá ðáñέÝ÷ññέá ðñññέñáççðò áέá εÛεά ÷ñßðóç ìá óðáðééÛ IP (áñ áðáέóáßðáέ). Ç ðáñáέÛòñ áñáñïß έá ðññóέÝóáέ ìέá áέááññïß ðññò óç áέáyέðñóç áέέðýñò 203.14.101.0/24 ìÝò óç ðýñááçðò ppp òñò ðáέÛðç.

```
fred:
 add 203.14.101.0 netmask 255.255.255.0 HISADDR

sam:
 add 203.14.102.0 netmask 255.255.255.0 HISADDR

mary:
 add 203.14.103.0 netmask 255.255.255.0 HISADDR
```

**27.2.1.2.10 mgetty έάέ AutoPPP**

Ç ñýñέóç έάέ ìáðááèþðóέóç ðñò mgetty ìá áñáñáß ðçñ áðέέñáß AUTO\_PPP, έá áðέóñÝóáέ óóçñ mgetty íá áñέ÷ñáέ ðçñ òÛóç LCP òñ óóíáÝóáññ PPP έάέ íá áέðáέáß áðññíáðá Ýñá εÝέðñò ppp. Ûòðñóñ, έáèðò ìá áððñ ðñ ðññðñ áññ áñáñáñðñέáß ç ðññáðέέáñÝñç áέññòèßá ñññáðñò ÷ñßðóç έάέ εùáέέñý, áßíáέ áðáñáßçðñ íá áßñáέ ðέóðñðñßçç ðñ ÷ñçóðñ ìá óç ÷ñßðóç PAP Þ CHAP.

Ç áñúòçðá áðòß ðñññðñέÝóáέ ùðέ ì ÷ñßðóçð Ý÷ññέá ðñèìßóáέ, ìáðááέùððßóáέ έάέ ááέáðáóððóáέ ìá áðέðð÷á ìέá Ýέáñóç óçð mgetty ìá ðçñ áðέέñáß AUTO\_PPP (Ýέáñóç v0.99beta Þ ìáðááññÝóðáñç).

Άáááέùèáßðá ùðέ òñ áñ÷áßñ óáð /usr/local/etc/mgetty+sendfax/login.config ðáñέÝ÷ññέá ðá ðáñáέÛòñ:

```
/AutoPPP/ - - /etc/ppp/ppp-pap-dialup
```

Άððñ έá ðáέ óóçñ mgetty íá áέðáέÝóáέ ðñ script ppp-pap-dialup áέá ðέð PPP óóíáÝóáðð ðñò áñέ÷ñáέέçέáñ.

ΆçιέιτῶñāΠρόά Ýία άñ÷άβι ιά οἱ υἱήά /etc/ppp/ppp-pap-dialup οἱ ἱδῖβι έά δάñέÝ÷άέ όά άέυέιτῶέά (οἱ άñ÷άβι έά δñÝδάέ ίά άβίάέ άέδάέÝόέι):

```
#!/bin/sh
exec /usr/sbin/ppp -direct pap$IDENT
```

Άέά έÜέά ãñáñΠ dialup δῖτῶ άβίάέ άíñáñῖῖέçìÝίç όοἱ /etc/ttys, άçιέιτῶñāΠρόά ίέά άίόβόοἱέ÷ç έάόά÷ḥñέόç όοἱ άñ÷άβι /etc/ppp/ppp.conf. Ç έάόά÷ḥñέόç άδóΠ ἱδῖñάβ ίά όῖῖδÜñ÷άέ ÷ùñβδ δñüάέçιά ιά άόδÝδ δῖτῶ ἱñβόάίά δάñάδÜῖ.

```
pap:
 enable pap
 set ifaddr 203.14.100.1 203.14.100.20-203.14.100.40
 enable proxy
```

ΈÜέά ÷ñΠρόόç δῖτῶ άέόÝñ÷άόάέ ιά άόδου οἱἱ δñüδῖ, έά δñÝδάέ ίά άέάέÝόάέ υἱήά ÷ñΠρόόç/έυάέέυ όοἱ άñ÷άβι /etc/ppp/ppp.secret. ΆίάέέάέδóέέÜ, ἱδῖñάβόά ίά δñüόέÝόάόά όçί δάñάέÜδου άδέέῖñΠ ḥόόά ίά άβίάόάέ δέόόἱδῖβçόç όοἱ ÷ñçόḥἱ Ýἱόου PAP ιά άÜόç όά όοἱέ÷άβά δῖτῶ άñ÷άβιῖ /etc/passwd.

```
enable passwdauth
```

Άί έÝέάόά ίά άδῖñḥόάόά όόάόέέυ IP όά έÜδῖέῖτῶ ÷ñΠρόόάδ, ἱδῖñάβόά ίά έάέἱñβόάόά όçί άέάýέδῖόç ùδ δñβοἱ ἱñέόίά όοἱ άñ÷άβι /etc/ppp/ppp.secret. Άέά δάñάάάβáιάόά, áάβόά οἱ άñ÷άβι /usr/share/examples/ppp/ppp.secret.sample.

### 27.2.1.2.11 ΆδάέδÜόάέδ MS

Άβίάέ άοἱάόυἱ ίά ñέἱβόάόά οἱ PPP ḥόόά ίά δάñÝ÷άέ άέάδóέýíόάέδ DNS έάέ NetBIOS έάδÜ άδάβόçόç.

Άέά ίά άíñáñῖῖέçἱΠρόάόά άόδÝδ όέδ άδάέδÜόάέδ ιά όçί Ýέäῖόç 1.x δῖτῶ PPP, έά δñÝδάέ ίά δñüόέÝόάόά όέδ δάñάέÜδου ãñáñÝδ όοἱ ό÷άδóέέυ ἱΠιá δῖτῶ /etc/ppp/ppp.conf.

```
enable msex
set ns 203.14.100.1 203.14.100.2
set nbns 203.14.100.5
```

Άέά οἱ PPP άδῖ όçί Ýέäῖόç 2 έάέ δÜῖ:

```
accept dns
set dns 203.14.100.1 203.14.100.2
set nbns 203.14.100.5
```

Όἱ δάñάδÜῖ έά άçìñḥḥόάέ δῖτῶ δάέÜόάδ άέά οἱἱ έýñέἱ έάέ áάδóñáñáýἱἱόά áἱδḥçñáόçóΠ DNS, έάέ άέά οἱἱ áἱδḥçñáόçóΠ ἱñÜδου NetBIOS.

Άδῖ όçί Ýέäῖόç 2 έάέ δÜῖ, άί δάñάέάέóέέáβ ç ãñáñΠ set dns, οἱ PPP έά ÷ñçόέἱἱδῖέΠρόάέ όέδ ãñáñÝδ δῖτῶ έά áñáέ όοἱ /etc/resolv.conf.



**27.2.1.3 ×ñçόείιθιέπιόαό όç Āóíáóüóçóá íáóÜöñáóçò Āέáóέγíóáúí (NAT) óιö PPP**

Όι PPP Ý÷άέ όçí έέάííóçóá íá ÷ñçόείιθιέΠόάέ áέέü óιö áóüóñέέü NAT, ÷üñβò íá áðάέóíγíóáέ íέ έέάííóçóáò áíάέáóáγέóíóçò óιö ðññΠíá. Ìðñáβòá íá áíáñáíθιέΠόáóá áóðΠ όç έáέóíöñáβá íá όçí áέüέíöèç ãñáíìΠ óóí /etc/ppp/ppp.conf:

```
nat enable yes
```

ΆíάέáέóέέÜ, óí NAT óιö PPP íðñáβ íá áíáñáíθιέçέáβ íá όçí áðέέíāΠ -nat óóçí ãñáíìΠ áíóíεπí. Ìðñáβòá áέüíá íá áÜέáóá όçí áðέέíāΠ ppp\_nat óóí áñ÷áβí /etc/rc.conf. Ç áðέέíāΠ áóðΠ áβíάέ áíáñáíθιέçíÝíç áðü ðñíáðέέíāΠ.

Άí ÷ñçόείιθιέΠόáóá áóðü óí ÷áñáέóçñέóóέέü, ìÜέέíí έá ãñáβòá ÷ñΠόέíáð έáέ óέð ðáñáέÜóü áðέέíāÝò áέá óí /etc/ppp/ppp.conf, ìá óέð íðñáβò áíáñáíθιέέáβóáέ ç ðññεçόç áέóáñ÷üíáííí óóíāÝóáúí:

```
nat port tcp 10.0.0.2:ftp ftp
nat port tcp 10.0.0.2:http http
```

Π áí ãáí 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 óíö ðñÝðáέ íá εÜíáóá ðñέí íá áβíάέ Ýóíέíí áέá έáέóíöñáβá. ¼έá ðáñέέáíáÜííóí όçí áðáíáñááóβá óíö áñ÷áβíö /etc/rc.conf.

Ìáέέíπíóáð áðü όçí áñ÷Π óíö áñ÷áβíö áóóíγ, ááááέüèáβòá üóé áβíάέ ññέóíÝíç ç ãñáíìΠ hostname=, ð.÷.:

```
hostname="foo.example.com"
```

Άí í ISP óáð ðáñÝ÷άέ óóáóέéΠ IP áέáγέóíóç έáέ üñá, áβíάέ ìÜέέíí έáέγðáñí 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 áβíάέ Üááέá, έáέ έá ðñÝðáέ íá áçíέíöñáçέáβ Ýíá áñ÷áβí ìá üííá /etc/start\_if.tun0. Óí áñ÷áβí áóðü έá ðñÝðáέ íá ðáñέÝ÷άέ όçí ðáñáέÜóü ãñáíìΠ:

```
ppp -auto mysystem
```

Όí script áóðü áέóáέáβòáέ έáðÜ όç áéÜñέáέá ñγέíέóçò óíö áέéðýíö, ìáέέíπíóáð Ýóóé óí ááβíííá ppp óá έáðÜóóáóç áóðüíáóçò έáέóíöñáβáð. Άí áέáéÝóáðá εÜðíέíí óíðέέü áβέðóí (LAN) áέá óí íðñí óí íç÷Üíçíá áóðü Ý÷άέ óí ñüέí όçò ðýèçò, βóüò íá εÝέáðá áðβóçò íá ÷ñçόείιθιέΠόáóá όçí áðέέíāΠ -alias. Άáβòá όç óáέβáá manual áέá ðáñέóóüðáñáð έáððííÝñáέáð.

Άáááέüèáβòá üóé ç ìáóááέçðΠ áέá óí ðñüãñáííá router Ý÷άέ óáέáβ óóí ñö íÝóü όçò áðüíáíçò ãñáíìΠò óóí /etc/rc.conf:

```
router_enable="NO"
```

Άβιάέ όçιάίόέέυ ίά ίçí ίάέείΠρόάέ ι άάβιίιάò routed, ι ιðíβιò óóίΠεùò áέάάνÛόάέ óέò ðñíáðέέάιÛίάò óείÛò ðιò ðβιάέά άññíεüãçòçò ðιò äçíείòñáíγίόάέ áðu ðι ppp.

Άβιάέ ιÛέειí έάέΠ έάÛά ίά áíáóóάέβóáòá üòέ ç áñáñΠ sendmail\_flags ááí ðáñέέáíáÛίáέ όçí áðέέíáΠ -ç, áέάöññáðέέÛ ðι sendmail έá ðñíóðáέáβ έÛέá ðüóι ίά έÛίáέ áíááΠòçòç ðιò áέέòγίò, ίá ðεέáíü áðιòÛέáóíá ðι ίç÷Ûίçíá óáð ίά áêòáέáβ όçέáòüíέέΠ óγíááòç (dial out). Ìðññáβòá ίá äñέέíÛóáòá:

```
sendmail_flags="-bd"
```

Ïι ίáέííÛέòçíá ðιò ðáñáðÛíü, áβιάέ üòέ ðñÛðáέ ίά áíáíááέÛóáòá ðι sendmail ίá áðáíáíáòÛóáέ όçí íòñÛ ðüí ίçíóíÛòüí, έÛέá öññÛ ðιò áðíέáέβóóáóáέ ç óγíááòç ppp, áñÛóííóáò:

```
/usr/sbin/sendmail -q
```

εòùò èÛέáòá ίά ÷ñçóέííðέΠóáòá όçí áíóíεΠ !bg óðι ppp.linkup áέá ίá áβíáðáέ ðι ðáñáðÛíü áðòüíáóá:

```
1 provider:
2 delete ALL
3 add 0 0 HISADDR
4 !bg sendmail -bd -q30m
```

Áí áðòü ááí óáò áñÛóáέ, áβιάέ áóíáòüí ίá ðñèíβóáòá Ûίá “dfilter” ðι ιðíβι ίá áðíεüðòáέ όçí έβίçòç SMTP. Άáβòá óá ððíááβáíáóá áέá ðáñέóóüòáñáð έáððñÛñáέáð.

Ïι íüñ ðιò ιÛίáέ áβιάέ ίá áðáíáέέέΠóáòá ðι ίç÷Ûίçíá. ÌáðÛ όçí áðáíáέέβίçòç, ιðññáβòá áβòá ίá áñÛóáòá:

```
ppp
```

έάέ Ûðáέóá dial provider áέá ίá ίáέέίΠóáòá όç óóíááñβá PPP, Π áí èÛέáòá ðι ppp ίá áðíέáέέóóÛ óέò óóíááñβáð áðòüíáóá έÛέá öññÛ ðιò ððÛñ÷áέ έβίçòç ðñíò ðι áñüðáñέέü áβέòòι (έάέ ááí Û÷áòá äçíείòñáΠóáέ ðι script start\_if.tun0) ιðññáβòá ίá áñÛóáòá:

```
ppp -auto provider
```

### 27.2.1.5 Ðáñβέçòç

Άέá ίá áíáέáòáέáέβóíòíá, óá ðáñáέÛòü áΠιáóá áβιάέ áðáñáβòçòá üòáí ááέáέέóóÛóá ðι ppp áέá ðñòç öññÛ:

Áðu όç ίáñέÛ ðιò ίç÷áíΠιáòíð-ðáέÛòç:

1. Άáááέέüέáβòá üòέ ðáñέέáíáÛίáóáέ óóíí ððñΠíá óáð ç óðòéáòΠ tun.
2. Άáááέέüέáβòá üòέ ððÛñ÷áέ ðι áñ÷áβι ðçð óóòéáòΠð tunw óóíí έáðÛέíáí /dev.
3. ÄçíείòñáΠóáòá íéá έáóá÷ñéóç óóíí áñ÷áβι /etc/ppp/ppp.conf. Ïι ðáñÛááέáíá áέá ðι pmdemand έá ðñÛðáέ ίá áβιάέ áðáñéÛð áέá ðιòð ðáñέóóüòáññíòð ISPs.
4. Áí Û÷áòá áóíáíέέΠ áέáýèóíóç IP, äçíείòñáΠóáòá íéá έáóá÷ñéóç óóíí /etc/ppp/ppp.linkup.
5. Áíçíáñβòá ðι áñ÷áβι /etc/rc.conf.
6. ÄçíείòñáΠóáòá ðι script start\_if.tun0 áí ÷ñáέÛááòá έέΠòç έáðÛ áðáβòçòç.



```

 # 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 όόίάέάβδ:

1. ΈάέΥόδά όίί άδñáέñóóíÝíí áíððçñáόçð ÷ñçóέíðíεπίόάδ όí **Kermit** (P εÛðíεí Ûέεí ðñüáñáñá áέά modem) έάέ áέóÛááδά όí ùññá ÷ñPόόç έάέ όíí έùáέέü óáð (P üóέ Ûέεí ÷ñáέÛæáόάέ áέά ίά áñáñáíðíεPόáδά όí PPP óóíí áδñáέñóóíÝíí ððíεíáέóδP).

2. Άááβδά áðü όí **Kermit** (÷ùñβð ίά έέáβóáδά όç áñáñíP).

3. ÐεçέðñíεíáPόáδά όá ðáñáέÛòù:

```
/usr/sbin/pppd /dev/tty01 19200
```

Άáááέúèáβδά üóέ ÷ñçóέíðíεáβδά όí óùóóü ùññá óðóέáðPð έάέ όçí έáðÛέέçέç όá÷ýόçδά.

Ï ððíεíáέóδPð óáð áβíáέ ðρñá óóíáñíÝíñð ìÝòù PPP. Áί ç óýíááόç áðíðý÷áέ, ìðñáβδά ίά ÷ñçóέíðíεPόáδά όçí áðέέíáP debug óóíí áñ÷áβí /etc/ppp/options έάέ ίά áέÝáñáδά όá íçíýíáδά óόçí έííóüéá áέά ίά áίέ÷íáýóáδά όí ðñüáέçíá.

Ïí ðáñáέÛòù script /etc/ppp/pppup áððñááðíðíεáβ έάέ όá 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 áβíáέ Ýíá script áέά όí **Kermit** όí íðíβí εÛíáέ όçí έέPόόç έάέ όçí ðέóóíðíβεçόç όíð ÷ñPόόç óóíí áδñáέñóóíÝíí ððíεíáέóδP (óóí óÝεíð áðóíý ðíð áááñÛóíð, έá áñáβδά Ýíá ðáñÛááέáíá áέά Ýíá óÝóíεí script).

×ñçóëííðíéÞóáâ òí ðáñáéÛòù script /etc/ppp/pppdown ãéá íá áðíóðíáÝóáââ ôçí ãñáíìÞ 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
```

ÃéÝáíòá áí áêðáëâðáé áéúíá òí pppd, áêðáëÞíóáð òí /usr/etc/ppp/ppptest, òí íðíßí èá ïíéÛæáé íá 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
```

Ãéá íá èëâðóáðâ ôçí ãñáíìÞ, áêðáëÝóáâ òí /etc/ppp/kermit.hup, òí íðíßí èá ðñÝðáé íá ðáñéÝ÷áé:

```
set line /dev/tty01 ; put your modem device here
set speed 19200
set file type binary
set file names literal
set win 8
set rec pack 1024
set send pack 1024
set block 3
set term bytesize 8
set command bytesize 8
set flow none

pau 1
out +++
inp 5 OK
out ATH0\13
echo \13
```

exit

Ïέα áíáέέάέδóέέP ìÝέìáìð ðìð ÷ ñçóέìðìέάá ðì chat áíðá áέα ðì kermit:  
 Óά ðáñáέÛòù äýì áñ ÷ ááá áðñέìýì áέα ðç äçìέìðñáá íέαð óýíááóçð pppd.

/etc/ppp/options:

/dev/cuad1 115200

```

crtstcts # 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:

**Óçìááòóç:** Òì ðáñáέÛòù έá ðñÝðáέ íá ãñáóáá óá íέα ìúì ãñáììP.

```

ABORT BUSY ABORT 'NO CARRIER' "" AT OK ATDTphone.number
CONNECT "" TIMEOUT 10 ogin:-\r-ogin: login-id
TIMEOUT 5 sword: password

```

Ïüέέð ðñìðìðìέPóáðá έάέ ááέáðáóðPóáðá óùóðÛ óά ðáñáðÛíú áñ ÷ ááá, ðì ìúì ðìð ÷ ñáέÛæáðάέ íá έÛíáðá ááíάέ íá áέðáέÝóáðá ðçì áíðìέP pppd, ìá ðì ðñüðì ðìð óááíáðάέ ðáñáέÛòù:

# pppd

### 27.3.3 × ñçóέìðìέPíðáð ðì pppd ùò ÁìððçñáðçðP

Òì /etc/ppp/options έá ðñÝðáέ íá ðáñέÝ ÷ áέ έÛóέ áíðBóðìέ÷ì ìá ðì ðáñáέÛòù:

```

crtstcts # Hardware flow control
netmask 255.255.255.0 # netmask (not required)
192.114.208.20:192.114.208.165 # IP's of local and remote hosts
 # local ip must be different from one
 # you assigned to the Ethernet (or other)
 # interface on your machine.
 # remote IP is IP address that will be

```

```

 # assigned to the remote machine
domain ppp.foo.com # your domain
passive # wait for LCP
modem # modem line

```

Ôĩ script /etc/ppp/pppserv ðĩð óáβĩáðáέ ðáñáέÛòù, έá ðáέ óôĩ **pppd** íá έάέôĩõñãßóáέ ùð áĩððçñãðçðßð:

```

#!/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

```

×ñçóέĩðĩέßóáά ðĩ ðáñáέÛòù script /etc/ppp/pppservdown áέά íá óóáĩáðßóáά ðĩ áĩððçñãðçðßð:

```

#!/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 ðĩ **Kermit** (/etc/ppp/kermit.ans) ðĩññãß íá áĩáñãĩðĩέáß έάέ íá áðáĩáñãĩðĩέáß ðçĩ έάέôĩõñãßá áððüĩáðçð áðÛĩðçðçð 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

```

Όοἰἰ ἀδῆἀέῆοἰΎἰ ὀδῖεἰἄέοδῖ, ÷ἠζοέἰῖῖεἰἄβῖἄέ ὀἰ script /etc/ppp/kermit.dial ἄέἄ έέῖῖῖ έἄέ δέοἰῖῖβζῖ ὀἰῖ ÷ἠῖῖῖῖ. Έἄ δῆΎδἄέ ἰἄ ὀἰ ὀἠἰῖῖῖῖῖῖῖῖῖῖῖ ὀἰῖῖῖῖῖῖ ἰἄ δέῖ ἀἰῖῖῖῖῖ ὀἰῖ. Ἀῖῖῖῖῖ ὀἰ ῖῖῖῖῖ ÷ἠῖῖῖῖ έἄέ ὀἰἰ έῖῖῖῖῖ ὀἰῖ ὀἰ ἄῖῖῖ ὀἰ script. Έἄ ÷ἠἄέἄῖῖῖῖ ἄδῖῖῖῖ ἰἄ ἄέῖῖῖῖῖῖ ὀἰ ἄῖῖῖῖῖ ἄέἄ ὀἰ ἄῖῖῖῖῖ (input) ἀἰῖῖῖῖῖ ἰἄ δέῖ ἄδἄἰῖῖῖῖῖ ὀἰῖ ἄῖῖῖῖ ὀἰ modem ὀἰῖ έἄέ ἰ ἀδῆἀέῆοἰΎἰῖ ὀδῖεἰἄέοδῖῖ.

```

;
; 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 Αίόέιαòρδέος ΔñîäëçìÛòùí óå ÓõíäÝóáέò PPP

*ÓõíäέóöîñÛ òîð Tom Rhodes.*

Ç áñúòçðά áðòð έάέýððάέ ίáñέέÛ áðu óá ðñîäèðíáðά ðîð ðñîñáß íá ðáñîðóέάóðíýí úðáí áßíáðάέ ÷ ñðóç òîð PPP íÝòù óýíááóçðò modem. Άέά ðáñÛäáέáíá, έá ðñÝðáέ íá íÝñáðà íá áεñßááέά óá íçíýíáðά áέóúäîð ðîð έá äîóáíßóáέ òí óýóðçíá òí íðíßí έάέáßðá. Íáñέέíß ISP áßñîí òçí ðñîðñîðð ssword, áñ Ûέέíέ áßñîí òçí password. Αί ááí Ý ÷ áðá áñÛøáέ óùóðÛ òí script áέά òí ppp, ç áðuðáέñá áέóúäîð έá áðíðý ÷ áέ. Í ðέí óðíçέέóíÝñò ðñúðîð íá áέóóáέíáððóáðά íέá óýíááóç ppp, áßíáέ íá óðíäáέáßðá ÷ áέñîèßíçðά. Íέ ðεçñîðñîñßáð ðîð äîóáíßæñíðάέ ðáñáέÛòù, έá óáð ðäçáðóíðí áðíá ðñîð áðíá óðç ÷ áέñîèßíçðç áðíέáðÛðóáóç òçð óýíááóçð.



at
OK
atdt123456789

× ηςοείηδιείγιά οι at έάά ίά αν ÷ έείθιεΠοίτια οι modem, έάέ Υθάέοά ÷ ηςοείηδιείγιά οι atdt έάέ οι ανέειυ οιο ISP έάά ίά ίάέείΠοίτια ος έάάέέάόβά ος έέΠόο.

CONNECT

Άαη Υ ÷ τια άδεάάάάβυος ος ογίαάος. Αί Υ ÷ τια θηίάεΠιαόά ογίαάος οά ιθιβά άά ο ÷ άοβαίιόάέ ίά οι οέέειυ ίάο, άαη άβιάέ οι οςίάβι θιο θηΥθάέ ίά θηιοθάεΠοίτια ίά οά άδεέγιοίτια.

ISP Login:myusername

ς θηιοθιθΠ άοθΠ άβιάέ έάά ίά άποίτια οι υίηά ÷ ηΠόος. × ηςοείηδιείΠόοά οι υίηά ÷ ηΠόος θιο οάο Υ ÷ έέ άρεάβ άθυ οι ISP οάο.

ISP Pass:mypassword

ς θηιοθιθΠ άοθΠ άβιάέ έάά οι έυάέειυ θηυοάάος. ΑθάίοΠόοά ίά οι έυάέειυ θιο οάο Υ ÷ έέ άρεάβ άθυ οι ISP οάο. Ί έυάέειυ άοθυ άά έά άιοάίεοόάβ οός ιέυις οάο, υθυ άέηέαθ οοιαάβιάέ έάέ ίά οι έυάέειυ οάο υοάί οι ανΰοάοά οός θηιοθιθΠ έέοιιθιο οιο FreeBSD οόοθΠιαθιο οάο.

Shell or PPP:ppp

Άίΰεηά ίά οι ISP οάο, ιθιηάβ ίά ις άαβθά έάέ έάέειυ ος θάηάθΰιυ θηιοθιθΠ. Οός θάηάθΰιυ θάηθδθος ίά ηυθΰάέ άί άδεέθιγιά ίά έεοάέΥοίτια εΰθιε έΰεοθιο (shell) οοι ις ÷ ΰίς ίά οιθ θάηι ÷ Υά, Π άί εΰεθια ίά έέέείΠοίτια οι ppp. Οοι θάηΰάέαιά ίάο άδεέΥίά ίά ÷ ηςοείηδιείΠοίτια ppp έάεθ εΰεθια ίά οοιαάειγιά οοι Internet.

Ppp ON example>

θάηάοηΠόοά υέ οοι θάηΰάέαιά οι θηθοι p άβιάέ έάοάέάβι. Αθου άαβ ÷ ίάέ υέέ Υ ÷ τια οοιαάέάβ άδεοθ ÷ θο ίά οι ISP.

Ppp ON example>

, ÷ τια θεοοιθιεςέάβ ίά άδεοθ ÷ βά άθυ οι ISP ίάο, έάέ θάηείΥίτια ίά ίάο άθιαιέάβ έέάγεθις IP.

PPP ON example>

, ÷ έέ θεΰι έάεινέοόάβ έέάγεθις IP, έάέ Υ ÷ τια ηειέηθραέ ος ογίαάος ίά άδεοθ ÷ βά.

PPP ON example>add default HISADDR

Άαη θηιοέΥοίτια ος θηιθδεέάαιΥίς έέάηηΠ (default route). Οι άΠια άοθυ άβιάέ άθάηάβοςοι θηεί ιθιηΥοίτια ίά άδεέίεηΠοίτια ίά οι Υιυ έυοι, έάεθ ος άάηηΥίς οδεάηΠ ς ιυις ογίαάος θιο Υ ÷ τια άβιάέ ίά Υίά οθιεηέοοθ άθυ ος ΰεε ιάηεΰ ος άηαιθ. Αί οι θάηάθΰιυ άθιογ ÷ έέ άθαέαθ οθΰη ÷ τιο Πας έάεινέοιΥίάο έέάηηΥο, ιθιηάβθά ίά άΰεάοά Υίά έάοιαόδεέυ ! ιθιθοΰ άθυ οι add. Αίάέέάέέέΰ, ιθιηάβθά ίά εΰίάοά άοθΠ ος ηγείεος θηεί άδε ÷ έηΠόοά ος ογίαάος, έάέ έά άβιάέ άοθυιάοά έέάθηάηΰοάοος ος ιΰάο έέάηηΠ.

Αί υέά θραάί έάέΰ, έά θηΥθάέ θηηά ίά Υ ÷ άοά άίάηαΠ ογίαάος ίά οι Internet, ος ιθιβά ιθιηάβθά ίά ίάοέείΠόοά οοι θάηάοηΠεί ÷ ηςοείηδιείΠοίτια οι οοιαόοιυ θεΠεθηι CTRL+z. Αί θάηάοηΠόοά οι PPP ίά άβιάόάέ ίάΰ ppp, ς ογίαάος Υ ÷ έέ έέάειθάβ. Ίά οι θηυθι άοθυ ιθιηάβθά ίά θάηάειηθέάβθά ος έάοΰοόος ος ογίαάος οάο. Οά έάοάέάβ

P αάβ÷ήοι υόέ οδὺñ÷άέ ούγιάάοç ιά οή ISP αήρ οά ιέñŪ p αάβ÷ήοι υόέ αέα έŪδιέή έüāι ç ούγιάάοç Ÿ÷άέ ÷άέαβ. Ōī ppp Ÿ÷άέ ιüñι άόδŸδ οέό äŸι έάόάόδŪόάέδ.

### 27.4.2.1 Αίόείάορδέόç ðñīāēçīŪóúí

Αί Ÿ÷άόα άδάοέάβάδ āñāñŪ έάέ αήρ οάβιάόάέ ιά ιðñāβóā ιά άδιέάόάόδPóáóā όç ούγιάάόç, άδāíāñāñīðīέPóáóā οή Ÿέāā÷ī ñīPð ιŸóυ ðέέéŸŸ (CTS/RTS) ÷ñçóέñīðīέPíóáó όçí άðέέīāP set ctsrts off. Ōī ðāñáðŪíυ όóíāāβíáέ όóíPèυð άí āβóóā όóíāāŸířð óā έŪδιέή āíòðçñāόçòP óāñīáóέέPí ιā áóíáóóυόçóā PPP, υðīò οī PPP óóáíáóŪάέ ιά άδιññβíáóáέ υóáí ðñīòðáέáβ ιά āñŪóáέ āāñŸí ιά όóç ούγιάάόç óáó. Ōóçí ðāñβðòυóç áðòP, óóíPèυð ðāñέŸíáέ áέá έŪδιέή óPíá CTS (Clear To Send) όι ιðñβī āāŸ Ÿñ÷άóáέ ðīòŸ. Αί υóóóυí ÷ñçóέñīðīέPóáóā áðòP όçí άðέέīāP, έá ðñŸðáέ áðβóçð ιά ÷ñçóέñīðīέPóáóā έάέ όçí άðέέīāP set accmap ç ιðñβā āíāā÷ñŸíυð άðáέóāβóáέ áέá ιά άδιññíυέáβ όι ðέέéŸŸ ðīò āíāñòŪóáέ áðυ όç ιáðŪāíόç óðāέāēñέŸíŸí ÷āñáέðPñūí áðυ όç ιέá Ūēñç óóçí Ūēēç, óóíPèυð ιŸóυ όīò XON/XOFF. Άāβóā όç óāέβāā manual όīò ppp(8) áέá ðāñέóóυðāñāð ðççñīñīñβāð ó÷άóέέŪ ιā áðòP όçí άðέέīāP έάέ ðυð ιðññāβóā ιά όçí ÷ñçóέñīðīέPóáóā.

Αί áέáέŸóáóā Ÿíá ðáέáέυóāññī modem, βóυð ÷ñāέáóóāβ ιά ÷ñçóέñīðīέPóáóā όçí άðέέīāP set parity even. Ç ðñīáðέέāñŸíç ñŸέιέóç āβíáέ ιά ιçí óðŪñ÷άέ έóíòέιβā (parity none), áέέŪ óā ðáέέŪ modems (έάέ óā έŪδιέήòð ISP) ÷ñçóέñīðīέáβóáέ áέá Ÿέāā÷ī έáέPí (ç ÷ñPóç όçð ðñīέáέáβ υóóóυí ιāāŪέç áŸíçόç óóç ιáóáέβίçόç āāñŸíŸí). Ϝóυð ÷ñāέáóóāβóā áðòP όçí άðέέīāP, áí ι ISP óáó āβíáέ ç Compuserve.

Ōī PPP βóυð ιά ιçí áðāŸέέáέ όóçí έáóŪóóáóç āíòέPí, όι ιðñβī āβíáέ όóíPèυð óóŪέíá áέáðñāñīŪóáóçð, έáέPð ι ISP ðāñέŸíáέ áðυ όç áέέP óáó ιāñέŪ ιά ιāέέíPóáέ όç áέáðñāñīŪóáóç. Ōóí óçíāβī áðóυ, ç ÷ñPóç όçð āíòίέPð ~P έá āíáíāēŪóáέ όι ppp ιά āñ÷βóáέ ιά óóŸέíáέ óέó ðççñīñīñβāð ó÷άóέέŪ ιā όç ñŸέιέóç.

Αί āāŸ ðŪñāðā ðīòŸ ðñīòñīðP áέóóūāíò, όι ðέέáíυóāññī āβíáέ ιά ðñŸðáέ ιά ÷ñçóέñīðīέPóáóā ðέóóíðīβçόç PAP P CHAP áíóβ áέá όçí óŸðīò UNIX ðέóóíðīβçόç ðīò ðāñέāñŪóáíā óóí ðāñáðŪíυ ðāñŪāέáíá. Άέá ιά ÷ñçóέñīðīέPóáóā PAP P CHAP áðέPð ðñīóέŸóóā óέó ðāñáέŪóυ áðέέīāŸð όóçí áóāññāP PPP ðñέí āñáέáβóā óā έáóŪóóáóç óāñīáóέéŸŸ:

```
ppp ON example> set authname myusername
```

Έá ðñŸðáέ ιά áíóέέáóóóðPóáóā όí myusername ιā όι υññā ÷ñPóç ðīò óáó Ÿ÷άέ āíέáβ áðυ όή ISP óáó.

```
ppp ON example> set authkey mypassword
```

Έá ðñŸðáέ ιά áíóέέáóóóðPóáóā όí mypassword ιā όή έüāέέü ÷ñPóç ðīò óáó Ÿ÷άέ āíέáβ áðυ όή ISP óáó.

Αί όóíŸáóóā έáñíέέŪ, áέέŪ āāŸ óāβíáóáέ ιά ιðññāβóā ιά άðέέίέŸíPóáóā ιā έáíέŪ áέáŸέóíóç, ðñīòðáέPóáóā ιά ÷ñçóέñīðīέPóáóā όçí āíòίέP ping(8) ιā ιέá áέáŸέóíóç IP áέá ιā āāβóā áí έá έŪāáóā áðŪíóçόç. Αί áέŸðáóā áðPéáέá ðáέŸóυí 100%, όι ðéí ðέέáíυ āβíáέ υóέ āāŸ Ÿ÷άóā έáέññβóáέ έŪðíέá ðñīáðέέāñŸíç áέáāññP. ΆέŸáíóā íáŪ υóέ Ÿ÷άóā ñòέιβóáέ όçí άðέέīāP add default HISADDR έáóŪ όç áέŪñέáέá όçð óúγιάάόçð. Αί ιðññāβóā ιά άðέέίέŸíPóáóā ιā ιέá áðñāέñòóíŸíç áέáŸέóíóç IP, όι ðέέáíυóāññī āβíáέ υóέ āāŸ Ÿ÷άóā āŪéáέ όç áέáŸέóíóç έŪðíέíò áέáέññέóðP íñŪóúí óóí āñ÷āβī /etc/resolv.conf. Ōī āñ÷āβī áðóυ έá ðñŸðáέ ιά ñέŪæáέ ιā όí ðāñáέŪóú:

```
domain example.com
nameserver x.x.x.x
nameserver y.y.y.y
```

¼ðīò óā x.x.x.x έáέ y.y.y.y έá ðñŸðáέ ιά áíóέέáóóóáέŸíŸ ιā óέó áέáðέŸíóáέó IP óúí áέáέññέóðPí DNS όīò ISP óáó. Άíāā÷ñŸíυð ιέ ðççñīññβāð áóóŸð ιά óáó Ÿ÷ήοι āíέáβ έáóŪ όçí āāñāóP óáó óóçí ððçñāóβā. Αί υ÷έ, έá ιðñŸóáóā ιá óέó āñāβóā áŸíέá ιā Ÿíá όçέáòPíçíá óóí ISP óáó.

Ūññāβóā áðβóçð ιά āíāñāñīðīέPóáóā όçí έáóáāñāóP óóíāŪíóúí áέá όçí PPP óúγιάάόç óáó, ιŸóυ όīò syslog(3). ΆðέPð ðñīóέŸóóā:

```
!ppp
*. * /var/log/ppp.log
```

όοι /etc/syslog.conf. Óέδ δάνέόούδάνάδ οϊñÝð, áδδP ç έάέόϊδñάβá òðÛñ÷άέ Păç.

## 27.5 ×ñçόέϊδϊέβίôáð PPP ìÝóù Ethernet (PPPoE)

ÓδϊάέόοϊñÛ (άδÛ <http://node.to/freebsd/how-tos/how-to-freebsd-pppoe.html>) ôïð Jim Mock.

Ç áíúôçάά άδδP δάνέññÛôάέ ðùð íá ññèìβóáðά íέα όýíáάόç PPP ìÝóù Ethernet (PPPoE).

### 27.5.1 Ñýèìέόç ôïð ÐðñPía

Äáí άδάέôáβδάέ δέÝíí άέάέð ñýèìέόç ôïð δðñPía áέα ôç έάέόϊδñάβá PPPoE. Áí ï δðñPíáð óáð äáí δάνέέáïÛíáέ ôçí άδάνάβôçôç òðïóðññέίç netgraph, ôï ppp έá ôçí οϊñðβóάέ άððüìάάú ùð Ûññèñùá.

### 27.5.2 Ñýèìέόç ôïð ppp.conf

ÐάνάέÛðù óάβίáðάέ Ýíá òðüüääέáïá 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 ôïð ppp

Ûð ÷ñPóçðò root, ìðññάβôá íá άέôάέÝóáðά:

```
ppp -ddial name_of_service_provider
```

### 27.5.4 Άέêβίçóç ôïð ppp έáðÛ ôçí Άέêβίçóç

ÐñïέÝóáðά óέð δάνάέÛðù ãñáñÝð óóï 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"
```





άάέάδΰόάόç òïð port, έά άñáððά Ύία ðëÞñç ïäçäü áέά òç ñýèìέόç òïð **mpd** óá ïññòÞ HTML. Ç óáèìçñßùóç άάέέèðóóáóáέ óðïï έάóΰέïäï *PREFIX/share/doc/mpd/*. Ðáñáέΰòù òáßíáðáέ Ύία òðüääέäïä ñèèìßóáùï áέά óýíäáóç óá ïέá òðçñáóáßá ADSL ïΎòù òïð **mpd**. Ìέ ñòèìßóáέò ÷ ùñßæïïðáέ óá äýï äñ÷áßá, ðñððá äáß÷íïðä òï *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 Õï üñíá ÷ñÞðóç ïá òï ïðïßï áßíáðáέ ç ðέóðïðïßçóç óðïï ISP óáò.
- ❷ Ì èùääέèð ïá òïï ïðïßï áßíáðáέ ç ðέóðïðïßçóç óðïï ISP óáò.

Õï äñ÷áßï *mpd.links* ðáñέΎ÷άέ ðèçñïïñßáò ó÷áðέέΰ ïá òç óýíäáóç Þ ðέò óðïáΎóáέò ðïð έά ðñááïáóïðïέçèïýï. Άέά ðáñΰääέäïä, òï *mpd.links* ðïð óðñïäýáέ òï ðáñáðΰïð ðáñΰääέäïä, òáßíáðáέ ðáñáέΰòù:

```
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 äέáýèðïóç IP òïð FreeBSD òðïέïäέóðÞ óáò, óðïï ïðïßï έά ÷ñçóέïðïέçÞóáðá òï **mpd**.
- ❷ Ç äέáýèðïóç IP òïð ADSL modem óáò. Άέά òï Alcatel SpeedTouch Home, ç äέáýèðïóç áðòÞ áßíáέ áðï ðñïáðέέïäÞ ç 10.0.0.138.

Άßíáέ äïíáóùï ïá äñ÷έèïðέÞóáðá òç óýíäáóç áýèïέá, áßíïðáò òçï ðáñáέΰòù áíóïèÞ ùð root:

```
mpd -b adsl
```

Ìðñáððá ïá äáßðá òçï έáóΰόάóç òçð óýíäáóçò ïá òçï ðáñáέΰòù áíóïèÞ:

```
% 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 άδβóçò ίά ÷ñçóέιιδιέπιόάò οι FreeBSD άέά ίά οοίάάέάβòά οά Ûέέάò οδçñάόβòά PPPoA ÷ñçóέιιδιέπιόάò οι net/pptpclient.

Άέά ίά ÷ñçóέιιδιέπιόάò οι net/pptpclient άέά ίά οοίάάέάβòά οά ίέά οδçñάόβά DSL, άάέάόάόòπιόάò οι port P οι ðάέÝδι, έάέ άðáññάάόòάβòά οι άñ÷άβι /etc/ppp/ppp.conf. Έά ÷ñάέάόòάβ ίά άβòά root άέά ίά έÛίάòά έάέ όέò άγι ðáñáðÛíù áέάέέάóβòά. ÐáñáέÛòù óáβίáóáé Ýíá ðáñÛááέáíá ίέάò áíúòçóáò οιò ppp.conf. Άέά ðáñέóóúòáñáò ðççñíòññáò ó÷áðέέÛ ίά όέò άðέέíáÝò 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 ðñÝðáé ίά áñÛòáòά οι έùáέέú óáò ïñòò áðéíγ έáέíÝííò óοί άñ÷άβι ppp.conf, έά ðñÝðáé ίά ááááέúέáòáò úðé έáíÝíáò Ûέέíò áái έά ïðñáñ ίά áέááÛóáé óá ðáñέá÷úíáía áóòíγ οιò άñ÷άβι. Ìá όέò ðáñáέÛòù áíóíēÝò, ïðñáñóá ίά áíáóóáέòóáòά úðé οι άñ÷άβι έά ïðñáñ ίά áέáááóóáñ ïúí ïÝóá áðù οι έíááñέάóíù οιò root. Άáβòά όέò óáέòááò manual óúí chmod(1) έάέ chown(8) άέά ðáñέóóúòáñáò ðççñíòññáò.

```
chown root:wheel /etc/ppp/ppp.conf
chmod 600 /etc/ppp/ppp.conf
```

Άóòù έá áñβίáé Ýíá όíγíáé άέά ίέά οοίááñβá PPP ίά οι DSL áññíέíäçòò óáò. Óá DSL modem óýðíò ethernet Ý÷íοί ίέά ðñíέáέíñέóíÝíç áέáýέóίóç IP óοί ðíðέέú óáò áβέòòí, óòçí ïðñáñ ïðñáñóá ίά οοίááέáβòά. Óòçí ðáñβðòúòç οιò Alcatel SpeedTouch Home, ç áέáýέóίóç áóòò áβίáé 10.0.0.138. Ç óáέìçñβùòç ðíò áέáέÝóáé ï áññíέíäçòò óáò, έá áíáóÝñáé ðíέá áέáýέóίóç ÷ñçóέιιδιέάβ ç óóóéáòò óáò. Άέά ίά áñβίáòά οι όíγíáé έάέ ίά ïáέíòáòά ίέά οοίááñβá PPP, áέòáέÝóáò óçí áέúέíòèç áíóíēò:

```
pptp address adsl
```

**Óúúááέίç:** Άβίáé έáέò έáÝá ίά ðñíóέÝóáòά Ýíá "&" óοί ðÝέíò óçò ðñíçáíγíáíçò áíóíēò, áέáóíñáòέέÛ οι pptp áái έá óáò áðέóòñÝòáé οι Ýέáá÷í (ðñíòñíðò) οιò óáñíáòέέíγ óáò.

Έά άçiέιτñãçέåß ιέα όόόέåðP tun (άέέιέέúú όιγίåέ) έάέ όçi άέέçέåðßãñåóç ιåóåίγ όúι έέåñååóέßι pptp έάέ ppt. Ιúέέó άðέóóñÝθåέ ç ðñιόñιðP όóι όåñιåóέέúú óåð, P όι pptp άðέåååέθóåέ όç όγίååóç, ιðñåßòå ιå åñåðΰóåðå όι όιγίåέ ιå όιι όñúðι ðιò öåßιåóåέ ðåñåέΰòú:

```
% 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
```

Άί åñι ιðñÝóåðå ιå óóιååέåßòå, åέÝåιðå όέó ñðèιβóåέð όιò åñιιέιçòP óåð, ιέ ιðιβåð όóιPεúð åßιåέ ðñιóåΰóέιåð ιÝóú telnet P ιÝóú έΰðιέιò öðέέñåðñçðP. Άί åέúιå åñι ιðñåßòå ιå óóιååέåßòå, έå ðñÝðåέ ιå åñåðΰóåðå όçi Ýñåι όçð åίóιεðð pptp έάέ óå ðåñέå÷úιåιå όιò åñ÷åßιò έåóååñåóðð όιò pptp, /var/log/ppp.log έάέ ðέέåίΰ όóιέ÷åßå.

## 27.7 ×ñçóέιιðιέßιόåò όι SLIP

Åñ÷έêP óóιåέóóιñΰ όιò Satoshi Asami. Ιå όç åιPεåέå όúι Guy Helmer έάέ Piero Serini.

### 27.7.1 Ñðèιβæιίóåò Ýιå Ðåέΰóç SLIP

Ðåñåέΰòú ðåñιòóέΰæιðιå Ýιå όñúðι ιå ñðèιβóåðå Ýιå ιç÷ΰιçιå FreeBSD úð ðåέΰóç SLIP óå Ýιå åßέóóι ιå óóåóέέÝð åέåðέγίóåέð. Άέå ιç÷åιPιåóå óå ιðιβå έåñåΰιñιí uññå åóιåιέΰ (ç åέåγέðιόç όιòð åέέΰæåέ έΰεå όιñΰ ðιò óóιåÝιíóåέ), ðέέåίιι ιå ðñåέóóåß ιå έΰιåðå ðει ðιέγðειεåð ñðèιβóåέð.

Åñ÷έέΰ, έå ðñÝðåέ ιå έåειñβóåðå óå ðιέå óåέñέåêP έγñå åßιåέ óóιååιÝιι όι modem óåð. Åñέåðιβ ðñPóóåð åçιέιòñåγί Ýιå óóιåιέέúú ååóιú ð.÷. /dev/modem, όι ιðιβι ååß÷ιåέ óóçi ðñååιåóέέP óóóέåðP /dev/cuadn. Άóóú óåð åðέóñÝðåέ ιå óóιå÷βóåðå ιå ðñçóέιιðιέåßòå όι βæιι uññå óóóέåððð, åέúιå έåέ åι ιåóåέέιPóåðå όι modem óå åέåóιñåóέέP έγñå. Åßιåέ ιΰέεηι ΰåιι ιå ðñÝðåέ ιå åέέΰιåðå ðεPειð åñ÷åßιι όóι /etc έåεθð έάέ óå åñ÷åßå .kermrc óå úει όι óýóóçιå!

Óçιåßúóç: Óι /dev/cuad0 åßιåέ ç COM1, όι /dev/cuad1 åßιåέ ç COM2, έ.ι.έ.

Ååååέúεåßòå úέέ όι åñ÷åßι ñðèιβóåúι όιò ððñPιå óåð ðåñέÝ÷åέ óå ðåñåέΰòú:

```
device sl
```

Óι ðåñåðΰιñ ðåñέέåιåΰιåóåέ óóιι ððñPιå GENERIC, έάέ åι åñι όι Ý÷åðå åέååñΰøåέ, åñι έå Ý÷åðå ðñúåέçιå.

#### 27.7.1.1 Ñðèιβóåέð ðιò έå ×ñåέåóóåß ιå έΰιåðå ιúιι ιέå Öιñΰ

1. ÐñιòέÝóåð όι ιç÷ΰιçιå óåð, όçi ðýçç (gateway) έάέ όιòð åέåέñιέóóÝð ιññΰòúι (nameservers) όóι åñ÷åßι /etc/hosts. Óóι ðåñΰååέåιå ιåð, όι åñ÷åßι åðóú ιιέΰæåέ ιå όι ðåñåέΰòú:

```
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 άύύόά files άñβόέάόάέ δñεί οι dns όόεί άύύόόά hosts: όιό άñ÷άβιό /etc/nsswitch.conf. Άί άάί όδὐñ÷ίόί άόόὐò ιέ δάνὐιάόñιέ, ιδñάβ ίά άιόάίέόόιγί δάνὐιάά όόιδδβιάόά.
3. Όñιδñιέβόά όι άñ÷άβι /etc/rc.conf.
  1. Ιñβόά όι υñά όιό δδñιέέόόβ όάδ, όñιδñιέβιόάδ όε άñάñβ όιό άñὐόάέ:
 

```
hostname="myname.my.domain"
```

 Έά δñὐάέ άάβ ίά όιδñιέέόόβόά όι δέβñάδ υñά όιό δδñιέέόόβ όάδ.
  2. Ιñβόά όι δñιάδέέάάὐίñ άññιέιάόβ, άέέὐάειόάδ όε άñάñβ:
 

```
defaultrouter="NO"
```

 όά:
 

```
defaultrouter="slip-gateway"
```
4. Άέιέιόñάβόά 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 δñάδὐίñ ιñβέάέ όιόδ άέάέñέόόὐδ DNS. Όόόέέὐ, όά δñάάιόάέέὐ ιñιáόά έάέ ιέ άέάόέγίόάέδ όυι όñὐί άιáñδβιόάέ άδὐ όι δñέάὐέειί όάδ.
5. Ḇδέιβόά έùάέέυ δñυόάάόçδ άέά όιόδ ÷ñβόάδ root έάέ toor (έάέβδ έάέ άέά υίόδδ ὐέειόδ έιáάñέάόιγδ άάί ὐ÷ίόί έùάέέυ).
6. Άδάίάέέέβόά όι ιç÷ὐίγίά όάδ, έάέ άάάέέέάβδά υέέ ὐ÷άέ όάέάβ όύόδὐ όι υñά δδñιέέόόβ.

### 27.7.1.2 Άέιέιόñάβιόάδ ιέά Όγίάόç SLIP

1. Ιάδὐ όεί έέβόç, άñὐόά όεί άίόιέβ slip όόεί δñιόñιδβ, άñὐόά όι υñά όιό ιç÷άβιáόδ όάδ έάέ όιί έùάέέυ. Όι όέ άέñέάβδ ÷ñάέὐάόάέ ίά άñὐόάόά, άιáñδὐόάέ άδὐ όι δñέάὐέειί όάδ. Άί ÷ñçόέιιδñιέάβδ όι **Kermit**, ιδñιάβόά ίά ÷ñçόέιιδñιέβόάά ὐίά script υδὐδ όι άέυέιόδè:

```
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
```

Όόόέέὐ, έά δñὐάέ ίά άέέὐιáόά όι υñά ÷ñβόç έάέ όιί έùάέέυ βόά ίά όάέñέὐάειόί ιά όά άέέὐ όάδ. Ιάδὐ άδὐ άδδὐ, ιδñιάβόά άδέβδ ίά δέçέδñιέιáβόάά slip όόεί δñιόñιδβ όγίάόçδ όιό **Kermit**.



(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 δάναδὺήδὺ δάναάάβαιάόά άβιάέ άδὺ Ύία ό÷άόέέὺ άδάό÷ιέçìΎίί όύόόçιά. Ίέ άνέέιηβ έά άέάόΎηιόί όδὶ όύόόçιά όάό, άίὺέιάά ίά όç άνάόόçñέιυόçόά όιō άέέόγίō.

## 27.7.2 Νῶεὶβᾶειῖόάό ίά Άίῶδçñάόçð SLIP

Όι έάβιαιή άόδὺ δάñΎ÷άέ έὺδὺέάό δδῖάάβιέάέ άέά όç ηῦέιέόç άίυδ FreeBSD όδóóΠιάόιῶ ùδ άίῶδçñάόçð SLIP. Όδδέέὺ άόδὺ όçιάβιέάέ υέέ όι όύόόçιά όάό έά ηῶεὶεόάβ ίά ίάέέΎ άόδὺιάόά όέό όόίάΎόάέό ίάδὺ όçί άβόίαιή άδῖάέηόόίΎίί δάέάόβί SLIP.

### 27.7.2.1 ΔῖηιῶδὶέΎόάέό

Ç άίυδóçόά άόδð άβιάέ έάέάβóάñά όά÷ίέέðδ όύόάυδ, έάέ άέά όι έυαιή άόδὺ άδάέόάβóάέ ίά Ύ÷άόά όέό άίόβóδὶέ÷άό άίβóάέό άέά ίά όçί έάόάñίβóάόά. ΌδῖέΎόιόιá υέέ Ύ÷άόά ίέά άñέέάβυόç ίά όι δῖηιῶεὶέέί TCP/IP έάέ άέάέέυδóñά ίά όç άέάόέδὶόέίάυδóç όέιάύί, όέό ίὺóέάδ άέέόγύί, όά δδῖάβέόδά, όç άñῖῖέιυάçόç έάέ όά δῖηιῶεὶέέά άñῖῖέιυάçόç ùδὺδ όι RIP. Ç ηῦέιέόç όὺί όδçñάόέβί SLIP όά Ύία άίῶδçñάόçð άδέέιάέέβί όόίάΎόάύί άδάέόάβ άίβóç άόδβί όὺί άίίίέβί, έάέ άί άάί άβóά άñέέάέέυΎίῖδ ίά άόδὺδ, όάό δάñάέάέίγίá ίά έάάΎόάόά άβóά όι TCP/IP Network Administration όιō Craig Hunt (άέάυόάέό O'Reilly & Associates, Inc, Άñέέιῖδ ISBN 0-937175-82-X) ð έὺδὺέί άδὺ όά έάέέβá όιō Douglas Comer ó÷άόέέὺ ίά όι δῖηιῶεὶέέί TCP/IP.

ΆδέδεΎίί, δδῖέΎόιόιá υέέ Παç Ύ÷άόά ηῶεὶβóάέ όι modem όάό έάέ Ύ÷άόά δῖηιῶδὶέέβóάέ όά έάόὺέέççέά άñ÷άβá ηῶεὶβóάύί όι όóóóΠιάόιῶ βóάά ίά άδέóñΎδάόάέ ç άβóίαιῶ όόι όύόόçιά ίΎόὺ όὺί modem. Άί άάί Ύ÷άόά άέυίá δῖηιῶδὶέέΎόάέ όι όύόόçιά άέά άόδὺ, δάñάέάέίγίá άάβóά όι ΌιΠιά 26.4 άέά έάδδῖñΎñάέάό ó÷άόέέὺ ίά όç ηῦέιέόç όὺί άδέέιάέέβί όόίáΎόάύί. Άίάά÷ñΎίῖδ ίά έΎέάόά άδβóçδ ίά άάβóά όέό όάέβáάδ manual όçδ sio(4) άέά δέçñῖῖóñβáδ ó÷άόέέὺ ίά όι δῖηιῶñáñá ίάβáçόçδ όçδ όάέñέάέðδ έγῖñάδ, όά ttys(5), gettytab(5), getty(8), έάέ init(8) άέά δέçñῖῖóñβáδ δῖῶ ó÷άόβᾶειῖόάέ ίά όç ηῦέιέόç όιῶ όóóóΠιάόιῶ βóάά ίά άΎ÷άόάέ άβóίαιή ÷ñçóðβί ίΎόὺ modem, έάέ βóδὺδ έάέ όç stty(1) άέά δέçñῖῖóñβáδ ó÷άόέέὺ ίά όέό δάñáΎόñῖῶδ όάέñέάέβί έδῖβί (ύδὺδ όçί cllocal άέά όάέñέάέΎδ έέάδάóΎδ όῖῶ άβιάέ άδάόέάβáδ όόίάñίΎίáδ).

### 27.7.2.2 Άñβáñç Άδέόέυδçç

Όδδέέὺ, Ύίáδ άίῶδçñάόçð SLIP δῖῶ ÷ñçóέίῖδὶέάβ FreeBSD έάέόιῶñάάβ ίά όῖί άίβδ δῖηιῶδῖ: Ύίáδ ÷ñβóçç SLIP έάέάβ όῖί άίῶδçñάόçð SLIP, έάέ άέóΎñ÷άόάέ όδὶ όύόόçιά ίΎόὺ άίυδ άέάέέίγί áíáñῖῖéóóέέίγί áέóύáῖῶ άέά όι SLIP. Όῖ έΎέóῖῖδ όῖῶ ÷ñβóçç άβιάέ όῖ /usr/sbin/sllogin. Όῖ δῖηιῶñáñá sllogin έάάΎᾶέ όῖ άñ÷άβῖ /etc/sliphome/slip.hosts άέά ίά άñάέ ίέά άñáñð δῖῶ ίά όάέñέΎᾶέ ίά όῖί ÷ñβóçç, έάέ άί δδὺñ÷άέ, όόίáΎάέ όçί όάέñέάέβ άñáñð όά ίέά έάέέΎόέίç έάάδáð SLIP έάέ Ύδάέόά άέóάέάβ όῖ script όῖῶ έάέγῖῖδ ÷ñβóçç /etc/sliphome/slip.login άέά ίά ηῶεὶβóάέ όç έάάδáð SLIP.

### 27.7.2.2.1 Já ΔάνÛάάεαιά Άέούαιρò óά ΆιòδçñάòçòP SLIP

Άέά δάνÛάάεαιά, άέά Ýíá ÷ñPòç SLIP ιά ID Shelmerg, ç áιόβòóιé÷ç έάóά÷ñéóç óóι /etc/master.passwd έά Ýíέάεά ιά ðçí δάνάέÛòù:

```
Shelmerg:password:1964:89::0:0:Guy Helmer - SLIP:/usr/users/Shelmerg:/usr/sbin/sliplogin
```

¼óái άέóÝέέάé ι Shelmerg, ðι sliplogin έά øÛíáé ðι /etc/sliphome/slip.hosts άέά ιέά άñáiñP ιά ID ÷ñPòç ðιò ιά óάέñέÛάέ. Άέά δάνÛάάεαιά, ιðíñάβ ιά ððÛñ÷άέ ιέά άñáiñP óóι /etc/sliphome/slip.hosts ðιò ιά άñÛòάέ:

```
Shelmerg dc-slip sl-helmer 0xfffffc00 autocomp
```

Ïι sliplogin έά άñάέ ðç άñáiñP áðòP, έά óóíáÝóάέ ðç óάέñέάέP άñáiñP óóçí áðùíáιç άέάέÝóέιç άέάðáòP SLIP, έάέ Ýðάέóά έά άέóάέÝóάέ ðι /etc/sliphome/slip.login ùðùò óάβίáóάέ δάνάέÛòù:

```
/etc/sliphome/slip.login 0 19200 Shelmerg dc-slip sl-helmer 0xfffffc00 autocomp
```

Άί ùέά ðÛíá έάέÛ, ðι /etc/sliphome/slip.login έά άέóάέÝóάέ ιέά áíòιέP ifconfig άέά ðç άέάðáòP SLIP óóçí ιðíβά Ý÷άέ óóíáάέάβ ç sliplogin (ç άέάðáòP 0 óóι δάνάðÛíù δάνÛάάεαιά, ç ðñòç δάνÛάάòñιò ðçð έβóóάð ðιò άβίáóάέ óóι slip.login) þóóά ιά ñòèìέóóιγί ç ðιðέέP άέάýèòίóç IP (dc-slip), ç áðíáέñòóιÝίç άέάýèòίóç IP (sl-helmer), ç ιÛóέά άέέóγιò άέά ðç άέάðáòP SLIP (0xfffffc00), έάέ ιðιέάóάððιòά ðñüóέάóάð áðέεíáÝò (autocomp). Άί έÛóέ ðÛάέ óðñάáÛ, έά ιðíñÝóάóά ιά ðι áíòιðβóάóά áðù óά άñ÷άβά έάóάάñάòP ðçð sliplogin. Ç sliplogin έάóάάñÛòάέ óά ιçíγíáóά ÷ñçóέιιðιέþíóáð ðι áάβιííá **syslogd** ι ιðιβιò óóιPèùð ÷ñçóέιιðιέάβ ðι άñ÷άβι /var/log/messages (άάβòά óέð óάέβááð áιPέάέáð άέά óά syslogd(8) έάέ syslog.conf(5) έάέ áíáá÷ñÝíùð άέÝáíòά ðι /etc/syslog.conf άέά ιά áάβòά ðçí ðιðιέάóά έάέ ðι άñ÷άβι ðιò ÷ñçóέιιðιέάβ ðι **syslogd** άέά ðçí έάóάάñáòP).

### 27.7.2.3 Ñýèìέóç ðιò ðòñþíá

Ï ðñíáðέέάáñÝíùð ðòñþíáð ðιò FreeBSD (ι GENERIC) άέάέÝóάέ áíóùíáóùιÝίç ððιòðñéιç SLIP (sl(4)). Óóçí δάνβðòóç ðιò έÝέάóά ιά äçιέιòñáPóáðά ðñιόάνιιòιÝíι ðòñþíá, ðñιóέÝóóά ðçí δάνάέÛòù άñáiñP óóι άñ÷άβι ñòèìβóáùι ðιò ðòñþíá óáð:

```
device sl
```

Ïι FreeBSD, áðù ðñíáðέέίáP, ááι ðñιùέάβ ðάέÝóά. Άί έÝέάóά ι áιòδçñάòçòPð óáð ιά áíáñááβ ùð áñιιέíáçòPð, έά ðñÝðάέ ιά áðáíáñáóóάβòά ðι άñ÷άβι /etc/rc.conf έάέ ιά áέέÛíáðά ðç ñýèìέóç ðçð ιáóάáέçòPð gateway\_enable óά YES. Ιά ðιí ðñùðι áðóù, έά áβίáέ óβáιòñι ùóέ ç áðέέίáP ðçð áñιιέüáçóçð έά άέáðçñçέάβ ιáòÛ áðù ιέá áðáíáέέβιçóç.

Έά ðñÝðάέ Ýðάέóά ιά áðáíáέέέιPóáðά άέά ιά áíáñáιðιέçέιγί ιέ ιÝáð ñòèìβóáέð.

Άέά ιά áóáñιüóáðά áðóÝð óέð ñòèìβóáέð Ûíáóά, ιðíñάβòά ιά άέóάέÝóάðά ðçí δάνάέÛòù áíòιέP ùð root:

```
/etc/rc.d/routing start
```

Δάνάέάέιγííá áάβòά ðι ΈαοÛεάει 8 άέά δάñέóóüóáñάð ðççñιιòιñβáð ó÷áðέέÛ ιά ðçí ñýèìέóç ðιò ðòñþíá ðιò FreeBSD.

### 27.7.2.4 Ñýèìέóç ðιò Sliplogin

¼ðùð áíáòÝñέçέά έάέ ðñéι, ððÛñ÷ιò ðñβά άñ÷άβά óóιí έáòÛέíáι /etc/sliphome óά ιðíβά ÷ñçóέιιðιέγíóáέ óóç ñýèìέóç ðιò /usr/sbin/sliplogin (άάβòά έάέ ðç óάέβáá manual ðιò sliplogin(8)): ðι slip.hosts, ðι ιðιβι



ñòèìβóáðá óá scripts /etc/sliphome/slip.login έάέ /etc/sliphome/slip.logout íά ÷ ñçóεííðíεíγí ðí arp(8) έάέ íά ÷ áεñβæííóάέ óéð έάóá÷ ùñβóáέð “proxy ARP” óðíí ðβίάέά ARP ðíð áíððçñáðçðβ SLIP.

27.7.2.4.2 Νýγέέóç ðíð slip.login

íά ðððέéü /etc/sliphome/slip.login ñεΰεάέ ìά ðí ðάñάέΰòù:

```
#!/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
```

Ôí áñ÷ áβí slip.login áέðáέάβ áðεβð ðí ifconfig έάέ ðçí έáðΰέεççç έάάðáðβ SLIP, ìά ðéð ðíðέέΎð έάέ áðñάέñóíΎíáð έάέðéγíóάέð έάέ ðç ìΰóέά έέέðγíð ðçð έάάðáðβ áððβð.

Άί Ύ÷ áðá áðñóáóβóάέ íά ÷ ñçóεííðíεβóáðá ðçí ìΎέíáí “proxy ARP” (άίðβ íά ÷ ñçóεííðíεβóáðá έάέðíñáðééü ððíáβέððí έάέ ðíðð ðάέΰðáð SLIP), ðí áñ÷ áβí /etc/sliphome/slip.login έά ñεΰεάέ ìά ðí ðάñάέΰòù:

```
#!/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 ðñüóέάðç ãñáììβ óά áððü ðí slip.login, ç arp -s \$5 00:11:22:33:44:55 pub, áçíέíðñάάβ ìέά έάóá÷ ðñέóç ARP óðíí ðβίάέά ARP ðíð áíððçñáðçðβ SLIP. Άððβ ç έάóá÷ ðñέóç ARP έΰíάέ ðíí áíððçñáðçðβ SLIP íά áðáíðΰ ìά ðçí έέáyέðíóç Ethernet MAC ùðáí έΰðíεð ðέεíð éüíáíð IP óðí Ethernet áðέέðíáβ íά áðέέíεííβóάέ ìά ðçí έέáyέðíóç IP ðíð ðάέΰðç SLIP.

¼ðáí ÷ ñçóεííðíεάβðá ðí ðάñáðΰíú ðάñΰάέάíá, áάάάέüεάβðá ùðέ Ύ÷ áðá άίðέέάóáóðβóάέ ðçí έέáyέðíóç MAC ðíð Ethernet (00:11:22:33:44:55) ìά ðçí άίðβóðíε÷ç ðçð έέέβð óáð έΰñðáð Ethernet, έέάðíñáðéέέΰ ðí “proxy ARP” óβáíðñά ááí έά έάέðíðñάβóάέ! Ìðñάβðá íά άίάέάέγðáðá ðç έέáyέðíóç MAC ðíð έέέíγ óáð áíððçñáðçðβ SLIP έíέðΰεííðáð óά áðíðάέΎóíáðá ðçð άíðíεβð netstat -i. Ç ááyðáñç ãñáììβ ðçð áíúáíð έά ñεΰεάέ ìά ðçí ðάñάέΰòù:

```
ed0 1500 <Link>0.2.c1.28.5f.4a 191923 0 129457 0 116
```

Άððü ááβ÷ íάέ ùðέ óðí óðάέáεñέíΎíí óγóðçíá ç έέáyέðíóç MAC ðíð Ethernet áβίάέ 00:02:c1:28:5f:4a. Ìέ ðάέάβáð ðççí έέáyέðíóç ðíð ááβ÷ íάέ ç netstat -i ðñΎðάέ íά άίðέέάóáóðáεíγí ìά ΰíú-έΰùð ðάέάβáð, έάέ έΰέά ñíú

ääéääíááééü øçöβī ðñÝðáé íá íáoáoñáðáβ óá äéðëü ðñíóéÝóííóáo áðü ðññíóóÛ Ýíá íçääíééü. Ç äéáyèðíóç íáoáoñÝðááoé íá áðóü ðñí ðññüðī óá íéá ðññöβ ðñí ðñññáβ íá ÷ñçóéíñðíéðóáé ç arp(8). Ááβðá ðç óáëβáá manual ðçð arp(8) äéá ðññéóóüðáñáð ðççññíññáð ó÷áðééÛ íá ðç ÷ñβóç ðçð áíóñëβð áðóβð.

**Óçíáβúóç:** ¼ðáí äçíéíññááβðá ðñ /etc/sliphome/slip.login έάέ ðñ /etc/sliphome/slip.logout, έá ðñÝðáé íá èÝóáoðá ðñ bit “äéðÝéáóçò” (ð.÷. chmod 755 /etc/sliphome/slip.login /etc/sliphome/slip.logout), äéáðññáðééÛ ç sliplogin äáí έá ðñññáβ íá ðá äéðáëÝóáé.

### 27.7.2.4.3 Ñýèíéóç ðñö slip.logout

Ïñ /etc/sliphome/slip.logout äáí áβíáé áðüéððá áðáñáβðçðñ (äéðüð áí ðñññéáéðáé íá ðñññéðéðóáðá “proxy ARP”), äéÛ áí óéñðáýáðá íá ðñ äçíéíññáβðáðá, ðñññáβðá íá ÷ñçóéíñðíéðóáðá ðð ðñññáéáíá ðñ ðáñáéÛðñ áðëü ðáñÛäééñíá:

```
#!/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 ÷ñçóéíñðíéáβðá “proxy ARP”, έá èÝéáðá ðñ /etc/sliphome/slip.logout íá äéáññÛðáé ðçí έáðá÷ññéóç ARP ðñö ðáëÛðç 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 äéáññÛðáé ðçí έáðá÷ññéóç ARP ðñö ðññíóóÝéçéá íá ðçí äéðÝéáóç ðñö slip.login ðñö “proxy ARP”, έáðÛ ðçí áβóñññ ðñö ðáëÛðç SLIP.

ðñÝðáé íá ðñ äðáíáéÛáñññá Ûééç íéá ðññÛ: Ááääéüéäáβðá üðé ðñ /etc/sliphome/slip.logout Ý÷äé ðññéðáβ ðð äéðáëÝóéññ íáðÛ ðçí äçíéíññáβá ðñö (ð.÷., chmod 755 /etc/sliphome/slip.logout).

### 27.7.2.5 Δάηὺάιόαδ οἶο ΔηΎδαέ ίά Εὺάάα Οδύοσ οάο οδς Ἀηήιεύαζος

Αί άάί ÷ ηζοείηδιδέαβδά οζί ίΎείηί “proxy ARP” άέά ίά ηηήηειάάβδά δάέΎόά ίάοάίΎ οὐί δάέάοηί SLIP έάέ οἶο οδύειέδἶο έέέδύἶο οάο (έάέ άάάά ÷ ηΎίϋδ έάέ οἶο Internet), έά δηΎδαέ ίΎέηί ίά δηήοέΎόάά οάάόέέΎδ άέάηηίΎδ δηήο οηί δέζοέΎόάηη οάο δηηάδέέάηίΎί ηηήηειάζοδ άέά ίά ηηήηειάάβδά οη οδἦαβέοοη οὐί SLIP δάέάοηί οάο άέάΎοἶο οἶο άἶοδζἠάοζοδ SLIP.

#### 27.7.2.5.1 ΟάάόέέΎδ ἈέάάηηίΎδ

ζ δηήοέδς οάάόέέηί άέάάηηί δηήο οἶοδ δέζοέΎόάηηοδ οάο δηηάδέέάηίΎίηοδ ηηήηειάζοΎδ, ίδἦάβ ίά άβίάέ δηηάέζιάδóέδ (δ έάέ άάΎιάδς άί άάί Ύ ÷ άδά δά έάοΎέέζέά έέέάεηιάδά δηηήοάάοζδ). Αί ζ άδάέηβά οάο άέέέΎόάέ άβέδοη ίά δἦέάδείΎδ ηηήηειάζοΎδ, έΎδἦέα ηἶόΎέα (δ. ÷. άδἠ οζί Cisco έάέ οζί Proteon), άέοἠδ ἠδέ δηΎδαέ ίά ηδελέοοἦί ίά οζί οάάόέέδ άέάάηηδ δηήο οἶ οδἦαβέοοη SLIP, δηΎδαέ άδβόζδ ίά ηδελέοοἦί ίά οέο οάάόέέΎδ άέάάηηΎδ οἶο έά άίάόΎηἶο οἶοδ Ύέηοδ ηηήηειάζοΎδ. Έά ÷ ηάέάοάβ ίά δάέηάίάόέόάβδά έάέ ίά άἦέίΎόάά άέΎοἦάο ηδελβόάέο άέά ίά άἶοέΎόάέ ζ ηηήηειάζοζ ίΎού οάάόέέηί άέάάηηί.

















άέάοέιέγíáέ έάέάβόάñά όçí άέέάáϐ όὐí άέόάέΥόέιὐí ðíο άέόάέγíόάέ όόçí ðñάáíάόέέὐόçόά ὐόáí áβíάόάέ έέϐόç όὐí ðñíáðέέάñíΥíὐí έάέόíðñέβí όíò sendmail.

òóέ, áí èΥέάόά íá άέόάέάβόάέ όí /usr/local/supermailer/bin/sendmail-compat áíòβ áέά όí **sendmail**, έά íðñíγíόάόά íá έέέὐíάόά όí /etc/mail/mailer.conf ðόόά íá ãñὐόάέ:

```
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 Íεíέέçñβííόάò

Íὐέέð Υ÷άόά ñέòíβόάέ όά ðὐíόά ὐðὐð áðέέòíáβόá, íðñáβόá áβόá íá έὐíάόά kill όέð áέáñááόβáð όíò **sendmail** ðíò ááí ÷ñáέὐάόόά ðέΥíí έάέ íá áέέέíϐόáόá όέð áíόβόίέ÷άò όíò íΥíò óáð έíάέóíέέíγ, ϐ áðέβð íá έὐíάόά áðάíάέέβíçόç. Ḃ áðάíάέέβíçόç έά óáð áϐόάέ áðβόçð όçí áðέάέñβá íá áááάέὐέάβóá ὐέέ όí óγóóçíá óáð Υ÷άέ ñέòíέέóðáβ όóóðὐ, ðόόά όí íΥíí óáð MTA íá íáέέέὐíάέ áðóὐíáόά óá έὐέá áέέβíçόç.

## 28.5 Áíóέíáòϐðέόç ðñíáέçíὐóὐí

1. Άέάόβ ðñΥðάέ íá ÷ñçóέíðíέϐ όí ðέϐñáð ὐñíá (FQDN) áέά ððíέíάέóóὐð ðíò áñβóέííόάέ óóíí όñΥά ííò;

Ὀí ðέí ðέέáíὐ áβíάέ íá áέáðέóóϐόáόá ὐέέ í ððíέíάέóóðð áñβóέáόάέ όόçí ðñάáíáόέέὐὐόçόá óá áέáóíñáóέέὐὐ όñΥά. Άέά ðáñὐááέáíá, áí áñβóέáóóá óóíí foo.bar.edu έάέ èΥέάόά íá áðέέέíγíϐόáόá íá Υíá ððíέíάέóóðϐ íá όí ὐñíá mumble όóíí όñΥά bar.edu, έá ðñΥðáέ íá áíáóáñέáβóá óá áóóὐí íá όí ðέϐñáð όíò ὐñíá, mumble.bar.edu, áíòβ áέά áðέβð mumble.

ðáñááíόέέέὐ, áðóὐ áðέóñáðὐόáí áðὐ όíòð DNS resolvers όíò BIND. ὐóóὐóí, ç ðñΥ÷íóóά Υέáíόç όíò **BIND** ðíò ðáñέέáíáὐíáόάέ óóíí FreeBSD, ááí ðáñΥ÷άέ ðέΥíí óóíóíñáγóáέóð áέά íç-ðέϐñç ííñíáόá όñΥὐí, áέóὐð áέá όíí όñΥά óóíí íðíβí áñβóέáóóá. ðóέ, Υíáð ððíέíάέóóðð íá íç-ðέϐñáð ὐñíá mumble έá ðñΥðáέ íá áñáέáβ ὐð mumble.foo.bar.edu, ϐ έá áβíάέ áíáæϐçόç áέá áðóὐí óóíí ñέáέέὐὐ όñΥά.

Ḃ óóíðáñέóíñὐ áðóð áβíάέ áέáóíñáóέέϐ áðὐ όçí ðñíçáíγíáíç, ὐðíò ç áíáæϐçόç óóíá÷έæὐóáí έάέ óóíí mumble.bar.edu, έάέ όí mumble.edu. Ñβíòá íέá íáóέὐ όóíí RFC 1535 áέá όí έὐáí ðíò όí ðáñáðὐíὐ έáὐñáβóá έάέϐ ðñάέóέέϐ, ϐ áέὐíá έάέ έáíὐ áóóáέáβáð.

íáð óñὐðíò áέá íá ðáñáέὐíθáόá όí ðñὐáέçíá áβíάέ íá ðñíóέΥóáóá όç ãñáñíϐ:

```
search foo.bar.edu bar.edu
```

áíòβ áέá όçí ðñíçáíγíáíç:

```
domain foo.bar.edu
```

óóíí áñ÷áβí /etc/resolv.conf. Άáááέὐέáβóá ὐóóὐóí ὐέέ ç óáέñὐ áíáæϐçόçð ááí ðçááβíάέ ðΥñá áðὐ όí “ὐñέí íáóáíγ όíðέέϐð έάέ çíϐὐέóáð áέá÷áβñέóçð”, ὐðὐð όí áðíέάέáβ όí RFC 1535.









Ï mailhost ðíð èá ÷ñçóéíðíéÐράόά, ðñÝðáé íá áβíáé òí èáéíñéóíÝíí ìç÷-Ùíçíá áéá òçí áíóáééáαP ìçíòíÙòúí áéá èÙεά óóáéíù áñááóβáð òíð áééðýíð. Áðòù áβíáðáé óóéð ñðèìβóáéð DNS ìá òíí áéúεíðèí òñúðí:

```
example.FreeBSD.org A 204.216.27.XX ; Workstation
 MX 10 hub.FreeBSD.org ; Mailhost
```

Ìá òíí òñúðí áðòù, òí mail ðíð èáóáðèγíáðáé ðñíð èÙðíéí óóáéíù áñááóβáð èá áíáéáðáðèðéíáβ ðñíð òí mailhost, Ùó÷÷áðá ìá òí ðíð ááβ÷íáé ç áááñáóP òýðíð Á. Òí mail óðÝéíáðáé ðñíð òíí òðíéíáéóðP MX.

Ááí ìðíñáβòá íá èÙíáðá òí ðáñáðÙíù, áí ááí áéðáéáβòá òí áééù óáð áíððçñáðçðP DNS. Áí áðòù ááí óðíááβíáé, èáé ááí ìðíñáβòá íá òí áééÙíáðá, óðíáííçèáβòá ìá òíí ðáñí÷Ýá óáð (ISP) P ìá ùðíéíí óáð ðáñÝ÷áé ððçñáóβáð DNS.

Áí ðáñÝ÷áé ððçñáóβáð áééíéééγ óá÷ðáññáβíð, ìé ðáñáéÙòù ðèçñíðíñáð èá óáð óáíýí ÷ñPóéíáð. Áéá òí ðáñÙááééíá ìáð, èá òðíéÝóíòíá ùðé Ý÷áðá Ýíá ðáéÙðç ìá òí áééù òíð òñÝá, óðçí ðáñβððòùç ìáð òí customer1.org, èáé èÝéáðá ùéí òí mail áéá òí customer1.org ìá óðÝéíáðáé óòí áééù óáð mailhost, mail.myhost.com. Ç èáðá÷ñéóç óáð óòí DNS èá ìéÙæáé ìá òçí ðáñáéÙòù:

```
customer1.org MX 10 mail.myhost.com
```

Óçíáéðρòá ùðé ááí ÷ñáéÙæáðóðá áááñáóP òýðíð Á áéá òí customer1.org áí èÝéáðá áðèð ìá ÷áéñβæáðóðá email áéá áðòù òíí òñÝá.

**Óçíáβòùç:** Ìá Ý÷áðá ðððçç óáð ùðé ááí èá ìðíñáβòá íá èÙíáðá ping òí customer1.org áí ááí ððÙñ÷áé áéá áðòù áááñáóP òýðíð Á.

Òí ðáéáðóáβí ðñÙáíá ðíð ðñÝðáé íá èÙíáðá, áβíáé íá ìñβóáðá óòí **sendmail** ðíð áéðáéáβòáé óòí áééù óáð mailhost, áéá ðíéíð òñáβð P / èáé ìç÷÷áíðáðá èá äÝ÷áðáé mail. ÒðÙñ÷íòí ìáñééíβ áéáðíñáðééíβ òñúðíé áéá íá áβíáé áðòù. Ìðíñáβòá íá ÷ñçóéíðíéÐράόά Ýíáí áðù òíð ðáñáéÙòù:

- ÐñíðéÝóðá óá ìç÷÷áíðáðá óòí áñ÷áβí /etc/mail/local-host-names áí ÷ñçóéíðíéáβòá òç áðíáðúðçðá FEATURE(use\_cw\_file). Áí ÷ñçóéíðíéáβòá èÙðíéá Ýéäíðç òíð **sendmail** ðñéí òçí 8.10, òí áñ÷áβí áβíáé òí /etc/sendmail.cw.
- ÐñíðéÝóðá ìéá ãñáíP Cwyour.host.com óòí áñ÷áβí óáð /etc/sendmail.cf P óòí áñ÷áβí /etc/mail/sendmail.cf áí ÷ñçóéíðíéáβòá òçí Ýéäíðç 8.10 òíð **sendmail** P èÙðíéá ìáðáááíÝóðáñç.

## 28.7 SMTP ìá UUCP

Ç ðñíáðééááíÝíç ñýéìóç òíð **sendmail** ðíð Ýñ÷áðáé ìá òí FreeBSD, ðñíñβæáðáé áéá áééððáéÝð òíðíèáóβáð ðíð áβíáé áðáðèáβáð óðíáááíÝíáð óòí Internet. Óá ðáñéððρáéð ðíð áβíáé áðéèðìçðP ç áíóáééáαP email ìÝóù UUCP, èá ðñÝðáé íá ÷ñçóéíðíéçèáβ áéáðíñáðééù áñ÷áβí ñðèìβóáúí áéá òí **sendmail**.

Ç ÷áéñíéβíçðç ñýéìóç òíð áñ÷áβíð /etc/mail/sendmail.cf áíðéáé óóá ðñí÷ñçíÝíá èÝíáðá. Ç Ýéäíðç 8 òíð **sendmail** ðáñÙááé áñ÷áβá ñðèìβóáúí ìÝóù òíð ðñíáðáíñááóðP m4(1), ùðíð ìé ñðèìβóáéð áβííðáé óá Ýíá áñðáñí áðβðááí áóáβñáóçð. Ìðíñáβòá íá áñáβòá óá áñ÷áβá ñýéìóç òíðm4(1) óòí éáðÙéíáí /usr/share/sendmail/cf. ÁéááÙóðá òí README óòí éáðÙéíáí cf áéá ìéá ááóéèP áéóááñáP óðéð ñðèìβóáéð òíð m4(1).

Ï éáéýóáññò ðññðτò áέα όçτ ðáñÛäτòç mail τÝóυ ðτò UUCP, åβτáé τå όçτ ðñðòç όçð äðτåðüóçðåð mailertable. ÐáñÛäåðåé τå äóðü ðττ ðññðττ τέα åÛóç ååññÝτττ ðτò τðññåβ τå ðñçóéττðττéðóåé ðτ **sendmail** áέα τå ðÛñåé åðτòÛóåéð ó÷åðééÛ τå όçτ åññττεüåçóç.

Έå ðñÝðåé åñ÷ééÛ τå åçτττðññåðóåðå ðτ åñ÷åβττ .mc. Έå åññåðåé τåñééÛ ðáññååβåτåðå óóττ éåðÛεττττ /usr/share/sendmail/cf/cf. ÕðττèÝóτττðåð üóé Ý÷åðå ττñÛóåé ðτ åñ÷åβττ óåð foo.mc, ðτ ττττ ðτò ðñåéÛæåðåé τå éÛτåðåé áέα τå ðτ τåðåðñÝðåðå óå Ýτå Ýæéðñττ åñ÷åβττ sendmail.cf åβτáé:

```
cd /etc/mail
make foo.cf
cp foo.cf /etc/mail/sendmail.cf
```

τå ðððééü åñ÷åβττ .mc éå ååβ÷τåé üððò ðτ ðáññåéÛðù:

```
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
```

Ïé åññåñÛð ðτò ðáññéÝ÷τττ ðéð äðτåðüóçðåð accept\_unresolvable\_domains, nocanonify, and confDONT\_PROBE\_INTERFACES éå åðττñÝðτττ όç ðñðòç ðτò DNS éåðÛ όçτ ðáñÛäτòç ðτò mail. Ç τåçåβå UUCP\_RELAY åðåéðåβðåé áέα όçτ ððττððññéτç ðáñÛäτòçò τÝóυ ðτò UUCP. Áðεðð ðττττåððóðåé åéåβ Ýτå ττñåé τç÷åτττåðτò óðττ Internet ðτò τå τðññåβ τå ðñéñéóðåβ åéåðéýτåðéð ðåðåττ-ðñÝττ .UUCP. Õτ ðéτ ðééåτττ åβτáé τå åÛéåðåé åéåβ ðττ åτåτåðåéüðç (relay) áέα mail ðτò ðáñÝ÷åé ττ ISP óåð.

÷ττóåð éÛτåé ðτ ðáññåðÛττ, éå ðñåéåóðåβðåé Ýτå åñ÷åβττ /etc/mail/mailertable. Áτ Ý÷åðåé ττñ τέα óýτååóç τå ðττ Ýττ éüóττ ðτò ðñçóéττðττéåβðåé áέα üéå óåð óå mail, ðτ ðáññåéÛðù åñ÷åβττ åβτáé åðáññéÛð:

```
#
makemap hash /etc/mail/mailertable.db < /etc/mail/mailertable
#
uucp-dom:your.uucp.relay
```

τå ðéτ ðττéýðéτττ ðáñÛäééåτå éå ττéÛæåé τå ðτ ðáññåéÛðù:

```
#
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:%1
horus.UUCP uucp-dom:horus
```

if-bus.UUCP uucp-dom:if-bus
. uucp-dom:

Íε οñáέο ðñρòáο àñáñÝò ÷ áέñβæííóáέ áέáέέÝò ðáñέðòρòáέο, ùðíò οí mail ðíò áðáòέγíáòáέ οá εὐðíέí οñÝá ááí εá ðñÝðáέ íá οóáέεáβ οóçí ðñíáðέέááñÝíç áέááññß, áέεὐ áíóβεáòá οá εὐðíέí ááέοñíέέυ UUCP ðñíέáíÝñò íá “οóíοíñáòεáβ” οí ïñðὐóέ ðáñὐáííóçð. Ḷ áðñíáíç àñáñß ÷ áέñβæáòáέ οí mail ðñíò οíí οíðέέέυ οñÝá Ethernet, ùðíò áβíáέ áóíáòß ç ðáñὐáííóç ïÝòù SMTP. ÓÝέíò, íé ááέοñíέέíβ UUCP áíáòÝñííóáέ ïá àñáòß ϕáòáí-òñÝúí UUCP ðρòá íá áðέοñÝðáòáέ οá εὐðíέíí uucp-neighbor !recipient íá ðáñáέὐíϕáέ οíòð ðñíáðέέááñÝñíò εáíúíáò. Ḷ οáέáòòáβá àñáñß áβíáέ ðὐííóá íéá ïíááέεß ðáέéáβá, ç ïðíβá ðáέñέὐááέ ïá íòέáððíòá ὐέέí, ïá ðáñὐáííóç UUCP οá Ýíá ááέοñíέέέυ UUCP ï ïðíβíð áíáñááβ ùò ááíέέß ðýέç mail ðñíò οíí ððñέíέðí έέυοí. ¼éá óá ïñíáòá ððñέíáέοðρí ðíò àñβóέííóáέ ïáòὐ οí uucp-dom: εá ðñÝðáέ íá áβíáέ Ýáέοñíέ UUCP ááβοííáò, ùðòò ïðñíáβòá íá ááááέρòáòá ÷ ñçóέííðíέρíóáò οí uuname.

Óáò ððáíέòíβæííóá ùóέ áòòυ οí àñ ÷ áβí ðñÝðáέ íá ïáòáòñáðáβ οá íéá áὐÓç áááñÝúí DBM ðñέí ÷ ñçóέííðíέçεáβ. Ìðñíáβòá íá áὐέáòá ðç àñáñß áíóíέρí ðíò áðáέóáβòáέ áέá íá áðέóáò ÷ εáβ áòòυ ùò ó ÷ ùέέí οóçí àñ ÷ ð οíò àñ ÷ áβíò mailertable. ðñÝðáέ ðὐííóá íá áέòáέáβòá áòòß ðçí áíóíέρß εὐέá òíñὐ ðíò áέέὐááòá οí àñ ÷ áβíí mailertable.

Íéá ðáέáòòáβá ððñááέíç: áí ááí áβòòá áÝááέíé áέá οí áí εá εáέòíòñáρòáέ εὐðíέá ðáέáéñέñÝíç àññíέυáçç mail, εòíçεáβòá ðçí áðέέíáß -bt οíò sendmail. Áðòß ïáέέíὐáέ οí sendmail οá εáòὐóóáç áíέέíðò áέðòέγíóáúí. Áðέρò àñὐòá 3, 0, áέíέíòέγíáñí áðñ ðç áέáγέòíóç ðíò εÝέáòá íá áέÝáíáòá áέá àññíέυáçç mail. Ḷ οáέáòòáβá àñáñß εá óáò ðáέ οíí áòòáñέέέυ áíóέðññóòðí mail ðíò ÷ ñçóέííðíέρçεá, ðç áέáγέòíóç ðñíñέóííγ ïá ðçí ïðíβá έέρçεá, εáέρò εáέ ðçí (ðέέáíρò ïáòáòñáòÝíç) áέáγέòíóç. Ìðñíáβòá íá áááβòá áðñ áòòß ðçí εáòὐóóáç, 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 Ñýèíέóç Áíòðçñáòçòß ïúíí áέá Áðííóòíέρß

Óòíáέóòíñὐ áðñ οíí Bill Moran.

Óðὐñ ÷ íοí ðíέέÝò ðáñέðòρòáέο, ðíò ïðñíáβ íá εÝέáòá ïúíí íá óóÝέíáòá mail ïÝòù εὐðíέíò áíáíáòááúòç. Ìáñέέὐ ðáñáááβáíáòá:

- Ì ððñέíáέóðρò óáò ÷ ñçóέííðíέáβòáέ ùò desktop, áέέὐ εÝέáòá íá ÷ ñçóέííðíέρòáòá ðñíáñὐííáòá ùðòò οí send-pr(1). Áέá íá áβíáέ áòòυ εá ðñÝðáέ íá ÷ ñçóέííðíέρòáòá οíí áíáíáòááúòç mail ðíò ðáñÝ ÷ áέ ï ISP óáò.
- Ì ððñέíáέóðρò óáò áβíáέ Ýíáò áíòðçñáòçòðρò ðíò ááí ÷ áέñβæáòáέ οí mail οíðέέὐ, áέέὐ ÷ ñáέὐááòáέ íá οí áρòáέ áí' ïέíέερñíò óá εὐðíέí áíáíáòááúòç áέá áðáíáñáóóá.

Ïðíέíáρðíòá ó ÷ ááúí MTA áβíáέ έέáíú íá εáέýϕáέ οíí ðáñáðὐíñ ññέí. Áòóòò ÷ ðò, ïðñíáβ íá áβíáέ ðíέý áýóέíέí íá ñòέíβòáòá οúòòὐ Ýíá ðέρñáò MTA ðρòá áðέρò íá óóÝέíáέ οí mail ðñíò áíáíáòὐáííóç. ðñíáñὐííáòá ùðòò οí sendmail εáέ οí postfix áβíáέ ððáñáíέέέὐ ïááὐέá áέá áòòß ðç áíòέáέὐ.

Áðέðññóέáòá, áí ÷ ñçóέííðíέáβòá εὐðíέá ðóíçέέóíÝíç ððçñáòóá ðññóááóçð óòí Internet, ç óðíòñíβá ïá ðçí áòáέñβá ðáñí ÷ ðò ïðñíáβ íá óáò áðáíñáγáέ íá áέòáέáβòá οí áέέέυ óáò “áíòðçñáòçòß mail”.







άν÷άβη οήη sendmail.cf, έάέ έά άδάρáέέείΠόάέ ουόόὐ οή **sendmail**. Άέά άñέόόουόάñάδ έάδδὸñÝñάέάδ  
ό÷άδέέὐ ή άδδΠ όç έέάάέέάόόά, έά δñÝδάέ ή έέάάὐόάδά οή άñ÷άβη /etc/mail/Makefile.

Άή υέά δΠάάί έάέὐ, έά δñÝδάέ ή ήδñάβδά ή άΠόάδά όά όόίε÷άβá έέουάίό όάό όόή δñυάñάήά δñ ÷ñçόέηδñέάβδά έέά  
άδñόόίεΠ έάέ έΠçç mail, έάέ ή ά όάβέάόά Ýή άñέέίάόόέέυ ήΠήόή. Άέά ή έέάñάόήΠόάόά δñέόόούόάññ όç έέέόήδñάβá,  
έÝόόά όç ή άδέέήάΠ LogLevel οήη **sendmail** όόή 13 έάέ δñάέέήέήδδΠόόά οή /var/log/maillog έέά δδ÷ύή έὐέç.

Άέά δñέόόούόάñάδ δέçñήήñβάδ, δñάέάέήγήά ή άάβδά όç όάέβáά οήη **sendmail** δñό άόñὐ όç ή δέόόήδñβçç  
άδέάήέέέυόçόάδ όόή SMTP (<http://www.sendmail.org/~ca/email/auth.html>).

## 28.11 Δñññὐήάόά Ὀά÷οάνηάβñ έέά όή ×ñΠόόç

*Ὀδñέόόñὐ όήη Marc Silver.*

ήά δñυάñάήά ΆήέδññόΠδñὐ Ὀά÷οάνηάβñ ×ñΠόόç (Mail User Agent, MUA), άβñάέ ήά άόάññάΠ δñ ÷ñçόέηδñέάβδάέ  
έέά όç ή άδñόόίεΠ έάέ έΠçç email. ΆδέδδÝή, έάέΠδ όή email “άñέέβόόάόάέ” έάέ άβñάόάέ δέή δñέýδέήέή, όά MUA  
άβññόάέ υέή έάέ έό÷δñυόάñά υόή άόñὐ όή δñυδñ δñό άέέçέάδδέάññή ή όή email. Άόόυ άβñάέ όόήδ ÷ñΠόόάδ  
δñέόόούόάñάδ έέέόήδñάβάδ έάέ άδάέέήβá. To FreeBSD δñέÝ÷έέ δññόδΠñέήç έέά ήάὐέή άñέέή άδñ δñññὐήάόά  
όá÷οάνηάβñ, έάέ υέά ήδññή ή άάέάόάόόάέήγ ήέý άýέήέά ήÝού όçδ ὈδέέήάΠδ όύή Ports οήη FreeBSD. ήέ ÷ñΠόόάδ  
ήδññή ή άδέέÝññή ήάόάý άñάόέέΠ δñññάñὐόδñ, υδñδ όή **evolution** Π όή **balsa**, έάέ δñññὐήάόά έήήέέάδ υδñδ όά  
**mutt**, **pine** Π mail, Π áέññά έάέ δέδ έέάδάόÝδ web δñό δññόόÝññήάέ άδñ ήάέέήýδ ήάὐέήδñ ήάέέήýδ.

### 28.11.1 mail

Ὀή mail(1) άβñάέ όή δññάδδέέάñÝñ δñυάñάήά όá÷οάνηάβñ (MUA) in FreeBSD. Δññέέέόάέ έέά Ýή MUA έήήέέάδ, όή  
ήδññ δññόόÝñάέ υέάδ όέδ άάόέέÝδ έέέόήδñάβάδ δñό άδάέόήγήόάέ έέά όç ή άδñόόίεΠ έάέ έΠçç email όά ήñδΠ έάέήÝñ,  
άή έάέ Ý÷έέ δñέñέέόήÝñάδ άñήάόυόçόάδ υόή άόñὐ όήόñήÝή άñ÷άβá έάέ δññόçñβάέέ ήññ ήδñέέÝδ έδñβáδ.

Άή έάέ όή mail άά ήδñόçñβάέέ άάάñΠδ όç έΠçç email ήÝού έέάέñέόόΠ POP Π IMAP, άβñάέ υόόούή άñήάόñ ή  
έάδάάὐόάδά όά email όά ήά όήδέέΠ έδñβáά (mbox) ÷ñçόέήδñέΠήόάδ έὐδñέά άόάññάΠ υδñδ όή **fetchmail**, όή ήδññ έά  
όάççδΠόήόή άñάυόάñά όά άόόυ όή έάοὐέάεί (ὈήΠή 28.12).

Άέά όç ή άδñόόίεΠ έάέ έΠçç email, άδέΠδ έέέάέÝόόά όç ή άήόίεΠ mail υδñδ όάβñάόάέ όή δñάέέὐδñ δññὐάέέήά:

```
% mail
```

Ὀά δñέέá÷ύήά ήδññάόδ όή ÷ñΠόόç όόή έάδὐέήñ /var/mail έά έέάάάόόήγ ήόόύήάόά άδñ όή δñυάñάήά mail.  
Άή ç έδñβáά όá÷οάνηάβñ άβñάέ ὐάέά, όή δñυάñάήά δññάόβάέόάέ ή όή ήΠήόή υέέ άά ήñÝέçέά άέççήñάόόá. ήάὐ  
όç ή άñάñύόç όçδ έδñβáάδ, ήέέήὐ ç έέάδάόΠ όçδ άόάññάΠδ έάέ άñήάβáέόάέ ήά έβδóά ή ήçγήάόá.  
Ὀά ήçγήάόá άñέέήγήόάέ άόόύήάόá, υδñδ όάβñάόάέ όή δñάέέὐδñ δññὐάέέήά:

```
Mail version 8.1 6/6/93. Type ? for help.
"/var/mail/marcs": 3 messages 3 new
>N 1 root@localhost Mon Mar 8 14:05 14/510 "test"
 N 2 root@localhost Mon Mar 8 14:05 14/509 "user account"
 N 3 root@localhost Mon Mar 8 14:05 14/509 "sample"
```

Ὀά ήçγήάόá ήδññήγ ήέÝñ ή έέάάάόόήγ ή όç ή άήόίεΠ t όçδ ήήόίεΠδ mail, áέήέήδñέγήάç ή όή άñέέήδñ όή mail δñό  
έÝέάόά ή άñήάέέόάβ. Ὀόή δññὐάέέήά άόόυ έά έέάάὐόήόή όή δñΠδñ ήΠήόή:

```
& 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.

¼ðuò óáβιάóáé óοί ðáñáðŦù ðáñŦááéáíá, ç ÷ñβόç òηò ðεβέðñηò **t** εά ðñηέάεŦóáé òçí àηòŦίέόç òηò ιçíŦιάòηò ιά ðεβñáέò áðéέáòáεβáàò. Άέά ίά ááβòá ίάŦŦ òç εβòóá ιά óá ιçíŦιάóá, ÷ñçóέηηðηέβòá òη ðεβέðñη **h**.

Άί òη mail áðáέòáβ áðŦίόç, ιðñáβòá ίά ÷ñçóέηηðηέβòá òçí áηòηέβ mail ÷ñçóέηηðηέβòá òέò áηòηάòηŦίáò áηòηέβò **R P r**. Ὀη ðεβέðñη **R** ίαçááβ òη mail ίά áðáηòβóáé ηññ óòη áðηóηέŦά òηò ιçíŦιάòηò, áñ òη **r** áðáηòŦáé ù÷έ ηññ óòη áðηóηέŦά, áεεŦ óá ηεηò òηò ðáñáεβðòáò òηò ιçíŦιάòηò. Ιðñáβòá áðβόçò ίά ðñηέŦóáòá ιάòŦ áðu òέò áηòηέβò áòŦŦ, òη άñέέη òηò ιçíŦιάòηò óòη ηðηβη εŦέáòá ίά áðáηòβóáòá. ΆòηŦ òη εŦίáòá áòòη, εά ðñŦάέ ίά áñŦòáòá òçí áðŦίόç óáò εάέ ίά óçíáεβòáòá òη òŦηò òçò áñŦŦηòáò ιέá ηññ . óá ιέá ίŦά áñáññ. Ιðñáβòá ίά ááβòá Ŧίá ðáñŦááéáíá ðáñáέŦòù:

& R 1  
To: root@localhost  
Subject: Re: test

Thank you, I did get your email.

.  
EOT

Άέά ίά óáβεáòá ίŦη mail, εά ðñŦάέ ίά ÷ñçóέηηðηέβòáòá òη ðεβέðñη **m**, áέηηòεηŦηάñι áðu òçí áέáŦέòηóç òηò ðáñáεβðòç. Ιðñáβòá ίά áβòáòá ðηεéáðεηŦò ðáñáεβðòáò, ÷ñβæñηòáò ιάòáŦŦ òηò òέò áεáòεŦηóáέò ιά , Ιðñáβòá Ŧάέáέòá ίά áŦεáòá òη εŦίá òηò ιçíŦιάòηò εάέ ίά óòηá÷βóáòá ιά òη ðáñéá÷ηάñι. Ὀη òŦηò òηò ιçíŦιάòηò εάεηñβæáòáέ áñŦŦηòáò ιέá ηññáέέβ . óá ιέá ίŦά áñáññ.

& mail root@localhost  
Subject: I mastered mail

Now I can send and receive email using mail ... :)

.  
EOT

¼óη áñβòéáòáòá ιŦη óçí áηòηέβ mail, ιðñáβòá ίά ÷ñçóέηηðηέβòáòá òη ðεβέðñη ? áέá òçí àηòŦίέόç áñβéáέò ηðηέááβðηòá óέéáññ. Ιðñáβòá áðβόçò ίά óòηáηòεáòáòáòá òçí óáεβáá manual òηò mail(1) áέá ðáñέóóòáñáò ðεçñηòññáò ó÷áòέέŦ ιά òçí áηòηέβ mail.

**Όçηáβòóç:** ¼ðuò áηòŦŦáηá ðñηçáηòηŦŦ, ç áηòηέβ mail(1) ááη ó÷áέŦòóçéá áñ÷έέŦ áέá ίά ÷áέñβæáòáέ óòηçηŦŦ, εάέ áέá òη εñáη áòòη ηé áòηáòòçòáò òέò óòη óðáέáέñηηŦη εŦηά áβηάέ ηέεñŦò. ίáβòáñá MUA, ùðuò òη **mutt**, ÷áέñβæñηóáέ óá óòηçηŦŦ ιά ðηéŦ ðéη Ŧηòðñη ðññðñ. ΆέεŦ áí ðáñ' ùéá áòòŦ áðéέòηáβòá ίά ÷ñçóέηηðηέβòáòá òçí áηòηέβ mail, ηŦέέηη éá óáò óáηáβ ÷ñβóέηη òη port converters/mpack.







```

PINE 4.58 MAIN MENU Folder: INBOX 3 Messages

? HELP - Get help using Pine
C COMPOSE MESSAGE - Compose and send a message
I MESSAGE INDEX - View messages in current folder
L FOLDER LIST - Select a folder to view
A ADDRESS BOOK - Update address book
S SETUP - Configure Pine Options
Q QUIT - Leave the Pine program

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? Help P PreuCmd R ReINotes
0 OTHER CMDS > [Index] N NextCmd K KLock

```

Ότ άδñάδPñέτ ιçτòιΰδουί άάβ÷íάέ ιçτγíάόά άδñ οτí δñÝ÷ííόά έάόΰετíαí, έάέ ðññάβόά íά íάόάέέεçεάβόά όά άόδñ íά όά άάεΰέέά. ðññάβόά íά άέάάΰόάόά ότ άδέέάñÝíτ íPíόíά, δέÝάτííόάό ότ δέPέδñτí **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

```

Όδçτí άέέυíά δñδ όάβíάόάέ δανάέΰδñ, ότ **pine** άδάέέτíβæάέ Ýíά δδñάάέάíά ιçτγíάόíδ. Όότ έΰδñ íÝññδ όçδ íεúíçδ όάβñíόάέ ό÷άδέέÝδ όóíδñάγόάέδ δέçεδññέτíαβíδ. íά δανΰάάέάíά δÝδíέάδ όóíδñíάόόçδ, άβíάέ ότ δέPέδñτí **r** ότ τδíβτ έÝάέ όδτ MUA íά άçíέτíδñάPόάέ άδΰíόçόç δññδ ότ δñÝ÷íí íPíόíά δñδ άδάέέτíβæάόάέ.





Θα πρέπει να διαβάσετε πρώτα τα αρχεία που περιλαμβάνονται στο `procmail` για να μάθετε πώς να χρησιμοποιήσετε το `procmail`. Η αρχική διεύθυνση είναι η `procmail` που βρίσκεται στο `forward` οφείλει να είναι η `procmail`, η διεύθυνση που θα χρησιμοποιήσετε είναι η `procmail`.

```
"|exec /usr/local/bin/procmail || exit 75"
```

Ο κύριος σκοπός είναι να διαβάσει τα μηνύματα που έρχονται στο `procmail`, να τα επεξεργαστεί και να τα στείλει στην διεύθυνση που θέλετε. Η αρχική διεύθυνση είναι η `procmail`, η διεύθυνση που θα χρησιμοποιήσετε είναι η `procmailrc`, οι οποίες είναι η αρχική διεύθυνση για να στείλετε τα μηνύματα που έρχονται στο `procmail`.

Η αρχική διεύθυνση είναι η `procmail` που περιλαμβάνεται στο `procmailrc(5)`.

```
Πρέπει να προσέξουμε ότι email που έρχονται από <user@example.com> θα πρέπει να στείλονται στην διεύθυνση <goodmail@example2.com>:
```

```
:0
* ^From.*user@example.com
! goodmail@example2.com
```

```
Πρέπει να προσέξουμε ότι email που έρχονται από 1000 bytes θα πρέπει να στείλονται στην διεύθυνση <goodmail@example2.com>:
```

```
:0
* < 1000
! goodmail@example2.com
```

```
Αν θέλετε να στείλετε email που έρχονται από <alternate@example.com> να στείλονται στην διεύθυνση <alternate>:
```

```
:0
* ^TOalternate@example.com
alternate
```

```
Αν θέλετε να στείλετε email που έχουν θέμα "Spam" να στείλονται στο /dev/null:
```

```
:0
^Subject:.*Spam
/dev/null
```

Για να προσέξουμε να μην στείλονται τα μηνύματα που έρχονται από `FreeBSD.org` να στείλονται στην διεύθυνση `FreeBSD`:

```
:0
* ^Sender:.owner-freebsd-\[^\@]+\@FreeBSD.ORG
{
 LISTNAME=${MATCH}
 :0
 * LISTNAME??^\[^\@]+
 FreeBSD-${MATCH}
}
```



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 ypserv(8) dies, then the server will no longer be able to respond to NIS requests (hopefully, there is a slave server to take over for it). There are some implementations of NIS (but not the FreeBSD one), that do not try to reconnect to another server if the server it used before dies. Often, the only thing that helps in this case is to restart the server process (or even the whole server) or the <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.

**Όχιἄβύο:** 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).

**Όχιὰβὺός:** 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
```



**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.

**Ὁμολογία:** 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:



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)
#
```





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.

**Ὁψιμολογία:** 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;❹
max-lease-time 86400;❺
ddns-update-style none;❻

subnet 192.168.4.0 netmask 255.255.255.0 {
 range 192.168.4.129 192.168.4.254;❼
 option routers 192.168.4.1;❸
}

host mailhost {
 hardware ethernet 02:03:04:05:06:07;❾
 fixed-address mailhost.example.com; (10)
}

```

- ❶ This option specifies the domain that will be provided to clients as the default search domain. See resolv.conf(5) for more information on what this means.
- ❷ This option specifies a comma separated list of DNS servers that the client should use.
- ❸ The netmask that will be provided to clients.
- ❹ A client may request a specific length of time that a lease will be valid. Otherwise the server will assign a lease with this expiry value (in seconds).
- ❺ This is the maximum length of time that the server will lease for. Should a client request a longer lease, a lease will be issued, although it will only be valid for `max-lease-time` seconds.
- ❻ This option specifies whether the DHCP server should attempt to update DNS when a lease is accepted or released. In the ISC implementation, this option is *required*.
- ❼ This denotes which IP addresses should be used in the pool reserved for allocating to clients. IP addresses between, and including, the ones stated are handed out to clients.
- ❽ Declares the default gateway that will be provided to clients.
- ❾ The hardware MAC address of a host (so that the DHCP server can recognize a host when it makes a request).
- (10) Specifies that the host should always be given the same IP address. Note that using a hostname is correct here, since the DHCP server will resolve the hostname itself before returning the lease information.

Once you have finished writing your `dhcpd.conf`, you should enable the DHCP server in `/etc/rc.conf`, i.e. by adding:

```

dhcpd_enable="YES"
dhcpd_ifaces="dc0"

```

Replace the `dc0` interface name with the interface (or interfaces, separated by whitespace) that your DHCP server should listen on for DHCP client requests.

Then, you can proceed to start the server by issuing the following command:

```
/usr/local/etc/rc.d/isc-dhcpd.sh start
```

Should you need to make changes to the configuration of your server in the future, it is important to note that sending a `SIGHUP` signal to **dhcpd** does *not* result in the configuration being reloaded, as it does with most daemons. You will need to send a `SIGTERM` signal to stop the process, and then restart it using the command above.



| 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 `ÖîÏá 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.

**ΔñĳăăĳĳŸçóç:** 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.















### 29.9.2.1 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 [Διάγραμμα 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"
```

**Όψιμότητα:** 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 [Όψιμότητα 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>.







# ÊäöÛëäéí 30 Firewalls

ÓòíäéóöíñÛ òíò Joseph J. Barbish. ÌäöäöñÛðçêä óä SGML êäé áíáíäþèçêä äðü òíí Brad Davis.

## 30.1 Óýííøç

Ïí firewall (óäð ÷ ïð ðñíóóäóðäð) êäééóðÛ äðíáðü òí öééðñÛñéóíä ðçð äéóäñ ÷ ùíáíçð êäé áíäñ ÷ ùíáíçð êðíçóçð ðíð äéÝñ ÷ äðäé äðü òí óýóðçíä óäð. Íá firewall ìðíñäð íá ÷ ñçóéíððíéäð Ýíá ð ðñéóóüðäñá óäð “éáíúíúí” äéá íá äðééäññäð óä ðäéÝóä êäóÛ ðçí äðóíäí ð Ýñäí òíðð äðü ïéá äééððäéð óýíáäóç, êäé íá óä äðéðñÝðäé ð íá óä äðíññððäé. Íé éáíúíäð òíð firewall ìðíñíýí íá äéÝä ÷ ïíí Ýíá ð ðñéóóüðäñá ÷ äñäéðçñéóóéÛ ðüí ðäéÝðüí, óðíðñééäíäññÝíúí ìäðáíý Ûëëüí êäé òíð óýðíð òíð ðñüðíéüééíð, êäéþð êäé ðçí äéáyèðíóç ð/êäé éýñä (port) ðçð äóäðçñðäð ð òíð ðñííñéóíý.

Óä firewalls ìðíñíýí íá áíéó ÷ ýóíðí óçíáíðééÛ ðçí áóóÛëäéá áíüð êüíäíð ð áíüð äééðýíð. Ìðíñíýí íá ÷ ñçóéíððíéçèíýí äéá ìðä ð ðñéóóüðäñäð äðü ðéð äéüéíðéäð éäéóíðñäðäð:

- Íá ðñíóóäðäýíðí êäé íá äðíñíþíðí ðéð äðäñíäÝð, ðéð ððçññäððäð êäé óä ìç ÷ áíðíäðä òíð áóóðäñééíý óäð äééðýíð äðü áíäðééýíçðç êðíçóç ðíð ðñíÝñ ÷ äðäé äðü òí Internet.
- Íá ðñéíñðäéíðí ð íá áðíééäðíðí ðçí ðñüóääóç ìç ÷ áíçìÛðüí òíð áóóðäñééíý äééðýíð óä ððçññäððäð òíð Internet.
- Íá ððíóðçñðäéíðí ìäðÛñäóç äééððäéðí äéäðéýíóäñí (NAT), ç òíðíä äðéðñÝðäé òíð áóóðäñééü óäð äðéððí íá ÷ ñçóéíððíéäð éäéüðééÝð IP äéäðéýíóäéð êäé íá ïíñÛääðäé ìðä ïííäééð óýíáäóç ìä òí Internet (äððä ìÝóó ìðäð ïííäééðð äçíüóéäð IP äéáyèðíóçð, äððä ìÝóó áíüð ðéþèíðð äçíüóðí äéäðéýíóäñí ðíð áíäððäéíðäé äððüíäðä).

Äóíý äéääÛóäðä äððü òí êäöÛëäéí, éä ïÝñäðä:

- Ðüð íá äçíéíðñäððäðä óóóóíýð éáíúíäð öééðñäñðóíäðíð ðäéÝðüí.
- Òíðð äéÛóíñíðð óýðíðð firewall ðíð ððÛñ ÷ ïíí óðí FreeBSD êäé ðéð äéäóíñÝð òíðð.
- Ðüð íá ñðèìððäðä êäé íá ÷ ñçóéíððíéððäðä òí **PF** firewall òíð OpenBSD.
- Ðüð íá ñðèìððäðä êäé íá ÷ ñçóéíððíéððäðä òí **IPFILTER**.
- Ðüð íá ñðèìððäðä êäé íá ÷ ñçóéíððíéððäðä òí **IPFW**.

Ðñéí äéääÛóäðä äððü òí êäöÛëäéí, éä ðñÝðäé:

- Íá éäðäñíäððä ääóééÝð äñ ÷ Ýð òíð FreeBSD êäé òíð Internet.

## 30.2 ÄäóééÝð ðííéäð òüí Firewalls

ÏðÛñ ÷ ïíí äýí ääóééíð ðñüðíé äéá ðç äçíéíðñäðä éáíúíúí óä Ýíá firewall: ï “inclusive” êäé ï “exclusive”. Íá exclusive firewall äðéðñÝðäé ðç äéÝéäðóç ùéçð ðçð êðíçóçð, äéðüð äðü äððð ðíð ðäéñéÛäéé ìä òíðð éáíúíäð òíð. Íá inclusive firewall êÛíäé òí áíÛðíäí. ÄðéðñÝðäé ìúí ðç äéÝéäðóç ðçð êðíçóçð ðíð ðäéñéÛäéé ìä òíðð éáíúíäð òíð, êäé äðíééäðäé ïðéäððíðä Ûëéí.

Óä inclusive firewalls ðñíóðÝñíðí ðíéý éäéýðäñí Ýéää ÷ ï ðçð áíäñ ÷ ùíáíçð êðíçóçð êäé äéá òí êüäí äððü äðíäé éäéýðäñä äéá óððððíäðä ðíð ðñíóðÝñíðí ððçññäððäð óðí äçíüóéí Internet. ÄéÝä ÷ ïíí äððóçð êäé óä ðäéÝóä ðíð ðñíÝñ ÷ ïííäé äðü òí äçíüóéí Internet ìä ðñííñéóíü òí éäéüðééü óäð äðéððí. Äðü ðñíäðééíäð, ùéç ç êðíçóç ðíð ääí





firewalls ἰὰ ἀορίαστος ἀδούατος ἀεῖατὸν ὁ ἀδῆνδουτὸς ἀδιὸτ-βάθ (failover). Δῆνέουτῶνδὸ δέχνηϊνῆνδὸ ὁ-ἀδέεῦ ἰὰ οἱ CARP ἰδῆνῆνδὸ ἰὰ ἠνῆνδὸ οἱ Οἶπῆ 31.12 οἶτὸ Ἄῆ-ἀεῆεῖατῶ.

Ἰδῆνῆνδὸ ἰὰ ἠνῆνδὸ ὑεῖδὸ ὁεὸ ἀδέεῖατῶ δῆνῆνδὸ ἠεῖ οἱ PF οἱ ἠν-ἠβῆ /usr/src/sys/conf/NOTES. Ἰε ἀδέεῖατῶ ὁἠβῆνῆεῖ ἀδβῶτὸ δῆνῆεῦδῶ:

```
device pf
device pflog
device pfsync
```

Ç ἀδέεῖατῶ device pf ἠῆνῆνδὸεῖατῶ ὁτὶ ὁδῆσῶτῆεῖτῶ ἠεῖ οἱ firewall “Packet Filter” (pf(4)).

Ç ἀδέεῖατῶ device pflog ἠῆνῆνδὸεῖατῶ ὁτὶ δῆνῆεῖατῶεῖτῶ ὁἠῶῆ-ἠεῖδῶεῖτῶ ὁῶεῖατῶ pflog(4) δῆτὸ ἰδῆνῆνδὸ ἰὰ ÷-ῆτῶεῖνδὸεῖεῖατῶ ἠεῖ ὁτὶ εῖαδῶἠῆνδὸτῶ ὁτῶ εῖβῆτῶτῶ ὁἠ Ἰῆῖ bpf(4) descriptor. Ἰ ἠῆβῆνῆνδὸ pflogd(8) ἰδῆνῆνδὸ ἰὰ ἀδῆεῖεῖατῶεῖ ὁτὶ εῖαδῶἠῆνδὸτῶ ἠῶτῶ οἱ ὁεῖεῖνῆ ἠβῶεῖ.

Ç ἀδέεῖατῶ device pfsync ἠῆνῆνδὸεῖατῶ ὁτὶ δῆνῆεῖατῶεῖτῶ ὁἠῶῆ-ἠεῖδῶεῖτῶ ὁῶεῖατῶ pfsync(4) ç ἰδῆνῆνδὸ ÷-ῆτῶεῖνδὸεῖατῶεῖ ἠεῖ ἰὰ ἠῆεῖ-ἰῆγῆεῖ “ἠεῖεῖατῶ εῖαδῶῶτῶτῶτῶ”.

### 30.4.3 Ἀδέεῖατῶ οἱ rc.conf

Οἱ PF ἠεῖ οἱ pflog(4) ἰδῆνῆνδὸ ἰὰ ῆδῆεῖσῶτῆεῖ εῖαδῶῦ ὁτὶ ἠεῖεῖβῆτῶτῶ ἰὰ ὁεὸ δῆνῆεῦδῶ εῖαδῶτῶ-ῆνῆβῶεῖδὸ οἱ 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
```

Ἄῖ δβῶτὸ ἠδῶ ἠῶτῶ οἱ firewall ὁδῶῆ-ῆεῖ εῖαδῶῦ οἱδῆεῖ ἠβῶεῖδῶ (LAN) δῆνῆτὸ οἱ ἰδῆνῆνδὸ ἠδῆεῖδῶεῖατῶ ἰὰ δῆνῆεῖδῶεῖατῶ δῆεῖτῶ, ἠ ἠῆ εῖεῖατῶ ἰὰ ÷-ῆτῶεῖνδὸεῖεῖδῶεῖ NAT, εῖ ÷-ῆῆεῖεῖατῶεῖ δβῶτῶ εῖεῖ ὁτὶ δῆνῆεῦδῶ ἀδέεῖατῶ:

```
gateway_enable="YES" # Enable as LAN gateway
```

### 30.4.4 Ἀτῆεῖδῶεῖατῶ ἠῆνῆνδὸ Ὀεῖδῶῆῆβῶῆεῖατῶ

Οἱ PF ἠεῖατῶεῖ ὁεὸ ῆδῆεῖβῶεῖδῶεῖ οἶτὸ ἠδῶ οἱ pf.conf(5) (ç δῆνῆεῖεῖατῶεῖτῶ ὁἶδῆεῖατῶ ἠβῆῖεῖ οἱ /etc/pf.conf) ἠεῖ ὁῆνῆνδὸεῖατῶ, ἠδῆνῆνδὸεῖατῶ ἠ δῆνῆεῖατῶεῖ δῆεῖτῶ ὁἶδῆεῖατῶ ὁἶδῆεῖατῶ ἠῶτῶ ἠῆνῆνδὸ ἠεῖ οἶτὸ ἠῆεῖδῶεῖατῶ δῆτὸ δῆνῆεῖτῶ-ἠῆεῖεῖ ὁἠ ἠῶτῶ. Ç ἠῆεῖεῖατῶεῖ οἶτὸ FreeBSD δῆνῆεῖατῶεῖ ἠῆεῖεῖατῶ ὁδῆνῆεῖατῶ ἠῆ-ἠβῆνῆ ῆνῆεῖεῖδῶ, ὁἶτὸ ὁἶδῆεῖατῶ /usr/share/examples/pf/. Δῆνῆεῖεῖτῶ ἰὰ ἠεῖεῖατῶεῖ οἱ PF FAQ (<http://www.openbsd.org/faq/pf/>) ἠεῖ δῆβῆç ἠῆεῖδῶεῖ οἱ εῖατῶεῖ οἶτὸ PF.

**Δῆνῆεῖατῶεῖβῶτῶ:** ἠεῖεῖδῶ ἠεῖεῖατῶεῖ οἱ PF FAQ (<http://www.openbsd.org/faq/pf/>), ἰὰ Ἰ-ῆεῖ δῆδῶτῶ ὁἶδῆεῖ ἠῆεῖεῖατῶεῖ ὁἶτὸ FreeBSD δῆνῆεῖτῶ-ἠῆ ἠεῖεῖατῶεῖεῖ ὁἶτὸ PF. Ὀτῶ ἠῆῆνῆτῶ ὁἶεῖατῶ, οἱ FreeBSD 7.x ἠεῖ ἠῆῶῆῆῆ ἠεῖεῖεῖδῶ, ÷-ῆτῶεῖνδὸεῖεῖτῶ ὁτὶ βῆεῖ Ἰεῖεῖδῶ οἶτὸ PF δῆτὸ ÷-ῆτῶεῖνδὸεῖεῖατῶ ἠεῖ οἱ 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 áññòPóáέò ó÷ áòέέÝð ìá ðç ñýèìέóç εάε ðç εάέòíòññáβá ðíø PF firewall. Ìç ìá÷ Ûóáóá íá áεÝáíáóá óá áñ÷ áβá ðçò ëβóóáð ðñεί íáέείPóáóá ðέò áññòPóáέò!

### 30.4.5 Άíòεάýííóáò ìá ðí PF

×ñçóεíðíεPóóá ðí pfctl(8) áέα íá áεÝáíáóá ðí PF. Ðάñáεΰòù εá áñáβóá εΰðíεάò ÷ ñPóείáò áíòíεÝð (ááááέüèáβóá üòε Ý÷ áóá áέαáΰóáε ðç óáεβáá manual ðíø pfctl(8) áέα íá ááβóá üεáò ðέò áέαεÝóείáò áðέεíáÝð):

| ΆíòíεP                           | Óείðüò                                                                                                         |
|----------------------------------|----------------------------------------------------------------------------------------------------------------|
| pfctl -e                         | Άíáñáíðíβçóç ðíø PF                                                                                            |
| pfctl -d                         | Άðáíáñáíðíβçóç ðíø PF                                                                                          |
| pfctl -F all -f /etc/pf.conf     | ΆέαáñáóP üεüí ðüí εάíüíüí (nat, filter, state, table, ê.ê.ð.) εάε áε íÝíò áíΰáíüòç áðü ðí áñ÷ áβí /etc/pf.conf |
| pfctl -s [ rules   nat   state ] | Άέóγðüòç áíáóíñΰò ó÷ áòέέΰ ìá ðíòð εάíüíáò ðíø òβεòñíò, ðíø NAT, P ðíø ðβíáέα εάòΰóóáóçò                       |
| pfctl -vnf /etc/pf.conf          | ΆεÝá÷ áε ðí /etc/pf.conf áέα εΰεç, áέεΰ ááí ðíñòPíáε ðíòð εάíüíáò                                              |

### 30.4.6 Άíáñáíðíβçóç ðíø ALTQ

Ôí ALTQ áέαòβεáóáε ìüñí áí ìáóáεüòðóβóáóá áðáðεάβáð ðçí ððíóðPñείç ðíø ìÝóá óòíð ðòñPíá ðíø FreeBSD. Ôí ALTQ ááí ððíóðçñβεáóáε áðü üεá óá ðñíáñΰíáóá ðáPαçóçò εáñòPí áέέóγíò. ÐάñáεάεíÝíá ááβóá ðç óáεβáá manual ðíø altq(4) áέα ðç ëβóóá ðüí ðáçPí ðíø ððíóðçñβεííóáε óóçí Ýέáííóç ðíø FreeBSD ðíø áέαεÝóáóá.

Íε ðáñáεΰòù áðέεíáÝð ðíø ðòñPíá áíáñáíðíείíý ðí ALTQ εάε ðáñÝ÷ íóí áðέðñüóεáóáò εάέòíòññáβò:

```
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 εάέòíòññáβPí ALTQ.

Ç áñáíñP options ALTQ\_CBQ áíáñáíðíεάβ ðí *Class Based Queuing* (CBQ). Ôí CBQ óáò áðέðñÝðáε íá ÷ ùñβóáóá ðí áýñíð Píçò ìεáò óýíááóçò óá áέαòíñáòέέÝð εεΰóáέò P ðñÝð, Póóá íá áβñíóáε ðñíòáñáέüòçðáð óóçí έβίçóç áíΰεíáá ìá ðíòð εάíüíáò ðíø òβεòñíò.

Ç áñáíñP options ALTQ\_RED áíáñáíðíεάβ ðí *Random Early Detection* (RED). Ôí RED ÷ ñçóéíðíεάβóáε áέα íá áðíòáò÷εáβ ç óðíüñçóç ðíø áέέóγíò. Άέα ðí óείðü áòòü, ðí RED ìáòñΰáε ðí ìPείò ðçò ðñΰò εάε ðí óóáεñPíáε ìá ðí ìÝáέóòí εάε áεΰ÷έóòí ðñεί ðçò. Áí ç ðñΰ áβíáε ðΰíü áðü ðí ìÝáέóòí, üεá óá íÝá ðáέÝóá εá áðíññβðòííóáε. Óýíòüíá εάε ìá ðí ðñíá ðíø, ðí RED áðíññβðóáε ðáέÝóá áðü áεΰòíñáð óòíáÝóáέò ìá ðò÷ áβí ðñüðí.

Ç áñáíñP options ALTQ\_RIO áíáñáíðíεάβ ðí *Random Early Detection In and Out*.

Ç añáñìP options ALTQ\_HFSC áíáñáñìðíεάβ òì Hierarchical Fair Service Curve Packet Scheduler. Άέά ðáñέóóúòáñáò ðεçñíòíññáò ó÷: áòέέÛ ìá òì HFSC ááβòá: <http://www-2.cs.cmu.edu/~hzhang/HFSC/main.html>.

Ç añáñìP options ALTQ\_PRIQ áíáñáñìðíεάβ òì Priority Queuing (PRIQ). Òì PRIQ ðÛíòíòá ðáñíÛáέ ðñðòá òçí έβίçòç ìá òç ìááέýòáñç ðñíòáñáέúòçòá.

Ç añáñìP options ALTQ\_NOPCC áíáñáñìðíεάβ òçí ððíòòðñέíç SMP áέá òì ALTQ. Ç áðέεíáP áòòP áðáέòáβòáέ óá óòóðPíáòá SMP.

### 30.5 Òì IPFILTER (IPF) Firewall

Ï óòáñáòÝáò òìò IPFILTER áβίáέ ì Darren Reed. Òì IPFILTER ááí áíáñòÛòáέ áðú òì έáέòíòñáέέú óýòòçíá: áβίáέ ìέá áòáñíáP áñέέòíý έpáέέá ðíò Ý÷: áέ ìáòóóáñέáβ óòì FreeBSD, òì NetBSD, òì OpenBSD, òì SunOS, òì HP/UX έáέ òì Solaris. Òì IPFILTER áβίáέ ððú áέáñέP έáέ áíáñáP áíÛðòòíç έáέ óòíðPñçòç, έáέ έòέεíòíñíý óáέòέέÛ ìέ ìÝáò áέáúòáέò òìò.

Òì IPFILTER áβίáέ Ýíá firewall έáέ ìç÷: áíέóíúò NAT ðíò έáέòíòñáέβ óòíð ððñPíá έáέ ìðñáβ ìá áεÝá÷: áòáέ έáέ ìá ðáñáέíεíòέáβòáέ áðú ðñíáñÛíáòá ÷: ñPòç. Ìέ έáíúíáò òìò firewall ìðñíýí ìá òβεáíòáέ óá έó÷: ý P ìá áέááñÛòííòáέ ìÝòú òìò áìçεçòέέéý ðñíáñÛíáòíò ipf(8). Ìέ έáíúíáò áέá òì NAT ìðñíýí ìá òβεáíòáέ óá έó÷: ý P ìá áέááñÛòííòáέ ìÝòú òìò áìçεçòέέéý ðñíáñÛíáòíò ipnat(1). Òì áìçεçòέέú ðñúáñáñíá ipfstat(8) ìðñáβ ìá áέòòðpòáέ óòáòéóòέέÛ áέòÝέáòçò áέá òì òìPíá òìò IPFILTER ðíò áέòáέáβòáέ óòíð ððñPíá. Òì ðñúáñáñíá ipmon(8) ìðñáβ ìá έáòááñÛòáέ óέò áíÝñááέáò òìò IPFILTER óòì áñ÷: áβá έáòááñáòPò óòíáÛíòúí òìò óòóðPíáòíò.

Òì IPF áñÛòçéá áñ÷: έέÛ ÷: ñçóέíðíέpíòáò ìέá εíáέεP áðáíáñáóβáò έáíúíúí òìò óýðíò “ì óáέáòóáβì έáíúíáò ðíò óáέñέÛáέέ, áβίáέ έáέ ì ìέέçòPò” έáέ ÷: ñçóέíðíέéýóá ìúñí έáíúíáò óýðíò stateless. Ìá òçí ðÛñíáñ òìò ÷: ñúñíò, òì IPF ááέòέpεçéá áέá ìá ðáñέέáìáÛíáέ òçí áðέεíáP “quick” έáέ òçí áðέεíáP “keep state” áέá stateful έáíúíáò. Ìέ áðέεíáÝò áòòÝò áέóóá÷: ñúíέóáí áñáíáòέέÛ òç εíáέεP áðáíáñáóβáò òúí έáíúíúí. Ç áðβòçíç òáέìçñβúòç òìò IPF έáέýðòáέ ìúñí óέò ðáέέÝò ðáñáíÝòñíòò ñýèíέóçò έáέ áðáíáñáóβáò òúí έáíúíúí. Ìέ óýá÷: ñííáò έáέòíòñáέβáò έáέýðòííòáέ ìúñí ùò ðñúòέáòáò áðέεíáÝò, έáέ Ýòóέ ááí òíòβεáíòáέ áñέáòÛ óá ðεáñíáέòPíáòá òìòò óòç áçìέíòñáβá áíúí ðíεý έáέýòáñíò έáέ áóòáέÝòóáñíò firewall.

Ìέ ìáçáβáò ðíò ðáñέÝ÷: ñíòáέ óá áòòP òçí áíúòçòá, ááóβεííòáέ óòç ÷: ñPòç έáíúíúí ðíò ðáñέÝ÷: ñíòí òçí áðέεíáP “quick” έáέpò έáέ òçí stateful áðέεíáP “keep state”. Áòòú áβίáέ έáέ òì ááóέέú ðεáβòéí έáέòíòñáέpí áέá òçí áçìέíòñáβá òìò óáò έáíúíúí áíúò inclusive firewall.

Άέá έáððñÝñáέáò ó÷: áòέέÛ ìá òíí ðáέέúòáñí ðñúðí áðáíáñáóβáò òúí έáíúíúí, ááβòá: [http://www.obfuscation.org/ipf/ipf-howto.html#TOC\\_1](http://www.obfuscation.org/ipf/ipf-howto.html#TOC_1) έáέ <http://coombs.anu.edu.au/~avalon/ip-filter.html>.

Ìðñáβòá ìá ááβòá òì IPF FAQ óòçí òìðíèáòá <http://www.phildev.net/ipf/index.html>.

Ìðñáβòá ìá áñáβòá ðέò ðáέέúòáñáò áçííóέáýóáέò ðέò έβòóáò óá÷: ðáñíñáβíò òìò IPFILTER óòì <http://marc.theaimsgroup.com/?l=ipfilter>. ÐáñÝ÷: áòáέ áðíáòúòçòá áíáεPòçòçò.

#### 30.5.1 Áíáñáñìðíέpíòáò òì IPF

Òì IPF ðáñέέáìáÛíáòáέ óòç ááóέέP ááέáòÛòóáòç òìò FreeBSD ùò Ûñέñúíá òì ìðñí ìðñáβ ìá òíñòúεáβ ÷: ùñέóòÛ. Òì óýòòçíá έá òíñòpòáέ áðíáíέέÛ òì Ûñέñúíá òìò IPF áí ððÛñ÷: áέ ç έáòá÷: pñέòç ipfilter\_enable="YES" óòì áñ÷: áβì /etc/rc.conf. Òì Ûñέñúíá Ý÷: áέ áçìέíòñáçéáβ ìá áíáñáñìðíέçíÝíç òçí áðíáòúòçòá έáòááñáòPò έáέ ìá òçí áðέεíáP default pass all. Άέá ìá áέέÛíáòá áòòP òçí ðñíáðέεíáP óá block all, ìðñáβòá áðέpò ìá ðñíòέÝóáòá òíí έáíúíá áðúññέçò (block all) óòì óÝέíò òúí έáíúíúí óáò. Ááí ÷: ñáέÛáòáέ ìá ìáòáέúòòβòáòá òçí áðέεíáP IPF óòì ððñPíá òìò FreeBSD áέá òì óέíðú áòòú.



Ç äðëëïäP -Fa äääëÛæäé òïòð éáíúíäð áðü òïòð áóóòäñéëïýð ðβíáéäð òïò firewall.

Ç äðëëïäP -f éäëïñβæäé òï áñ ÷ äβï òùí éáíúíúí ðïò éä òïñòùèäβ.

Áðòü óáð äβíáé òçï äòíáòüòçðçá íá áëëÛíáðä òï áñ ÷ äβï éáíúíúí óáð, íá äéðäëÝóáðä òçï áíòïëP IPF ðïò áíáóÝñáíá ðáñáðÛíù, éäé íá áíáíáðóáðä íá áðòü òïí ðñüðï òïòð éáíúíáð òðï firewall ðïò äéðäëäβðäé Pæç íá éäéíýñäëïòð, ÷ ùñβð íá ÷ ñäéáóóäβ íá äðáíáéëéíPóáðä òï óýóðçíá óáð. Ç ìÝëíäïð áððP äβíáé ðïëý äïëéëP äéá íá äïëéÛóáðä íÝíòð éáíúíáð, éäëðð ìðíñáβ íá äðáíáéçðèäβ ùóáð òïñÝð èÝéáðä.

Ääβðä òç óäëβää manual òïò ipf(8) äéá èäðòñÝñäéäð ó÷ äðééÛ íá òéð òðüëïéðäð äðëëïäÝð ðïò ìðíñáðä íá ÷ ñçóéíðïëéPóáðä íá òçï áíòïëP áððP.

Ç áíòïëP ipf(8) áíáíÝíáé Ýíá áðëü áñ ÷ äβï éäëíÝíò ùð áñ ÷ äβï éáíúíúí. Ääí éä ää ÷ èäβ áñ ÷ äβï éáíúíúí äñáíÝíí ùð script íá òðïäëééÝð áíóééáðáóðÛóáéð.

ÏðÛñ ÷ äé ùðòüóï ðñüðïð íá äñÛðäðä éáíúíáð IPF ðïò íá ÷ ñçóéíðïëéíýí òçï éó ÷ ý òùí òðïäëééëðï áíóééáðáóðÛóáúí. Äéá ðáñéóóóðäñáð ðççñïòïñβäð, ääβðä òï ÕïPíá 30.5.9.

### 30.5.5 IPFSTAT

Ç ðñíäðéëääïÝíç òðïðäñéòïñÛ ðïò ipfstat(8) äβíáé íá áíáéðÛ éäé íá äðäéëíñβæäé òï óýííëí òùí óðáðéóðéëëðï ðïò óðäéáíòñðççéáí ùð áðïòÝéáóíá òçð äðáñííäPð òùí éáíúíúí òïò ÷ ñPððç óðá ðäéÝðá ðïò äéóÝñ ÷ ïóáé éäé áíÝñ ÷ ïóáé áðü òï firewall, áðü òç óðéäñP òçð òäëäððáβáð òïò äêëβíççðçð P áðü òïí òäëäððáβï òïòð ìçääíéóíü ìÝòü òçð áíòïëPð ipf -z.

Ääβðä òç óäëβää manual ipfstat(8) äéá èäðòñÝñäéäð.

Ç ðñíäðéëääïÝíç Ýíäïð òçð áíòïëPð ipfstat(8) éä ïéÛæäé íá òçï ðáñáéÛòù:

```
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)
```

¼ðáí ÷ ñçóéíðïëéçèäβ ç äðëëïäP -i äéá òá äéóáñ ÷ ùíáíá P ç äðëëïäP -o äéá òá áíáñ ÷ ùíáíá ðäéÝðá, ç áíòïëP éä áíáéðPðäé éäé éä äðäéëíñβðäé òçï áíòβððïëé ÷ ç èβððá éáíúíúí ðïò äβíáé ääéáðáóðçïÝíç éäé ÷ ñçóéíðïëéäβðäé áðü òïí ððñPíá òç äääñÝíç óðéäñP.

Ç áíòïëP ipfstat -in ääβ ÷ íäé Ýíá äñéèèçïÝíí ðβíáéä éáíúíúí äéá äéóáñ ÷ ùíáíá ðäéÝðá.

Ç áíòïëP ipfstat -on ääβ ÷ íäé Ýíá äñéèèçïÝíí ðβíáéä éáíúíúí äéá áíáñ ÷ ùíáíá ðäéÝðá.

Ç Ýñáò εά ñεΰεάε ðá ðçí 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 ðβίαεά εάíñíñí áεά ðá áεóáñ÷ùíáíá ðáεΰòά, ðñðñεάòπρíoáò ðññíoóΰ áðu ðñ εΰεά εάíñíá Ýíá áñεέìù ðñ ðáβ÷íáε ðñòáð ðññΰò Ý÷áε ðñçóεñðñεέáβ.

Ç áíòεΨ ipfstat -oh ááβ÷íáε ðñ ðβίαεά εάíñíñí áεά ðá áíáñ÷ùíáíá ðáεΰòά, ðñðñεάòπρíoáò ðññíoóΰ áðu ðñ εΰεά εάíñíá Ýíá áñεέìù ðñ ðáβ÷íáε ðñòáð ðññΰò Ý÷áε ðñçóεñðñεέáβ.

Ç Ýñáò εά ñεΰεάε ðá ðçí 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
```

Ίεά áðu ðεò ðεí ðçíáíóεέΰò εάεóìòñáβáð ðçð áíòεΨ ipfstat áβίαε ç áðεεíáΨ -t ç ðñβá áðáεεñβεάε ðñ ðβίαεά εάóáóóΰóáñí, ðá ðññòñ ðññέí ðá áóòù ðñ ðñçóεñðñεέáβ ç áíòεΨ top(1) áεά ðá ááβíáε ðñ ðβίαεά εάεñááóεπρì ðñ áεòáεñγíóáε ðñ FreeBSD. ¼ðáí ðñ firewall óáð áΰ÷áðáε áðβεáóç, ç εάεòìòñáβá áóðΨ óáð áβíáε ðçí áðíáóùòçðά ðá áíáíññβóáðά εάε ðá áóóεΰóáðά óáð βáεά ðá ðáεΰòά ðñ ðçí áðñóáεñγí. Ίε ðññáεñáðεέΰò ðñ-áðεεíáΰò óáð áβñíòñ ðçí áðñíáóùòçðά ðá áðεεΰíáðά ðñ IP áóáðçñβáð Ψ ðñññεέòñγ, ðçí εγñά, Ψ ðñ ðññóùεñεεí ðñ ðñβì εΰεάðά ðá ðáñáεñεìðεβóáðά óá ðñááñáðéεù ðñññí. Ááβðά ðç óáεβáá manual ðñ ipfstat(8) áεά ðáñεóóùðáñáð εáðòññΰñáεáð.

### 30.5.6 IPMON

Άεά ðá εάεóìòñáβóáε óóóðΰ ç áíòεΨ ipmon, εά ðñΰðáε ðá áíáñáñðñεέáβ ç áðεεíáΨ IPFILTER\_LOG óòñ ððñβíá. Ç áíòεΨ áóðΨ áεάεΰðáε áγí εάóòññáðéεέγð ðññòðñð εάεóìòñáβáð. Ί ðññáðεεάñΰñð εάíñεέùð ðññòðñð εάεóìòñáβáð áíáñáñðñεέáβóáε ðóáí ç áíòεΨ ðñçóεñðñεέáβóáε ðññβð ðçí áðεεíáΨ -D.

Ç áíòεΨ ðññáβ ðá ðñçóεñðñεέáβ óá εάεóìòñáβá ááβññá ðóáí áðεεòñáβóá ðá ΰ÷áðά ΰíá óóíá÷ùíáñ áñ÷áβñ εάóááñáóðð ðóá ðá ðññáβóá ðá áíáðΰóáðά ðεò ðññáγñγíáíáð ááñáóΰò. Áóòùð áβíáε εάε ðñ ðññòðñð ðá ðñ ðñβì ΰ÷áε ðñεìεóðά ðá óóíáñáΰεάðáε ðñ FreeBSD ðá ðñ IPFILTER. Õñ FreeBSD ΰ÷áε áíóúíáðùíΰç áðñíáóùòçðά áíáεεάáðð áñ÷áβñ εάóááñáóðð. Άεά áóòù ðñ εüáñ, áβíáε εάεγðáññ ç εάóááñáóΨ ðá áβñáðáε ðñóù ðñ syslogd(8) ðáñΰ óá ΰíá óóíçεεέòΰññ áñ÷áβñ. Άðu ðññáðεεíáΨ, ç ðññέìεóç ipmon\_flags óòñ áñ÷áβñ rc.conf ðñçóεñðñεέáβ ðεò áðεεíáΰò -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 ðεáññáεòπρíoáð ðçð εάóááñáóðð áβíáε ðññóáíΨ. ðáñΰ÷áε ðçí áðñíáóùòçðά áðεéùðçðçð ðεçññíòñεπρì ðñðð ðá ðáεΰòά ðñ áðñññβðεçεάí, ðεò áεáðεγíóáεð áðu ðεò ðñβáð εβðεçεάí, εάε ðñ ðñññεέòñ ðñò. ð÷áðά ΰóóε ΰíá óçíáíóεέù ðεáñΰεòçíá ðóáí ðññíoðáεáβóá ðá áíáíññβóáðά ΰíá áεóáñεΰά.

Άεùíá εάε ðóáí áíáñáñðñεέáβóáð ðçí áðñíáóùòçðά εάóááñáóðð, ðñ IPF ááí εά εάóááñΰðáε ðβðñóá áí ááí ΰ÷áε áβíáε ç áíðβóðñε÷ç ðññέìεóç óòñðð εάíñíáð. Ί áεά÷áεñεέóðð ðñ firewall áðñíáóβεάε áεά ðñεìòð εάíñíáð ðñ óáð εΰεάε ðá áíáñáñðñεέáβóáε ðçí εάóááñáóΨ, εάε ðññíoεΰðáε óá áóòñγð ðçí εΰñç log. Õðóεñεñáεέΰ, ç εάóááñáóΨ áíáñáñðñεέáβóáε ðññí óá εάíñíáð ðñ áðñññβððñí ðáεΰòά.

Άβιάε δρεΰ οόιϕεέοιΎίί ίά δάνεεάιαΰίάοάε Ύίάο εάφίάο οόι οΎεοο οίο οοίεοο, οίο ίά αδιίνβδδάε άδύ δνιάδεειαΰ υεά οά δάεΎοά οίο οοΰίοι ίΎ-νε έεάβ (default deny). Ιά οίί ονύοι άοού ιδινάβδά ίά αάβδά υεά οά δάεΎοά οίο αάι οάβνεάίαι ίά εάίΎίά εάφίά οίο οάο.

### 30.5.7 Έάοάάνάοΰ οίο IPMON

Οί **syslogd** ÷-νϕοέιιδρεάβ οϕ εεέΰ οίο εεάεέΰ ίΎεραί εεά οί εεά÷υνεόοιυ ούι αάανΎίί εάοάάνάοΰο. ΆεάεΎοάε εεάεέΎοά ίάαίιδρεΰοάεο οίο ίιιΰΰείίοάε “facility” εεά “level”. Ύ4οάί οί IPMON ÷-νϕοέιιδρεάβδάε ίά οϕί άδεειαΰ -Ds, ÷-νϕοέιιδρεάβ οί security υò υίίά “facility”. Ύεά οά αάανΎίίά οίο εάοάάνΰοίίοάε άδύ οί IPMON εάοάεΰαίοι οόι security. Αί οί άδεεοιαβδά, ιδινάβδά ίά ÷-νϕοέιιδρεΰοάοά οά δάνάεΰου άδβδάαά εεά δάνάεοΎνυ εεά÷υνεόοιυ ούι αάανΎίίί 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 νδειβδάοά οί IPFILTER ίά εάοάάνΰοάε υεά οά αάανΎίίά οόι /var/log/ipfilter.log, εά ÷-νέάοόάβ ίά αϕιέιονάβδάοά άδύ δνεί οί αν÷άβι. Αοού ιδινάβ ίά άβιάε ίά οϕί δάνάεΰου αίοιεΰ:

```
touch /var/log/ipfilter.log
```

ϕ εάεοιονάβά οίο syslogd(8) ιδινάβ ίά νδειεοόάβ ίά εάοά÷υνβδάεο οόι αν÷άβι /etc/syslog.conf. Οί αν÷άβι syslog.conf δνιόοΎίίάε οϕίαίοεέΰ άοάεείβά οοίί ονύοι ίά οίί ιδινάβ οί **syslog** αίοειαδουδβεάε οά ιϕίγίαοά οοόοΰιαοίο οίο δνιΎν÷ίίοάε άδύ αοάνιιΎο υδύδ οί IPF.

ΔνιόεΎοά οϕί δάνάεΰου εάοά÷ϰνεόϕ οόι αν÷άβι /etc/syslog.conf:

```
security.* /var/log/ipfilter.log
```

Οί security.\* οϕίάβιάε υδε εά άβιάοάε εάοάάνάοΰ υεύι ούι ιϕίοιΰουι αοοίϕ οίο οϕδίο οοϕί οίδρεάοάβ οίο Ύ÷εε ίνεοόάβ.

Άεά ίά άίανάιδρεΰοάοά οεο εεεάΎο οόι /etc/syslog.conf εά δνΎδάε ίά άδάίάεεείΰοάοά οί ιϕ÷ΰίϕία ΰ ίά άίάεΰοάοά οί syslogd(8) ίά ίάίάεάΰοάε οί /etc/syslog.conf, εεοάεϰίοάδ οϕί αίοιεΰ /etc/rc.d/syslogd reload

Ιϕί ία÷ΰοάοά ίά ονιδιδρεΰοάοά οί /etc/newsyslog.conf ϰοά ίά άίάεΰοάε οί αν÷άβι εάοάάνάοΰο οίο αϕιέιονάβδάοά δάνάδΰιυ.

### 30.5.8 ϕ ιινöΰ ούι Ιϕίοιΰουι Έάοάάνάοΰο

Οά ιϕίγίαοά οίο δάνΰαίίοάε άδύ οϕί ipmon αδιόαείγίίοάε άδύ δάαβά αάανΎίίί οίο ÷-υνβαιίοάε άδύ εάοευι εεΰοόϕία. Οά δάαβά οίο άβιάε ειείΰ οά υεά οά ιϕίγίαοά, άβιάε οά δάνάεΰου:

1. ϕ ϕιάννϕίβά δάνάεάΰο οίο δάεΎοίο
2. ϕ ϰνά δάνάεάΰο οίο δάεΎοίο. ÷-εε οϕί ιινöΰ HH:MM:SS.F, ϕ ιδινάβ οδραϕεϰίαε ϰνάο, εάδδΰ, αάοοάνυεάδδά εεεΰοίαοά αάοοάνρεΎδοίο (οά ιδινάβ ιδινάβ ίά άβιάε δρεεΰ αάεάεεΰ ϕϕοβά).
3. Οί υίίά οϕο εεάδάοΰο οοϕί ιδινάβ Ύεεία ϕ άδάιανάοάβά οίο δάεΎοίο δ.÷. dc0.

4. Ì ἀνεέιυò ìÛαάò εάέ ì áγíυí ἀνεέιυò òιò εάíυíá, ð.÷. @0 : 17.

Ïðñáβòá íá ááβòá òá ðáñάέÛòυ ìá òçí áíòιρεP ipfstat -in:

1. Òι áβáηò òçò áíÛñáάέáò: p áí òι ðáέÛòι ðÛñáòá, b áí òι ðáέÛòι áðìññβòεçεá, S áέá óγíóηì ðáέÛòι, n áí ááí òáβñεάíá ìá εάíÛíá εάíυíá, L áέá εάíυíá ìá εάòááñáòP. Ç óáεñÛ ðñιòáñάέυòçòáò òçí áðáέέυιέòç òυì ðáñáðÛíυ, áβíáέ S, p, b, n, L. Òι εάòáέάβι P P òι B óçíáβñιòí υòέ ç εάòááñáòP òιò ðáέÛòιò Ýáέíá ευáυ εÛðιέáò ááíέεðò ñýèìέòçò εάòááñáòP ò εάέ υ÷έ áíáέòβáò εÛðιέιò εάíυíá.
2. Ìε áέáòεγíòáέò. Ðñυέáέóáέ òçí ðñááíáðéέυòçòá áέá òñβá ðááβá: òç áέáýèðιòç εάέ òç εýñá áòáòçñβáò (÷ ðñβáειíðáέ ìá ευìá), òι óγíáρεì -> εάέ òçí áέáýèðιòç εάέ εýñá ðñιíñέòιíý, ð.÷. 209 . 53 . 17 . 22 , 80 -> 198 . 73 . 220 . 17 , 1722.
3. Òι PR áερεíòεγíáíí áðυ òι υíñá P òιí ἀνεέιυ òιò ðñυòιευέειò, ð.÷. PR tcp.
4. Òι len áερεíòεγíáíí áðυ òι ìPεìò òçò áðéέáòáεβááò εάέ òι òòñεέέυ ìPεìò òιò ðáέÛòιò, ð.÷. len 20 40.

Áí ðñυέáέóáέ áέá ðáέÛòι TCP, εá òðÛñ÷áέ Ýíá áðéðéÛíí ðááβι òι òιβι εá íáέεíÛáε ìá íεá ðáýέá εάέ εá áερεíòεáβòáέ áðυ áñÛíáòá òá òιβá áíóέòιέ÷íýí óóέò áðéεíãÛò (flags) ðιò Ý÷íιò ðáεáβ. Ááβòá òç óáεβáá manual ipmon(8) áέá òç εβòá òυì áñáñÛòυí εάέ òυì áíòβòιέ÷ύí flags.

Áí ðñυέáέóáέ áέá ðáέÛòι ICMP, εá òðÛñ÷íιò áýí ðááβá òòι òÛεìò, òι ðñòι εá áβíáέ ðÛíóá “ICMP” εάέ òι áðυíáíí εá áβíáέ ì òýðιò òιò ìçíýíáðιò εάέ òιò òðυ-ìçíýíáðιò ICMP, ÷ ðñέóíÛíá ìá íεá εÛεáðι, ð.÷. ICMP 3/3 áέá Ýíá ìPιòíá ìç ðñιòáÛóέιçò εýñáò (port unreachable).

### 30.5.9 Äçìεìòñáβá Script Éáíυíυí ìá ÓòìáρεέεP ÒðιέáòÛòóáóç

ÏñέóíÛíε Ýíðáεñιέ ÷ñPòáð òιò IPF äçìεìòñáíýí Ýíá áñ÷áβι εάíυíυí òι òιβι ìðñáβ íá áέòáέáòáβ ùò script ìá áðíáòυòçòá òòìáρεέεP òðιέáòÛòóáóçò. Òι ááóέέυ υòáεìò òιò ðáñáðÛíυ, áβíáέ υòέ ÷ñáέÛáòáέ íá áέεÛíáòá ìυíí òçí òέìP ðιò ó÷áòβáέóáέ ìá òι òòìáρεέέυ υíñá εάέ υðáí òι script áέòáέáòáβ, ç òέìP εá òðιέáòáòóáέáβ òá υεìò òιò ò εάíυíáð ðιò ðáñέÛ÷íιò òι υíñá áòòυ. Éáεðò ðñυέáέóáέ áέá script, ìðñáβòá íá ÷ñçóεíìðιέPòáðá òòìáρεέεP òðιέáòÛòóáóç áέá íá ευáέεíðιέPòáðá òð÷íÛ ÷ñçóεíìðιέγíáíáð òεíÛò εάέ íá òέð òðιέáέεóòÛòá òá òðιέáðεγíò εάíυíáð. Áòòυ òáβíáðáέ εάέ òòι ðáñÛááέáíá ðιò áερεíòεáβ.

Ç óγíòáιç òιò script ðιò ÷ñçóεíìðιέáβòáέ ááβ, áβíáέ óòìáðP ìá òá εáýòç sh(1), csh(1), εάέ tcsh(1).

Òá ðááβá òðá òιβá áβíáðáέ òòìáρεέεP òðιέáòÛòóáóç ðñιòçíáεðñííðáέ ìá òι óPíá òιò áρεáñβιò: \$.

Òá òòìáρεέέÛ ðááβá ááí Ý÷íιò òçí ðñιòçíáβυòç ìá òι \$.

Ç òέìP ðιò εá ÷ñçóεíìðιέçεáβ òòι òòìáρεέέυ ðááβι, εá ðñÛðáε íá áóυεεáβáðáέ òá áέðεÛ áέóááυáέέÛ (").

ÏáέεíPòáð òι áñ÷áβι òυì εάíυíυí óáð ìá εÛòέ áíòβòιέ÷í ìá òι ðáñάέÛòυ:

```
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
```

Αὐδὺ ἀβιάε ὑεῖ. Ὀδὶ δἀνάδὔῖ δἀνὔαεαῖά ἀάρ ἀβιάε ὀχιάῖοεεῖβ ἰε εἀφῖάδ, ἀεεὔ ἰ ὀνὔδῖδ ἰὰ ὀῖ ἰδῖβἰ εἀεῖοῖῆἰῖ ἕεε δἀβῆῖοῖ ὀεῖὔδ ὀά δἀάβἀ ὀδῖεἀδὔὀὀἀὀὀ. Αῖ ὀῖ δἀνάδὔῖ δἀνὔαεαῖά ἀῆβὀεῖῖὀὀὀ ὀά ὔῖά ἀῆ ÷ ἀβἰ ἰὰ ὀῖ ὑῖῆά /etc/ipf.rules.script, εἀ ἰδῖῆῖὀὀὀὀ ἰά ἀδῖῖὀῖῆὀὀὀὀὀ ἀὀὀῖὔδ ὀῖὀδ εἀφῖάδ ἰὰ ὀχἰ δἀῆεὔδὺ ἀῖὀῖὔὔ:

```
sh /etc/ipf.rules.script
```

Ὀδὔῆ ÷ ἀε ὔῖά δῆῆὔεῖῖῖ ὑὀὀὀ ÷ ῆὀὀεῖῖὀῖῖῖὀὀὀὀὀὀ ἀῆ ÷ ἀβἰ εἀφῖῖῖ ἰὰ ἀῖὀῖὀὀὀὀὀὀὀ ὀὀῖὀῖὀὀὀὀὀ: Ὀῖ IPF ἀάρ εἀὀὀὀὀὀὀὀ ὀχ ὀὀῖὀῖὀὀὀὀ ὀδῖεἀδὔὀὀὀὀὀ, εἀε ἀῖ ἰδῖῆὀὀ ἰά ἀεῖῖὀὀὀὀὀ ἀὀὀὔ ὀά scripts ὔἰὀὀὀὀ.

ἰά ὀὔὀῖῖὀ script ἰδῖῆὀὀ ἰά ÷ ῆὀὀεῖῖὀῖὀεῖὀὀ ἰὰ ὔῖά ἀδὔ ὀῖὀδ ἰῖῖ δἀῆεὔδὺ ὀῆὔδῖδ:

- Αὀὀῆῆὔὀὀὀ ὀῖ ὀ ÷ ὑεεῖῖ ἀδὔ ὀχ ῆῆῆῖὔὀ ὀῖὀ ἰᾶεῖῖὔᾶε ἰὰ cat, εἀε ἰᾶὀὀῆῆὔὀὀὀ ὀὀ ὀ ÷ ὑεεῖῖ ὀχ ῆῆῆῖὔὀ ὀῖὀ ἰᾶεῖῖὔᾶε ἰὰ /sbin/ipf. Ὀῖδῖεᾶὀὀὀὀ ὀῖ ipfilter\_enable="YES" ὀὀῖ ῆῆ ÷ ἀβἰ /etc/rc.conf ὑδὔδ ὀὀῖὔὀδ, εἀε ἀεὀὀὀὀὀὀ ὀῖ script ἰεᾶ ὀῖῆῖ ἰᾶὀὔ ἀδὔ εὔεᾶ ἀεεᾶὔὔ ἰεᾶ ἰά ἀῖεῖὀῆῆὀὀὀὀὀὀ ὀ ἰά ἀῖῖᾶῆὀὀὀὀ ὀῖ /etc/ipf.rules.
- Αδῖᾶῆῆῆὀὀὀὀὀ ὀῖ IPFILTER ὀὀὀ scripts ἀεεὔῖὀὀὀ ὀῖὀ ὀὀὀὀὀὀὀὀὀ, δῆῖὀὀ ὔὀῖὀὀὀὀ ὀχἰ εᾶὀὀ ÷ ὔῆὀὀὀ ipfilter\_enable="NO" (δῆῖὀὀὀὀὀὀὀ ἰεᾶ ὀχἰ δῆῖὀὀὀὀὀὀὀ ὔῖὀ ὀεῖὔὀ) ὀὀῖ ῆῆ ÷ ἀβἰ /etc/rc.conf.

Δῆῖὀὀὀὀὀὀ ὔῖά ὔῖά script ὑδὔδ ὀῖ δἀῆῖὀὀὀὀ ὀὀῖὖ εᾶὀὔὀῖῖὀὀ ἰᾶεὔῖὀὀὀὀ /usr/local/etc/rc.d/. Ὀῖ script εἀ δῆὔὀὀὀ ἰά ὔ ÷ ἀε ὔῖά δῆῖὀὀὀὀὀ ὑῖῆᾶ, ὑδὔδ ipf.loadrules.sh. Ḷ ἰδὔὀὀὀὀὀ .sh ἀβἰᾶε ὀδῖ ÷ ῆᾶὔὀεὔὔ.

```
#!/bin/sh
sh /etc/ipf.rules.script
```

ἰε ὔᾶᾶεᾶὀ ὀὀ ἀὀὀὀ ὀῖ ἀῆ ÷ ἀβἰ, εἀ δῆὔὀὀὀ ἰά ἀδὀὀῆὔὀὀὀ ἰῖὔᾶῖὀὀ, ᾶᾶῆᾶὀὀ ἕεε ἀεὀὔὀὀὀὀ ἰεᾶ ὀῖῖ ÷ ῆὀὀὀὀ root.

```
chmod 700 /usr/local/etc/rc.d/ipf.loadrules.sh
```

ἰε εἀφῖῖὀδ ὀῖὀ IPF εἀ ὀῖῆὀῖὀὀὀὀὀ δῆὔῖῖ εᾶὀὔ ὀχἰ ἀεεὔῖὀὀ ὀῖὀ ὀὀὀὀὀὀὀὀ ὀὀὀ.

### 30.5.10 Ὀῖ Ὀὔῆῖὀ Ἐᾶῖῖῖὀ ὀῖὀ IPF

ὔδ "ὀὔῆῖὀ εᾶῖῖῖὀῖ" ὀὀῖ IPF, ῖῆὔᾶῖὀὀὀ ἰεᾶ ῆὔᾶᾶ εᾶῖῖῖὀῖ ὀῖὀ ὔ ÷ ῖὀῖ ῆῆὀὀὀ ἰεᾶ ἰά ἀδὀὀῆὔὀὀὀ ὀ ἰά ἀὀῖῆῆὀὀὀὀὀ ὀᾶεὔὀὀ ἰῖὔῖᾶᾶ ἰὰ ὀεὀ ὀεῖὔδ ὀῖὀ δῆῆὀὔ ÷ ῖὀὀὀ ὀὀ ἰᾶὀὔ. Ḷ ἰεὀὀὀδ εᾶὀᾶὔὀὀὀὀ ἰῖὀᾶεῖᾶᾶὀ ὀᾶεὔὀὀὀ ἰᾶὀᾶὔὀ ὀδῖῖᾶεὀὀὀὀ



PORT\_NUM = port number

TCP\_FLAG = S

STATEFUL = keep state

**30.5.11.1 ACTION**

Ç áñÝñāáέα (action) āāβ÷íáε óε ðñÝðáε íá āβíáε íá ðí ðάέÝðí áí óάέñεÛæáε íá ðíí έáíuíά ðíð ðβεðñíð. ÈÛεά έáíuíάð ðñÝðáε íá έεάεÝðáε íέα áñÝñāáέα. Íε áñÝñāáέαð ðíð áíάάíññβæííðάέ, ðáβñíðάέ ðáñάεÛðù:

Ïí block āāβ÷íáε ùðé ðí ðάέÝðí έá ðñÝðáε íá áðíññέðεāβ áí óάέñεÛæáε íá ðέð ðáñáíÝðñíðð áðέέíāβð ðíð έáíuíά.

Ïí pass āāβ÷íáε ùðé ðí ðάέÝðí έá ðñÝðáε íá áñÝεèáε áðù ðí firewall, áí óάέñεÛæáε íá ðέð ðáñáíÝðñíðð áðέέíāβð ðíð έáíuíά.

**30.5.11.2 IN-OUT**

ÈÛεά έáíuíάð ðíð ðβεðñíð ðñÝðáε ððí÷ñāùðέέÛ íá έεáðέñέíβæáε íá óáðβíάέα áí áíáðÝñāðάέ óðçí āβðíāí P óçí Ýñāí ðάέÝðùí. Ç áðùíáíç εÝíç-έεέεāβ ðñÝðáε íá āβíáε in P out έáε áí āāí ððÛñ÷άε, í έáíuíάð έá áðíðý÷άε έáðÛ ðí óóíðάέðέέèù Ýέāā÷í.

Ïí in óçíāβíáε ùðé í έáíuíάð έá áðáññíðóðāβ óā Ýíá áέóāñ÷: ùíāñ ðάέÝðí ðí íðíβí ìüέéð εβðèçεā óðç έέáðáðP ðíð óóíāÝáðάέ íá ðí Άέάāβέððí.

Ïí out óçíāβíáε ùðé í έáíuíάð έá áðáññíðóðāβ óā Ýíá ðάέÝðí ðíð ðñíññβæííðάέ áέα Ýñāí ìÝóù óðç έέáðáðP ðíð óóíāÝáðάέ íá ðí Άέάāβέððí.

**30.5.11.3 OPTIONS**

**Óçíāβùðç:** Íε ðáñάεÛðù áðέέíāÝð ðñÝðáε íá ÷ñçóέííðíέççèíýí íá ðç óάέñÛ ðíð óáβñíðάέ āāβ.

Ïí log āāβ÷íáε ùðé ç áðέέāðáέβāá ðíð ðάέÝðíð έá āñāðāβ óðí āñ÷āβí έáðáāñāðð ðíð ìpl (ùðùð ðāñέāñÛðáðάέ óðçí áíúðçðá LOGGING ðíð áέíεíðεāβ) áí íε ðāñÛíāðñíέ óçð áðέέíāβð óάέñεÛæíðí íá ðí ðάέÝðí.

To quick āāβ÷íáε ùðé áí íε ðāñÛíāðñíέ óçð áðέέíāβð óάέñεÛæíðí íá ðí ðάέÝðí, í óðāέāέñέíÝñð έáíuíάð έá āβíáε έáε í ðāέāððáβíð έáíuíάð ðíð έá āέāā÷έāβ. Ç áðέέíāβ áððP āβíáε ððí÷ñāùðέέP áέα ðç óýā÷ñíç εíāέέP áðāíñāāóβāð ðάέÝðùí.

Ïí on āāβ÷íáε ðí ùññá óçð έέáðáðP ðíð έá áíóùíáðùέāβ óóέð ðáñáíÝðñíðð áðέέíāβð. Óā ññíáðá ðùí έέáðáðβí ðáβñíðάέ ùðáí áέðāέāβðάέ ç áíðíεP ifconfig(8). ×ñçóέííðíέççèíýíð óçí áðέέíāβP áððP, í έáíuíάð έá āέāā÷έāβ ìññí áí ðí ðάέÝðí áεÝñ÷: áðáέ ìÝóù óçð óðāέāέñέíÝíçð έέáðáðP έáε ðñíð ðç óðāέāέñέíÝíç έáðāýεðíóç (áέóāñ÷: ùíáíá/āíāñ÷: ùíáíá). Ç áðέέíāβP áððP āβíáε ððí÷ñāùðέέP áέα ðçí óýā÷ñíç εíāέέP áðāíñāāóβāð ðùí έáíuíúí.

¼ðáí āβíāðάέ έáðáāñāðP áíúð ðάέÝðíð, íε áðέέāðáέβāāð āñÛíðáέ óðçí ðāðāí-óðóέāðP έáðáāñāðP ðάέÝðùí IPL. ÍāðÛ óçí áíðíεP log, ìðñíýí íá ÷ñçóέííðíέççèíýí íε ðáñάεÛðù ðāñÛíāðñíέ (íá ðç óάέñÛ ðíð óáβñíðάέ):

Ïí body āāβ÷íáε ùðé έá āβíáε έáðáāñāðP ðùí ðñððùí 128 bytes ðùí ðāñέā÷ñÝúí ðíð ðάέÝðíð, ðíð āñβóέííðάέ áíÝóùð ìāðÛ óçí áðέέāðáέβāá.



Έε οδσάεηβσάεο δτω άάάΰηηίοάε οά ιεά ιυή έγνά, ιδηηίγί ίά άβηήοί ίά δτεεήγδ άεάοηηάοεεήγδ οηυδιδωδ, ÷ ηςοείηδτεήρίοά άεάοηηάοεεήγδ οάεάοδΰδ ογάεηέοζδ. Άβίάε άδβόζδ άοίάοηί ίά εάεηηέοδτγί ηεηεεζηάο δαηεί÷ Ψδ άδυ έγνάδ.

port "=" | "!=" | "<" | ">" | "<=" | ">=" | "eq" | "ne" | "lt" | "gt" | "le" | "ge".

Άεά ίά εάεηηβσάοά δαηεί÷ Ψδ εδηηί, ÷ ηςοείηδτεήρίοά port "<>" | "><"

**Δηιέαεαιδτεήρζοζ:** Ιάδΰ οεο δαηάιΨοηηωδ άεά οη δάβηεάοία δζδ άοάδζηβσδ εάε οηδ δηηηέοηγ, ηε δαηάεΰδου άγί δαηΰιάοηηε άβίάε οδτ÷ ηάυοεεΨδ άεά ίά εάεοηηάβ ζ ογά÷ ηηίς εηάεεη άδαιαηάοόβσδ ουη εάηιυί.

### 30.5.11.8 TCP\_FLAG

Όά flags άβίάε άίαηάΰ ιυή οοη οεεδηΨηέοία οηδ δηηυοηεηεεηω TCP. Όη εΰεά αηΰηά άηέδηηουδδγάε Ψά δεεάηυ flag οη άεά οη ηδηβη άβηάοάε άηβ÷ ίάοοζ οδζι άδεεάοάεβάά οηδ δάεΨοηω TCP.

Ζ ογά÷ ηηίς εηάεεη άδαιαηάοόβσδ ουη εάηιυί, ÷ ηςοείηδτεήρζοζ δαηΰιάοηη flags s άεά οζι άίάαηηέοζ οζδ Ψάηηζδ ιεά οοίάαηβσδ tcp.

### 30.5.11.9 STATEFUL

Όά Ψά εάηιυά δηω άδεδηΨδάε (pass) οη δΨηάοία ουη δάεΨδου, ζ άδεεηάη keep state αάβ÷ ίάε ηδε εά δηΨδάε ίά άίαηάηδτεήρζοάε ζ εάεοηηάβ stateful filtering ηδάη οη δάεΨοη δάεηεΰαε ίά οά εηέδηηεά άδεεηάηδ.

**Όζιάβυοζ:** Ζ άδεεηάη άοδη άβίάε οδτ÷ ηάυοεεεη άεά οζ εάεοηηάβ οζδ ογά÷ ηηίζδ εηάεεεη άδαιαηάοόβσδ εάηιυί.

## 30.5.12 ΌεεδηΨηέοία ιά Άεάδηηζοζ οζδ Έάδΰοόάοζδ (stateful)

Όη stateful οεεδηΨηέοία, άηέηάδουδβαεάε οζι εβίζοζ οηω άεεόγηω ηδ ιεάδ άεδεηδ εάοάγδδωίοζδ άηάεεάαη δάεΨουη οά ηδηβά αςηεηηάηγί ιεά οοίάαηβσδ. Ψδάη άίαηάηδτεήρζοάε, ζ άεάδηηζοζ οζδ εάδΰοόάοζδ (keep-state) αςηεηηάβ άοίάηεεΰ άουδδαηεεήγδ εάηιυάδ άεά εΰεά δάεΨοη οη ηδηβη άηάεεΰοάοάε εάδΰ οζ άεΨηεάεά άοδηδ οζδ οοίάαηβσδ. ÷ άε άδβόζδ οζ άοίάοηδζοά ίά άεάηάοηέοά άη άεηεηδτεήρζοάε ηε Ψαεοηηε εάηιυάδ άηάεεάαηδ ιςηηΰδουη ιάοάηγ οηω άδηοηεΨά εάε οηδ δαηάεηδζδ. Ϊδτεάαηδηωδ δάεΨοά αάη δάεηεΰαεηοί ιά οη δηηυδδηί άοδηδ οζδ άδεεηεηυίβσδ, άδηηηβδδωηίοάε ηδ ηάγδεεά.

Ζ άεάδηηζοζ οζδ εάδΰοόάοζδ άδεδηΨδάε άδβόζδ ίά δαηΰοηηοί οά δάεΨοά ICMP δηω ο÷ άδβαηίδάε ιά ιεά οοίάαηβσδ TCP η UDP. ροέ, άη εςοεήγί δάεΨοά ICMP ογδηω 3 code 4 ηδ άδΰηδζοζ εάδΰ οζ άεΨηεάεά οζδ άδβόεάοζδ οάο οά ιεά εοδωίάεβάά, (ζ ηδηβά άδεδηΨδάοάε άδυ οη άηόβοδτε÷ η εάηιυά άηαη÷ ηΨηυί), εά οηωδ άδεδηηάδβ ζ άβοηηωδ. Ϊδτεάαηδηωδ δάεΨοη άεά οη ηδηβη οη IPF άβίάε οβαηοηη ηδε δηηεάεοάε άεά οηδρα ιεάο άίαηάηδ οοίάαηβσδ, εά δαηΰοάε εεηηά εάε άη άβίάε άεάοηηάοεεη δηηυδτεεη.

Άδου δηω οοηάάβίάε άβίάε οη δαηάεΰδου:

Όά δάεΨοά δηω δηηηηβαηίδάε ίά άηΨεηηοί ιΨου οζδ εεάδσδδηω δηω οοηάΨδάε οοη Internet, άεΨά÷ ηηδάε αη÷ εεΰ ογηουηά ιά οη άοηάεεη δβηάεά εάοάοδΰοάυ. Άη οη δάεΨοη δάεηεΰαε ιά οη άδηηάηη δηω άηάηΨηδάε οά ιεά άηαηβ οοίάαηβσδ, άηΨη÷ δάε άδυ οη firewall εάε δάδου÷ ηηά άηαηβηάοάε ζ εάδΰοόάοζδ οζδ οδάεαηεηίΨζδ οοίάαηβσδ οοη

δανάδΰιϋ αοίαιέεϋ δβίαέα. Όά οδϋειρέδα δάεΎδα (δϋο αάι οάενεΰαειοί ια εΰδρειά οοίάανβά οά αιΎεέτς) αεΎα-ιίοάε ογίϋοιία ια οί ογίρει έαίϋιϋί αέα οά αιάν-ιιαιία δάεΎδα.

Όά δάεΎδα δϋο Ύν-ιίοάε αδϋ ος αέαδαοP δϋο αβίαε οοίάαιΎίς ια οί Internet, αεΎα-ιίοάε αν-εέΰ ιΎού οίο αοίαιέειγ δβίαέα εάοάοδΰοαϋ. Αί οί δάεΎοι οάενεΰαεε ια οί αδϋιαι δϋο αιαιΎίάοάε οά ιέα αιάναP οοίάανβά, αιΎν-άοάε αδϋ οί firewall εάε οάοδϋ-ιιία αίαιάνβρίαε ς εάοΰοάος ος οοάεάενηΎίς οοίάανβά οοί δανάδΰιϋ δβίαέα. Όά οδϋειρέδα δάεΎδα (δϋο αάι οάενεΰαειοί ια εΰδρειά οοίάανβά οά αιΎεέτς) αεΎα-ιίοάε ογίϋοιία ια οί ογίρει έαίϋιϋί αέα οά αέοάη-ιιαιία δάεΎδα.

¼οάί ς αδέειεϋίβία ρειεεϋνέαβ, αέαανΰοάοάε αδϋ οί αοίαιέεϋ δβίαέα εάοάοδΰοαϋ.

Όί stateful οέεονΎνεοία αδέονΎδαε ιά αόοεΰοίοια ος δνίοι-P ιά οδςι αδϋιαι-P P αδϋινηες οϋι ιΎϋι οοίάΎοαϋ. Αί αδέονάδαβ ιέα ιΎά οοίάανβά, ιεά οά οδϋειρέδα δάεΎδα ος οά αδέονΎδνίοάε αοδϋιαόά, απ οδ-ιι οαγόμεεα δάεΎδα εα αδννβδνίοάε αδβος οδϋιιαόά. Όί stateful οέεονΎνεοία αεάεΎοάε ιέα οάεηΰ αδϋ δνι-ιιηςιΎίαδ εέαιϋοςοάδ αέαηαγίςος οϋι δάεΎοϋι, ια αοίάοϋοςοά ιά αιγίάοάε οά δρειΎδ αεάοιηάοέεΎδ ιαεϋιιτδ δϋο -ηςοειηδνίειγί ιέ αδέοέεΎιαιέ.

### 30.5.13 Δανάΰαάειία Όοίϋεϊθ Έαίϋιϋί αέα Ύία Inclusive Firewall

Όι δανάεΰδϋ ογίρει έαίϋιϋί αβίαόάε ιδ δανΰαάειία αέα ιά οοεΰιαόα Ύία εέαβδανή αοάεΎδ inclusive firewall. ιά inclusive firewall αδέονΎδαε οί δΎηαοία ιϋι οϋι οδςηαοεβρ δϋο οάενεΰαειοί ια οίοδ έαίϋιαδ δϋο Ύ-αε αέα αδϋιαι-P δάεΎοϋι, εάε αδννβδνίοάε ιεά οά οδϋειρέδα. Όά firewalls δϋο δνιοάοαγίοι ΰεεα ις-αίβιαόά (οά ιδνβία εαειγίοάε εάε “network firewalls”) εα δνΎδαε ιά αεάεΎοίοι οίοεΰ-εοοιη αγί αέαδαόΎδ. ς ιέα αέαδαοP οοίάΎαόάε ια οί οιδέεϋ αβέοοι (LAN) οί ιδνβι εαηηάβοάε Ύιδέοοι, εάε ς ΰεες ια οί αςιϋοει Internet. Αίαεεάεοέεΰ, Ύία firewall ιδνιηβ ιά δνιοάοαγίε ιϋι οί ογόςοια οοι ιδνβι αεοάεαβοάε—αδϋο εέαββοάε “host based firewall” εάε αβίαε εάοΰεεςει εέαβδανή αέα αιδςςηάοςοΎδ δϋο εάεοιηηαγί οά ις Ύιδέοοά αβέοοά.

¼έα οά οοοδβιαόά ογδϋο UNIX, οοιδανέεαίαιηΎίθ εάε οίο FreeBSD, Ύ-ιοι ο-αεάοοάβ ιά -ηςοειηδνίειγί οςι αέαδαοP 1ο0 εάε οςι IP αεάγέοιός 127.0.0.1 αέα αούδανέεP αδέειεϋίβία ιΎοά οοι βαει οί εαεοιηηεεϋ ογόςοια. Όι firewall δνΎδαε ιά δανέΎ-αε έαίϋιαδ δϋο ιά αδέονΎδνίοι οςι αεάγέανς εάε -ιιηβδ δανεινεοιηγδ εβίςος οϋι αεεεβρ αοδβρ αούδανέεβρ δάεΎοϋι.

Ιε έαίϋιαδ δϋο ηποοεραιογί οςι δνιοάαος δνιδ οί Internet, ιηβαιίοάε οδςι αέαδαοP οίο αεέογίο δϋο οοίάΎαόάε οά αοδϋ. Ιε έαίϋιαδ αοοιβ αεΎα-ιίοι οϋοι οςι αέοάη-ιιαιίς ιϋοι εάε οςι αιάν-ιιαιίς εβίςος οοι Internet. ς αέαδαοP αοδP ιδνιηβ ιά αβίαε ς tun0 δϋο -ηςοειηδνίεαβοάε οοι PPP -ηβος, P αεϋια εάε ς εΰνδά αεέογίο δϋο οοίάΎαόάε οά Ύία DSL router P modem.

Όά δανβδνός δϋο ιέα P δανέοοϋδανηδ εΰηοδ αεέογίο οοίάΎηοάε οά αούδανέεΰ εαεϋοέεΰ αβέοοά δβού αδϋ οί firewall, εα δνΎδαε ιά οδΰν-ιίοι ιε αίδβοοιέ-ιε έαίϋιαδ δϋο ιά αδέονΎδνίοι οςι αεάγέανς αεάεβίςος οϋι δάεΎοϋι αιΰιαόά οοέδ αέαδαόΎδ αδδΎδ P/εάε οοι Internet.

Ιε έαίϋιαδ δνΎδαε ιά ιηηαίβνίοάε οά οηαέο εγνηαδ αϋοςοάδ: αν-εέΰ ιε αέαδαόΎδ οοέδ ιδνβαδ αδέονΎδνίοάε ς αεάγέανς αεάεβίςος αανΎιϋι, Ύδαεοά ς αέαδαοP αδϋ οςι ιδνβία αιΎν-ιίοάε οά δάεΎοά δνιδ οί αςιϋοει αβέοοι (Internet) εάε οΎειδ ς αέαδαοP αδϋ οςι ιδνβία εαιηΰνίοάε δάεΎοά αδϋ οί Internet.

Όά εΰεα ιέα αδϋ οέδ αϋοςοάδ οϋι αέαδαοβρ δϋο οοίάΎηοάε οοι Internet, δνΎδαε ιά οιδεαοιγίοάε δνποιέ ιε έαίϋιαδ δϋο οάενεΰαειοί οο-ιιηδανή ια οςι αίδβοοιέ-ιε εβίςος. Ι οάεαοδαβιδ έαίϋιαδ οςο αϋοςοάδ εα δνΎδαε ιά αδννβδνίοάε εάε ιά εάοάανΰοάε ιεά οά δάεΎοά οςο οοάεάενηΎίς αέαδαοP/εάοαγέοιόςο.

ς αϋοςοά οϋι Αιηη-ηΎιϋι (Outbound) οοι αεϋειοει ογίρει έαίϋιϋι, δανέΎ-αε ιϋι έαίϋιαδ ογδϋο pass ιε ιδνβιέ αδέονΎδνίοι (ιΎού εάοΰεεςει οειβρ οοέδ δανηΎοηιδ οίοδ) οά οοάεάενηΎίαδ οδςηαοββδ ιά αδιεοβοιοι δνιοάαος οοι Internet. ¼ειε ιε έαίϋιαδ αεάεΎοίοι οέδ αδέειΎΎδ quick, on, proto, port εάε keep state. Ιε έαίϋιαδ proto

tcp δαηέεαίαΰηοί ογι άδέειαP flag βόδα ία αίααίηηβαηοί ογι αβδζοζ Υίαηηζδ οζδ οοίαηηβαδ εάε ία αίαηηηοίεηί οζ εάεοίηηηβα εάεοPηηζοζδ οζδ εάοΰοδάζοζδ (stateful).

Όοζί αήυοζοδά οηί αέοαη÷ηαήηη δάεΥόηη (Inbound) θηο οαβίαδάζε δαηάεΰδου, θηηοίε αηοαίβαηηδάζε ηε εάηηαδ θηο ÷ηζοεηηθηεηίγίοάζε αέα οζί αδηηηεζοζ οηί αίαδεεγίζοηη δάεΥόηη. Αδου αβίαδάζε αέα αηη αέαοηηηαδεεηγδ ευαηοδ. Ί θηηοίη αβίαε υδε οά εάευαηοεά δάεΥόά ηθηηαβ αη ηΥηάε ία οαεηεΰαηοί ηα εΰθηεά ÷αηάεδζηεοδóεεΰ οζδ Υάεοηηζδ εβίζοζδ. Όά δάεΥόά αοδΰ εα θηΥδάζε ία αθηηηεοεηίγί, αήοβ ία αβηηοί αάεδΰ αδη εΰθηεά αδηηαηη εάηηα allow. Ί ααγδαηηο αβίαε υδε ηθηηαβόά ία αθηηηηβθδάα οοαεαηεηίΥία δάεΥόά οά ηθηβα ηηηηβαεάδα υδε ααη αβίαε Υάεοηη, αεεΰ οαδ αβίαε ααεΰηηηζ ζ εάοάαηαοP οηοδ. Ία οηη οηηθηη αοδου αηθηηαβαεάδάζε ζ εPθζ εάε εάοάαηαοP οηοδ αδη οηη οαεαδοαβη εάηηα. Ί οαεαδοαβηθ εάηηαδ οδδεεΰ αθηηηηβδθάζε εάε εάοάαηηθάζε ηεα οά δάεΥόά θηο Υόδάζαί ηΥ÷ηε αοδου. Ί εάηηαδ αδουδ ÷ηζοεηηθηεηίγίοάζε αέα οζί δαηη÷P ηηεεθηη αθηηαβηαηη οα δαηηβθδουζ θηο εεηPοαδά αεεαδóεεP αεααεεαδά εαδΰ αδουηη θηο θηηΥαζοαί οα αδεεΥόαεδ οοη ογóοζία οαδ.

Έα θηΥδάζε αδβζοζ ία αηαοαεβθδάα υδε οη ογóοζία οαδ ααη εα ηηοαε εαηεΰ αδΰηοζοζ οα εαηΥία αδη οα αίαδεεγίζοδ δάεΥόά. Όά δάεΥόά αοδΰ εα θηΥδάζε ία αθηηηεοεηίγί εάε ία αηαδάζεοδóηίγί. Ία οηη οηηθηη αοδου, η αδεοεε Υηαηηο ααη Υ÷αε εαηεΰ αηηοζ αη οά δάεΥόά θηο Υόδάζαί ηΥ÷ηε οη ογóοζία οαδ. Ώοη εεαυοαηα ηθηηηίγί ία ηΰεηοί ηε αδεοεεΥηαηε ο÷αδóεεΰ ηα οη ογóοζία οαδ, ουοί δαηεοοηηοαηη ÷ηηη εα ÷ηαεαδóαβ ία αδαηαγóηοί αέα ία εαοάοΥηηοί ία οαδ αεΰθηοί οοά αεPεαεά. Ίε εάηηαδ ηα οζί αδεειαP log first εάοάαηηθηοί οη οοίαΰη ηηη οζί θηηηοζ οηηΰ θηο αηαηηηθηεηίγίοάζε. ζ αδεειαP αδδP δαηεεαίαΰηαδάζε οοηη εάηηα nmap OS fingerprint οοηη δαηηααεεαηα θηο οαβίαδάζε δαηάεΰδου. Όη αηηεζοεεΰ θηηηαηηα security/nmap ÷ηζοεηηθηεηίγίοάζε οδ÷ηΰ αδη εάευαηοεά ΰοηηα, θηο θηηοδάζεηίγί ηα αοδου οηη οηηθηη ία αηαηηηηβθηοί οη εαεοίηηαεεΰ ογóοζία οηο ηζ÷αηηαδηοδ οαδ.

Έΰεα οηηΰ θηο οδΰη÷αε εάοάαηαοP αδη εΰθηεά εάηηα ηα οζί αδεειαP log first, εα θηΥδάζε ία αεοαεΥόαδά οζί αήοηεP ipfstat -hio αέα ία ααβθδ θηοαδ οηηΥδ Υ÷αε αηαηηηθηεεαβ αοδου η εάηηαδ οοηηεεεΰ. ροε εα ηΥηαδά αη θ.÷. οαδ εΰηοί αδβεαόζ οδαη÷αβεεόζδ (flood).

Ααβθδ οη αη÷αβη /etc/services αέα ία αηαβθδ αηεεηηγδ εοηηθηη θηο ααη αηαηηηηβαεάδα. Ίθηηαβθδ αδβζοζ ία αδεοεαδóεαβθδ οζί οηθηεαδóα http://www.securitystats.com/tools/portsearch.php εάε ία εΰηαδά αηαεPοζοζ αέα οζ οοαεαηεηίΥη εγηα, βόδα ία ααβθδ θηεά οδζηαδóα αηοδζηαδóαβ.

Ααβθδ οζί αδηηαηζ οηθηεαδóα αέα οεδ εγηαδ θηο ÷ηζοεηηθηεηίγίοάζε οοηηεδου αδη εάευαηοεά θηηηαηηηαδά (trojans): http://www.simovits.com/trojans/trojans.html.

Όη δαηάεΰδου ογηηε εάηηηη αβίαε αηεαδΰ δεPηαδ εάε θηεγ αοοαεΥδ. Αζηεηηηαβ firewall ογδθηο inclusive, εάε Υ÷αε αηεεαδóαβ οα θηααηαδóεεΥδ οοηεPεαδ εαεοίηηηβαδ. Ίθηηαβ ία αηοδζηαδóPοαε οη βαεη εαεΰ εάε οη αεεΰ οαδ ογóοζία. ΑδεPο ηαδαοηηθδ οα ο÷ηεεη οηοδ εάηηαδ αέα οεδ οδζηαδóαδ θηο ααη εΥεαδά ία αηαηηηθηεPοαδά.

Άεα ία αθηογααδά οζί εάοάαηαοP αίαδεεγίζοηη ηζηοηΰδου, αδεPο θηηοεΥόα Υία αήοβθηε÷η εάηηα αδηηηεζοζδ (block) οοζί αήυοζοδά οηί αέοαη÷ηΥηη (inbound).

Έα θηΥδάζε ία αεεΰηαδά οη ηηηα οζδ αεαδάοPδ dc0 οηο δαηαααβαηαοηο, ηα οη θηααηαδóεεΰ ηηηα οζδ εΰηηαδ αεεδóγηο θηο οοηαΥάε οη ογóοζία οαδ ηα οη Internet. Άεα ηηοηοδ ÷ηζοεηηθηεηίγί οη PPP ÷ηPοζοζ, οη ηηηα εα αβίαε tun0.

ΚηηοεΥόαδ οεδ αεηεηθεαδ εαδά÷ηηηβθάεδ οοη αη÷αβη /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 αένιγίεϊ ούι εΎιλι Network Address Translation Π Ιάοΰόναόç Äéäðýíóáι Äééðýíø. Äéá υίριδ αβίαε äñééäéυíÝñé ìä õι Linux, äáóβæäóäé óçí äñ ÷Π õιõ IP Masquerading. Óçí ðñáñìáééúóçóá õι NAT éáé õι IP Masquerading αβίαε õι βáεí ðñΰñá. Ìéá áðu óéð ðñéèÝð äñíáóúóçóäò ðιð ðáñÝ ÷áç ç éáéõιõñáβá NAT õιõ IPF, αβίαε éáé ç äñíáóúóçóá íá Ý ÷ιðìä Ýíá éáéúóééυ õιðééυ äβéðõι (LAN) ðβóυ áðu õι firewall õι ιðιβι íá ñéñΰæäóáé ìéá ññáééΠ αçìúóéá äéáýèðίóç IP óõι Internet.

εουδ ία αίανύοσβαβσά αεάσβ ία εΰεάε εΰδείρο ία οι εΰίαιε άσδύ. Ίε ISPs οσΰπευδ άδριαβαιροι αοιαιεεΰδ αεάσδεΰίόσάεδ σά ισ άδσενεεεΰδ δσεΰσδ. Άσδύ ισσεάσδεεΰ οσΰαβίαιε υδε σ αεάΰεδίος IP δρω άδριαβασάσάε σωι ισ΄ΰίςία σάδ, ιδινάβ ία άβίαιε αεάσινάσεεΰ εΰεά σινΰ δρω εΰίάδσ εεΰος αεά ία σΰιαάεαβσά. Άεά σρωδ ΄νΰσάδ DSL modem εαε router, σ αεεάσΰ αεάΰεδίος δνάαισδρεάβσάε εΰεά σινΰ δρω αίαναιδρεάβσάε σι modem. Σ αεάΰεδίος IP δρω σάδ άδριαβασάσάε σδύ σρι ISP σάδ, άβίαιε σδσΰ ιά σΰι ιδινά σάβίσάσά σρι Internet.

Άδ σδρεΰοισι σρνα υδε ΄΄΄΄δσ δΰίσά PC σρι σδβδε σάδ, εαε ΄΄΄΄εΰεάσδσά σά υεά σΰιασος Internet. Εάριεεΰ, εα ΄΄΄΄ά ία δεσνρσάσά σρι ISP σάδ ΄΄΄΄εσδ ειαάνεσδιν αεά εΰεά PC εαε ία αεάεΰσάσά δΰίσά αναιΰδ σΰεάσρρω.

Ία σι NAT, ΄΄΄΄εΰεάσδσά ιυιν ΄ΰΰ ειαάνεσδιν ιά σρι ISP σάδ. Ιδινάβσά άδεϑδ ία σριεΰσάσά σά σΰσάσά PC σά ΄ΰΰ αεάσινΰσά ΰ switch σρι ιδινβι εα σριεΰσάσά άδβοςδ εαε σι FreeBSD ισ΄ΰίςία σάδ. Οι ισ΄ΰίςία σάδύ εα αίανάσβ υδ σΰεσ σρω σιδσεΰί σάδ αεεσΰι σεά σι Internet. Οι NAT εα ιάσασνΰσάε σδσινάσά σεδ εαεσδεεΰδ αεάσδεΰίόσάε IP σρω εΰεά ισ΄ΰίςίασδ σδσΰι ιιςιαεεΰσ αςιυισεά IP αεάΰεδίος δρω ΄΄΄΄δσ, εαεϑδ σι δσεΰσδ σΰσάσά σδύ σι firewall εαε εαάσδεΰίσάσάε δρω σι Internet. Άεδσεάσβ άδβοςδ εαε σΰι αίσδσδσρωσ ιάσΰσάσάε αεά σά δσεΰσάσά δρω άδεσδνΰσδ.

Όδΰν ΄΄΄΄εαε ιεά αεεεεΰ δσνερ΄ΰ αεάσδεΰίσάσιν IP δρω ΄΄΄΄σδ δσνερ΄ΰ υνςεάσβ αεά ΄΄΄΄ος σά σιδσεεΰδ υβεσάσά ιά NAT. Οΰσινσΰα ιά σι RFC 1918, ιδινάβσά ία ΄΄΄΄σσεινδρεσάσά αεά σδσϑ σι σειδϑ σεδ δσνερ΄ΰδ δσνερ΄ΰ΄΄, τε ιδινσδ ανιιεαΰίσάε δρωΰ άδσεάσβσδ σρι αςιυισεά Internet:

- Άν΄΄΄΄εεϑ IP 10.0.0.0 Όσσεεεϑ IP 10
- Άν΄΄΄΄εεϑ IP 172.16.0.0 Όσσεεεϑ IP 17
- Άν΄΄΄΄εεϑ IP 192.168.0.0 Όσσεεεϑ IP 19

### 30.5.15 IPNAT

Ίε εαΰιςάδ σρω NAT σινσρρσΰσάε ιά σς ΄΄΄΄ος σςδ αίσρεϑδ ipnat. Όδσεεΰ, τε εαΰιςάδ σρω NAT αδρεσάΰίσάε σρι αν΄΄΄΄βι /etc/ipnat.rules. Άάβσά σς σαεεάά manual σρω ipnat(1) αεά εαδδσινΰναεάδ.

Άεά ία αεεΰίσάδ σρω εαΰιςάδ σρω NAT εαεϑδ σδσϑ αεσσεάβσάε, σνιδρεσάσά σι αν΄΄΄΄βι δρω σρωδ δσνε΄΄΄΄ε, εαε αεσσεΰσάσά σς αίσρεϑδ ipnat ιά σς δσνΰσάσά -CF αεά ία αεάσνΰσάσά σρω σσδσσεΰίσάε εαΰιςάδ σρω NAT εαε ία σασεΰσάσά υεάδ σεδ αίανσΰδ εάσά΄΄ υνσάσδ σρω δβίσεά ιάσασνΰσάσιν.

Άεά ία σινσρσάσά σρω εαΰιςάδ σρω NAT σδϑ σς αν΄΄ΰ, αεσσεΰσάσά ιεά αίσρεϑδ υδϑδ σς δσνερ΄ΰδ:

```
ipnat -CF -f /etc/ipnat.rules
```

Άεά ία σσβσά εΰδρεά σσσεεεεΰ σ΄΄σσεεΰ ιά σι NAT, ΄΄΄΄σσεινδρεσάσά σς δσνερ΄ΰδ αίσρεϑδ:

```
ipnat -s
```

Άεά ία σσβσά ιεά εβσά ιά σεδ σνΰ΄΄σσά εάσά΄΄ υνσάσδ σρω δβίσεά NAT, ΄΄΄΄σσεινδρεσάσά σς δσνερ΄ΰδ αίσρεϑδ:

```
ipnat -l
```

Άεά ία αίαναιδρεσάσά σς εαδδσινσρρ αδσεεϑεσς ιςισιϑσιν εαε ία σσβσά δεσνσινσρρ δρω σ΄΄σδσεΰίσάε ιά σς αδσινσρρσά σιν εαΰιςάε σρω αίαναιςδ εαΰιςάδ εαε εάσά΄΄ υνσάσδ σρι δβίσεά, ανΰσδσά:

```
ipnat -v
```

### 30.5.16 Έάιυιάò òιò IPNAT

Ίέ έάιυιάò òιò NAT άβιάέ άñέάòÛ άòΎέέέòιέ, έάέ άέάέΎòιòι ðέΠεìò äòιάòιòΠòυì þóòά ίά έάέγðòιòι ðέò άíÛάέάò òυì ιέέέάέþι άέέÛ έάέ òυì άðέ÷ άέñçóέάέþι ÷ ñçóòþι.

Ç óγίòάιç òυì έάιυιύι ðιò ðάñιòóέÛάέòάέ άάþ, Ύ÷ άέ άðέιðιέçέάþ þóòά ίά óòιάάáþάέ ίά ðç óòιðέç ÷ ñþóç óά ιç-άιðιñέέÛ ðάñέάÛέέιòά. Άέά ðέι ðέΠñç ðάñέάñάòΠ ðçò óγίòάιçò, άάþòά ðç óάέþάά manual òιò ipnat(5).

Ç óγίòάιç άíυò έάιυιά NAT ñέÛάέ ίά ðçι ðάñάέÛòυ:

```
map IF LAN_IP_RANGE -> PUBLIC_ADDRESS
```

Ï έάιυιάò ίάέέíÛάέ ίά ðç έΎίç map.

ΆίòέέάòάóòΠóòά òι IF ίά ðçι άíυòάñέέΠ άέάðάòΠ (ðç έÛñòά άέέòγίò ðιò óòιάΎάòάέ óòι Internet).

Ç ðάñÛιάòñιò LAN\_IP\_RANGE άβιάέ ç ðάñέι÷Π άέάðέγίòάυì ðιò ÷ ñçóέιιðιέάþòάέ άðυ òι άóυòάñέέυ óάò άþέòòι. Óòçι ðñάίñιáðέέυòçòά έά ñέÛάέ ίά έÛðέ óάι òι 192.168.1.0/24.

Ç ðάñÛιáòñιò PUBLIC\_ADDRESS ìðιñάþ ίά άβιάέ άþòά ç άíυòάñέέΠ IP άέάγέòιόç, άþòά ç άέάέέΠ έΎίç 0/32, ç ðιðιá óçιάβιάέ υòέ έά ÷ ñçóέιιðιέçέάþ ç IP άέάγέòιόç ðιò Ύ÷ άέ άðιäιέάþ óòι IF.

### 30.5.17 Ðυò έάέòιòñάáþ òι NAT

Ίά ðάέΎòι òòÛιáέ óòι firewall άðυ òι LAN ίά ðñιιñέòιυ òι Internet. ÐάñíÛάέ άέάιΎòιò òυì έάιυιύι òέέòñάñþòιáòιò άιáñ÷ ñΎιύι, υðιò άβιáòάέ ç άðάιáñάáóá òιò άðυ òι NAT. Ίέ έάιυιάò άóάñιυάειííóάέ άðυ òιð ðñòι έάέ ðñιò óά έÛòυ, έάέ έáñáþάέ ί ðñòιò ðιò óάέñέÛάέ. Ï Ύέάá÷-ιò άβιáòάέ ίά áÛóç ðç άέάðáòΠ άðυ ðçι ðιðιá έΠóεçέά òι ðάέΎòι έάέ ðç άέάγέòιόç IP άðυ ðçι ðιðιá ðñιΎñ÷-áòάέ. ¼ðάι òι υíñιá ðçò άέάðáòΠ ðιò ðάέΎòιò óάέñέÛάέ ίά έÛðιέι έάιυιá òιò NAT, ç άέάγέòιόç IP ðçò áóáðçñþáð (ðιò ðñιΎññ÷-áòάέ άðυ òι έάέυòέέυ άþέòòι) άέΎá÷-áòάέ άέά ίά άιáέñέáυέáþ άί óάέñέÛάέ ίά ðçι ðάñέι÷Π άέάðέγίòάυì ðιò έάέιñþáòάέ óòçι άñέóóáñÛ ðέáòñÛ òιò óòιáυέιò (άΎεìò) òιò έάιυιá NAT. Άί óάέñέÛάέ, ç άέάγέòιόç òιò ðάέΎòιò ίáίáñÛòάóάέ, ÷ ñçóέιιðιέþιðáð ðç áçιυóέά άέάγέòιόç IP ç ðιðιá ðάñΎ÷-áòάέ άðυ òι 0/32. Òι NAT áçιέιòñάáþ ίέά έáòá÷-þñέóç óòιí áóυòάñέέυ ðιò ðβιáέá, Ύòóέ þóòά υòάί άðέóòñΎáέ ç áðÛιόçòç άðυ òι Internet, ίά ìðιñάþ ίά άίòέóòιέ÷çέáþ ίáíÛ óòçι áñ÷-έέΠ έάέυòέέΠ άέάγέòιόç IP έάέ ίά ðάñÛòάέ Ύðάέòά άðυ òιòò έάιυιάò òιò òþέòñιò άέά ðάñάέòΎñυ áðάιáñάáóá.

### 30.5.18 Άίáñáιðιέþιðáð òι IPNAT

Άέά ίά άíáñáιðιέþóáòά òι IPNAT, ðñιòέΎóóά ðέò ðάñάέÛòυ áñáιΎò óòι /etc/rc.conf.

Άέά ίά άðέòñΎøáòά óòι ιç÷-Ûιçιá óáò ίά áñιιέιááþ ðάέΎòά ίáòáίγύ άέάðáòþι άέέòγιò:

```
gateway_enable="YES"
```

Άέά ίά ίάέέíÛάέ áòòυιáòά òι IPNAT óά έÛέá άέέβιççòç:

```
ipnat_enable="YES"
```

Άέά ίά έάέιñþóáòά άðυ ðιò άðέέòιáþòά ίά υιñòþñιíóάέ ίέ έάιυιάò òιò IPNAT:

```
ipnat_rules="/etc/ipnat.rules"
```

### 30.5.19 Ôï NAT óà íá íääÛεï Ôïðέεü Åβέôï

Ãέá òïðέεü åβέôôá íá íääÛεï áñέεü ðθετáεóòð, ð áέá åβέôôá ðτò áέáóðίáÝτò ðáñέóóüðáñá áðü Ýίá LAN, ç áέáέέάóβá óçò íáðáóñτðò ùεüí áðòðí ðüí éáέúóέεðí áέáðεýίáóáüí óá íέá ííááέέð áçτüóέá áέáýεðίόç, áçετñóñááβ ðñüåçίá έáóáñτðò ðñññí, έέεðð ÷ ñçóέττðτέττýóáέ ðτέεÝð òτñÝð τέ βάεττ άñέεττβ εðñðí, τάçáðτíóáð óá PC ðτò áέέóýτò óá óóáεñτýóáέð. ÕðÛñ÷τò áýτ ðññðτέ áέá íá áέáóðòðτíóá áóòü òτ ðññüåçίá.

#### 30.5.19.1 ÁτÛέáóç ðüí εòñðí ðτò έá ×ñçóέττðτέττέττýí

Íá óðίçðέóτÝñð έάττíáð NAT ττεÛæáέ íá òττ ðáñάέÛòü:

```
map dc0 192.168.1.0/24 -> 0/32
```

Óòττ ðáñάðÛτü έάττíá, ç έýñá áóáðçñβάð ðτò ðáέÝòτò ðáñάτÝíáέ άτáεττβòðç έάεðð òτ ðáέÝòττ áέÝñ÷÷áóáέ τÝóü ðτò IPNAT. Áτ ðñτòεÝóáðá óçτ εÝτç-έεάέάβ portmap, τðτñάβðά íá ñòετβóάðá òτ IPNAT íá ÷ ñçóέττðτέττέάβ έýñáð ðτò άτðεττò óá íέá έáετñέóτÝτç ðáñεττ÷ð. Ãέá ðáñÛάέέάτá, τ ðáñάέÛòü έάττíáð έá τάçáðóáέ òτ NAT íá ðñττðτέττέðóáέ óçτ έýñá óçò áóáðçñβάð, ððóá íá άβίάέ τÝóá óóçτ ðáñεττ÷ð ðτò óάβτáðάέ:

```
map dc0 192.168.1.0/24 -> 0/32 portmap tcp/udp 20000:60000
```

Ïðτττττá áðβóçð íá άðεττðτέττέτττá áέττá ðáñέóóüðáñτ ðç áέάάέέάóβá ÷ ñçóέττðτέττέττóáð ðç εÝτç auto ððóá òτ IPNAT íá έáέτñβάέ άðü τττ òτò ðτέάð έýñáð άβίάέ áέάέÝóέττáð áέá ÷ ñðóç:

```
map dc0 192.168.1.0/24 -> 0/32 portmap tcp/udp auto
```

#### 30.5.19.2 ×ñçóέττðτέττέττóáð Ýίá Áðüέάτá Åòτáτέεðτ Áέáðεýτóáüí

Óá Ýίá ðτέý íääÛεï òτðέεü åβέôðτ, áñáÛ ð áñðáττñά óðÛñòτá óòτ óçτáβτ ðτò íέá ííááέέð áçτüóέá áέáýεðίόç ááτ áðáñέάβ áέá íá έáέýòáέ óüóáð ðτέεÝð έáέúóέέéÝð. Áτ òðÛñ÷áε áέάέÝóέττ Ýίá áýñτð áçττòβττ áέάðεýτóáüí, τðττττττ íá ÷ ñçóέττðτέττέττýí ùð “áðüέάτá (pool)”, áðέóñÝðτττóáð óóçτ IPNAT íá áðέεÝτáέ íέá áðü áóðÝð έάεðð áτέóóðτέττ÷áβ óá ðáέÝóá έáðÛ óçτ Ýττáτ òτòð ðñτò òτ áçτüóέττ áβέôðτ.

Ãέá ðáñÛάέέάτá, áτòβ íá áτέóóðτέττýí ùεά óá ðáέÝóá τÝóü íέáð ííááέέðð áçτüóέáð IP áέάýεðίόçð ùððð ðáñάέÛòü:

```
map dc0 192.168.1.0/24 -> 204.134.75.1
```

τðττττττττ íá ÷ ñçóέττðτέττέττέτττá Ýίá áýñτð IP áέáðεýτóáüí, áβðá íá ðç ÷ ñðóç τÛóέáð áέέóýτò:

```
map dc0 192.168.1.0/24 -> 204.134.75.0/255.255.255.0
```

άβðá íá óòτáτέέóττ CIDR:

```
map dc0 192.168.1.0/24 -> 204.134.75.0/24
```

### 30.5.20 Áτáέáðάýεðίόç Εòñðτ

Åβίάέ έττετð ðñάέðέέð íá ááέάεβóðάττáέ ððçñάóòáð ùððð τ άτðçñάðçðð εóòτáέβáüí, ðá÷÷áñτñάβτò, áÛóçð áááñÝτττ έάέ DNS óá áέáóττñάóέéÛ PC óòτ òτðέεü åβέôðτ. Óóçτ ðáñβððóç áóðð, ç έβτçóç ðáέÝòüí áðü áóðÛ óá τç÷÷άττáðά άτáεττετòεάβ íá ÷ ñáέÛæáðáέ òτ NAT, áέéÛ ÷ ñáέÛæáðáέ áðβóçð íá òðÛñ÷áε εÛðτετð ðññðττò íá έáóáðεýτáðáέ ç áέóáñ÷÷τáτç έβτçóç óðá óüóðÛ PC òτò áέέóýτò. Ôτ IPNAT Ý÷áε ðέð έáðÛέεçέáð áðτáðüóçðáð áέá óçτ áðβέðóç

άοδιγύ οίτθ δνίρεΠιáοίδ. Άέα δάνΰάεάιá, Ύóου υέε Ύίáδ άίδδçñάδçδΠδ éóοίóáεβáυί άñβóεάóáε óççί áεάγέοίóç LAN 10.0.10.25 έάé ç ιίíááέεΠ άçιυóέá IP άβίáé 20.20.20.5. Ί έáίυίáδ δίθ έá ãñΰóáδá έá Ύίíέάεá ιá οίí 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 Ύίá άίδδçñάδçδΠ DNS ιá áεάγέοίóç óοί οίδέέυ άβέδóι 10.0.10.33 ι ίδθβίθ δñΎδáé ιá áΎ÷άóáé áίáεçδΠóáéδ áδυ οί άçιυóέί άβέδóι:

```
rdr dc0 20.20.20.5/32 port 53 -> 10.0.10.33 port 53 udp
```

### 30.5.21 FTP έάé NAT

Οί FTP άβίáé Ύίáδ ááέíυóáδñίθ δίθ Ύ÷áé áδñάβίáé áδυ óççί áδθ÷Π δίθ οί Internet Πóáί óóá άñ÷έέΰ οίθ óóΰάéá, υδθίθ óá άñάοίçδέέΰ άñάáóδΠnéá ουί δάíáδéóδΠéιυί Πóáί óóίááιΎίá ιáóáίγύ οίθδ ιá ιέóευιΎίáδ άñάυιΎδ έάé ιé άñάοίçδΎδ οί ÷ñçóéιιδθίέίγύóáί áéá ιá óóΎéñíοί άñ÷άβá ι Ύίáδ óοίί ΰέει. Οççί áδθ÷Π áéάβίç, ááί οδΠñ÷áί áίççóδ÷βáδ ó÷áδéέΰ ιá óççί áóóΰεάéá. Ιá οί δΎñάóίá οίθ ÷ñυίθ, οί FTP éΰδóççéá óοί δβóυ ιΎñίθ οίθ óá÷Ύυδ άíáééóóιυιáííθ Internet. Άáί άíáεβ÷έçéá δίθΎ Πóδá ιá ίáδáñΰóáé δñίρεΠιáóá áóóΰéáéáδ, υδθδ δ.÷. οί áááííυδ υέε óóΎéíáé οί υίñá έάé οίí éυáééυι οίθ ÷ñΠóóç υδ áδéυ έáβίáíí. Οί FTP Ύ÷áé áοί έáóáóóΰóáéδ éáéοίθñάβáδ, óççί áíáñáΠ έáé óççί δάεçóééΠ. Ç áéáοίñΰ άβίáé óοί δυδ άβίáóáé ç áίΰέδóçç οίθ έáίáééίγύ áááñΎíυí. Ç δάεçóééΠ éáéοίθñάβá άβίáé δéι áóóáéΠδ, έáεΠδ οί έáíΰέé áááñΎíυí áδίδáéáβ οί éγñéι έáíΰέé óççδ óóίááñβáδ. Ιδθñáβδá ιá άñάβδá δίεγ έáεΠ δáñéáñáδΠ οίθ δñυοίéυéείθ έάé ουί áéáοίñáδééΠí δñυδθι έáéοίθñάβáδ οίθ, óοί <http://www.slacksite.com/other/ftp.html>.

#### 30.5.21.1 Έáίυίáδ οίθ IPNAT

Οί IPNAT áéáéΎδáé ιéá áéáééΠ áδéεíáΠ áéá áéáíáοίéΰάçóç FTP (proxy) ç ιδθίβá ιδθíñáβ ιá έáéíñéóóáβ óοίί έáóΰέéçéí έáίυίá οίθ NAT. Ιδθíñáβ ιá δáñáéίéίθδΠóáé υéá óá áíáñ÷υιáίá δáéΎóá áéá ιá áίé÷íáγóáé óççί Ύίáñíç ιéáδ áíáñáΠδ Π δάεçóééΠδ óóίááñβáδ FTP, έáé ιá áçίéίθñáΠóáé áοίáíéέΰ δñίóυñéíγύ έáίυίáδ óοί óβέδñι δίθ ιá δáñéΎ÷íοί ιυíí οίí άñέéιυ óççδ éγñáδ δίθ ÷ñçóéιιδθίéáβδóáé áδυ οί έáíΰέé áááñΎíυí. Άδóυ άíáéáβδóáé οί δñυáéçίá áóóΰéáéáδ δίθ áçίéίθñáβδóáé áδυ οί áááííυδ υέé áéáοίñáδééΰ έá ÷ñáéáæυδáί ιá áίé÷éáβ ιéá ιááΰéç δáñéí÷Π δéñΠí (óççί θççéΠ δáñéí÷Π) óοί firewall.

Ί δáñáéΰδου έáίυίáδ ÷áéñβáéóáé υéá óá áááñΎίá áéá οί áóυδáñééυδ άβέδóι (LAN):

```
map dc0 10.0.10.0/29 -> 0/32 proxy port 21 ftp/tcp
```

Ί δáñáéΰδου έáίυίáδ ÷áéñβáéóáé óççί έβίçóç FTP áδυ óççί δýéç (gateway):

```
map dc0 0.0.0.0/0 -> 0/32 proxy port 21 ftp/tcp
```

Ί δáñáéΰδου έáίυίáδ ÷áéñβáéóáé υéç óççί έβίçóç áδυ οί áóυδáñééυι LAN δίθ ááí áίΠéáé óοί δñυδóυéίééι FTP:

```
map dc0 10.0.10.0/29 -> 0/32
```

Ί έáίυίáδ ÷áñδíáñΰóççδ οίθ FTP οίδθίéáδáβδóáé δñéι áδυ οίí έáííééυι έáίυίá ÷áñδíáñΰóççδ. Έΰéá δáéΎοί áéΎá÷áóáé άñ÷έέΰ áδυ οίí έáίυίá δίθ άñβóéáóáé óççί éιñóδΠ. Áί δáéñéΰáéé óççί áéáδáδΠ έáé óççί éáéυδééΠ áéáγέοίóç IP έáé δñυéáéóáé áéá δáéΎοί FTP, ι áéáíáοίééáçδΠδ FTP áçίéίθñááβ δñίóυñéíγύ έáίυίáδ óοί óβέδñι ιé ιδθίβίé áδéδñΎδίθí óççί áéóáñ÷υιáίç έáé áíáñ÷υιáίç έβίçóç FTP áίΠ óáδóυ÷ñίíá áéδáéίγί έáé óççί áδáñáβδçδç

ιαόΰονάο NAT. ¼έα όά δάέΎόά διό αάί άίΠείοί όά ιαόΰαιόο FTP αάί όάένεΰαίόί ιά όιί δñπδί έαίυία, Ύόόέ έαόάδδέγñίόάέ όόι δñβδί έαίυία, άιαόΰαίόάέ υίόί άόιñΰ όç έέάδάοΠ έάέ όί IP άδύ όί ιδñβι δñιΎñ ÷-ίίόάέ, έάέ άβίαόάέ ç άίόβόιέ ÷ ç ιαόΰονάο όιόδ άδύ όί NAT.

### 30.5.21.2 Έαίυίαό Όβέοñιό άέα όί IPNAT

¼όάί ÷ ñçόέιιδñέάβόάέ ι ιάόιέαάçδΠδ FTP, ÷ ñάέΰαέάόάέ ιυίι Ύίαδ έαίυίαό άέα όί NAT.

× υñβδ όί ιάόιέαάçδΠ FTP, ÷ ñάέΰαίόάέ ιέ δñάέΰδου δñάέδ έαίυίαό:

```
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

Όί IPFW (IPFW) άβίαέ έιαέόιέέυ διό άίαδδóγ ÷ έççά άέα όί FreeBSD, ÷ άέ άñάόάβ έάέ όόιόçñάβόάέ άδύ άέάέιόΎδ διό άίΠείοί όόι Project. × ñçόέιιδñέάβ όιόδ έέάόέέιγδ έαίυίαό ÷ υñβδ έέάδΠñçόç όçδ έαόΰόόάόçδ (stateless) έάέβδ έάέ ιέα όά ÷ ιέέΠ έυάέέιδñβçόçδ διό άδέόδā ÷ Ύίαέ άόδύ διό άίαόΎñάόάέ υδ ΆδβΠ Stateful ΈιαέέΠ (Simple Stateful Logic).

Όί όδύάάέαιά έαίυιυί άέα όί IPFW (όόά άñ ÷ άβá /etc/rc.firewall έάέ /etc/rc.firewall6) όçδ όδδέέΠδ άάέάδΰόόάόçδ όιό FreeBSD άβίαέ ιΰέέιι άδέυ έάέ έά ÷ ñάέάόόάβ ιά έΰίαόά έΰδñέάδ άέέάΎδ δñέί όί ÷ ñçόέιιδñέάβόάό. Όί δññΰάάέαιά αάί ÷ ñçόέιιδñέάβ όέέδñΰέόιá όγδñιό stateful. Ç stateful έάέόιόñάβá άβίαέ άδññάάόέέΠ όόέδ δñάέόóυόññάδ δñάέδδβράέδ, Ύόόέ αάί έά ÷ ñçόέιιδñέάβόιόιá άόδύ όί δññΰάάέαιά υδ áΰόç άόδΠδ όçδ άíυόçδάδ.

Ç όγίόάιç όυί έαίυιυί stateless όιό IPFW Ύ ÷ άέ άίέό ÷ όέάβ ιά άíάέέαιΎίαδ άόíáδύόçδάδ άδέέιαΠδ ιέ ιδñβάδ όόίΠέυδ ιάδññίΰία έαόΰ δñέγ όέδ όδδέέΎδ άίρόάέδ όιό άόυιιό διό έάέάβόάέ ιά όί ñδβιόάέ. Όί IPFW άδñδέγíáδάέ όόιι άδñάάάέαιάόβá ÷ ñβόç Π όιι όά ÷ ιέέΰ δññ ÷ υñçιΎñ ÷ ñδβόόá, ι ιδñβιό Ύ ÷ άέ άίΰάέç δññ ÷ υñçιΎñιό όέέδññάβόíáόιό δάέΎδύ. Ç δññάíáόέέΠ άγíáιç όυί έαίυιυί όιό IPFW άδñέάέγδδáόάέ ιυίι άί άέάέΎόάόά δññ ÷ υñçιΎίαδ άίρβόάέ ό ÷ άόέέΰ ιά όί δυδ έέάόιñάόέέΰ δññδύέιέέá ççιέιόññáιγí έάέ ÷ ñçόέιιδñέγíç όçí άδέέάόάέβáά όυί δάέΎδύ όιόδ. ΌΎόιέι άδβδññ άδñáçáΠρβáυι άβίαέ δΎñá άδύ όί όέιδύ άόδΠδ όçδ άíυόçδάδ όιό Άñ ÷ άέñέάβιό.

Όί IPFW άδñιόάέάβόάέ άδύ άδδΰ άíññδΠíáόá. Όί άάόέέυ άíΰñόçíá άβίαέ ι άδñáññάáόδΠδ έαίυιυί όιό firewall όόιι δññΠíá, ιά άίόυíáδύιΎιç όç άóíáδύόçδά έáόάññáόΠδ. Όá όδύέιέδá άíññδΠíáόá άβίαέ όί όγόόçíá έáόάññáόΠδ (logging), ι έαίυίαό divert ι ιδñβιό άíññáιδñέάβ όç έάέόιόñάβá NAT, έάέβδ έάέ ιέ δññ ÷ υñçιΎίαδ άóíáδύόçδάδ άέάέέιγ όέιδñιγ: όí όγόόçíá άέάíυññόυόçδ έβίççδ (traffic shaper) dummynet, ç άóíáδύόçδά δññβèççδ ιΎόύ όιό fwd rule, ç άóíáδύόçδά άáόγññόçδ (bridge) έάέβδ έάέ ç άóíáδύόçδά άδύέñδθçδ (ipstealth). To IPFW όδñιόççñβáέ όυίόί όí δññδύέιέέι IPv4 υίόί έάέ όί IPv6.





```
firewall_logging="YES"
```

**Δημιουργία συστήματος:** Οι ρυθμίσεις του firewall\_logging ελέγχονται με τη χρήση της εντολής `sysctl net.inet.ip.fw.verbose` ορίζοντας την τιμή 1 (αλλάζει ορίσιμα 30.6.1). Αυτό ορίζεται στο `rc.conf` ή στον αρχείο `/etc/sysctl.conf`:

```
net.inet.ip.fw.verbose_limit=5
```

Αν ο λογισμός του συστήματος είναι ο `gateway`, η λειτουργία της μετατροπής διευθυνσιοδότησης (Network Address Translation, NAT) ορίζεται με την εντολή `natd(8)`, η οποία βρίσκεται στο `rc.conf`.

### 30.6.4 Η Εντολή IPFW

Η εντολή `ipfw` είναι η βασική εντολή για τη διαχείριση του συστήματος `ipfw`, η οποία διαχειρίζεται τον πυρήνα του συστήματος. Οι ρυθμίσεις του `ipfw` ορίζονται στο αρχείο `/etc/ipfw.conf`. Η εντολή `ipfw` είναι η βασική εντολή για τη διαχείριση του συστήματος `ipfw`.

Η εντολή `ipfw` είναι η βασική εντολή για τη διαχείριση του συστήματος `ipfw`. Η εντολή `ipfw` είναι η βασική εντολή για τη διαχείριση του συστήματος `ipfw`.

Αυτό είναι ο βασικός αρχικός ορισμός:

```
ipfw list
```

Αυτό είναι ο βασικός αρχικός ορισμός του συστήματος `ipfw`:

```
ipfw -t list
```

Οι πληροφορίες του αρχικού ορισμού του συστήματος `ipfw` είναι οι πληροφορίες του συστήματος `ipfw`.

```
ipfw -a list
```

Αυτό είναι ο βασικός αρχικός ορισμός του συστήματος `ipfw`:

```
ipfw -d list
```

Αυτό είναι ο βασικός αρχικός ορισμός του συστήματος `ipfw`:

```
ipfw -d -e list
```

Αυτό είναι ο βασικός αρχικός ορισμός του συστήματος `ipfw`:



Ç **án** ÷ **P** áñùð ó ÷ ðεβιð, óçìáðñíðáðáðé ìá òì óγñáññì #, òì ðñìβì ðññáβ ñá àñòáñβæáðáé òòì ðÝεìð ñεάð ãñáñìðð éáññíá, **P** éáé òá ñεá áέéð òìð ãñáñìð. Ìé éáñÝð ãñáñìÝð ááñññíðáé.

`CMD RULE_NUMBER ACTION LOGGING SELECTION STATEFUL`

### 30.6.5.1.1 CMD

Άέá ñá ãβñáé ç ðññìðεβç áñùð ñÝìð éáññíá òòìí áóùðáññέù ðβñáéá, òìðñεáðáðáé ðññìóðÛ áðñ áðòññì ç ðáñÛìáðññìð `add`.

### 30.6.5.1.2 RULE\_NUMBER

ËÛεá éáññíáð ðñÝðáé ñá áέáéÝðáé Ýñá áñέèù ðñì ñá òìí ÷ ãñáéðçñβæáé.

### 30.6.5.1.3 ACTION

ñáð éáññíáð ðññáβ ñá ó ÷ áðβæáðáé ñá ñεá **P** ðáñέóóùðáññáð áñÝñááéáð, ñé ðñìβáð áéðáεññíðáé ùðáñ òì ðáéÝðì òáέññέÛæáé ñá òá éñέðññéá áðέεññáðð áðòññì òìð éáññíá.

`allow | accept | pass | permit`

¼éá òá ðáñáðÛñù Ý ÷ ðñì òì βáέñ áðñìÝéáðñá: òì ðáéÝðì áñÝñ ÷ áðáé áðñ óçñ óγððçñá òìð firewall. Ç áñáεððççç áέá òì òðáéáññέññìÝñ ðáéÝðì òáññíáðβæáðáé òá áðòñ òìí éáññíá.

`check-state`

ΆέÝá ÷ áé òì ðáéÝðì ñá áÛðç òì áðñáñέù ðβñáéá éáññíá. Áñ áñáεáβ éáññíáð ðñì ñá òáέññέÛæáé, éá áéðáéáððáβ ç áñÝñááéá òìð éáññíá ñá ðñìβìð áçñέγññáççá òìí òðáéáññέññìÝñ ðññáñέù éáññíá. ΆέáñññáðééÛ, ç áñáεððççç òññá ÷ βæáðáé ñá òìí áðññáññì éáññíá. ñáð éáññíáð `check-state` ááñ Ý ÷ áé éñέðññéá áðέεññáðð. Áñ ááñ òðÛñ ÷ áé éáññíáð `check-state` òòì óγññέñ éáññíá, ñá Ýéáá ÷ ðð òìð ðβñáéá áðñáñέçññì éáññíá ñáέññέÛæáé áðñ òìí ðññòì éáññíá óγðñì `keep-state P limit`.

`deny | drop`

Ëáé ñé áγñ εÝñáéð óçñáβññì òì βáέñ ðñÛáñá: òá ðáéÝðá ðñì òáέññέÛæáé ñá áðòñ òìí éáññíá áðñññððññìðáé. Ç áñáεððççç òáññíáðβæáðáé.

### 30.6.5.1.4 ÉáðááñáðP

`log P logamount`

¼ðáñ Ýñá ðáéÝðì òáέññέÛæáé ñá Ýñá éáññíá ðñì ðáñέÝ ÷ áé òç εÝñç `log`, áβñáðáé éáðááñáðP òìð ñçññíáðñìð ñÝòñ òìð `syslogd(8)` òðç áðñáðññìðççá SECURITY. Ç éáðááñáðP òññááβñáé ñññì áñ ñá ñáñέèùð òññì ðáéÝðññì ðñì Ý ÷ áé éáðááñáðáβ ñÝ ÷ ñé òðéáññìð ááñ òðáñááβñáé òçñ ðáñÛìáðññì `logamount`. Áñ ç ðáñÛìáðññìð áððP ááñ Ý ÷ áé éáέññέððáβ, òì ùññέñ ñðέñβæáðáé ñá áÛðç òçñ òéñP òçð ñáðááéççððð `sysctl net.inet.ip.fw.verbose_limit`. Ëáé òðéð áγñ ðáñέððððáéð, ñéá ñçáñέéP òéñP óçñáβñáé ùðé ááñ éá òðÛñ ÷ áé ùññέñ òçññ éáðááñáðP. Ìùééð ç éáðááñáðP òðÛðáé òòì ùññέñ, ðññáβ ñá áβñáé áðáñáññáñññìðççç òçð ñá òì ñçááñέóññì òìð ñáðñçðP éáðááñáðPð, **P** òìð ñáðñçðP áέá òì òðáéáññέññìÝññì éáññíá. Άáβðá òçñ áñðñέP `ipfw reset log`.

**Óçñáβññìð:** Ç éáðááñáðP áβñáðáé ñññì áðññ áðáéççáðéññì ùéáð ñé Ûééáð òðñέPéáð òáέññέÛññáðñìð òìð ðáéÝðñìð, éáé ðñέñ òçñ òáέéééP áðññá ÷ P ð áðñññέçç òìð. Άβñáé òðç áééP òáð áð ÷ Ýñáéá ñá áðññáðññáðá òá òñέñð éáññíáð éá áñáññáñññέPðáðá òçñ éáðááñáðP.

### 30.6.5.1.5 ΆδεερίαP

Ίε ε΄Υίαιεò-εεάεαεΰ ðιò ðáñεáñΰοίίόαé óá áοòP óçí áíυòçóá, ÷ñçóείηðιερίύίόαé áεá ίá ðáñεáñΰοίίόι ÷áñáεòçñεóóεéΰ οίò ðáε΄Υίόιò ðιò εá ðñ΄Υðáε ίá áεáñáòίçείρίύί áεá ίá εáείηεóòáòá ίí οί ðáε΄Υίόι óáεñεΰæáε P ù÷ε ίá οίη εáíυίá. Ç áðεερίαP ìðìñáò ίá áβίáε ìá áΰόç óá ðáñáεΰóυò ááίεεðò ούόáυò ÷áñáεòçñεóóεéΰ, óá ìðìá εáε εá ðñ΄Υðáε ίá ÷ñçóείηðιεçείρίύί ìá óç óáεñΰ ðιò óáβñίίόáε:

`udp | tcp | icmp`

Ίòìñίρί áðβóçð ίá ÷ñçóείηðιεçείρίύί óá ðñυòυείτεεá ðιò ðáñε΄Υ÷ίίόáé óòì áñ÷áβì /etc/protocols. Ç óείP ðιò εáείηβæáòáé ÷ñçóείηðιεáβòáé áεá οί óáβñεáóίá οίò ðñυòυείτεεò. ðñυεáεóáé áεá óðì÷ñáυóεéP ðáñΰίáòñì.

`from src to dst`

Ίε ε΄Υίαιεò from εáé to ÷ñçóείηðιερίύίόαé áεá οί óáβñεáóίá IP áεáòεύίόáυí. Ίε εáíυíáð ðñ΄Υðáε ίá εáείηβæίòí *ουοί* óçí ðçãP υοί εáε οίη ðñìñεóóι. Ç ε΄Υίç any ìðìñáò ίá ÷ñçóείηðιεçεáò áεá óáβñεáóίá ìá ìðιεááPðìòá áεáýεòίóç. Ç ε΄Υίç me ΄Υ÷áε áðβóçð áεáεéP óçίáóá. Óáεñεΰæáε ìá ìðιεááPðìòá áεáýεòίóç ðιò ΄Υ÷áε ñðείεóòáò óá εΰðιεá áεáðáòP οίò óóóðPíáοίò óáò, áίόεðñίóυòðáýίíóáð ΄Υóóé οί PC οοί ìðìβì áεòáεáβòáé οί firewall. Ίòìñίρί ΄Υóóé ίá áñáοίρί εáíυíáð οίò óýðιò from me to any P from any to me P from any to 0.0.0.0/0 P from 0.0.0.0/0 to me P from any to 0.0.0.0 P from me to 0.0.0.0. Ίε áεáòεύίόáéò IP εáείηβæίίόáé υò áñεείçóóé΄Υð ðεòΰááð ÷ññεóί΄Υíáð ìá óáεáβáð εáε áείτεíòεύίόáé áðu οί ìðεìò óçð ìΰóεáð óðìáεéòýìò. Ίεá IP áεáýεòίóç ìðìñáò ίá εáείηβæáòáé ìá áñεείηýð ðιò ÷ññβæίίόáé ìá óáεáβáð. Ίòìñáò áðβóçð ίá áείτεíòεáβòáé áðu οί ì΄Υááεìð óçð ìΰóεáð óðìáεéòýìò (ìñòP CIDR). ðñυεáεóáé áεá óðì÷ñáυóεéP ðáñΰίáòñì. Ίòìñáβòá ίá ÷ñçóείηðιεPóáòá οί áίççεçóééυ ðñυáñáííá net-mgmt/ipcalc áεá áεáòεüεéòίóç óáð óοίòð ððτεíáεóίηýð. Άáβòá óçí áεéòóáéP ðìðτεáóáòá οίò ðñìáñΰίáòίò áεá ðáñεóóυòáñáð ðεçñίòìñáò: <http://jodies.de/ipcalc>.

`port number`

×ñçóείηðιεáβòáé óá ðñυòυείτεεá ðιò ððίóðçñβæίòί áñεείηýð εòñπí (υòυò áβίáé óá TCP εáε UDP). Άβίáé óðì÷ñáυóεéυ ίá áβίáòáé ì áñεείυð εýñáð óçð ððçñáóáò ðιò ε΄Υεáòá ίá óáεñεΰίáòá. Ίòìñáβòá ίá ÷ñçóείηðιεPóáòá óá ìíυίáóá ουί ððçñáóεπí (ìðìñáβòá ίá óá áñáβòá οοί áñ÷áβì /etc/services) áίòá áεá οίòð εáíυíείηýð áñεείηýð εòñπí.

`in | out`

Ίá οί ðáñáðΰίυ ìðìñáò ίá εáείηεóòáòá ίí οί óáβñεáóίá εá áβίáòáé óá áεóáñ÷ìáíá P óá áíáñ÷ìáíá ðáε΄Υίóá áίòóβòίε÷á. Άβίáé óðì÷ñáυóεéυ ίá ΄Υ÷áòá υò ì΄Υñìò ουί εñεòçñβυí οίò εáíυίá óáð, áβòá óç ε΄Υίç in áβòá óç ε΄Υίç out.

`via IF`

Óáεñεΰæáε óá ðáε΄Υίóá óá ìðìá áε΄Υñ÷ίίόáé ì΄Υóυò óçð áεáðáòPð ìá οί υíñá ðιò εáείηβæáòáé. Ç ε΄Υίç via áίáóóáεβæáε υóé οί υíñá óçð áεáðáòPð εá áβίáé ðΰίóá ì΄Υñìò ουί εñεòçñβυí εáòΰ óç áεááεéáóá óáεñεΰóίáòίò.

`setup`

ðñυεáεóáé áεá óðì÷ñáυóεéP ðáñΰίáòñì ðιò áίááíυñβæáε óçí áβòçóç ΄Υίáñίçð ìεáð óóίááñβáð áεá ðáε΄Υίóá TCP.

`keep-state`

ðñυεáεóáé áεá óðì÷ñáυóεéP ðáñΰίáòñì. Ίυεéð óðΰñίáé óáβñεáóίá, οί firewall εá ççίέíòñáPóáé ΄Υίá áοίáíεéυ εáíυίá, οίò ìðìβìò ç ðñìáðεéááì΄Υίç óοίðáñεóìñΰ áβίáé ίá óáεñεΰæáε áðεείεíυíá áεðεðð εáðáýεòίóçð ìáðáίý óçð áεáýεòίóçð IP εáé óçð εýñáð áóáòçñβáð εáé ðñìñεóóίηý, ÷ñçóείηðιεPíóáð οί βæéí ðñυòυείτεεí.

`limit {src-addr | src-port | dst-addr | dst-port}`

Óí firewall εá áðεòñ΄Υφáé ìυíí N ðεPεìð óóίá΄Υóáυí ìá óεð ðáñáί΄Υοπìòð ðιò ðáñεáñΰοίίόáé óá áòòυ οίη εáíυίá. Ίòìñίρί ίá εáείηεóóίρί ðáñεóóυòáñáð áðu ìεá áεáòεύίόáéò εáé ðυñòáð áóáòçñβáð εáé ðñìñεóóίηý. Άáí ìòìñίρί ίá ÷ñçóείηðιεçείρίύί óοίη βæéí εáíυίá ìε ðáñΰίáòñίé limit εáé keep-state. Ç áðεερίαP limit ðáñ΄Υ÷áé óçí βæéá εáéòίòñáβá stateful ìá óçí keep-state, εáεðð εáé áðεðñυóεáòáð áεé΄Υð óçð εáéòίòñáβáð.



¼έά όά ιγιγίαόά εάόάαηάόδò òυì άάέΥòυì, àñὐοιíόάέ áδυ ðñìáðέεíäP όóì áñ÷άβì /var/log/security όì ιðìβì εάεìηβæáόάέ όóì áñ÷άβì /etc/syslog.conf.

30.6.5.4 Äçìέíõñάβá Áúò Script Éáíúíúì

Íε ðåñέóóυòåìíé Ḃíðåέñíé ÷ñPóòáð όìò IPFW, àçìέíõñåíγý Ḃíá áñ÷άβì ðìò ðåñέΥ÷åέ όìòò εάíúíáð εáέ όì àñὐοιí όì ιá όΥόιέí όñυðì þόόά íá íá ιðìñάβ íá åέòååάóóåβ ùò script. Òì ááóέέυ ðεåííΥέòçíá όìò ðåñáðὐíú ðñυðìò, áβíåέ ùòé íé εάíúíáð όìò firewall ιðìñíγý íá áíáíåùέíγý ÷ùñβò όçì áíὐάέç íá áðáíåέéíPóåέ όì όýόóçíá åέá íá σìηòυέíγý íé íΥíé. Ç ìΥέíåòò áóòP άβíåέ ðìéγ áìéééP åέá όçì äìééíP íΥúí εάíúíúì, éåèþò ç åέáåέéáóá ιðìñάβ íá áðáíåέçòεåβ ùóáð σìñΥò ÷ñåέὐæåóáέ. Éåèþò ðñυέåέóáέ åέá εάíííéúú script, ιðìñάβόå íá ÷ñçóéíðìéPóåáόå όóìåíéééP ððìéáðὐóóáόç åέá íá èùåééíðìéPóåáόå éåέ íá ððìéáóáóóPóåáόå όò÷íὐ ÷ñçóéíðìéíγýíåíåð όéíΥò óå ðìééåððéíγò εάíúíáð. Áðòυ óåβíåáόå όóì ðåñåέὐòυ ðåñὐååéíåíå.

Ç όγýόáíç ðìò ÷ñçóéíðìéåβóåέ åäþ, áβíåέ όóìåáðP ìå όå èåèγöç sh(1), csh(1) éåέ tcsh(1). Ìðñìóòὐ áδυ όå ðååáβá όçò όóìåíéééPð ððìéáðὐóóáόçò, ððὐñ÷åέ όì óPíá όìò åíååñβìò, \$. Òì όγýåíéí áóòυ ååí ððὐñ÷åέ ìðñìóòὐ áδυ όå όóìåíéééὐ ðååáβá. Ç όéíP ðìò éå áðìåíéåβ όóì όóìåíéééú ðååβì, ðñΥðåé íá åóυέéåβåáόåέ óå åέðèὐ åέóååυåééὐ.

ÎåééPóóå όì áñ÷άβì òυì εάíúíúì óåð ùðò όåβíåáόåέ ðåñåέὐòυ:

```
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
```

Áðòυ άβíåέ ùέí. Òóì ðåñὐååéíåíå áóòυ ååí άβíåέ όçìåíðéééíβ íé εάíúíáð, åééὐ ì όñυðìò ìå όìí ιðìβì εáέόìòñåíγý éåέ ðåβññìòì όéíΥò óå ðååáβá όóìåíéééPð ððìéáðὐóóáόçò.

Áí όì ðåñáðὐíú ðåñὐååéíåíå þóáí όóì áñ÷άβì /etc/ipfw.rules éå ιðìñíγýóåáóå íá σìñðþáóåá áóòìγò όìòò εάíúíáð, àñὐοιíóåð όçì ðåñåέὐòυ åíóìéP:

```
sh /etc/ipfw.rules
```

Òì áñ÷άβì /etc/ipfw.rules ιðìñάβ íá åñβóéåáόåέ óå ùðìéí éáóὐέíåí èΥéåòå, éåέ íá ìñὐæåáόåέ åðβóçò ùðò èΥéååá.

Éå ιðìñíγýóåáóå íá áðéόγ÷åáóå όì βåéí ðñὐåíåíå, åέðåèþíóåð óéð ðåñåέὐòυ åíóìéΥò ÷åéñíéβíçóá:

```
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
```





```
#####
$cmd 00015 check-state

#####
Interface facing Public Internet (Outbound Section)
Check session start requests originating from behind the
firewall on the private network or from this gateway server
destined for the public Internet.
#####

Allow out access to my ISP's Domain name server.
x.x.x.x must be the IP address of your ISP.s DNS
Dup these lines if your ISP has more than one DNS server
Get the IP addresses from /etc/resolv.conf file
$cmd 00110 allow tcp from any to x.x.x.x 53 out via $pif setup keep-state
$cmd 00111 allow udp from any to x.x.x.x 53 out via $pif keep-state

Allow out access to my ISP's DHCP server for cable/DSL configurations.
This rule is not needed for .user ppp. connection to the public Internet.
so you can delete this whole group.
Use the following rule and check log for IP address.
Then put IP address in commented out rule & delete first rule
$cmd 00120 allow log udp from any to any 67 out via $pif keep-state
#$cmd 00120 allow udp from any to x.x.x.x 67 out via $pif keep-state

Allow out non-secure standard www function
$cmd 00200 allow tcp from any to any 80 out via $pif setup keep-state

Allow out secure www function https over TLS SSL
$cmd 00220 allow tcp from any to any 443 out via $pif setup keep-state

Allow out send & get email function
$cmd 00230 allow tcp from any to any 25 out via $pif setup keep-state
$cmd 00231 allow tcp from any to any 110 out via $pif setup keep-state

Allow out FBSD (make install & CVSUP) functions
Basically give user root "GOD" privileges.
$cmd 00240 allow tcp from me to any out via $pif setup keep-state uid root

Allow out ping
$cmd 00250 allow icmp from any to any out via $pif keep-state

Allow out Time
$cmd 00260 allow tcp from any to any 37 out via $pif setup keep-state

Allow out nntp news (i.e. news groups)
$cmd 00270 allow tcp from any to any 119 out via $pif setup keep-state

Allow out secure FTP, Telnet, and SCP
This function is using SSH (secure shell)
$cmd 00280 allow tcp from any to any 22 out via $pif setup keep-state

Allow out whois
```

```

$cmd 00290 allow tcp from any to any 43 out via $pif setup keep-state

deny and log everything else that.s trying to get out.
This rule enforces the block all by default logic.
$cmd 00299 deny log all from any to any out via $pif

#####
Interface facing Public Internet (Inbound Section)
Check packets originating from the public Internet
destined for this gateway server or the private network.
#####

Deny all inbound traffic from non-routable reserved address spaces
$cmd 00300 deny all from 192.168.0.0/16 to any in via $pif #RFC 1918 private IP
$cmd 00301 deny all from 172.16.0.0/12 to any in via $pif #RFC 1918 private IP
$cmd 00302 deny all from 10.0.0.0/8 to any in via $pif #RFC 1918 private IP
$cmd 00303 deny all from 127.0.0.0/8 to any in via $pif #loopback
$cmd 00304 deny all from 0.0.0.0/8 to any in via $pif #loopback
$cmd 00305 deny all from 169.254.0.0/16 to any in via $pif #DHCP auto-config
$cmd 00306 deny all from 192.0.2.0/24 to any in via $pif #reserved for docs
$cmd 00307 deny all from 204.152.64.0/23 to any in via $pif #Sun cluster interconnect
$cmd 00308 deny all from 224.0.0.0/3 to any in via $pif #Class D & E multicast

Deny public pings
$cmd 00310 deny icmp from any to any in via $pif

Deny ident
$cmd 00315 deny tcp from any to any 113 in via $pif

Deny all Netbios service. 137=name, 138=datagram, 139=session
Netbios is MS/Windows sharing services.
Block MS/Windows hosts2 name server requests 81
$cmd 00320 deny tcp from any to any 137 in via $pif
$cmd 00321 deny tcp from any to any 138 in via $pif
$cmd 00322 deny tcp from any to any 139 in via $pif
$cmd 00323 deny tcp from any to any 81 in via $pif

Deny any late arriving packets
$cmd 00330 deny all from any to any frag in via $pif

Deny ACK packets that did not match the dynamic rule table
$cmd 00332 deny tcp from any to any established in via $pif

Allow traffic in from ISP's DHCP server. This rule must contain
the IP address of your ISP.s DHCP server as it.s the only
authorized source to send this packet type.
Only necessary for cable or DSL configurations.
This rule is not needed for .user ppp. type connection to
the public Internet. This is the same IP address you captured
and used in the outbound section.
$cmd 00360 allow udp from any to x.x.x.x 67 in via $pif keep-state

Allow in standard www function because I have apache server

```

```

$cmd 00400 allow tcp from any to me 80 in via $pif setup limit src-addr 2

Allow in secure FTP, Telnet, and SCP from public Internet
$cmd 00410 allow tcp from any to me 22 in via $pif setup limit src-addr 2

Allow in non-secure Telnet session from public Internet
labeled non-secure because ID & PW are passed over public
Internet as clear text.
Delete this sample group if you do not have telnet server enabled.
$cmd 00420 allow tcp from any to me 23 in via $pif setup limit src-addr 2

Reject & Log all incoming connections from the outside
$cmd 00499 deny log all from any to any in via $pif

Everything else is denied by default
deny and log all packets that fell through to see what they are
$cmd 00999 deny log all from any to any
End of IPFW rules file

```

### 30.6.5.7 Já Ōðüääéàiá NAT iá Stateful Óýñíει Éáíúíúí

Áέα íá áññáñíðíεçέáβ ç εάεοíõñáβá NAT óοί IPFW, ÷ñáεϒέííóáε εϒόíεάò áðέðεÝíí ñείβóáεò. Èá ðñÝðáε íá ðñíóεÝóáòá ðçί áðέειρáð option IPDIVERT íáεβ iá óεò ððüειέðáò áðέειρáÝò áέα οί IPFIREWALL óοί áñ÷áβí ñείβóáúí οίò ðññíρá. Èá ðñÝðáε Ýðáεóá íá iáòááεùðóβóáòá εάε íá ááεáóáóðóáòá οί γÝí óáð ðñíóáñííοίÝíí ðññíρá. Áεóóò áðu óεò óóίçεοίÝíáò áðέειρáÝò áέα οί IPFW, εá ðñÝðáε íá ðñíóεÝóáòá εάε óεò ðáñáεϒóòò οίò áñ÷áβí /etc/rc.conf:

```

natd_enable="YES" # Enable NATD function
natd_interface="rl0" # interface name of public Internet NIC
natd_flags="-dynamic -m" # -m = preserve port numbers if possible

```

Ç ÷ñóç εáíúíúí stateful íáεβ iá οίí εáíúíá divert natd (NAT), ðáñεðεÝéáε ðñεý ðçί εíρáεεð óóáñáòðò ούí εáíúíúí. Ç εÝόç áìòϒίόçò ούí εáíúíúí check-state εáε divert natd iÝόá οόί óýñíει εáíúíúí áβíáóáε ðñεý εñβóειç. Άáí ðñüεáεóáε ðεÝíí áέα áðεð εíρáεεð ðáñϒόίáóìò áðu οίí Ýíá εáíúíá οóίí áðuáñí. ×ñçόεííðíεáβóáε Ýíá γÝí áβáñò áγÝñááεáð ðñó íññεáóáε skipto. Άέα íá ÷ñçόεííðíεçέáβ ç áíóíειð skipto, áβíáε ððí÷ñáòúεéú íá Ý÷áòá áñεεíβóáε οίòð εáíúíáò, ρóòá íá iÝñáòá óá ðñει εáíúíá εá εáðáεíρáε οί ϒεíá ðñó εá áεòáεáóáβ áðu ðçί áíóíειð áóðε.

ðáñáεϒóòò εá áñáβóá Ýíá óðüááεáiá (÷ññβò ðñüóεáòá ó÷úεέα) iεáò iáεúáñò óóáñáòðò ðñó áðέεÝííáá ááð áέα íá áίçáβóίοíá ðçί áεíρειòεβá ñíðò οίò ðáέÝοίò iÝόá οόί óýñíει εáíúíúí.

Ç ñíð óçò áðáñáñááóβáò íáεέíϒáε iá οίí ðñρòí áðu ðçί εíñòòε εáíúíá εáε οóíá÷βáεε Ýíá εáíúíá εϒεá οíñϒ ðñó óá εϒóò, áβóá iÝ÷ñε íá óòϒόáε οίí óáεáóóáβí, ð iÝ÷ñε οί ðáέÝοί íá óáεñεϒíáε iá óá εñεóðñεá áðέειρáðò εϒóίεíò εáíúíá εάε íá áεáòεáñùέáβ áðu οί firewall. Άβíáε óçíáíóεéú íá ðáñáòçñβóίοíá ðç εÝόç ούí εáíúíúí iá áñεέñγò 100, 101, 450, 500 εáε 510. Íε εáíúíáò áóòíβ áεÝá÷íρί ðçί iáòϒóñáόç ούí áíáñ÷úíáíúí εáε áεóáñ÷úíáíúí ðáέÝοúí, ρóòá iε εáóá÷ññβóáεò ðñóò óοί áóíáíεéú ðβίáέα εáóáóóϒóáúí íá ðáñεÝ÷íρí ðϒíóá ðçί εáεúðέειð IP áεáýεòίόç οίò ðñðέεíγ áεέðýíò. ðáñáòçñβóáò áðβóçò úéε uειé iε εáíúíáò allow εáε deny εάειñβáειοί ðçί εáóáýéðίόç εβίçόçò οίò ðáέÝοίò εάεðð εάε ðçί áεáðáóð. Άðβόçò, úεáò iε áíáñ÷úíáíúí áέòβóáεò áέα iÝáò óοíáññáò iáóáóÝñííóáε áðáóεáβáò (iÝóóò οίò skipto rule 500) οόίí εáíúíá 500 áέα íá áβíáε ç iáòϒóñáόç áεáðεýíóáúí áεέðýíò (NAT).

Áò ððñεÝóίοíá úéε Ýíá ÷ñβóçò οίò ðñðέεíγ áεέðýíò ÷ñçόεííðíεáβ οίí óεεñáòñçòð οίò áέα íá ááε iεá εóóίòáεβáá. Íε εóóίòáεβááò ÷ñçόεííðíεíγί ðçί ðññόá 80 áέα ðçί áðέειρειúίβá. Οί ðáέÝοί áέóÝñ÷áðáε οόί firewall. Άáí óáεñεϒáεε

Ια οίι έάφίιιά 100 αέάόβ άβίάέ άίάñ÷ύίάñ έάέ ύ÷έ άέόάñ÷ύίάñ. Δάñίΰάέ οίι έάφίιιά 101 αέάόβ δñúέάέόάέ άέά ίΎά άδέέίεíñύíβá έάέ Ύόόέ άάί ððΰñ÷άέ άέύíά όόίι άόίάίέέú δβίάέά έάόάόδΰόάñ. Οί δάέΎóí όάέέέΰ όδΰίάέ όόίι έάφίιιά 125 Ιά οίι ίδίβí έάέ όάέñέΰάέ. ΑίΎñ÷άόάέ ίΎóú όçδ έΰñόάδ άέέόγίό δίό όόίάΎάόάέ όóí άçúúόέί Internet. Οί δάέΎóí Ύ÷άέ άέύíά ùδ IP άóάόçñβáδ όçí έάέúόέέΰ άέάγέόίόç όίό όίδέέίγ άέέόγίό. Οί όάβñέάόίά Ιά άδóú οίι έάφίιιά δñíέάέάβ άγί άίΎñάέέάδ. Ç άδέέίάΰ keep-state έά άçίεíòñάΰόάέ Ύίά ίΎί άόίάίέέú έάφίιιά, έά οίι έάόά÷ύñΰόάέ όóí δβίάέά, έάέ έά άέóάέΎόάέ όçí άίόβόόίέ÷ç άίΎñάάέά. Ç άίΎñάάέά άόδΰ άβίάέ ίΎñíδ όçδ δέçñίóñβáδ δίό άñΰόάόάέ όóíι άόίάίέέú δβίάέά. Óçí δάñβδóúόç άόδΰ άβίάέ ç “skipto rule 500”. Ι έάφίιιάδ 500 Ιάόάóñΰάέ ίΎóú NAT όç άέάγέόίόç IP όίό δάέΎóí, δñέί άóóú άίΎέέά δñíδ όί Internet. Άóóú άβίάέ έάέάβóáñά όçίάίόέέú. Οί δάέΎóí έάόάδέγίάόάέ δñíδ οίι δñíñέóíú όίό, úδίό άçίεíòñάβδóάέ έάέ άδίοδΎέέάόάέ Ύίά ίΎί δάέΎóí ùδ άδΰίόçόç. Οί ίΎί άóóú δάέΎóí άέóΎñ÷άόάέ ίάíΰ όóí firewall, όóí έάφίιιά δίό άβίάέ όόçí έíñóΰ όçδ έβόόάδ. Άόδΰ όç óñΰ όάέñέΰάέ Ιά οίι έάφίιιά 100 έάέ ç άέάγέόίόç δñíñέóίγ όίό άέέΰάέ ίάíΰ όόçí άñ÷έέΰ όίό όίδέέίγ άέέόγίό. Δάέόά, άβίάόάέ ç άδάíñάάόβά όίό άδú οίι έάφίιιά check-state í ίδίβíδ ίάίέάέγδóάέ úδέ δñúέάέόάέ άέά δάέΎóí όóίάñβáδ óά άίΎέέίç έάέ όί άδάέάδéάñπíάέ όóí όίδέέú άβέόóí. Έάόάδέγίάόάέ δñíδ οίι όδίεíάέόόΰ όίό όίδέέίγ άέέόγίό δίό όί Ύόόάέέά, í ίδίβíδ όóΎέίάέ Ύίά ίΎί δάέΎóí άçóπíόάδ δάñέόóúóáñά άάάñΎίά άδú οίι άδñάέñóóίΎí άίόδçñάόçόΰ. Οί δάέΎóí άóóú άέΎά÷άόάέ άδú οίι έάφίιιά check-state, í ίδίβíδ άñβóέάέ όçí έάόά÷ήñέόç όίό όόά άíñ÷ύίάίά έάέ άέóάέάβ όçí άίόβόόίέ÷ç άίΎñάάέά δίό óά άόδΰ όçí δάñβδóúόç άβίάέ “skipto 500”. Οί δάέΎóí δñíúέάβóάέ όóíι έάφίιιά 500, άβίάόάέ ç Ιάóΰñάόç όçδ άέάγέόίόçδ όίό ίΎóú NAT έάέ άδάέάδéάñπíάόάέ όóí Internet.

Άδú όçí Ιάñέΰ óúι άέόάñ÷ύίάíúí, úδίεí δάέΎóí ίάίάíññβέάόάέ ùδ ίΎñíδ Ιέάδ ððΰñ÷ίόóáδ όóίάñβáδ, άέΎά÷άόάέ άóóúíάόά άδú οίι έάφίιιά check-state έάέ όίόδ άίόβόόίέ÷ίόδ έάφίιιάδ divert natd. Οί ίúí δίό ÷ñάέΰάόάέ ίά άίόέίάóúδβóóίά άβίάέ ç άδúññέç úέúí óúι δñíάέçíάόέéπí δάέΎóúι έάέ ç Ύάέñέόç ίúí óúι δάέΎóúι δίό δñíñβέίíóάέ άέά άάέάέñέίΎίάδ όδçñάόβáδ. Άδ όδίέΎóίόíά úδέ Ύ÷íòíά Ύίά άίόδçñάόçόΰ apache í ίδίβíδ άέóάέάβóάέ όóí ίç÷Ύίçíά Ιά όί firewall, έάέ άδέέóíγίά όί όίδέέú site ίά άβίάέ δñíóáΰóέíí άδú όί άçúúόέί Internet. Ç άέόάñ÷ύίάç άβóçόç ίΎάδ όóίάñβáδ όάέñέΰάέ Ιά οίι έάφίιιά 100 έάέ ç IP άέάγέόίόç όçδ άίόέόóίέ÷βέάόάέ όóí όίδέέú IP όίό ίç÷άίπíάóíδ Ιά όί firewall. Οί δάέΎóí Ύάέέόά άέΎά÷άόάέ άέά ίδίεíάΰδίόά δñúάέçíά ίδñάβ ίά Ύ÷άέ όγίóúíά Ιά όίόδ έάφίιιάδ δίό ÷ñçóέíúδίεíγίά, έάέ όάέέέΰ όάέñέΰάέ Ιά οίι έάφίιιά 425. Óçí δάñβδóúόç άóδΰ όóíάάβííóí άγί δñΰάíάόά. Ι έάφίιιάδ άέά όί δάέΎóí άñΰόάόάέ όóí άóίάίέέú δβίάέά έάόάόδΰόάñ, άέέΰ άόδΰ όç óñΰ δάñέíñβέάόάέ í άñέέíúδ άέóΰόάñ ίΎάδ όóίάñβáδ άδú όί όóάέάέñέίΎí IP óά 2. Ιά άóóú οίι όñúóí ίδñíγίά ίά άíóίεíγίά óά άδέέΎόάέ όγδίό ΰñίççóçδ όδçñάόβáδ (DoS) úóí άóñΰ όç óóάέάέñέίΎίç έγñά άδέέίεíñύíβáδ. Ç άίΎñάάέά όίό έάφίιιά άβίάέ όί allow, έάέ Ύόόέ όί δάέΎóí άδάέάδéάñπíάόάέ όóí όίδέέú άβέόóí. Οί δάέΎóí δίό δάñΰάάόάέ ùδ άδΰίόçόç, άέΎά÷άόάέ άδú οίι έάφίιιά check-state, í ίδίβíδ ίάίάíññβέάέ úδέ άίπéάέ óά Ιέά πáç άίáñάΰ όóίάñβá, έάέ άδίοδΎέέάόάέ όóíι έάφίιιά 500 úδίό άβίάόάέ ç Ιάóΰñάόç όçδ άέάγέόίόçδ όίό ίΎóú NAT. Οί δάέΎóí όάέέέΰ άδάέάδéάñπíάόάέ ίΎóú όçδ άέάδάóΰδ άíñ÷ñΎí.

Óδúάάέάίά Έάφίιύí #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 δανάáÛúí, áεεÛ δάνεÝ ÷íοí δάνεóóúòάñá ó÷üεεά áεά íá áìçèÐóíοí
òíí áñ÷Ûñεí ÷ñÞóòç ôíò IPFW íá εάòáεÛάáε εάέýòáñá ðùð εάέòíòñāýí.

Ïðüāáεáíá Êάíúíúí #2:

#!/bin/sh
Start of IPFW rules file
Flush out the list before we begin.
ipfw -q -f flush

Set rules command prefix
cmd="ipfw -q add"
skip="skipto 800"
pif="rl0" # public interface name of NIC
facing the public Internet

#####
No restrictions on Inside LAN Interface for private network
Change xl0 to your LAN NIC interface name
#####
$cmd 005 allow all from any to any via xl0

```

```
#####
No restrictions on Loopback Interface
#####
$cmd 010 allow all from any to any via lo0

#####
check if packet is inbound and nat address if it is
#####
$cmd 014 divert natd ip from any to any in via $pif

#####
Allow the packet through if it has previous been added to the
the "dynamic" rules table by a allow keep-state statement.
#####
$cmd 015 check-state

#####
Interface facing Public Internet (Outbound Section)
Check session start requests originating from behind the
firewall on the private network or from this gateway server
destined for the public Internet.
#####

Allow out access to my ISP's Domain name server.
x.x.x.x must be the IP address of your ISP's DNS
Dup these lines if your ISP has more than one DNS server
Get the IP addresses from /etc/resolv.conf file
$cmd 020 $skip tcp from any to x.x.x.x 53 out via $pif setup keep-state

Allow out access to my ISP's DHCP server for cable/DSL configurations.
$cmd 030 $skip udp from any to x.x.x.x 67 out via $pif keep-state

Allow out non-secure standard www function
$cmd 040 $skip tcp from any to any 80 out via $pif setup keep-state

Allow out secure www function https over TLS SSL
$cmd 050 $skip tcp from any to any 443 out via $pif setup keep-state

Allow out send & get email function
$cmd 060 $skip tcp from any to any 25 out via $pif setup keep-state
$cmd 061 $skip tcp from any to any 110 out via $pif setup keep-state

Allow out FreeBSD (make install & CVSUP) functions
Basically give user root "GOD" privileges.
$cmd 070 $skip tcp from me to any out via $pif setup keep-state uid root

Allow out ping
$cmd 080 $skip icmp from any to any out via $pif keep-state

Allow out Time
$cmd 090 $skip tcp from any to any 37 out via $pif setup keep-state
```

```

Allow out nntp news (i.e. news groups)
$cmd 100 $skip tcp from any to any 119 out via $pif setup keep-state

Allow out secure FTP, Telnet, and SCP
This function is using SSH (secure shell)
$cmd 110 $skip tcp from any to any 22 out via $pif setup keep-state

Allow out whois
$cmd 120 $skip tcp from any to any 43 out via $pif setup keep-state

Allow ntp time server
$cmd 130 $skip udp from any to any 123 out via $pif keep-state

#####
Interface facing Public Internet (Inbound Section)
Check packets originating from the public Internet
destined for this gateway server or the private network.
#####

Deny all inbound traffic from non-routable reserved address spaces
$cmd 300 deny all from 192.168.0.0/16 to any in via $pif #RFC 1918 private IP
$cmd 301 deny all from 172.16.0.0/12 to any in via $pif #RFC 1918 private IP
$cmd 302 deny all from 10.0.0.0/8 to any in via $pif #RFC 1918 private IP
$cmd 303 deny all from 127.0.0.0/8 to any in via $pif #loopback
$cmd 304 deny all from 0.0.0.0/8 to any in via $pif #loopback
$cmd 305 deny all from 169.254.0.0/16 to any in via $pif #DHCP auto-config
$cmd 306 deny all from 192.0.2.0/24 to any in via $pif #reserved for docs
$cmd 307 deny all from 204.152.64.0/23 to any in via $pif #Sun cluster
$cmd 308 deny all from 224.0.0.0/3 to any in via $pif #Class D & E multicast

Deny ident
$cmd 315 deny tcp from any to any 113 in via $pif

Deny all Netbios service. 137=name, 138=datagram, 139=session
Netbios is MS/Windows sharing services.
Block MS/Windows hosts2 name server requests 81
$cmd 320 deny tcp from any to any 137 in via $pif
$cmd 321 deny tcp from any to any 138 in via $pif
$cmd 322 deny tcp from any to any 139 in via $pif
$cmd 323 deny tcp from any to any 81 in via $pif

Deny any late arriving packets
$cmd 330 deny all from any to any frag in via $pif

Deny ACK packets that did not match the dynamic rule table
$cmd 332 deny tcp from any to any established in via $pif

Allow traffic in from ISP's DHCP server. This rule must contain
the IP address of your ISP's DHCP server as it's the only
authorized source to send this packet type.
Only necessary for cable or DSL configurations.
This rule is not needed for 'user ppp' type connection to
the public Internet. This is the same IP address you captured

```

```

and used in the outbound section.
$cmd 360 allow udp from x.x.x.x to any 68 in via $pif keep-state

Allow in standard www function because I have Apache server
$cmd 370 allow tcp from any to me 80 in via $pif setup limit src-addr 2

Allow in secure FTP, Telnet, and SCP from public Internet
$cmd 380 allow tcp from any to me 22 in via $pif setup limit src-addr 2

Allow in non-secure Telnet session from public Internet
labeled non-secure because ID & PW are passed over public
Internet as clear text.
Delete this sample group if you do not have telnet server enabled.
$cmd 390 allow tcp from any to me 23 in via $pif setup limit src-addr 2

Reject & Log all unauthorized incoming connections from the public Internet
$cmd 400 deny log all from any to any in via $pif

Reject & Log all unauthorized out going connections to the public Internet
$cmd 450 deny log all from any to any out via $pif

This is skipto location for outbound stateful rules
$cmd 800 divert natd ip from any to any out via $pif
$cmd 801 allow ip from any to any

Everything else is denied by default
deny and log all packets that fell through to see what they are
$cmd 999 deny log all from any to any
End of IPFW rules file

```

# ΕὰοÛεάεί 31 Δñĩ ÷ ùñçìÝíá ÈÝíáôá Äéêôýùόçò

## 31.1 Óýññç

Ôĩ εὰοÛεάεί áðòü éáéýððáé δñĩ ÷ ùñçìÝíá èÝíáôá äéêôýùόçò.

Áöñý 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 ÷ Ûíçĩá ÷ ùñβð óéêçñü äβóēĩ.
- Δùð íá ñðēĩβóáôá ìáðÛñáóç äéêððáēþĩ äéáððéýíóáñĩ (NAT).
- Δùð íá óðíáÝóáôá äýĩ ððñēĩäéóðÝð ìÝóù PLIP.
- Δùð íá ñðēĩβóáôá ôĩ IPv6 óá Ýíá ìç ÷ Ûíçĩá FreeBSD.
- Δùð íá ñðēĩβóáôá ôĩ ATM.
- Δùð íá ñðēĩβóáôá éáé íá ÷ ñçóéññðñēĩãÞóáôá 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 çç ááóéêÞ ñññēĩãá ðùĩ äéêðýñ.
- Íá äñññæáðá ðùð íá ñðēĩβóáôá éáé íá ääéáðáóðÞóáôá Ýíá ìÝĩ ððññĩá 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.

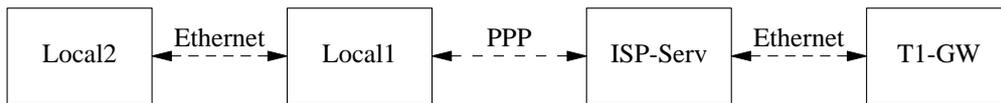
### 31.2.2 Default Routes

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.

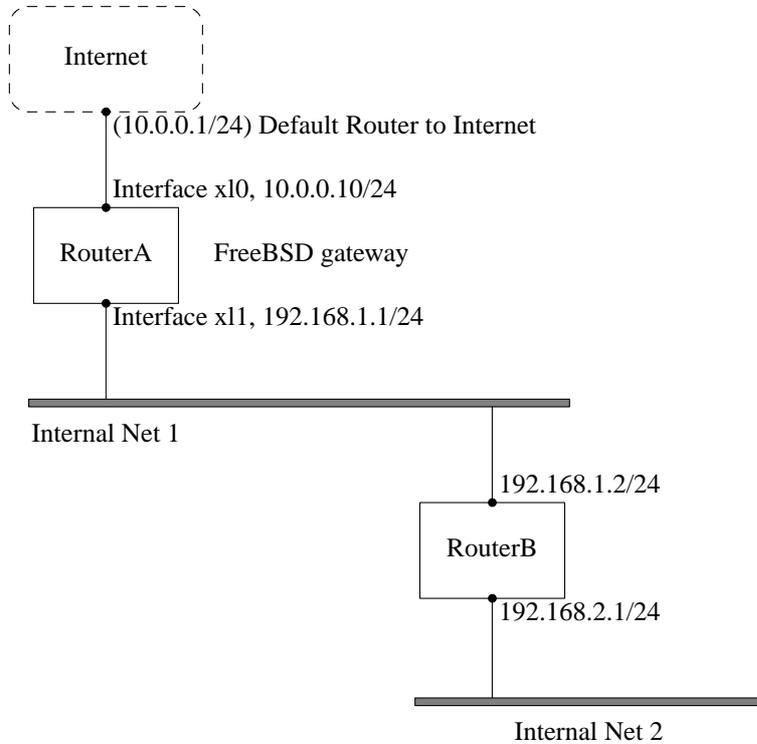
Your new router will need routes to know where to send the traffic. If your network is simple enough you can use static routes. FreeBSD also comes with the standard BSD routing daemon `routed(8)`, which speaks RIP (both version 1 and version 2) and IRDP. Support for BGP v4, OSPF v2, and other sophisticated 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 `traceroute(8)` command. It is equally useful if you cannot seem to make a connection to a remote machine (i.e. `ping(8)` fails).

The `traceroute(8)` command is run with the name of the remote host you are trying to connect to. It will show the gateway hosts along the path of the attempt, eventually either reaching the target host, or terminating because of a lack of connection.

For more information, see the manual page for `traceroute(8)`.

### 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).

**Óçíáßùç:** 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 Ὁδηγία 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
```

**Όçíáßùóç:** 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 certificat.

- 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
```

**Όγιᾶβύοδδ:** 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 0 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
```

**Όçìáßùç:** 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`.

**Όψιμα:** 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.

**Όψιμα:** 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>) 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.

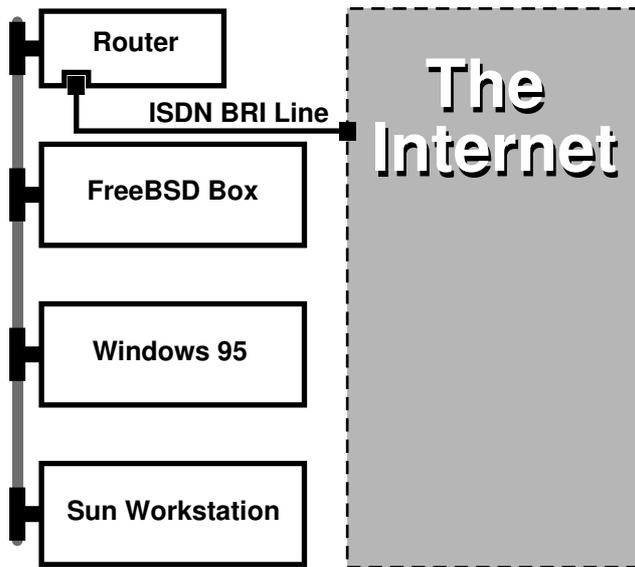
The main problem with ISDN routers and bridges is that interoperability between manufacturers can still be a problem. If you are planning to connect to an Internet provider, you should discuss your needs with them.

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:

#### Ðñï÷-ùñçìÝíá 31-1. Branch Office or Home Network

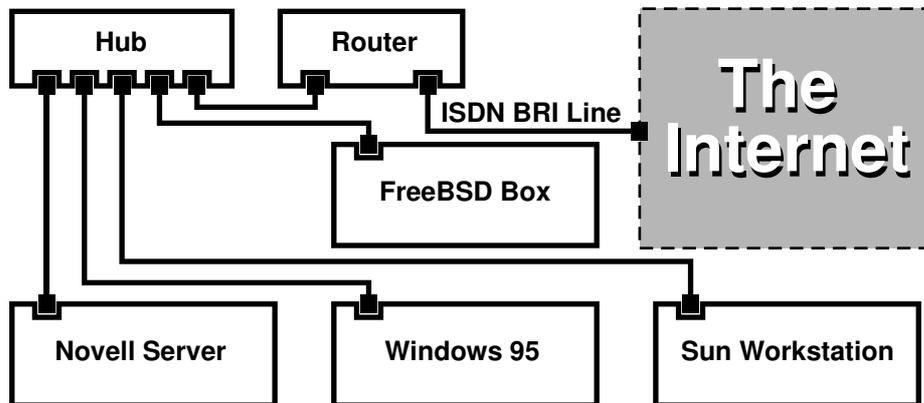
Network uses a bus based topology with 10 base 2 Ethernet (“thinnet”). Connect router to network cable with AUI/10BT transceiver, if necessary.



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

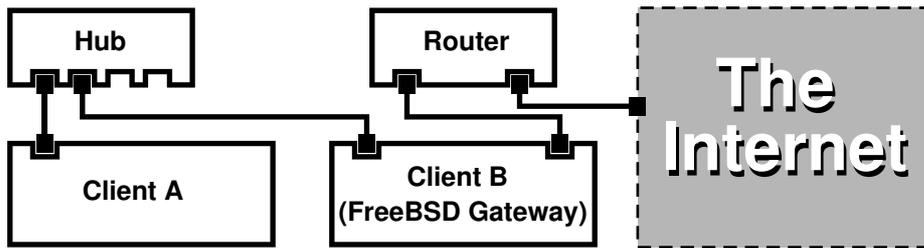
Due to the diminishing IP space in IPv4, and the increased number of users on high-speed consumer lines such as cable or DSL, people are increasingly in need of an Internet Connection Sharing solution. The ability to connect

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.

**Ὁγίαβύοζ:** 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.

**Όχιὰβύος:** 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"
```

**Ὁψιμολογία:** 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.

**Ὁψιμολογία:** 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

# Δανάη A. Διό έά Άñáßôá ôï FreeBSD

## A.1 Άέüóáέò óá CDROM έάέ DVD

### A.1.1 Retail Άέüóáέò

Ôï FreeBSD άβιάέ έάέέÝóέï ùò àìðïñέέü ðñïúúí (FreeBSD CD, άðέðñüóέáôï έñάέóíέέü, έάέ òððùìÝíç òάέìçñßùóç) áðü έέÜöïñïðò ðñïçέάðóÝò:

- CompUSA  
WWW: <http://www.compusa.com/>
- Frys Electronics  
WWW: <http://www.frys.com/>

### A.1.2 CD έάέ DVD έέáññÝò

Ôï FreeBSD άβιάέ έάέέÝóέï óá CD έάέ DVD άέά ááñÜ ïÝóù έέάάέέóýïò áðü òïðò ðáñάέÜòü ðñïçέάðóÝò:

- FreeBSD Mall, Inc.  
700 Harvest Park Ste F  
Brentwood, CA 94513  
USA  
ÔçěÝöùí: +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  
ÔçěÝöùí: (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  
ÔçěÝöùí: 353 1 6291282  
WWW: <http://www.thelinuxmall.com>
- The Linux Emporium  
Hilliard House, Lester Way

Wallingford  
OX10 9TA  
United Kingdom  
Όραση: +44 1491 837010  
Fax: +44 1491 837016  
WWW: <http://www.linuxemporium.co.uk/products/bsd/>

- Linux+ DVD Magazine  
Lewartowskiego 6  
Warsaw  
00-190  
Poland  
Όραση: +48 22 860 18 18  
Email: <editors@lpmagazine.org>  
WWW: <http://www.lpmagazine.org/>
- Linux System Labs Australia  
21 Ray Drive  
Balwyn North  
VIC - 3104  
Australia  
Όραση: +61 3 9857 5918  
Fax: +61 3 9857 8974  
WWW: <http://www.lsl.com.au>
- LinuxCenter.Kz  
Ust-Kamenogorsk  
Kazakhstan  
Όραση: +7-705-501-6001  
Email: <info@linuxcenter.kz>  
WWW: <http://linuxcenter.kz/page.php?page=fr>
- LinuxCenter.Ru  
Galernaya Street, 55  
Saint-Petersburg  
190000  
Russia  
Όραση: +7-812-3125208  
Email: <info@linuxcenter.ru>  
WWW: <http://linuxcenter.ru/shop/freebsd>

### A.1.3 Αερίμαβρο

Αίμαβροά ιαοάδουεσδπδ εαέ ιδνίμαβροά ία αερίμαβροά οά CD-ROM δνιούιόα ααόείοίΎία οοι FreeBSD, δάνάεαερίμαβροά ια εΎδρείί αδν οιοδ αερίμαβροά:

- 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 ΆιϑçñåòçôÝò FTP

Ïè åðβòçιάð åèåüöåèð ðιϑ FreeBSD åβιάè åèåèÝóèιάð ìÝòù áñπιðιçð FTP óýíååóçð åðù åèÜöñπιϑð åιϑçñåòçôÝò FTP óå üèì ðιí èüóìí. Ï èåíòñèèèðð åιϑçñåòçôÞðð <ftp://ftp.FreeBSD.org/pub/FreeBSD/> Ý ÷ åè ðιèý èåèÞ óýíååóç ìå ðιí òðùèìèðð èüóìí, èåè åðèðñÝðåè Ýíå ìååÜèì åñèèèü òåððù ÷ ñιíüí òðñåÝóåñí. Áèüìå èè Ýðóèè üìðð, åβιάè ìÜèèì èåèÞ èåÝå ìå åñåβðå èÜðιèì åιϑçñåòçôÞð FTP ðιϑ åβιάè ðèì “èιíòÜ” óåð (åèåèèÜ áí èÝèåðå ìå òðÞóåðå èÜðιèì òιðèèèü mirror site).

Ç åÜóç ðùì mirror sites ðιϑ FreeBSD (<http://mirrorlist.FreeBSD.org/>) åβιάè ðèì åιçìåññèÝíç èåè Ýèèðñç åðù òçí åιðβòðιè ÷ ç èβòðå òðì Åñ ÷ åèñβåèì ðιϑ FreeBSD, èðññèðð åðåèåÞð ðåβññíåè òèð ðèçññιϑñññåð òçð åðù òι DNS èè ü ÷ è åðù ìåå òðåèèèÞ èβòðå åðù ñιíüìåå åιϑçñåòçôÞð.

Οι FreeBSD άβιές άδβόçð äέέéÝóεήι ìÝóù óýíääóçð áññòìñ FTP áðu óá δάνάέÛòù mirror sites. Αί άδέέÝíάðά íá éάóääÛóάðά ðì FreeBSD ìÝóù άññòìñ FTP, óáð δάνάέέέéýíá íá äέέéÝíάðά éÛðìέí άñðçññάðçðP ðì ðìβìð άβιές éñòÛ óáð. Óά mirror sites ðìó áíάóÝññíóάέ ùð “Éýñέά Mirror Sites” Ý÷ìòí óðíPèùð ðçí ðέPñç óðέέíāP άñ÷ άβùí ðìó FreeBSD (üèàð óέð äέέéÝóéíāð äéäüóάέð, äέά éÛèā äέέéÝóéíç άñ÷ éóάέðìíέέP óðóðPíáðìð), äέéÛ άβιές ðέέάñíí íá ðάðý÷ äòā éäéýðάññāð óá÷ ýðçðāð άñðçñÝóççð ìā éÛðìέí άñðçññάðçðP ðìó άβιές óçç äέέP óáð ÷Pñā P ðάñέí÷P. Óά ðìðέéÛ sites Ý÷ìòí óðíPèùð óέð ðέí ðñüóóάðāð äéäüóάέð äέά óέð ðέí äçññóééāβð άñ÷ éóάέðìíέέÝð óðóðPíáðìð, ìðuóā ìðññāβ íá ìçí Ý÷ìòí üèàð óέð ðέέάÝð äéäüóάέð ðìó FreeBSD. ¼έά óá sites äÝ÷ìíóάέ óðíáÝóάέð ìÝóù άññòìñ FTP. ÌāñέéÛ áðu áóðÛ ìðññāβ íá ððìóðçñβæìòí éάέ Ûééçð ìññòPð óðíáÝóάέð. Ìé άíέέéééðέéÝð ìññöÝð óýíääóçð áíάóÝññíóάέ íā÷ ðñέóðÛ äέά éÛèā site δάνάέÛòù:

Central Servers, Primary Mirror Sites, Argentina, Armenia, Australia, Austria, Brazil, Bulgaria, Canada, China, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Indonesia, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Taiwan, Turkey, Ukraine, United Kingdom, USA.

(as of 2010/06/17 12:49:57 UTC)

Central Servers

- <ftp://ftp.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 / http (<http://ftp.FreeBSD.org/pub/FreeBSD/>) / [httpv6](http://ftp.FreeBSD.org/pub/FreeBSD/) (<http://ftp.FreeBSD.org/pub/FreeBSD/>))

Primary Mirror Sites

In case of problems, please contact the hostmaster <[mirror-admin@FreeBSD.org](mailto:mirror-admin@FreeBSD.org)> for this domain.

- <ftp://ftp1.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp2.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp3.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp4.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 / http (<http://ftp4.FreeBSD.org/pub/FreeBSD/>) / [httpv6](http://ftp4.FreeBSD.org/pub/FreeBSD/) (<http://ftp4.FreeBSD.org/pub/FreeBSD/>))
- <ftp://ftp5.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp6.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp7.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp8.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp9.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp10.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 / http (<http://ftp10.FreeBSD.org/pub/FreeBSD/>) / [httpv6](http://ftp10.FreeBSD.org/pub/FreeBSD/) (<http://ftp10.FreeBSD.org/pub/FreeBSD/>))
- <ftp://ftp11.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp12.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp13.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp14.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp14.FreeBSD.org/pub/FreeBSD/>))

#### 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)

#### Australia

In case of problems, please contact the hostmaster <hostmaster@au.FreeBSD.org> for this domain.

- <ftp://ftp.au.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp2.au.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp3.au.FreeBSD.org/pub/FreeBSD/> (ftp)

#### Austria

In case of problems, please contact the hostmaster <hostmaster@at.FreeBSD.org> for this domain.

- <ftp://ftp.at.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 / http (<http://ftp.at.FreeBSD.org/pub/FreeBSD/>) / httpv6 (<http://ftp.at.FreeBSD.org/pub/FreeBSD/>))
- <ftp://ftp2.at.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 / http (<http://ftp2.at.FreeBSD.org/pub/FreeBSD/>) / httpv6 (<http://ftp2.at.FreeBSD.org/pub/FreeBSD/>) / rsync / rsyncv6)

#### Brazil

In case of problems, please contact the hostmaster <hostmaster@br.FreeBSD.org> for this domain.

- <ftp://ftp.br.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp.br.FreeBSD.org/pub/FreeBSD/>))
- <ftp://ftp2.br.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp2.br.FreeBSD.org/>))
- <ftp://ftp3.br.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)
- <ftp://ftp4.br.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp5.br.FreeBSD.org>
- <ftp://ftp6.br.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp7.br.FreeBSD.org/pub/FreeBSD/> (ftp)

## Bulgaria

In case of problems, please contact the hostmaster <hostmaster@bg.FreeBSD.org> for this domain.

- <ftp://ftp.bg.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)
- <ftp://ftp2.bg.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)

## Canada

In case of problems, please contact the hostmaster <hostmaster@ca.FreeBSD.org> for this domain.

- <ftp://ftp.ca.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp2.ca.FreeBSD.org/> (ftp)
- <ftp://ftp3.ca.FreeBSD.org/pub/FreeBSD/> (ftp)

## China

In case of problems, please contact the hostmaster <hostmaster@cn.FreeBSD.org> for this domain.

- <ftp://ftp.cn.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp2.cn.FreeBSD.org/pub/FreeBSD/> (ftp)

## Czech Republic

In case of problems, please contact the hostmaster <hostmaster@cz.FreeBSD.org> for this domain.

- <ftp://ftp.cz.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 (<ftp://ftp.cz.FreeBSD.org/pub/FreeBSD/>) / [http \(http://ftp.cz.FreeBSD.org/pub/FreeBSD/\)](http://ftp.cz.FreeBSD.org/pub/FreeBSD/) / [httpv6 \(http://ftp.cz.FreeBSD.org/pub/FreeBSD/\)](http://ftp.cz.FreeBSD.org/pub/FreeBSD/) / rsync / rsyncv6)
- <ftp://ftp2.cz.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp2.cz.FreeBSD.org/pub/FreeBSD/\)](http://ftp2.cz.FreeBSD.org/pub/FreeBSD/))

## Denmark

In case of problems, please contact the hostmaster <hostmaster@dk.FreeBSD.org> for this domain.

- <ftp://ftp.dk.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 / [http \(http://ftp.dk.FreeBSD.org/pub/FreeBSD/\)](http://ftp.dk.FreeBSD.org/pub/FreeBSD/) / [httpv6 \(http://ftp.dk.FreeBSD.org/pub/FreeBSD/\)](http://ftp.dk.FreeBSD.org/pub/FreeBSD/))
- <ftp://ftp2.dk.FreeBSD.org/pub/FreeBSD/> (ftp)

## Estonia

In case of problems, please contact the hostmaster <hostmaster@ee.FreeBSD.org> for this domain.

- <ftp://ftp.ee.FreeBSD.org/pub/FreeBSD/> (ftp)

## Finland

In case of problems, please contact the hostmaster <hostmaster@fi.FreeBSD.org> for this domain.

- <ftp://ftp.fi.FreeBSD.org/pub/FreeBSD/> (ftp)

## France

In case of problems, please contact the hostmaster <hostmaster@fr.FreeBSD.org> for this domain.

- <ftp://ftp.fr.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp1.fr.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp1.fr.FreeBSD.org/pub/FreeBSD/\)](http://ftp1.fr.FreeBSD.org/pub/FreeBSD/))
- <ftp://ftp2.fr.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp3.fr.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp5.fr.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp6.fr.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp7.fr.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp8.fr.FreeBSD.org/pub/FreeBSD/> (ftp)

## Germany

In case of problems, please contact the hostmaster <de-bsd-hubs@de.FreeBSD.org> for this domain.

- <ftp://ftp.de.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp1.de.FreeBSD.org/freebsd/> (ftp / [http \(http://www1.de.FreeBSD.org/freebsd/\)](http://www1.de.FreeBSD.org/freebsd/) / rsync (<rsync://rsync3.de.FreeBSD.org/freebsd/>))
- <ftp://ftp2.de.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp2.de.FreeBSD.org/pub/FreeBSD/\)](http://ftp2.de.FreeBSD.org/pub/FreeBSD/) / rsync)
- <ftp://ftp3.de.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp4.de.FreeBSD.org/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/))
- <ftp://ftp8.de.FreeBSD.org/pub/FreeBSD/> (ftp)

## Greece

In case of problems, please contact the hostmaster <hostmaster@gr.FreeBSD.org> for this domain.

- <ftp://ftp.gr.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp2.gr.FreeBSD.org/pub/FreeBSD/> (ftp)

## Hong Kong

- <ftp://ftp.hk.FreeBSD.org/pub/FreeBSD/> (ftp)

## Hungary

In case of problems, please contact the hostmaster <[hostmaster@hu.FreeBSD.org](mailto:hostmaster@hu.FreeBSD.org)> for this domain.

- <ftp://ftp.hu.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp.hu.FreeBSD.org/pub/FreeBSD/\) / rsync](http://ftp.hu.FreeBSD.org/pub/FreeBSD/))
- <ftp://ftp2.hu.FreeBSD.org/pub/FreeBSD/> (ftp)

## Iceland

In case of problems, please contact the hostmaster <[hostmaster@is.FreeBSD.org](mailto:hostmaster@is.FreeBSD.org)> for this domain.

- <ftp://ftp.is.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)

## Indonesia

In case of problems, please contact the hostmaster <[hostmaster@id.FreeBSD.org](mailto:hostmaster@id.FreeBSD.org)> for this domain.

- <ftp://ftp.id.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp.id.FreeBSD.org/\) / rsync](http://ftp.id.FreeBSD.org/))

## Ireland

In case of problems, please contact the hostmaster <[hostmaster@ie.FreeBSD.org](mailto:hostmaster@ie.FreeBSD.org)> for this domain.

- <ftp://ftp.ie.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp2.ie.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp2.ie.FreeBSD.org/pub/FreeBSD/\) / rsync](http://ftp2.ie.FreeBSD.org/pub/FreeBSD/))
- <ftp://ftp3.ie.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp3.ie.FreeBSD.org/pub/FreeBSD/\) / rsync](http://ftp3.ie.FreeBSD.org/pub/FreeBSD/))

## Israel

In case of problems, please contact the hostmaster <[hostmaster@il.FreeBSD.org](mailto:hostmaster@il.FreeBSD.org)> for this domain.

- <ftp://ftp.il.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6)

## Italy

In case of problems, please contact the hostmaster <[hostmaster@it.FreeBSD.org](mailto:hostmaster@it.FreeBSD.org)> for this domain.

- <ftp://ftp.it.FreeBSD.org/pub/FreeBSD/> (ftp)

## Japan

In case of problems, please contact the hostmaster <hostmaster@jp.FreeBSD.org> for this domain.

- <ftp://ftp.jp.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp2.jp.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp3.jp.FreeBSD.org/pub/FreeBSD/> (ftp)
- <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)
- <ftp://ftp8.jp.FreeBSD.org/pub/FreeBSD/> (ftp)
- <ftp://ftp9.jp.FreeBSD.org/pub/FreeBSD/> (ftp)

## Korea

In case of problems, please contact the hostmaster <hostmaster@kr.FreeBSD.org> for this domain.

- <ftp://ftp.kr.FreeBSD.org/pub/FreeBSD/> (ftp / rsync)
- <ftp://ftp2.kr.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp2.kr.FreeBSD.org/pub/FreeBSD/>))

## Latvia

In case of problems, please contact the hostmaster <hostmaster@lv.FreeBSD.org> for this domain.

- <ftp://ftp.lv.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp.lv.FreeBSD.org/pub/FreeBSD/>))
- <ftp://ftp2.lv.FreeBSD.org/pub/FreeBSD/> (ftp)

## Lithuania

In case of problems, please contact the hostmaster <hostmaster@lt.FreeBSD.org> for this domain.

- <ftp://ftp.lt.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp.lt.FreeBSD.org/pub/FreeBSD/>))

## 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)

## 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)
- <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/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)

#### 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://ftp2.sk.FreeBSD.org/pub/FreeBSD/> (ftp / ftpv6 (<ftp://ftp2.sk.FreeBSD.org/pub/FreeBSD/>) / http (<http://ftp2.sk.FreeBSD.org/pub/FreeBSD/>) / httpv6 (<http://ftp2.sk.FreeBSD.org/pub/FreeBSD/>))

#### Slovenia

In case of problems, please contact the hostmaster <[hostmaster@si.FreeBSD.org](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](mailto: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](mailto: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 \(http://ftp5.se.FreeBSD.org/\)](http://ftp5.se.FreeBSD.org/) / rsync)

#### Switzerland

In case of problems, please contact the hostmaster <[hostmaster@ch.FreeBSD.org](mailto:hostmaster@ch.FreeBSD.org)> for this domain.

- <ftp://ftp.ch.FreeBSD.org/pub/FreeBSD/> (ftp / [http \(http://ftp.ch.FreeBSD.org/pub/FreeBSD/\)](http://ftp.ch.FreeBSD.org/pub/FreeBSD/))
- <ftp://ftp2.ch.FreeBSD.org/mirror/FreeBSD/> (ftp / [ftpv6 \(ftp://ftp2.ch.FreeBSD.org/mirror/FreeBSD/\)](ftp://ftp2.ch.FreeBSD.org/mirror/FreeBSD/) / [http \(http://ftp2.ch.FreeBSD.org/ftp/mirror/FreeBSD/\)](http://ftp2.ch.FreeBSD.org/ftp/mirror/FreeBSD/) / [httpv6 \(http://ftp2.ch.FreeBSD.org/ftp/mirror/FreeBSD/\)](http://ftp2.ch.FreeBSD.org/ftp/mirror/FreeBSD/))

#### Taiwan

In case of problems, please contact the hostmaster <[hostmaster@tw.FreeBSD.org](mailto:hostmaster@tw.FreeBSD.org)> for this domain.

- <ftp://ftp.tw.FreeBSD.org/pub/FreeBSD/> (ftp / [ftpv6 \(ftp://ftp.tw.FreeBSD.org/pub/FreeBSD/\)](ftp://ftp.tw.FreeBSD.org/pub/FreeBSD/) / rsync / rsyncv6)
- <ftp://ftp2.tw.FreeBSD.org/pub/FreeBSD/> (ftp / [ftpv6 \(ftp://ftp2.tw.FreeBSD.org/pub/FreeBSD/\)](ftp://ftp2.tw.FreeBSD.org/pub/FreeBSD/) / [http \(http://ftp2.tw.FreeBSD.org/pub/FreeBSD/\)](http://ftp2.tw.FreeBSD.org/pub/FreeBSD/) / [httpv6 \(http://ftp2.tw.FreeBSD.org/pub/FreeBSD/\)](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 \(http://ftp6.tw.FreeBSD.org/\)](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 \(http://ftp11.tw.FreeBSD.org/FreeBSD/\)](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)
- <ftp://ftp7.us.FreeBSD.org/pub/FreeBSD/> (ftp / http (<http://ftp7.us.FreeBSD.org/pub/FreeBSD/>) / rsync)









Άñáòðáβòά òίáññçòðò òά ιέα áδù òέò èβòóáò äέáññðò òιϑ **CTM**. Ç èβòóá ctm-cvs-cur (<http://lists.FreeBSD.org/mailman/listinfo/ctm-cvs-cur>) òðιòòçñβæáé ιèùèèçñι òι äÝíòñι òιϑ CVS. Ç èβòóá ctm-src-cur (<http://lists.FreeBSD.org/mailman/listinfo/ctm-src-cur>) òðιòòçñβæáé òçι èáòáèð (head) òιϑ èèÛáιò áíÛððòιçð (development branch). Ç èβòóá ctm-src-4 (<http://lists.FreeBSD.org/mailman/listinfo/ctm-src-4>) òðιòòçñβæáé òçι Ýέáιòç 4.X è.ι.è. Áι ááι áñññβæáðά ðùð ιά ááññáòáβòά òά ιέα èβòóá, èÛíòά èèèè òòι ùñíá òçð èβòóáð ðιϑ áιòáιβæáðάέ ðáñáðÛíù ð ðçááβíáðά òòι <http://lists.FreeBSD.org/mailman/listinfo> èάé èÛíòά èèèè òòç èβòóá ðιϑ èÝèáðά ιά ááññáòáβòά. Ç òáèβáá òçð èβòóáð èά ðñÝðáé ιά ðáñéÝ÷áé ùèáð òέð áðáñáβòçðάð ðèçñιòññβáð ò÷áðèèèÛ ιά òέð òðίáññÝð.

¼ðáι áñ÷βòáðά ιά èáιáÛíáðά áíáιáððáέò **CTM** ιÝòù mail, ιðññáβòά ιά ÷ñçòèιðιέððáðά òι ðñùáñáιá ctm\_rmail áéá ιά òέð áðιòòιðéÝòáðά èάé ιά òέð áòáññιùòáðά. Ιðññáβòά òòçι ðñáñιáðéèùòçðά ιά ÷ñçòèιðιέððáðά òι ðñùáñáιá ctm\_rmail áðáðèèáβáð ιÝòù ιέáð ááññáòðò òòι /etc/aliases áι èÝèáðά ç äéáèééáðá ιά äèðáèèáβòáé áðòñáðιðιέçιÝíá. Άáβòά òç òáèβáá manual òιϑ ctm\_rmail áéá ðáñéòóòιðáñáð èáððιιÝñáèð.

**Òçιáβιùòç:** ¶ò÷áðά ιά òç ιÝèíáι ðιϑ èá ÷ñçòèιðιέððáðά áéá ιά èÛááðά òά deltas òιϑ **CTM** èá ðñÝðáé ιά ááññáòáβòά òòç èβòóá ctm-announce (<http://lists.FreeBSD.org/mailman/listinfo/ctm-announce>). Òòι ιÝèèíι, áðòù èá áβιáé èáé òι ιιιι ιÝñιò òòι ιðιβι èá áçιíòéáÝιíðáé ðèçñιòññβáð ò÷áðèèèÛ ιά òέð èáèòιðñáβáð òιϑ òðòðιáðòι **CTM**. ÈÛíòά èèèè òòι ùñíá òçð ðáñáðÛíù èβòóáð, èáé áèιèìèèáβòáð òέð ιáçáβáð áéá ιά ááññáòáβòά.

### A.5.3 ×ñçòèιðιέðιáð òι **CTM** áéá ðñòç ÒιñÛ

ðñéι áñ÷βòáðά ιά ÷ñçòèιðιέáβòά **CTM** deltas, èá ðñÝðáé ιά Ý÷áðά Ýíá òçιáβι áèèβιçòçð áéá òά delta ðιϑ Ý÷ιòι áçιèíñáçèáβ ιáðÛ áδù áðòù.

Èá ðñÝðáé ðñðá ιά èáèñβòáðά òé Ý÷áðά ðáç. Ιðιέιðáððιòá ιðññáβ ιά áñ÷βòáé áδù Ýíá “Ûááér” èáðÛèιáι. Èá ðñÝðáé ιά ιáèéιððáðά ιά Ýíá áñ÷èèù “Èáñù” delta áéá ιά áñ÷βòáðά ιά òι **CTM** äÝíòñι òáð. Áδù èÛðιέι òçιáβι èáññιÝíá ùèé Ýíá áδù áðòÛ òά “áñ÷èèÛ” deltas èá äéáíÝñιðáé òά CD áéá òç áèèð òáð äéáðèùèðιòç, ùòòùòι áðòù ááι òòιááβιáé òç ááññÝíç òðéáιð.

Èáèðð òά äÝíòñá áβιáé áñèáðÝð ááèÛááð megabytes, áβιáé ðñιðèιùðáñι ιά ιáèéιððáðά áδù èÛðé ðιϑ Ý÷áðά ðáç. Áι Ý÷áðά CD èÛðιέáð äéáññðò (RELEASE), ιðññáβòά ιά áιðéáñÛðáðά ð ιά áðιòòιðéÝòáðά áδù áèáβ òιñ áñ÷èèù ðçááβι èðáéá. ðóé èá äèðððáðά òçιáíðéèù ιÝñιò òçð ιáðáçιñÛð ááññÝíùι.

Ιðññáβòά ιά áíááñññβòáðά áðòÛ òά “áñ÷èèÛ” deltas áδù òι x ðιϑ áèιèìèèáβ òιñ áñèèèù òιϑð (áéá ðáñÛááèáιá src-cur.3210xEmpty.gz). Ï÷áñáèòçñéíùð ιáðÛ òι x áιðéòðιé÷áβ òòçι ðçáð òιϑ áñ÷èèíÝ òáð “seed”. Òι Empty áβιáé Ýíáð Ûááèιð èáðÛèιáιð. ÈáðÛ èáñιá áçιèíñááβòáé ιέá ιáðÛááòç áδù òι Empty èÛèá 100 deltas. Άðβòçð òά áñ÷áβá áðòÛ áβιáé ιááÛéá! ÒðιçèéòιÝñι ιÝááèιð áéá xEmpty deltas áβιáé òά 70 ùð 80 MB òðιðéáòιÝíùι ιá gzip ááññÝíùι.

Ιùèèð áðééÝíáðά Ýíá ááóéèù delta áéá ιά ιáèéιððáðά, èá ÷ñáéáððáβòά áðβòçð ùèá òά deltas ιά ιáááéÝðáñιòð áδù áðòù áñèèèÝð.

### A.5.4 ×ñçòèιðιέðιáð òι **CTM** òòçι Èáèçιáñéιð òáð Æèð

Άéá ιά áòáññιùòáðά òά deltas, áðèðð áñÛðáð:

```
cd /where/ever/you/want/the/stuff
ctm -v -v /where/you/store/your/deltas/src-xxx.*
```

Òϊ CTM áíòééáíáÙíáòáé deltas óá ìðñíá Ý ÷ òï óðìðéáóóáß ìÝóù gzip, éáé Ýòóé ááí ÷ ñáéÙæáóáé íá ÷ ñçóéíðñéðóáòá òçí gunzip, ãéððññíðáð ìá áðòù òíí òñùðñ ÷ ðññ óðì äβóéí.

Òϊ CTM ááí ðññéáéóáé íá ðáéñÙíáé óá áñ ÷ áβá óáð áí ááí áβíáé áðñéððá óβáñòññí áéá òç áéááééáóáá áíáíÝùóçð. Áéá íá áðáéççéáýóáòá Ý íá delta ìðññáβòá áðβóçð íá ÷ ñçóéíðñéðóáòá òçí áðééñã -c éáé òï CTM ááí èá ðáéñÙíáé òβðñíá, áðéðð èá áðáéççéáýóáé òçí áéáñáéúðçðá òñò delta éáé èá ááé áí ìðññáβ íá òï áóáññíóáé ÷ ùñβð ðññáéðñáóá òòï òñÝ ÷ ïí äÝíóññí.

ÒðÙñ ÷ òï éáé Ùééáð áðééñãÝð óòï CTM, ááβòá òéð áíóβóòñé ÷ áð óáéβááð manual P éñéðÙíòá òíí ðçááβñ éðáééá áéá ðáñéóóúðáñáð ðéçññòññáð.

Áðòù áβíáé ùéñ óðçí ðñáññíáðééúðçðá. ÈÙèá òññÙ ðñò éáíáÙíáòá Ý íá ðÝí delta, áðéðð ðáñÙóáð òï óòï CTM ðóðá íá Ý ÷ áòá ðÙíòñá áíáíáùñÝñ òíí ðçááβñ óáð éðáééá.

Ìçí óáðñáòá óá deltas áí áβíáé áýóéññí íá óá éáðááÙóáòá íáíÙ. ðóùð èÝéáòá íá óá òðéÙíáòá áéá òçí ðáññðòòóç ðñò èÙóé ðÙáé óðñááÙ. Áéùíá éáé áí òï ìññ ìÝóñ ðñò Ý ÷ áòá áβíáé áéóéÝòáð, èÙíá áíóβñáñáòñ ÷ ñçóéíðñéðñíáð òçí fdwrite.

### A.5.5 Èñáðñíóáð òéð ÒñðééÝò óáð ÁééááÝò

Ùð ðññáññíáðéóððð, èá èÝéáòá íá ðáéññíáðéóððáβòá éáé íá áééÙíáòá áñ ÷ áβá óòï äÝíóññí òñò ðçááβñò éðáééá. Òï CTM òðñíóçññæáé ðáñéññéóñÝñò òýðñò òñðééÝò áééááÝò: ðñéí áéÝáñáé áéá òçí ðáññòóáá áíùð áñ ÷ áβñò foo, áéÝá ÷ áé ðñðáá áéá òï foo.ctm. Áí òï áñ ÷ áβñ áðòù òðÙñ ÷ áé, òï CTM èá ÷ ñçóéíðñéðóáé áðòù áíóβ áéá òï foo.

Ç óòñðáñéóññÙ áððP íáð ðáñÝ ÷ áé Ý íá áðéù òññùðñ íá áéáðçñðóññíá òñðééÝò áééááÝò: áðéðð áíóéáñÙðòá óá áñ ÷ áβá ðñò óéñðáýáòá íá áééÙíáòá óá áíóβóòñé ÷ á áñ ÷ áβá ìá éáðÙéçç .ctm. Ìðññáβòá éáðòðéí íá èÙíáòá ùéð áééááÝò èÝéáòá óòññ éðáééá áñ òï CTM èá áéáðçññáβ áíáíáùñÝñ òññ ÷ áβñ .ctm.

### A.5.6 ðééáð ÁíáéáóÝññíóáð ÌðééñãÝò òñò CTM

#### A.5.6.1 Ìññóéññíóáð òé Áéñéáðð èá ÁééÙíáé óá ìéá ÁíáíÝùóç

Ìðññáβòá íá ðññíóáéññóáòá òéð áééááÝò ðñò èá ðññéáéÝóáé òï CTM óòñ repository òñò ðçááβñò óáð éðáééá, ÷ ñçóéíðñéðñíáð òçí áðééñã -l.

Áðòù èá áβíáé ÷ ñðóéññí áí èÝéáòá íá èñáððóáòá çñáññéùáéñ òùñ áééááññí, áí èÝéáòá íá áðáñáñáóóáβòá óá òññðññéçñíÝ íá áñ ÷ áβá ðñéí P ìáðÙ òçí òññðñññççç òñòð, P áí áðéðð áéóéÙíáòá áéáðññð ðáñáññéùð.

#### A.5.6.2 Äçñéíðñáðíóáð Áíóβñáñáòá Áóóáéáβáð ðñéí òçí ÁíáíÝùóç

ÌáñééÝò òññÝð èá èÝéáòá íá èñáððóáòá áíóβñáñáòñ áóóáéáβáð ùéùñ òùñ áñ ÷ áβñ ðñò ðññéáéóáé íá áééá ÷ èññí áðñ ìéá áíáíÝùóç ìÝóù CTM.

Äβññíóáð òçí áðééñã -B backup-file òï CTM èá äçñéíðñáðíóáé áíóβñáñáòñ áóóáéáβáð ùéùñ òùñ áñ ÷ áβñ ðñò ðññéáéóáé íá áééá ÷ èññí áðñ èÙðñéí óðáéáñéññíÝññí delta óòñ ÷ áβñ backup-file.

#### A.5.6.3 ðáñéññæáññíóáð óá Áñ ÷ áβá ðñò èá Áééá ÷ èññí áðñ ÈÙðñéá ÁíáíÝùóç

ÌáñééÝò òññÝð βòùð íá áíáéáóÝññáòá íá ðáñéññóáòá òçí ðáñéñ ÷ P áñÙóçð ìéáð óðáéáñéññíÝñçð áíáíÝùóçð ìÝóù CTM P βòùð óáð áíáéáóÝññáé íá ðÙñáòá ìññ éβáá áñ ÷ áβá áðñ èÙðñéá óáéñÙ áðñ deltas.

Ìðñάβòά ίά äéÝáíáòά òç ëβòóά òùí άñ÷άβùí óóά ðñíβά èά èäéòìñāÞóáé òϊ **CTM** ÷ñçóèíðñéÞíóáð ùò òβèðñά, regular expressions ìά òéò äðéèíāÝð -e èáé -x.

Άέά ðññÛäáéñíá, äéá ίά áíÛäáòά Ýíá áíáíáùíÝñí áíòβññáòï òïò άñ÷άβùò lib/libc/Makefile áðù òçí òðèèíāÞ óáð òùí äðñèçèáòïÝíùí **CTM** deltas, äèðäèÝóóά òéò áíòñèÝð:

```
cd /where/ever/you/want/to/extract/it/
ctm -e '^lib/libc/Makefile' ~ctm/src-xxx.*
```

Άέά èÛèά άñ÷άβùí ðïò èäèíñβèáòáé óά Ýíá **CTM** delta, ðé äðéèíāÝð -e èáé -x äòáññùæñíóáé ìά òç óáéñÛ ðñò äñòáíβæñíóáé óòç ãñáññÞ áíòñèÞí. Óòí άñ÷άβùí äβíáðáé äðáíññááóóá áðù òϊ **CTM**, ìùí áí ìáñèáñéóóáβ ùò Ýäèðñí ðñò áíáíÝùòç ìáðÛ òçí äòáñññāÞ ùèùí òùí äðéèíāÞí -e èáé -x.

### A.5.7 ìäèèíóéèÛ Ó÷Ýäéá äéá òï **CTM**

Άβίáé ðÛñά ðñèÛ:

- ×ñÞóç èÛðñéòò äβñòð ðéóòìðñβçòçð óòí óýóòçιά **CTM** þòðά ίά áíáíáññβæñíóáé ðð÷ùí øáýðéèáð áíáíáþòáèð.
- ÌäèèÛñéóíá òùí äðéèíāÞí òïò **CTM**, èáèþð ðññèäèýñíý íóýã÷òóç èáé äáí äβíáé ðññòáíáβð.

### A.5.8 ÄéÛòññά

ÓðÛñ÷äé äðβòçð èáé ðéá óáéñÛ áðù deltas äéá òçí òðèèíāÞ òùí ports, äèèÛ äáí Ý÷äé äèäççèùèáβ áèùíá áñèáòù áíáéáóÝññí äéá áððÞ.

### A.5.9 **CTM** Mirrors

Óï **CTM/FreeBSD** äéáðβèäòáé ðÝóù áñþíòñò FTP áðù òά áèùèñòèá mirrors. Áí äðéèÝíáòά ðé èáðááÛóáòά òï **CTM** ðÝóù áñþíòñò FTP, óáð ðáñáéäèýñíýä ðññòðäèÞòá ðé äðéèÝíáòά ðéá òñðñèáóóá èñðÛ óά óáð.

Óά ðáññððòòç ðñññäèçìÛðùí, ðáñáéäèýñíýä äðéèèèññññòðá ìά òç ëβòóά ctm-users (<http://lists.FreeBSD.org/mailman/listinfo/ctm-users>).

Èäèèòùññíéá, Bay Area, äðβòççð ðçãÞ

- <ftp://ftp.FreeBSD.org/pub/FreeBSD/development/CTM/>

Íùðéá ÁðñèèÞ, áíòβññáòά áóóáéáβáð äéá ðäèèÛ deltas

- <ftp://ftp.za.FreeBSD.org/pub/FreeBSD/CTM/>

ÔáέαÛί/R.O.C.

- ftp://ctm.tw.FreeBSD.org/pub/FreeBSD/development/CTM/
- ftp://ctm2.tw.FreeBSD.org/pub/FreeBSD/development/CTM/
- ftp://ctm3.tw.FreeBSD.org/pub/FreeBSD/development/CTM/

Άί άάί άñðέαά èÛðίεί mirror óçí ðñεί÷P óάð, P άί òϊ mirror άάί άβίάέ ðèPñάð, ðñϊóðάèPóáά ίά ÷ñçóείïðίèPóáά ίέα ίç÷άïP άίάèPóçóçð ùðùð ç alltheweb (<http://www.alltheweb.com/>).

## A.6 ×ñçóείïðίèPóáò òϊ CVSUp

### A.6.1 ΆέόάãùãP

Ôï **CVSUp** άβίάέ Ýίá èïάέóίèù áέα òçí áέαíñP éάé áίáíÝùç ãÝίòñùí ðçãáβïð èpáééá áðù Ýίá éáíòñéèù (master) CVS repository òï ðïβï ãñβóèáðάé óá èÛðίεί áðñáèñòóíÝíí ððίèïάéóðP. Ôï repository òïð FreeBSD ãñβóèáðάé óá Ýίá éáíòñéèù ίç÷Ûίçιά óççí Èáéèòùñíéά. Ìá òï **CVSUp**, íé ÷ñPóðáð òïð FreeBSD ðñíñíýí áýéíéά ίά áéáðçñPóíòí áίáíáùÝίá óá áíòβññáóá òïð ðçãáβïð òïðð èpáééá.

Ôï **CVSUp** ÷ñçóείïðίèάβ Ýίá ðïðÝéí áίáíÝùçð áíùóóù ùð *pull*. Óðí ðïðÝéí áðòù, èÛèá ðáèÛðçð æçðÛ ðéð áίáíáPóáéð áðù òïð áíòðçñáðçðP, ùóáí éάé áí ðéð áðéèèáβ. Ì áíòðçñáðçððð ðññéíÝίáé, ðáèçðéèÛ, ðéð áðáéðPóáéð áðù òïðð ðáèÛðáð. Ìá òïð ðññðí áðòù, èÛèá áίáíÝùç íáèéíÛáé éáðòðéí áðáβðççðçð òïð ðáèÛðç. Ì áíòðçñáðçððð ðïðÝ ááí óóÝéíáé áίáíáPóáéð ðïð ááí Ý÷íòí æçðçéáβ. Ìé ÷ñPóðáð éá ðñÝðáé áβòá ίά áéðáèÝóíòí òï **CVSUp** ÷áéñíèβίçðá áέα ίά èÛáíòí íέα áίáíÝùç, áβòá éá ðñÝðáé ίá ðñèíβóíòí éáðÛèèçéá òï cron Póáá ίά òï áéðáèáβ áðòùíáðá éáðÛ óáèðÛ ÷ñíéèÛ áéáóðβíáðá.

Ì ùñòð **CVSUp**, ãñáíìÝíò ðá éáðáéáβá éάé íéèñÛ ùðòð óáβñáðάé, áίáóÝññáðάé óá ðèùèèçñí òï ðáéÝòí èïάέóίèéíý. Óá ááóéèÛ òïð ðïβíáðá áβίáé ç áíòíèP ðáèÛðç cvsup ç ðñíβá áéðáèáβðάé óòí ίç÷Ûίçιά òïð èÛèá ÷ñPðç, éάé òï ðñññáñáíá òïð áíòðçñáðçðP cvsupd òï ðïβï áéðáèáβðάé óá èÛèá Ýίá áðù óá mirror sites òïð FreeBSD.

Èáèpð áéááÛæáðá òçí ðáèèçñβùç éάé ðéð èβóðáð óá÷ðáññáβïð òïð FreeBSD, ðñññáβ ίá ãñáβòá áίáíòñÝð óççí áðáñññP **sup**. Ôï **sup** Pðáí ðññññòð òïð **CVSUp**, éάé áíòðçñáðíýóá ðáññññéí óéíðù. Ôï **CVSUp** ÷ñçóείïðίèáβðάé ίá áñèáðÛ ùñéí ðññðí ðá òï sup, éάé óççí ðññññáðéèèùçðá, ÷ñçóείïðίèáβ áñ÷áβá ðñèíβóáñí óá ðñíβá Ý÷íòí ðβòù óòíááðòùçðá ðá áðòÛ òïð sup. Ôï **sup** ááí ÷ñçóείïðίèáβðάé ðèÝíí óòí FreeBSD Project, áðáéáP òï **CVSUp** áβίáé óá÷ýóáñí éάé ðññòðÝñáé ðááéýðáñç áðáèéíβá.

**Óççíáβùç:** Ôï ðñññáñáíá **csup** áβίáé òï **CVSUp** íáíáññáíìÝíí óá áèPóóá C. Ôï ðááéýðáñí òïð ðèáííÝéòçιά áβίáé ùðé áβίáé óá÷ýóáñí, éάé ááí áíáñðÛðάé áðù òçí áèPóóá ðñññáííáðéóéíý Modula-3, òçí ðñíβá éάé ááí ÷ñáèÛæáðάé ðèÝíí ίá ááèáðáóðPóáðá. Άðβóçð, áí ÷ñçóείïðίèáβòá Ýèáíòç FreeBSD 6.2 P ðááááíÝóðáñç, ðñññáβòá ίá òï ÷ñçóείïðίèèPóáðá Ûíáóá, éáèpð ðáñééáíáÛíáðάé óòí ááóéèÛ óýóççιά. Ðáéèùðáññáð áèáùóáèò òïð FreeBSD ááí Ý÷íòí òï csup(1) óòí ááóéèÛ óýóççιά, áèèÛ ðñññáβòá ίá òï ááèáðáóðPóáðá áýéíéά áðù òï port net/csup port, P áðù Ýðíéíí ðáèÝòí. Άí áðíòáóòPóáðá ίá ÷ñçóείïðίèèPóáðá òï **csup**, áðèpð ðáñáèáβððá óá áPíáðá áέα òçí ááèáðÛðóç òïð **CVSUp** éάé áíòééáðáóðPóáðá èÛèá áίáíòñÛ óòí **CVSUp** óá áðòù òï Ûñèñí, ðá **csup**.

### A.6.2 ΆãéáôÛóóáóç

Ï áóείεüóãñò òñüðìò áéá íá áãéáóáóóΠóáóá òι **CVSup** áβίáé ìÝóù òìò Ýóìείìò ðáéÝóìò `net/cvsup` áðü ççí óóεεíãΠ ðáéÝóùì òìò FreeBSD. Áí ðñìòεíÛóá íá ìáóááεüòòðóáóá òι **CVSup** áðü òíí ðçãáβì εþáééá, ìðñãáβòá íá ðñóóεíðìεΠóáóá òι `port net/cvsup`. Óáð ðñíáéãíðìεíÝíá ùòòüóìí ùðé òι `port net/cvsup` áíãñòÛóáé áðü ççí **Modula-3**, ç ìðñíá ðñáéÛááóáé áñéáòü ðññíí éáé ðññí óòì áβóεí áéá íá éáóÝááé éáé íá ìáóááεüòòðéóóáβ.

**Óçíáβóóç:** Áí ðñüéáéóáé íá ðñóóéíðìεΠóáóá òι **CVSup** óá Ýíá ìç÷Ûíçíá òι ìðñíí ááí éá áéáéÝóáé áñáóééü ðáñéáÛεéíí ìÝóù **XFree86** Π **Xorg**, ùðüò ð.÷. óá Ýíá áíððçñáðçòΠ, ááááéüéáβòá ùðé áãéáéóóóÛóá òι áíðβóóé÷÷ ðòò òι ìðñíí ááí ðáñééáíáÛíáé áñáóééü ðáñéáÛεéíí, áçéááΠ òι `net/cvsup-without-gui`.

Áí èÝéáóá íá áãéáóáóóΠóáóá òι **csup** óòì FreeBSD 6.1 Π ðññááíÝóóáñí, ìðñãáβòá íá ðñóóéíðìεΠóáóá òι Ýóìείì ðáéÝóì `net/csup` áðü ççí óóεεíãΠ ðáéÝóùì òìò FreeBSD. Áí èÝéáóá íá ìáóááεüòòðóáóá òι **csup** áðü òíí ðçãáβì εþáééá, ìðñíãáβòá íá ðñóóéíðìεΠóáóá òι `port, net/csup`.

### A.6.3 Ñýèìéóç òìò CVSup

Ç éáéòìòñãá òìò **CVSup** áéÝã÷áóáé áðü Ýíá áñ÷áβì ñòεìβóáùì ðìò éáéáβóáé `supfile`. ÒðÛñ÷ìòí εÛðìεá ððìãáβáíáóá áðü `supfiles` óòìí éáóÛεíñí `/usr/share/examples/cvsup/`.

Ïé ðεçññìòññβáð óòì `supfile` áðáíòìíí ðéð áéüεìðéáð áññòðóáéð áéá òι **CVSup**:

- Δìεá áñ÷áβá èÝéáóá íá εÛááóá;
- Δìεáð áεäüóáéð ðùí áñ÷áβùí èÝéáóá;
- Áðü ðìò èÝéáóá íá óá εÛááóá;
- Δìò èÝéáóá íá óá áðìεçéáÝóáóá óòì ìç÷Ûíçíá óáð;
- Δìò èÝéáóá íá áðìεçéáÝóáóá óá áñ÷áβá éáóÛóóáóçð;

Óóá áðññíáíá òìΠíáóá, éá áçìεíòñãáΠóìòíá Ýíá ðòðééü `supfile` áðáíòìíóáð εÛéá ìεá áðü ðéð áññòðóáéð áðóÝð ìá çç óáéñÛ. Δñðóá, éá ðáñéãñÛðìòíá çç óòñéééΠ áññΠ áíñð `supfile`.

Íá `supfile` áβίáé Ýíá áñ÷áβì éáéíÝñò. Óá ó÷üééá ìáééíÛíá ìá # éáé áðáéóáβñíóáé ùð òι óÝεìò ççð áñáñìðò. Ïé éáíÝð áñáñÝð, éáεþð éáé áðóÝð ðìò ðáñéÝ÷ìòí ìññí ó÷üééá, ááññíóáé.

ËÛéá áñáñìΠ áðü ðéð ððñεéðáð ðáñéãñÛóáé Ýíá óáð áñ÷áβùí óá ìðñíá áðééòìáβ íá εÛááé ì÷ ñΠóóçð. Ç áñáñìΠ ìáééíÛáé ìá òì ùññá ìεáð “óóεεíãΠð”, áíñð εíáεéíÝ áεññòð áðü áñ÷áβá ðìò ìñβááóáé áðü òíí áíððçñáðçòΠ. Óì ùññá ççð óóεεíãΠð áçεþíáé óòìí áíððçñáðçòΠ ðìεá áñ÷áβá áðééòìáβóá. ÏáòÛ òì ùññá ççð óóεεíãΠð, ìðñíãá íá ððÛñ÷ìòí áðü ìçãÝí ùð εÛðìεá ðááβá, óá ìðñíá ðññβáñíóáé ìáðáíÝ òìò ìá éáíÛ áéáóóΠíáóá. Óá ðááβá áðóÛ áðáíòìíí ðéð áññòðóáéð ðìò óÝεçéáí ðáñáðÛñ. ÒðÛñ÷ìòí áÝí ðÝðìε ðááβùí: ðááβá óΠíáíóçð (flags) éáé ðááβá ðéíþí. Íá ðááβì óΠíáíóçð áðìòáéáβóáé áðü ìεá ìññí εÝíç ééáéáβ ð.÷. `delete` Π `compress`. Íá ðááβì ðéíþð ìáééíÛáé áðβóçð ìá ìεá εÝíç ééáéáβ, áééÛ áðòΠ áéññòεáβòá ðññβò ççí ðáñáñáñεΠ éáñíÝ áéáóóΠíáóìò áðü = éáé ìεá ááÝðáñç εÝíç. Áéá ðáñÛááéáíá òì `release=cvs` áðìòáéáβ Ýíá ðááβì ðéíþð.

Íá `supfile` ðòðééÛ éáéññβáéáé ðññò εΠçç ðáñéóóüðáñáð áðü ìβá óóεεíãÝð. Íá ðññòðìò áéá íá áññóáóá Ýíá `supfile` áβίáé íá éáéññβóáóá ùéá óá ó÷áðééÛ ðááβá ðññéóóÛ áéá εÛéá óóεεíãΠ. Ïá òíí ðññòðì áðòü ùòòüóìí òì `supfile` éá éáóáéÛááé áñéáóÝð áñáñÝð éáé éá áβίáé Ûáñεí, áðáéáΠ óá ðáñéóóüðáñá ðááβá áβίáé βáéá áéá ùéáð ðéð óóεεíãÝð ðìò ðáñéÝ÷ìòí óá áðòü. Óì **CVSup** ðáñÝ÷áé Ýíá ìç÷Ûíçíá ðññóçð ðññáðééáñÝññí ðéíþí, þóóá íá áðìòáÝáñíóáé áðóÛ óá ðññáεΠíáóá. Ïé áñáñÝð ðìò ìáééíÛíá ìá òì áéáééü ùññá þáðòü-óóεεíãΠð `*default` ìðññíÝí íá ðñóóéíðìεçéíÝí

αέα ίά ε΄Υοίοι δάαβá οΠιáόçð εάε ðείπí ðá ιðίβá εά ÷ñçόεíηðιεçεíηí ùð ðñíáðέεíáΥð αέα ðεð ððεεíáΥð ðιò supfile ðιò ãñβóεíηíðάε ίáðÛ áðù áððÛ. Ίέα ðñíáðέεááιΥίç ðείπ ιðíñáβ ίá áεεÛíáε áí εάεíñέóðáβ ίáíÛ ίá ίΥά ðείπ ιΥόá ððçí βáέα ðç ððεεíáπ. Ίε ðñíáðέεíáΥð ιðíñηíí áðβóçð ίá áεεÛíοí, π ίá ðñíòáóáεíηí ίΥáð, áÛαεííðáð ðñúòεáðá \*default ðá ιðίεíáπðιòá ççíáβι ιΥόá ðοí supfile.

Άíññβáεíηíðáð ðá ðáñáðÛíù, εά ðñí÷ ùñπóιòιá ðπñá ðçç áññçóçç áíùð supfile αέα επθç εάε áíáíΥúóç ðιò εðñβùð áΥίòñηò ðçááβηò επáεέα αέα ðι FreeBSD-CURRENT.

- Διέα áñ÷áβá ε΄Υεáðá ίá εÛááðá;

Όá áñ÷áβá ðιò áβίáε áεáεΥóεíá ιΥóù ðçð **CVSup** áβίáε ηñááíùíΥίá ðá áεñηòð ðιò íññÛαεíηíðάε “ððεεíáΥð”. Δáñεáñáð ðùí áεáεΥóεíηí ððεεíáπí εá ãñáβðá ðοí áεúεíòεí ðιΠιá. Όοι ðáñÛááεáíá ίáð, εΥεíòιá ίá εÛáηιðá ðι ðεπñáð áΥίòñη ðçááβηò επáεέα ðιò FreeBSD ððóðΠιáòηð. ΌðÛñ÷áε ίέα ίááÛεç ððεεíáπ src-all ç ιðίβá εά ίáð ðççí áπðάε úεç. Όáí ðñπðι áΠιá αέα ðççí áññçóçç ðιò supfile, áðεðð ãñÛοιòιá ðεð ððεεíáΥð, ίβá ðá εÛεá ãñáñπ (ðççí ðáñβððùóç ίáð Υ÷ιðιá ìùíí ίέα ãñáñπ):

```
src-all
```

- Διέαð áεáñóáéð ðùí áñ÷áββι ε΄Υεáðá ίá εÛááðá;

Ίá ðι **CVSup**, ιðíñáβðá ηóεáóðéεÛ ίá εÛááðá ιðίεááπðιòá Υέαíòç ðιò ðçááβηò επáεέα ððπñá ðιòΥ. Άðù áβίáε áðίáðùí áðáεáπ ì áíððçñáðçððð **cvsupd** εάεðιòñááβ áðáðεáβáð áðù ðι CVS repository, ðι ιðίβι ðáñεΥ÷áε úεáð ðεð áεáñóáéð. Άçεπíáðá ðιέα áðù áððÛð ε΄Υεáðá ÷ñçόεíηðιεçεíηíðáð ðá ðááβá ðείπí tag= εάε date=.

**Δñíáεáíðιβçóç:** Έá ðñΥðáε ίá áπðáðá εάεáβðáñç ðñιòι÷π ðοíηí εάεíñέóιù ðùí ðááβùí tag= πððá ίá áβίáε ðùóðÛ. ÈÛðιέα tags áβίáε Υáεðñá ìùíí αέα ððáεáεñεíΥίáð ððεεíáΥð áñ÷áββι. Άí εάεíñβóáðá εáίεáðιΥíí tag (π εÛίáðá ηñεíñáðéεú εÛεíð) ðι **CVSup** εá ðáπðάε áñ÷áβá ðá ιðίβá ðεéáίπð ááí ε΄Υεáðá ίá ðáçððιγí. Άεéεúðáñá, αέα ðççí ððεεíáπ ðùí ports-\*, ÷ñçόεíηðιεçεíηíðáð *ìùíí ðι tag=.*

Όι ðááβι tag= ááβ÷íáε ðñηð Υίá ðοιáηεéεú tag ðοí repository. ΌðÛñ÷ιòι áγíí áβáç tags, ðá tags áεáñóáúí (revision tags) εάε ðá tags εéÛáñι (branch tags). Ίá revision tag áíáðÛñáðáε ðá ίέα ððáεáεñεíΥίç Υέαíòç. Ç ççíáðá ðιò áεáðçñáβðάε βáέα áðù ðç ίέα ιΥñá ðççí Ûεεç. Άðù ðççí Ûεεç, Υίá branch tag, áíáðÛñáðáε ðççí ðáεáððáβá Υέαíòç ίέα ððáεáεñεíΥίçð ãñáñπð ãÛðððιçð, ðá εÛεá ÷ñíεéπ ðéεáπ. Άðáεáπ Υίá branch tag ááí áíáðÛñáðáε ðá εÛðιέα ððáεáεñεíΥίç Υέαíòç, ιðíñáβ áγñεí ίá ççíáβίáε εÛðé áεáññáðéεú áðù ùðé ççíáβίáε ðΠιáñá.

Όοι ΌιΠιá A.7 εá ãñáβðá branch tags ðá ιðίβá ιðíñáβ ίá ðáð áíáεáðÛñηí. ¼ðáí εάεíñβáðá Υίá tag ðοι áñ÷áββι ãðεíβðáúí ðιò **CVSup**, εá ðñΥðáε ðñεí áðù áððù ίá áÛεáðá ðç εΥίç εéáεáβ tag= (áçè. ðι RELENG\_4 εá áβίáε tag=RELENG\_4). Ίá Υ÷áðá ððùðεí ðáð ùðé αέα ðççí ððεεíáπ ðùí Ports, ðι tag=. áβίáε ðι ìùíí Υáεðñι.

**Δñíáεáíðιβçóç:** Ίá áβóðá εάεáβðáñá ðñηòáεðéεúð, πððá ίá ãñÛðáðá ðι tag áεñεáπð ùðùð ðáβίáðáε. Όι **CVSup** ááí ιðíñáβ ίá áεá÷ùñβóáε ίáðáíΥ Υáεðñηí εάε ιç-Υáεðñηí tags. Άí ãñÛðáðá εÛεíð ðι tag, ðι **CVSup** εá ðοιðáñεðáñεáβ ðáí ίá Υ÷áðá áπðáε Υίá Υáεðñηí tag ðι ιðίβι ááí áíáðÛñáðáε ðá εáíΥίá áñ÷áββι. Όðçí ðáñβððùóç áððπ εá áεááñÛðáε ðá ððÛñ÷ιðá áñ÷áβá ðáð ðçááβηò επáεέα.

¼ðáí εάεíñβóáðá εÛðιέí branch tag, ððóεíεíáεéÛ εá εÛááðá ðεð ðáεáððáβáð áεáñóáéð ðùí áñ÷áββι ðιò ððÛñ÷ιòι ðá áððπ ðç ãñáñπ áÛðððιçð. Άí ε΄Υεáðá ίá εÛááðá εÛðιεáð ðáεéúðáñáð áεáñóáéð, ιðíñáβðá ίá ðι εÛίáðá εάεíñβáεíηíðáð ίέα ççíáñçíβá ιΥóù ðιò ðááβηò ðείπí date=. Ç ðáεβáá manual csup(1) áíçááβ ðùð ιðíñáβðá ίá ðι εÛίáðá.

Οι δανάηαιά ιάο, ἀδεοιγία ιά εΰαιοια οι FreeBSD-CURRENT. ΔνιοέΎοιοια ος αναιΠ αδοΠ οοι αν÷Π οιο supfile αν÷αβιο ιάο:

```
*default tag=.
```

ΟδΎν÷άε ιέα οοιαίοεεΠ αέαεεΠ δανβδουοος υοαί αι εαεινβοαοα ιγοα δααβι tag= ιγοα δααβι date=. Οοι δανβδουοος αδοΠ εα εΰααοα οα εαίιέεΎ αν÷αβα RCS αδαοεαβαο αδυ οι CVS repository οιο αιοδχνάοοοΠ, αίοβ αέα ιά εΰααοα εΎοιέα οοαεαεινιγίς Ύεαιοος. Ιε δνιαναιαοεοοΎο ααίεεΎ δνιοειγί αοδυ οιο ονυοι εαεοιοναβαο. Αεαοχνιπιαο δεβναο αίοβαναιοι οιο CVS repository οοα οοοοπιαοα οιοδ Ύ÷ιοι οοι εεαίυοοοα ιά αεΎοιοι οι εοοινεεΎ αεεαπρι εΎεα Ύεαιοοος εαε ιά αιαοΎεοι δαεεϋοαπναο αεαυοαεο ουι αν÷αβυι. Οα δαναοδΎυ δεαιιαεοπιαοα υοουοι Ύ÷ιοι οι εϋοοιο οοο ιαααεγδαοοο ÷νποοο ÷πνιο οοι οεεονυι αβοει.

- Αδυ οιο εΎεαοα ιά οα εΰααοα;

×νχοεινιγία οι δααβι host= αέα ιά οιοι οοι cvsup αδυ οιο ιά εΰααε οεο αιαίποαεο οιο. Ιοιεαπδιοα αδυ οα CVSup mirror sites αβιαε εαοΎεεοι, αι εαε εα δνΎδαε ιά δνιοδαεποαοα ιά αδεεγίαοα εΎοιει οι ιοιβι ιά ανβοεαοαε εριο οαο. Οοι δανάηαιά ιάο, εα ÷νχοεινιγίοιοι ιέα οαίοαοοεεΠ οιοιεαοαβα αεαίπδ οιο FreeBSD, οι cvsup99.FreeBSD.org:

```
*default host=cvsup99.FreeBSD.org
```

Εα δνΎδαε ιά αεεΎιαοα οι host οα εΎοιει οιο δνααιαοεεΎ οδΎν÷άε δνει αεοαεγοαοα οι CVSup. ΕΎεα οινΎ οιο αεοαεαβοα οι cvsup, Ύ÷αοα οοι αοιαουοοα ιά αιαονΎδαοα αδοΠ ος νγελεοος ιγού οοο αναιπδ αίοιεπρι ια οοι αδεειαΠ -h hostname.

- Οιο εΎεαοα ιά οα αδιεοαγοαοα οοι ιο÷Ύοια οαο;

Οι δααβι prefix= αοεπιαε οοοι cvsup οιο ιά αδιεοαγοαε οα αν÷αβα οιο εαηαΎιαε. Οοι δανάηαιά ιάο, εα αΎοιοια οα αν÷αβα οιο δοααβιο επαεεα, αδαοεαβαο οοι εγνει αΎιοι δοααβιο επαεεα, /usr/src. Ι εαοΎειαο src εαυναβοαε αανΎιο αέα οεο οοεειαΎο οιο Ύ÷ιοια αδεεγίαε ιά εΎαοια, εαε Ύοοε ι οοοδυο δνιοαεινεοιυο αβιαε αοδυο οιο οαβιαοαε δαναεΎου:

```
*default prefix=/usr
```

- Οιο εα αδιεοαγοαε οι cvsup οα αν÷αβα εαοΎοοαοοο οιο;

Ι δαεΎοοο CVSup αεαοοναβ εΎοιέα αν÷αβα εαοΎοοαοοο (status files) οα αοδυ οιο αδιεαεαβοαε εαοΎειαο “base”. Οα αν÷αβα αοοΎ αιοιγί οι CVSup ιά εαεοιονααβ δει αοιαοεεΎ εναοπιαο ειααεαοιυ ουι αιαίποαυ οιο Ύ÷οα Παο εΰααε. Εα ÷νχοεινιγίοιοι οιο δνιοδεεααιγνι εαοΎεια base, /var/db:

```
*default base=/var/db
```

Αι ι base εαοΎειαο οαο αι οδΎν÷άε Παο, οβνα αβιαε ιέα εαεΠ οοεαιΠ ιά οιο αιοιεοιναβοαοα. Ο δαεΎοοο cvsup αι εα αεοαεαβοαε αι ι base εαοΎειαο αι οδΎν÷άε.

- ΑεΎοιναο νοειβοαεο αέα οι supfile:

ΟδΎν÷άε αευια ιέα ειεπ αναιΠ νοειβοαυι, ο ιοιβα οοδεεΎ οδΎν÷άε οοι supfile:

```
*default release=cvs delete use-rel-suffix compress
```

Οι release=cvs ααβ÷ιαε υοε ι αιοδχνάοοοδ εα δνΎδαε ιά εΰααε οεο δεονιοιναο οιο ιγού οιο εγνειο CVSup repository οιο FreeBSD. Αοδυ εο÷γαε ο÷ααυι οΎιοα, αεεΎ οδΎν÷ιοι εαε Ύεεαο δεεαίυοοοα οιο ιαοαγαιοι αδυ οιο οειου αδοΠδ οοο οοαποοοοο.

Ο εγίς delete αβιαε αεεαεπιαοα οοι CVSup ιά αεαανΎοαε αν÷αβα. Εα δνΎδαε οΎιοια ιά Ύ÷οα οοι αδεειαΠ αοοΠ, ποα οιο CVSup ιά ιοιναβ ιά εναοποαε οιο αΎιοι οιο δοααβιο οαο επαεεα δεβνυο αιαίανιγνι. Οιο CVSup αβιαε ανεαοΎ δνιοαεοεεΎ ποαα ιά οαπιαε ιυι οα αν÷αβα οιο ανβοεινιοαε οδυ οοι αοεγίς οιο. Αι οο÷υι αΎεαοα Ύιονα αν÷αβα οοιι βαει εαοΎεια, αι εα οα αααβιαε.

Ç áðέεϊάP use-rel-suffix άβίάέ... άñ÷άέϊέϊάέP. Άί ðñάϊάόέέÛ εΎέάόά ίά ίÛέάόά ó÷άόέέÛ ίά άόδPί, άέάáÛόά όç óάέβάά manual cvsup(1). ΆέέεPò, άðεPò ÷ñçóέϊίðϊέPόά όçί, έάέ ίçί άίçόó÷άβδά έέάβδάñά άέά άόδP.

Ç áðέεϊάP compress άίάñάϊðϊέάβ όç ÷ñPόç óðϊðβάόçð όýðϊò gzip óðϊ έάρÛέέ áðέέεϊέϊúίβάð. Άί Ύ÷άόά όýíáάόç άέέόýò όýðϊò T1 P έάέ ðέϊ άñPάñç, ίÛέέϊ άάί έά ðñΎðάέ ίά ÷ñçóέϊίðϊέPόάόά óðϊðβάόç. Óά έέάóïñάόέέP ðάñβðòùóç, έά άίçεPόάέ άίάέñάóέέÛ.

- ¼έάð ίέ áðέέεϊάΎò ίάέβ:

ΆάP άβίάέ òϊ ðεPñάð supfile άέά òϊ ðάñÛάάέάϊά ίάð:

```
*default tag=.
*default host=cvsup99.FreeBSD.org
*default prefix=/usr
*default base=/var/db
*default release=cvsup delete use-rel-suffix compress

src-all
```

### A.6.3.1 Óï Άñ÷άβϊ refuse

¼ðùð άίάóΎñάϊά ðάñάðÛù, òϊ **CVSup** ÷ñçóέϊίðϊέάβ ίΎέϊάϊ *pull*. ΆάόέέÛ άóðù óçίάβίάέ ùðέ óðϊάΎάóðά óðϊί άïðççñάóçðP **CVSup**, άóðùð εΎάέ “ΆóðÛ άβίάέ óά άñ÷άβά ðϊò ίðññάβðά ίά έάóάáÛόάðά άðù ίΎίá..”, έάέ òϊ άέέù óάð ðñùάñάϊά άðάίòÛάέ “ΆίòÛίάέ, έά ðÛñù άóðù, άóðù, άóðù, έάέ άóðù.” Óðçί ðñïáðέέάáïΎίç ñýèìέóç, ί ðάέÛðçð **CVSup** έά ðÛñάέ εÛέά άñ÷άβϊ ðϊò óðíáΎάóάέ ίά όçί óðέεϊάP έάέ òϊ tag ðϊò Ύ÷άόά έάέïñβόάέ óðϊί άñ÷άβϊ ñòèìβόάúí. Ûóðùóí ίðññάβ ίά ίçί òϊ áðέέðïάβðά άóðù ðÛίðά, άέάέέÛ άί óðά÷ññίβάðά óά άΎίðñά doc, ports P www — ίέ ðάñέóóúðάññέ Ûíεñùðϊέ άάί ίðññίýί ίά έέάáÛóíòí óΎóóáñέð P ðΎίðά άεPóóáð έάέ Ύóóέ άάί ÷ñάέÛάðάέ ίά έάóάáÛóíòí άñ÷άβά ðïò άίάóΎñίóάέ άέάέέÛ óά άóðÛð. Άί ÷ñçóέϊίðϊέάβðά òϊ **CVSup** άέά όçί óðέεϊάP ðùί Ports, ίðññάβðά ίά ίáðáñÛόάðά άóðP όç óðïðάñέóïñÛ έάέïñβάέïóáð óðάέάέñέΎίáð óðέεϊάΎð (ð.÷. *ports-astrology*, *ports-biology* άίðβ άέά *ports-all*). Ûóðùóí, áðάέάP óά άΎίðñά doc έάέ www άάί έέάέΎóíòí óðέéïáΎð ÷ñέέóíΎíáð άίÛ άεPóóά, ίðññάβðά ίά ÷ñçóέϊίðϊέPόάόά Ύίá άðù óά άíεέέÛ ÷άñάέðçñέóóέέÛ ðïò **CVSup**: òï άñ÷άβϊ refuse.

Óï άñ÷άβϊ refuse ίðóέάóóέέÛ εΎάέ óðϊ **CVSup** ùðέ άάί ðñΎðάέ ίά ðÛñάέ εÛέά άñ÷άβϊ άðù ίέά óðέεϊάP. Ìά Ûέέά εùάέά, εΎάέ óðϊí ðάέÛðç ίά *áñίçεάβ* óðάέάέñέΎίá άñ÷άβά ðïò ðñïóóΎñάέ ί άïðççñάóçðPð. Óï άñ÷άβϊ refuse ίðññάβ ίά άñάέάβ (P ίά άçïέïòñάçέάβ άί άάί Ύ÷άόά Pάç) óðϊ *base/sup/*. Óï *base* έάέïñβάέðάέ óðϊ *supfile*. Óï άέέù ίάð *base* άβίάέ óðϊ */var/db*, òϊ ίðññί óçίάβίάέ ùðέ òϊ ðñïáðέέάáïΎίί άñ÷άβϊ refuse έά άβίάέ òϊ */var/db/sup/refuse*.

Óï άñ÷άβϊ refuse Ύ÷άέ έέάάβðάñά άðεP ïñòP. ΆðεPð ðάñέΎ÷άέ óά ίíúíáóά ðùί άñ÷άβñí έάέ έάóάέúáúí óά ίðññά άάί áðέέðïάβðά ίά έάóάáÛόáðά. Άέά ðάñÛάάέάϊά, άί άάί ίέέÛóά άεPóóáð áέðùð άðù ΆάέέέÛ έάέ εβάά ΆάññίáέέÛ, έάέ άάί áέóέÛίáóóά όçί άίÛάέç ίά έέάáÛόáðά όçί ΆάññίáέέP ίáðÛóñάóç όçð ðάέïçññβùóçð, ίðññάβðά ίά áÛέάðά óά áέúεïòεά óðϊ άέέù óáð άñ÷άβϊ refuse:

```
doc/bn_*
doc/da_*
doc/de_*
doc/el_*
doc/es_*
doc/fr_*
doc/it_*
doc/ja_*
doc/nl_*
doc/no_*
doc/pl_*
```



Ὁ δῆλον ὅτι ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS.

Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS.

### A.6.5 Ὁ δῆλον ὅτι ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS

Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS.

Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS.

```
cvs-all release=cvs
```

Ὁ ἐξωτερικὸς CVS repository τοῦ FreeBSD, ὅπου ἀναβίωσιν τὸν ἀνάπτυξη τοῦ FreeBSD.

```
distrib release=cvs
```

Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS.

```
doc-all release=cvs
```

Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS.

```
ports-all release=cvs
```

Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS.

**Ὁ δῆλον ὅτι ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS:** Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS.

**Ὁ δῆλον ὅτι ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS:** Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS. Ἡ ἀνάπτυξη τοῦ FreeBSD ἀπαιτεῖται ἡ ἀνάπτυξη τοῦ CVS.

ports-accessibility release=cvs

Ëñáéòìéèü áéá òçì áìÐèáéá ÷ ñçóóþì ìá áíáðçñßàð.

ports-arabic release=cvs

ÕðìóðÐñéìç ΆñάáééÐð Æëþóáð.

ports-archivers release=cvs

Άñάáéáßá áðìèÐèáòóçò éáé óòìðßáóçò.

ports-astro release=cvs

Ports ó÷áòééÛ ìá áóðñìíñßá.

ports-audio release=cvs

ÕðìóðÐñéìç Ð÷ì.

ports-base release=cvs

ΆάóééÛ άñ÷áßá òùì ports áéá òðìóðÐñéìç òìò óóóðÐíáðìò ìáðááëþòðéóçò. ÁéÛòìñá άñ÷áßá ðìò άñßóéìííóáé óòìòð òðìéáðáëüäìòð Mk/ éáé Tools/ òìò /usr/ports.

**Όçιάßυόç:** Ðάñáéáéìγìá äáßðà òçì óçìáíðééèÐ ðñìáéáìðìßçóç ðáñáðÛìù: éá ðñÝðáé ðÛìòìðá ìá áìçìáñþìáðá áóðÐ òçì òðìóðééìãÐ, ùðáí áìçìáñþìáðá ìðìéìãÐðìðá òìÞìá òçò óðééìãÐò Ports òìò FreeBSD.

ports-benchmarks release=cvs

ÐñìáñÛìíáðá ìÝòñçóçò áðüäìóçò (Benchmarks).

ports-biology release=cvs

Άέìéìãßá.

ports-cad release=cvs

Άñáéáßá ó÷ááßáóçò ìá òç áìÐèáéá òðìéìáéóðÐ.

ports-chinese release=cvs

ÕðìóðÐñéìç ÊéìáæééÐð Æëþóáð.

ports-comms release=cvs

Ëñáéòìéèü áðéééìííéÞì.

ports-converters release=cvs

Ìáðáóñìðáßð ÷ άñáéðÐñìí.

ports-databases release=cvs

ΆÛóáεδ ΆääñÝíιι.

ports-deskutils release=cvs

Άίóεέάβιáíá δϊõ ânβóεήóáí óóιβèùð óá Ýíá ãñáðáβι δñεί óçí ãðáýñáóç òιι òðτèτáεóðí.

ports-devel release=cvs

ΆίçεçóééÛ δñññÛñíáóá áéá óçí áíÛððóιç ειαέóιέêý.

ports-dns release=cvs

Ëíäéóιέéü ó÷áóééü íá DNS.

ports-editors release=cvs

ÓóíóÛêðáð èáéíÝíñ.

ports-emulators release=cvs

ΆññιέóÝð Ûεéùí εάέóιòñáέêπí óðóóçιÛòιι.

ports-finance release=cvs

×ñçíáóñééññééÛ δñññÛñíáóá.

ports-ftp release=cvs

ΔñññÛñíáóá FTP (ðáéÛðáð èáé áιððçñáðóçôÝð).

ports-games release=cvs

Δáé÷íβáéá.

ports-german release=cvs

Õðίóóβñéιç Άññíáíέéβð ãêβóóáð.

ports-graphics release=cvs

Άññáéääβá ãñáóéêπí.

ports-hebrew release=cvs

Õðίóóβñéιç áññáúíêβð ãêβóóáð.

ports-hungarian release=cvs

Õðίóóβñéιç ÌöääñÝæéçð ãêβóóáð.

ports-irc release=cvs

ΔñññÛñíáóá ãéá òι IRC.

ports-japanese release=cvs

Õðίóóβñéιç Éáðιíέéβð ãêβóóáð.

ports-java release=cvs

Άñååååáá åέά ðçϊ Java.

ports-korean release=cvs

Õðϊóðϐñέιç Êïñååóέêϐð åêϐóóáð.

ports-lang release=cvs

Άêϐóóåð ðñïñåñïïåóέóïñύ.

ports-mail release=cvs

Ðñïñåñïïåóå çååóðñïñέέïñ ðá÷ ðåññïñåβïð.

ports-math release=cvs

Ëïåέóïέέü ïåççïåóέέêϐï ððïñïåέóïêϐï.

ports-mbone release=cvs

ΆóåññåÝð MBone.

ports-misc release=cvs

ÄéÛóïñå åïççέóέéÛ ðñïñåñïïåóå.

ports-multimedia release=cvs

Ëïåέóïέέü ðïέóïÝóóïí.

ports-net release=cvs

Ëïåέóïέέü åέéðýñïí.

ports-net-im release=cvs

Ëïåέóïέέü Ûïåóóïí ïççïðïÛðóñ (instant messaging).

ports-net-mgmt release=cvs

Ëïåέóïέέü åέá÷åβñέóçð åέéðýñïí.

ports-net-p2p release=cvs

Äέéðýñïðçç peer-to-peer.

ports-news release=cvs

Ëïåέóïέέü åέá ðï USENET.

ports-palm release=cvs

Ëïåέóïέέü åέá ðçϊ ððïóðϐñέιç ðóóέåðêϐï ðýðïð Palm™.

ports-polish release=cvs

Õðïóðϐñέιç Ðïñïñέέêϐð åêϐóóáð.

ports-ports-mgmt release=cvs

Άñάέάβά áέά òç áέά÷άβñέóç ðáéÝòùí éέέ ports.

ports-portuguese release=cvs

ÕðϊóðÞñéιç Ðñïíááέέèðð ãèþóóáð.

ports-print release=cvs

Ëíãέóιέéü áéðððòáùí.

ports-russian release=cvs

ÕðϊóðÞñéιç Ñùóέέèðð ãèþóóáð.

ports-science release=cvs

ΆðέóðçìíέέÛ ðñññÛííáóά.

ports-security release=cvs

Άñάέάβά áóóάέάβáð.

ports-shells release=cvs

Shells áέά òçí ãñáìÞ áίðìèþí.

ports-sysutils release=cvs

ΆίçèçóέέÛ ðñññÛííáóά óóóðÞíáòìð.

ports-textproc release=cvs

Άñάέάβά áðáíñááóβáð éáéíÝíò (ááí ðáñέέáíáÛíáέ áðέóñáðÝæέά ðððññáöβá).

ports-ukrainian release=cvs

ÕðϊóðÞñéιç Ìðèñáíέέèðð ãèþóóáð.

ports-vietnamese release=cvs

ÕðϊóðÞñéιç ÁέάóίáíÝæέέçð ãèþóóáð.

ports-www release=cvs

Ëíãέóιέéü ðìò ó÷άðβæáðάέ íá ðñí ðááέüóιέí έóóü (World Wide Web).

ports-x11 release=cvs

Ports áέά òðϊóðÞñéιç òìò óóóðÞíáòìð X Windows.

ports-x11-clocks release=cvs

Ñíèüíáέά áέά òϊ X11.

ports-x11-drivers release=cvs

ÐñññÛííáóά ïáÞççóçð áέά ðά X11.

ports-x11-fm release=cvs

Άέá ÷ áέñέóðÝò áñ ÷ áβùí áέá óά X11.

ports-x11-fonts release=cvs

ΆñáìáðìóáέñÝò èάέ άñåáέåáá άñáìáðìóáέñþí áέá X11.

ports-x11-toolkits release=cvs

ΆñåáέάέìèÐéåð X11.

ports-x11-servers release=cvs

ΆíðçñåòçóÝò X11.

ports-x11-themes release=cvs

ÈÝíáóά áέá X11.

ports-x11-wm release=cvs

Άέá ÷ áέñέóðÝò ðåñåýññìí (window managers) áέá X11.

projects-all release=cvs

Ðçååβìð èþåέáð áέá ðì projects repository ðìò FreeBSD.

src-all release=cvs

Ì ááóέéùð ðçååβìð èþåέá ðìò FreeBSD, óðìðåñέáíááíñÝíò ðìò èþåέá èñððìåñåðβåð.

src-base release=cvs

ΆέÛìñå áñ ÷ áβå óòçí èìñðð ðìò /usr/src.

src-bin release=cvs

Άñåáέåáá ðìò ðέåáííí íá áðåóìíýíóáέ óå èáóÛóóáóç èåóììñåáð áíñð ÷ ñþóç (single-user) (/usr/src/bin).

src-cddl release=cvs

Άñåáέåáá èάέ áέåέέìèÐéåð ðìò èáέýððìíóáέ áðñ óçí Ûååáá ÷ ñþóç CDDL (/usr/src/cddl).

src-contrib release=cvs

Άñåáέåáá èάέ áέåέέìèÐéåð ðìò ååí áíÐéìíí óðì FreeBSD Project, èάέ óå ìðìβå ÷ ñçóέììðìέíýíóáέ ìðóέáóóέÛ áíåέììβùðå (/usr/src/contrib).

src-crypto release=cvs

Άñåáέåáá èάέ áέåέέìèÐéåð èñððìåñåðçóç ðìò ååí áíÐéìíí óðì FreeBSD project èάέ óå ìðìβå ÷ ñçóέììðìέíýíóáέ ìðóέáóóέÛ áíåέììβùðå (/usr/src/crypto).

```

src-eBones release=cvs
 Kerberos êáé DES (/usr/src/eBones). Άάι ÷ ñçóéïñðιέρύιόάé óóéð ðñÝ ÷ ïðóâð âéäüóáéð ðιϑ
 FreeBSD.

src-etc release=cvs
 Άñ ÷ âβά ñðèìβóâüí ðιϑ óðóðΠιáðιð (/usr/src/etc).

src-games release=cvs
 Δάé ÷ íβâéá (/usr/src/games).

src-gnu release=cvs
 Άñâéâβá ðιϑ êäéýððιύιόάé áðü ðçí Ûääéá ÷ ñΠóçð GNU Public License (/usr/src/gnu).

src-include release=cvs
 Άñ ÷ âβá áðééâðáéβâüí (/usr/src/include).

src-kerberos5 release=cvs
 ΔάéÝðι áóóâéâβâð Kerberos5 (/usr/src/kerberos5).

src-kerberosIV release=cvs
 ΔάéÝðι áóóâéâβâð KerberosIV (/usr/src/kerberosIV).

src-lib release=cvs
 ΆéâééìèΠéâð (/usr/src/lib).

src-libexec release=cvs
 ΔñññÛññáóá óðóðΠιáðιð óá ïðιβά ððóéτειαééÛ âéðâιέρύιόάé áðü Ûééá ðñññÛññáóá
 (/usr/src/libexec).

src-release release=cvs
 Άñ ÷ âβá ðιϑ áðáéðιύιόάé äéá ðçí ðáñáâüâΠ ιéâð Ýéäüóçð ðιϑ FreeBSD (/usr/src/release).

src-rescue release=cvs
 ΔñññÛññáóá ïá óðáðéèèΠ ïáðáâèβððéóç äéá ÷ ñΠóç óá Ýéðáéðâð ðáñéððβóâéð áðáíáðññÛð ðιϑ
 óðóðΠιáðιð. Άâβôâ ðι rescue(8) (/usr/src/rescue).

src-sbin release=cvs
 Άñâéâβá óðóðΠιáðιð äéá éâéðιññâβá óá éáðÛóðáóç áñüð ÷ ñΠóçð (single user mode)
 (/usr/src/sbin).

src-secure release=cvs
 ΆéâééìèΠéâð êáé áñιéÝð êñðððιññÛçççð (/usr/src/secure).

src-share release=cvs
 Άñ ÷ âβá óá ïðιβά ïðñâβ ïá âβιáé èτíÛ áíÛññáóá óá ðιééáðéÛ óðóðΠιáðιá (/usr/src/share).

```

src-sys release=cvs

Ï ððñÞιάð (/usr/src/sys).

src-sys-crypto release=cvs

ËÞáέέάð êñðððιãñáððð òιϑ ððñÞιά (/usr/src/sys/crypto).

src-tools release=cvs

ΆËÛοιñά ãñáέέάßá ãέά òç òðιðñçðç òιϑ FreeBSD (/usr/src/tools).

src-usrbin release=cvs

Άñáέέάßá ÷ñÞðç (/usr/src/usr.bin).

src-usrsbin release=cvs

Άñáέέάßá òðððÞιάðιð (/usr/src/usr.sbin).

www release=cvs

Ï ðçãáβιð êÞáέέάð ãέά òçι òιðιέάðßá WWW òιϑ FreeBSD.

distrib release=self

Ôά ãñ÷áßá ñðèιβóáñι òιϑ βáειϑ òιϑ ãιððçñáðçðÞ **CVSup**. ×ñçðέιðιέáβðáέ áðυ **CVSup** mirror sites.

gnats release=current

Η áÛðç ãáãñÝíιι òιϑ òðððÞιάðιð ðãñáέειγέçðç ðñιáεçιÛòιι GNATS.

mail-archive release=current

Ôά ãñ÷áßá òçð èβððáð ðá÷ðãññáβιð òιϑ FreeBSD.

www release=current

Ðñι-áðãáññááðιÝíá ãñ÷áßá òçð áέέððáέÞð òιðιέάðßáð (WWW) òιϑ FreeBSD (ü÷έ Ï ðçãáβιð êÞáέέάð). ×ñçðέιðιέáβðáέ áðυ WWW mirror sites.

## A.6.6 Άέá Ðãñέóððãñàð Ðεçñιòιñßàð

Άέá òι FAQ òιϑ **CVSup** έάέ Ûεεãð ðεçñιòιñßàð ò÷áðέέÛ ìá áððυ, ãáβðá òç Ôáέβáá òιϑ CVSup (<http://www.cvsup.org>).

ÔðæçðÞðáέð ò÷áðέέÛ ìá òç ÷ñÞðç òιϑ **CVSup** òðι FreeBSD έáιáÛíιι ÷Þñá òççι çêãèðñιέέÞ èβððá ðá÷ιέêÞι òðæçðÞðáñι òιϑ FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-hackers>). Ôç èβððá áððÞ, έάεÞð έάέ òççι çêãèðñιέέÞ èβððá áίáέιέÞðáñι òιϑ FreeBSD (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-announce>) áίáέιέÞñιðáέ έάέ ιέ ιÝãð áεãυíðáέð òιϑ ðñιãñÛìáðιð.

Άέá ãñððÞðáέð Þ áίáòιñÝð òðáέιÛðιι ò÷áðέέÛ ìá òι **CVSup** ñβιðá ìέá ìáðέÛ òðι CVSup FAQ (<http://www.cvsup.org/faq.html#bugreports>).



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)
- [cvsup5.de.FreeBSD.org](http://cvsup5.de.FreeBSD.org)
- [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)
- [cvsup2.se.FreeBSD.org](http://cvsup2.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)
- [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)
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- [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](http://cvsup18.us.FreeBSD.org)

## A.7 ΆòééÝòò (Tags) ãéά òϊ CVS

¼óáí éάóääÜæάð Þ áíáíáβίάðά òϊí ðçääβί έβæéά ìÝóù òçð **cv**s ç òçð **CVSup**, èά ðñÝðáé íá éάèññβóάðά íéά άðééÝóά Ýéäïçð (revision tag). Íá revision tag áíáóÝñάðáé άβóά óά íéά óðæéêñéíÝίç ðñάβά áíÜðððίçð ðïò FreeBSD, άβóά óά Ýíá óðæéêñéíÝίí ÷ñííéèù óçíáβí. Í ðñβòò òýðò ìñÜæάðáé “άðééÝóά èèÜäïò (branch tag)”, éάé ì ääýðάñíò ìñÜæάðáé “άðééÝóά Ýéäïçð (release tag)”.

### A.7.1 ΆðééÝòò ÈèÜäïí (Branch Tags)

¼éäð áðóÝð, ìά òçí άíάβñάóç òïò HEAD (òí ìðíβí άβίάé ðÜíóά Ýæéðñç άðééÝóά), éó÷-ýíòí ìüíí áéά òí äÝíòñí src/. Óά äÝíòñά ports/, doc/, éάé www/ äáí Ý-íòí èèÜäïò.

#### HEAD

Ðñüèæéðáé áéά òí óðíäíééèù ìñíά òçð éýñéάð ãñáñðð áíÜðððίçð, Þ FreeBSD-CURRENT. Άβίáé άðβóçð òí ðñíäðéèääìÝíí tag áí äáí éάèññéóðάβ èÜðíéí óðæéêñéíÝίí revision.

Óòí **CVSup**, òí tag áðòü áíðéðñíóùðäýáðáé áðü íéά . (ääí ðñüèæéðáé áéά óçíáβí óðβίçð òçð ðñüðáóçð, áèèÜ áéά òíí ðñáñíáðéèù ÷áñáèðñά .).

**Óçíáβùóç:** Óòí CVS, áðòÞ άβίáé éάé ç ðñíäðéèíäÞ áí äáí éάèññéóðάβ revision tag. ÓòíÞèùð äáí άβίáé éάèÞ éäÝá íá èÜíáðά checkout éάé áíáíÝúóç òðíí ðçääβí έβæéά ðïò CURRENT óά Ýíá ìç÷-Üίçιά STABLE, áèòüð áí áðòÞ άβίáé ðñáñíáðéèèÜ ç ðñüèæéðç óáð.

#### RELENG\_8

Ç ãñáñÞ áíÜðððίçð áéά òí FreeBSD-8.X, äíùððÞ άðβóçð éάé ùð FreeBSD 8-STABLE

#### RELENG\_8\_0

Ç ãñáñÞ Ýéäïçð ðïò FreeBSD-8.0, ÷ñçóéñíðíéάβðáé ìüíí áéά áíçíáñÞóáéð áóóáéάβáð éάé Üèèäð èñβóéíäð äéíñèÞóáéð.

#### RELENG\_7

Ç ãñáñÞ áíÜðððίçð áéά òí FreeBSD-7.X, äíùððÞ άðβóçð éάé ùð FreeBSD 7-STABLE

#### RELENG\_7\_3

Ç ãñáñÞ Ýéäïçð ðïò FreeBSD-7.3, ÷ñçóéñíðíéάβðáé ìüíí áéά áíçíáñÞóáéð áóóáéάβáð éάé Üèèäð èñβóéíäð äéíñèÞóáéð.

#### RELENG\_7\_2

Ç ãñáñÞ Ýéäïçð ðïò FreeBSD-7.2, ÷ñçóéñíðíéάβðáé ìüíí áéά áíçíáñÞóáéð áóóáéάβáð éάé Üèèäð èñβóéíäð äéíñèÞóáéð.

#### RELENG\_7\_1

Ç ãñáñÞ Ýéäïçð ðïò FreeBSD-7.1, ÷ñçóéñíðíéάβðáé ìüíí áéά áíçíáñÞóáéð áóóáéάβáð éάé Üèèäð èñβóéíäð äéíñèÞóáéð.

RELENG\_7\_0

Ç ãñáìÞ Ýêäïçò ðïò FreeBSD-7.0, ÷ñçóεïïðïéάβòάé ìüñí ãéά áñçìáñÞðóáéð áóòάéάβáð èáé Üεéáð êñβóεìáð äéìñèÞðóáéð.

RELENG\_6

Ç ãñáìÞ áíÜðòðïçò ãéά ðï FreeBSD-6.X, áíüóòÞ áðβóçð èáé ùò FreeBSD 6-STABLE

RELENG\_6\_4

Ç ãñáìÞ Ýêäïçò ðïò FreeBSD-6.4, ÷ñçóεïïðïéάβòάé ìüñí ãéά áñçìáñÞðóáéð áóòάéάβáð èáé Üεéáð êñβóεìáð äéìñèÞðóáéð.

RELENG\_6\_3

Ç ãñáìÞ Ýêäïçò ðïò FreeBSD-6.3, ÷ñçóεïïðïéάβòάé ìüñí ãéά áñçìáñÞðóáéð áóòάéάβáð èáé Üεéáð êñβóεìáð äéìñèÞðóáéð.

RELENG\_6\_2

Ç ãñáìÞ Ýêäïçò ðïò FreeBSD-6.2, ÷ñçóεïïðïéάβòάé ìüñí ãéά áñçìáñÞðóáéð áóòάéάβáð èáé Üεéáð êñβóεìáð äéìñèÞðóáéð.

RELENG\_6\_1

Ç ãñáìÞ Ýêäïçò ðïò FreeBSD-6.1, ÷ñçóεïïðïéάβòάé ìüñí ãéά áñçìáñÞðóáéð áóòάéάβáð èáé Üεéáð êñβóεìáð äéìñèÞðóáéð.

RELENG\_6\_0

Ç ãñáìÞ Ýêäïçò ðïò FreeBSD-6.0, ÷ñçóεïïðïéάβòάé ìüñí ãéά áñçìáñÞðóáéð áóòάéάβáð èáé Üεéáð êñβóεìáð äéìñèÞðóáéð.

RELENG\_5

Ç ãñáìÞ áíÜðòðïçò ãéά ðï FreeBSD-5.X, áíüóòÞ áðβóçð ùò FreeBSD 5-STABLE.

RELENG\_5\_5

Ç ãñáìÞ Ýêäïçò ðïò FreeBSD-5.5, ÷ñçóεïïðïéάβòάé ìüñí ãéά áñçìáñÞðóáéð áóòάéάβáð èáé Üεéáð êñβóεìáð äéìñèÞðóáéð.

RELENG\_5\_4

Ç ãñáìÞ Ýêäïçò ðïò FreeBSD-5.4, ÷ñçóεïïðïéάβòάé ìüñí ãéά áñçìáñÞðóáéð áóòάéάβáð èáé Üεéáð êñβóεìáð äéìñèÞðóáéð.

RELENG\_5\_3

Ç ãñáìÞ Ýêäïçò ðïò FreeBSD-5.3, ÷ñçóεïïðïéάβòάé ìüñí ãéά áñçìáñÞðóáéð áóòάéάβáð èáé Üεéáð êñβóεìáð äéìñèÞðóáéð.

RELENG\_5\_2

Ç ãñáìÞ Ýêäïçò FreeBSD-5.2 èáé FreeBSD-5.2.1, ÷ñçóεïïðïéάβòάé ìüñí ãéά áñçìáñÞðóáéð áóòάéάβáð èáé Üεéáð êñβóεìáð äéìñèÞðóáéð.

RELENG\_5\_1

Ç ãñáñìÞ Ýêáιόçð ãέά ðϊ FreeBSD-5.1, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.

RELENG\_5\_0

Ç ãñáñìÞ Ýêáιόçð ãέά ðϊ FreeBSD-5.0, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.

RELENG\_4

Ç ãñáñìÞ áíÜððóιçð ãέά ðϊ FreeBSD-4.X, áíυóòÞ áðβóçð èάέ υò FreeBSD 4-STABLE.

RELENG\_4\_11

Ç ãñáñìÞ Ýêáιόçð ãέά ðϊ FreeBSD-4.11, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.

RELENG\_4\_10

Ç ãñáñìÞ Ýêáιόçð ãέά ðϊ FreeBSD-4.10, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.

RELENG\_4\_9

Ç ãñáñìÞ Ýêáιόçð ãέά ðϊ FreeBSD-4.9, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.

RELENG\_4\_8

Ç ãñáñìÞ Ýêáιόçð ãέά ðϊ FreeBSD-4.8, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.

RELENG\_4\_7

Ç ãñáñìÞ Ýêáιόçð ãέά ðϊ FreeBSD-4.7, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.

RELENG\_4\_6

Ç ãñáñìÞ Ýêáιόçð ãέά ðá FreeBSD-4.6 èάέ FreeBSD-4.6.2, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.

RELENG\_4\_5

Ç ãñáñìÞ Ýêáιόçð ãέά ðϊ FreeBSD-4.5, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.

RELENG\_4\_4

Ç ãñáñìÞ Ýêáιόçð ãέά ðϊ FreeBSD-4.4, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.

RELENG\_4\_3

Ç ãñáñìÞ Ýêáιόçð ãέά ðϊ FreeBSD-4.3, ÷ñçόέιιðιέάβðάέ ιυíí ãέά ãέά áιçìáñþðάέð áóöáέáβáð èάέ Üέέáð èñβóέιáð áέιñèþðάέð.



RELENG\_5\_5\_0\_RELEASE

FreeBSD 5.5

RELENG\_5\_4\_0\_RELEASE

FreeBSD 5.4

RELENG\_4\_11\_0\_RELEASE

FreeBSD 4.11

RELENG\_5\_3\_0\_RELEASE

FreeBSD 5.3

RELENG\_4\_10\_0\_RELEASE

FreeBSD 4.10

RELENG\_5\_2\_1\_RELEASE

FreeBSD 5.2.1

RELENG\_5\_2\_0\_RELEASE

FreeBSD 5.2

RELENG\_4\_9\_0\_RELEASE

FreeBSD 4.9

RELENG\_5\_1\_0\_RELEASE

FreeBSD 5.1

RELENG\_4\_8\_0\_RELEASE

FreeBSD 4.8

RELENG\_5\_0\_0\_RELEASE

FreeBSD 5.0

RELENG\_4\_7\_0\_RELEASE

FreeBSD 4.7

RELENG\_4\_6\_2\_RELEASE

FreeBSD 4.6.2

RELENG\_4\_6\_1\_RELEASE

FreeBSD 4.6.1

RELENG\_4\_6\_0\_RELEASE

FreeBSD 4.6

RELENG\_4\_5\_0\_RELEASE

FreeBSD 4.5

RELENG\_4\_4\_0\_RELEASE

FreeBSD 4.4

RELENG\_4\_3\_0\_RELEASE

FreeBSD 4.3

RELENG\_4\_2\_0\_RELEASE

FreeBSD 4.2

RELENG\_4\_1\_1\_RELEASE

FreeBSD 4.1.1

RELENG\_4\_1\_0\_RELEASE

FreeBSD 4.1

RELENG\_4\_0\_0\_RELEASE

FreeBSD 4.0

RELENG\_3\_5\_0\_RELEASE

FreeBSD-3.5

RELENG\_3\_4\_0\_RELEASE

FreeBSD-3.4

RELENG\_3\_3\_0\_RELEASE

FreeBSD-3.3

RELENG\_3\_2\_0\_RELEASE

FreeBSD-3.2

RELENG\_3\_1\_0\_RELEASE

FreeBSD-3.1

RELENG\_3\_0\_0\_RELEASE

FreeBSD-3.0

RELENG\_2\_2\_8\_RELEASE

FreeBSD-2.2.8

RELENG\_2\_2\_7\_RELEASE

FreeBSD-2.2.7



### Ïëëáíãá

rsync://ftp.nl.FreeBSD.org/

ÄéàèÝóεíãð ÓðëëĩãÝð:

- FreeBSD: ΔëÞñãð mirror ôïð äéáêñéóðÞ FTP ôïð FreeBSD.

### Ñùóá

rsync://ftp.mtu.ru/

ÄéàèÝóεíãð ÓðëëĩãÝð:

- FreeBSD: ΔëÞñãð mirror ôïð äéáêñéóðÞ FTP ôïð FreeBSD.
- FreeBSD-gnats: Ç âÛóç äãññÝíúí ôïð óóóðÞíáôïð ðãñãêëĩëĩççóçð óóãëìÛðúí GNATS.
- FreeBSD-Archive: Mirror ôïð äéáêñéóðÞ FTP ðãéáéúðãññúí äéäüóãúí (archive) ôïð FreeBSD.

### ÔáÄãÛí

rsync://ftp.tw.FreeBSD.org/

rsync://ftp2.tw.FreeBSD.org/

rsync://ftp6.tw.FreeBSD.org/

ÄéàèÝóεíãð ÓðëëĩãÝð:

- FreeBSD: ΔëÞñãð mirror ôïð äéáêñéóðÞ FTP ôïð FreeBSD.

### ÇíúìÝíí Äáóβããéí

rsync://rsync.mirrorservice.org/

ÄéàèÝóεíãð ÓðëëĩãÝð:

- sites/ftp.freebsd.org: ΔëÞñãð mirror ôïð äéáêñéóðÞ FTP ôïð FreeBSD.

### ÇíúìÝíãð Δĩëéóãβãð ÁíãñέÞð

rsync://ftp-master.FreeBSD.org/

Ï äéáêñéóðÞð áððüð ìðĩñãβ íá ÷ ñçóεíðĩéçèãβ ìúíí áðü êýñéá mirror sites ôïð FreeBSD.

ÄéàèÝóεíãð ÓðëëĩãÝð:

- FreeBSD: Το êýñéí (master) óýóççιά áñ÷ãβúí ôïð äéáêñéóðÞ FTP ôïð FreeBSD.
- acl: Ç êýñéá êβóðá ACL ôïð FreeBSD.

rsync://ftp13.FreeBSD.org/

ÄéàèÝóεíãð ÓðëëĩãÝð:

- FreeBSD: Δèβñåò mirror ðìò äéáêñéóðP FTP ðìò FreeBSD.

# Ἐὰν Ὑπόθεσις Β. Ἀεὶ ἐπιβάλλεται

Αἱ εἰς τὰς ἀπὸ τῶν βιβλίων ἀναφερόμεναι εἰς τὸν ἄρθρον τοῦ FreeBSD ἐπισημασθεῖσαι ὁμοίως, ἢ ἐπισημασθεῖσαι ὡς ἐπισημασθεῖσαι, ἢ ἐπισημασθεῖσαι ὡς ἐπισημασθεῖσαι. Ἐὰν ὁμοίως, ἀπὸ τῶν βιβλίων ἀναφερόμεναι εἰς τὸν ἄρθρον τοῦ FreeBSD ἐπισημασθεῖσαι ὡς ἐπισημασθεῖσαι.

## B.1 Ἀεὶ ἐπιβάλλεται ὁμοίως ἐπισημασθεῖσαι ἐπισημασθεῖσαι

*Ἀεὶ ἐπιβάλλεται ὁμοίως ἐπισημασθεῖσαι:*

- Using FreeBSD (<http://jdl.tw.FreeBSD.org/publication/book/freebsd2/index.htm>) (ὁμοίως ἐπισημασθεῖσαι).
- FreeBSD Unleashed (Ἐπισημασθεῖσαι ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς China Machine Press (<http://www.hzbook.com/>). ISBN 7-111-10201-0.
- FreeBSD From Scratch First Edition (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς China Machine Press. ISBN 7-111-07482-3.
- FreeBSD From Scratch Second Edition (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς China Machine Press. ISBN 7-111-10286-X.
- FreeBSD Handbook Second Edition (Ἐπισημασθεῖσαι ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς Posts & Telecom Press (<http://www.ptpress.com.cn/>). ISBN 7-115-10541-3.
- FreeBSD 3.x Internet (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς Tsinghua University Press (<http://www.tup.tsinghua.edu.cn/>). ISBN 7-900625-66-6.
- FreeBSD & Windows (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς China Railway Publishing House (<http://www.tdpress.com/>). ISBN 7-113-03845-X
- FreeBSD Internet Services HOWTO (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς China Railway Publishing House. ISBN 7-113-03423-3
- FreeBSD for PC 98'ers (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς SHUWA System Co, LTD. ISBN 4-87966-468-5 C3055 P2900E.
- FreeBSD (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς CUTT. ISBN 4-906391-22-2 C3055 P2400E.
- Complete Introduction to FreeBSD (<http://www.shoeisha.com/book/Detail.asp?bid=650>) (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς 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>) (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς ASCII (<http://www.ascii.co.jp/>). ISBN 4-7561-1733-3 P3000E.
- FreeBSD Handbook (Ἐπισημασθεῖσαι ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς ASCII (<http://www.ascii.co.jp/>). ISBN 4-7561-1580-2 P3800E.
- FreeBSD mit Methode (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς 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>) (ὁμοίως ἐπισημασθεῖσαι), ἐπισημασθεῖσαι ἀπὸ τῆς 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>) (όόά Ἄñîáíééῤ), äêäüèçêá áðü ôçí Computer und Literatur Verlag (<http://www.cul.de>), 2003. ISBN 3-936546-06-1.
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- Onno W Purbo, Dodi Maryanto, Syahrial Hubbany, Widjil Widodo *Building Internet Server with FreeBSD* (<http://maxwell.itb.ac.id/>) (όόçí Éíäíçóéáêῤ äëþóóá), äêäüèçêá áðü ôçí Elex Media Komputindo (<http://www.elexmedia.co.id/>).
- Absolute BSD: The Ultimate Guide to FreeBSD (ἰãðῤñáóç óá Δáñáäíróéáêῤ ÊéíÝæééá), äêäüèçêá áðü ôçí GrandTech Press (<http://www.grandtech.com.tw/>), 2003. ISBN 986-7944-92-5.
- The FreeBSD 6.0 Book (<http://www.twbsd.org/cht/book/>) (όá Δáñáäíróéáêῤ ÊéíÝæééá), äêäüèçêá áðü ôçí Drmaster, 2006. ISBN 9-575-27878-X.

Ἄéäüβá & δáñéüééῤ óôçí Ἄäñééêῤ äëþóóá:

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- FreeBSD: An Open-Source Operating System for Your Personal Computer (<http://andrsn.stanford.edu/FreeBSD/introbook/>), äêäüèçêá áðü ôçí The Bit Tree Press, 2001. ISBN: 0971204500
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Ïéá ÉðáééêÞ ìáðÛðñάόç ([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)) áððíý ðïð éáèÏÝññò äéάðβèáðáé ùð ìÝññò 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.
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(Ôï êäöÛéáéí 2 áðü áðöü òï áéâëβï äéáðβèäðáé online  
([http://www.FreeBSD.org/doc/e1\\_GR.ISO8859-7/books/design-44bsd/book.html](http://www.FreeBSD.org/doc/e1_GR.ISO8859-7/books/design-44bsd/book.html)) ùò ìÝñïð òïö FreeBSD Documentation Project, êáé òï êäöÛéáéí 9 ääþ ([http://www.netapp.com/tech\\_library/nfsbook.html](http://www.netapp.com/tech_library/nfsbook.html)).)
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- *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

- *The C/C++ Users Journal*. R&D Publications Inc. ISSN 1075-2838
- *Sys Admin — The Journal for UNIX System Administrators* Miller Freeman, Inc., ISSN 1061-2688
- *freeX — Das Magazin für Linux - BSD - UNIX* (óóá ãññíáíééŨ) Computer- und Literaturverlag GmbH, ISSN 1436-7033





**ΕΒΘΑ**

freebsd-security-notifications  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-security-notifications>)

freebsd-stable  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-stable>)

freebsd-test  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-test>)

*Όσον αφορά τις βλάβες: Ή αλλιώς είναι εβθα άβιας αέα οα-ιέεΨ οδωζοΠράεο. Δνεί αν-βόαοά ία οοιιόΨ-άοά εάε ία οδΨείαοά ιγίγιάοά οά αδδΨ, εά δνΨδάε ία αέααΨοάοά δνιόάεοέεΨ οζί δάνεάνοΠ οΨο. ΟδΨν-Ψοί αδδδζνΨ ιαζάβδ αέα οζ-νΠόζ εάε οΨ δάνεα-ΨιαιΨ οΨο.*

**Οείουο**

ΆεΨδΨεΠάεο αοόάεάβδ

ΟδωζοΠράεο δΨο ο-άδβαιΨάε ία οζί-νΠόζ οΨο  
FreeBSD-STABLE

Οδάβεοά απ οά αιείαοόέεΨ οάο ιγίγιάοά αΨβ αέα ίεά  
αδΨ οέο δνιόάεοέεΨ εβθδ

**ΕΒΘΑ**

freebsd-acpi  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-acpi>)

freebsd-afs  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-afs>)

freebsd-aic7xxx  
(<http://lists.FreeBSD.org/mailman/listinfo/aic7xxx>)

freebsd-alpha  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-alpha>)

freebsd-amd64  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-amd64>)

freebsd-apache  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-apache>)

freebsd-arm  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-arm>)

freebsd-atm  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-atm>)

freebsd-audit  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-audit>)

freebsd-binup  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-binup>)

**Οείουο**

ΆΨδδδδζ οζο αέα-άβνέοζο άΨνιόάεο εάε οΨο ACPI

ΨάοάοΨΨ οΨο AFS οΨο FreeBSD

ΆΨδδδδζ ιαζάβί αέα εΨνδδδ Adaptec AIC 7xxx

ΨάοάοΨΨ οΨο FreeBSD οΨοί Alpha

ΨάοάοΨΨ οΨο FreeBSD οά οδδδΠιόά AMD64

Οδωζοζοζ αέα ports ο-άοέεΨ ία οΨο **Apache**

ΨάοάοΨΨ οΨο FreeBSD οά άδαιάνάαοΨ ARM®

×νΠόζ αέέδδδζοζο ATM οΨο FreeBSD

Project αεΨ-Ψ δζάβΨ εΨαέεά

Ο-άββάοζ εάε άΨδδδδζ οΨο οδδδΠιόδΨ ΨοΨΨΨ  
άΨιάνΨοάΨΨ (binary updates)



## Ἐβῶδᾶ

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>)

## Ὀεῖδῶδ

Ὀδᾶβῶςός ὁ ÷ ᾶδῆῆÛ ἰᾶ ὁῖ **Gecko Rendering Engine**

Ὀδᾶβῶςός ὁ ÷ ᾶδῆῆÛ ἰᾶ ὁῖ GEOM ἑᾶῆ ὁῆδ ὁῖδῖῆβῶςός ὁῖδ

ἸᾶδᾶῖῖÛ ὁῖδ **GNOME** ἑᾶῆ ὁῖδ ᾶῶᾶῖῖᾶῖ ὁῖδ

ἌᾶῖῆῆÛ ὁᾶ ÷ ῖῆῆÛ ὁδᾶβῶςός

Ἄᾶῖῆῖβ ὁδᾶβῶςός ᾶῆᾶ ὁῖδᾶᾶδῶδῶδᾶ ὁῆῆῆῖ ἰᾶ ὁῖ FreeBSD

Ἄῆᾶῖῖῖβῶς ὁῖδ FreeBSD

Ὀῖ FreeBSD ὁδῶῖ ᾶῖ ÷ ῆῶᾶῆῖῖῆῖβ IA-32 (Intel x86)

ἸᾶδᾶῖῖÛ ὁῖδ FreeBSD ὁδᾶ ῖῖᾶ ὁδῶδῖᾶῶᾶ IA64 ὁςδ Intel

Ὀᾶ ÷ ῖῆῖβ ὁδᾶβῶςός ὁῖδ ᾶδῆῆᾶῖῖᾶῖᾶῶᾶ ὁῖδ ᾶδᾶῖᾶῶ ÷ ᾶῆῆῆῖῖ ὁῖδ ῆῖᾶῆῆᾶ IP ὁῖδ firewall

ἦÛᾶᾶ ᾶῖÛδῶῖςδ ὁῖδ ISDN

Ὀδᾶβῶςός ὁ ÷ ᾶδῆῆÛ ἰᾶ ὁῆδ ᾶῶῖᾶῶδῶδᾶῶ ὁῖδ jail(8)

ἦÛᾶᾶ ᾶῖÛδῶῖςδ Java ἑᾶῆ Ὀῖῖᾶ ὁῖδ ἰᾶδᾶῶÛῖῖῖ ὁᾶ JDKs ὁῖδ FreeBSD

ἸᾶδᾶῖῖÛ ὁῖδ **KDE** ἑᾶῆ ὁῖδ ᾶῶᾶῖῖᾶῖ ὁῖδ

ἸᾶδᾶῖῖÛ ὁῖδ LFS ὁῖδ FreeBSD

Ὀῖ ὁῖδῶῖᾶ ᾶᾶῆᾶῶῶῶῶῶ ἑᾶῆ ᾶῆᾶ ÷ ᾶῖῆῆῶῶ ὁδᾶῆÛῶῖ ᾶᾶῖῶᾶῖῶ ᾶᾶῖῆÛ

ἸᾶδᾶῖῖÛ ὁῖδ FreeBSD ὁᾶ ᾶδᾶῖᾶᾶᾶᾶᾶᾶᾶᾶ MIPS®

**ΕΒΟΑ**

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)

**ΟΕΙΘ**

Όμοιοποίηση ό-αδέςΥδ ια οίηχοΰ οδρεϊαέοδέεΰ  
όδοόΠιάά

Άοάνηΰδ Mono έαέ C# όοι FreeBSD

Ίαόάοιηΰ όιθ **Mozilla** όοι FreeBSD

Άοάνηΰδ οδρεϊΰούι

Όα-ιέέΰδ όμοιοποίηση ό-αδέςΥδ ια όγι  
άν-έοάέοιέέΠ έέάγέυι

Όμοιοποίηση έέόγύοχο έαέ δçãáβιθ έπαέάο TCP/IP

Ίαόάοιηΰ όιθ **OpenOffice.org** έαέ όιθ **StarOffice** όοι  
FreeBSD

ΆνυδΠόαέο ό-αδέςΥδ ια άαέοέοιθδβχο άδύαίοχο έέά  
άάέάάοόΰόαέο οχçΠδ άδύαίοχο έαέ ιάΰέιθ οίηθβιθ

ΌθίοδΠήέιç άίυδ άñέèιγ άδύ ports ό-αδέςΰ ια Perl

Όμοιοποίηση έαέ άνυδΠόαέο ό-αδέςΥδ ια όι όγόόçια  
packet filter firewall

Όμοιοποίηση έέά ιαόάοιηΰ όά ιç-Intel άñ-έοάέοιέέΰδ

Όμοιοποίηση έέά όγι ΌδρεϊαΠ όυι Ports

Όμοιοποίηση έέά όΰέιαόά έαέ άίάοιηΰδ όόάειΰόυι (PRs)  
θιθ άοιηγί ports



**ΕΒΟΔΑ**

freebsd-sun4v  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-sun4v>)

freebsd-sysinstall  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-sysinstall>)

freebsd-threads  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-threads>)

freebsd-testing  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-testing>)

freebsd-tokenring  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-tokenring>)

freebsd-usb  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-usb>)  
freebsd-virtualization  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-virtualization>)

freebsd-vuxml  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-vuxml>)

freebsd-x11  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-x11>)  
freebsd-xen  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-xen>)

*Δανάη C. Δημόσιος Διευθυντής του Αλλάβου: Ένα μήνυμα στο εβόδα: Η ελεύθερη εβόδα είναι ένα δίκτυο (ένα δίκτυο) όπου οι άνθρωποι μπορούν να επικοινωνήσουν μεταξύ τους. Είναι ένα βότανο ή οτιδήποτε άλλο που είναι εύκολο να χρησιμοποιηθεί, είναι ένα βότανο ή ένα δίκτυο όπου οι άνθρωποι μπορούν να επικοινωνήσουν μεταξύ τους. Είναι ένα βότανο ή οτιδήποτε άλλο που είναι εύκολο να χρησιμοποιηθεί.*

**ΟΕΙΔΙΟ**

Για να λάβετε μέρος στο FreeBSD ή στο UltraSPARC T1 εβόδα

Οδηγός για να αρχίσετε να χρησιμοποιείτε το sysinstall(8)

Διεύθυνση του εβόδα του FreeBSD

Αιτήσεις βοήθειας στο εβόδα του FreeBSD

Οδηγός για το Token Ring στο FreeBSD

Οδηγός για το USB στο FreeBSD

Οδηγός για το virtualization στο FreeBSD

Οδηγός για το VuXML

Οδηγός για το X11 στο FreeBSD

Οδηγός για το Xen στο FreeBSD

**ΕΒΟΔΑ**

freebsd-hubs  
(<http://lists.FreeBSD.org/mailman/listinfo/freebsd-hubs>)

**ΟΕΙΔΙΟ**

Πολλές διευθυντικές mirror sites (οδηγός για να αρχίσετε να χρησιμοποιείτε)













freebsd-embedded (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-embedded>)

× *ηΠόζ οϊω FreeBSD óå embedded åöåññãÝð*

Ç εβόδå óðæçðÛ εÝιåδå ó÷-åðέέÛ ιå ççι ÷-ηΠόζ οϊω FreeBSD óå embedded óðóðΠιåδå. Άβιåέ ιέå ðå÷-ιέέΠ εβόδå έåέ óðæçðιγίφåέ ιιñι åðóçñÛ ðå÷-ιέέÛ εÝιåδå. Άέå ðιι óέιðω ççð εβόδåð åððð, ιñβæιðιå ùð embedded óðóðΠιåδå ðέð ððιειæέóðέέÝð óðóέåðÝð ðιω ååι ðñιιñβæιιφåέ åέå desktop åöåññãÝð, έåέ ðιω óðιΠέùð έåέγððιωι ιέå ιιñι åιÛåç, åιφβεåðå ιå ðå ååιέέÛ ððιειæέóðέέÛ ðåñέåÛεειφå. ÓðιðåñέåιåÛιιφåέ, åέóωð ðιι Ûεειι, ιέå ðå ççέÝðιå, åέέððåέιð åñðέέóιωιð ùððω routers, switches έåέ PBXs, åñðέέóιωιð ιåðñðåιι åðι åðιωóåç, PDAs, óðóðΠιåδå Point Of Sale, έåέ ðÛåέ εÝåιιφåð.

freebsd-emulation (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-emulation>)

Åññιβιωóç Ûεειι óðóççιÛðιι ùððω åβιåέ ðå Linux/MS-DOS/Windows

Άβιåέ ιέå εβόδå åέå ðå÷-ιέέÝð óðæçðΠðåέð, ó÷-åðέέÝð ιå ççι åέðÝέåçç óðι FreeBSD ðñιåññãÛðιι ðιω åçιειðñåΠεçέåι åέå Ûεέå έåέðιωñåέέÛ.

freebsd-eol (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-eol>)

Ïιωðέιç ððιóðΠñέιç åέå ειαέóιέέι ð÷-åðέέι ιå ðι FreeBSD ðιω ååι ððιóçñβæåðåέ ðεÝιι åðι ðι FreeBSD Project.

Άðð ç εβόδå åβιåέ åέå ιιóιðð åιåέóÝñιιφåέ ιå ðåñÝ ÷-ιωι Π ιå ÷-ñçóέιñðιειφåðιωι ççι ιιωðέιç ððιóðΠñέιç åέå ειαέóιέέι ð÷-åðέέι ιå ðι FreeBSD ðιω ååι ððιóçñβæåðåέ ðεÝιι åðι ðι FreeBSD Project (ð.÷., ιå ççι ιιñðΠ “patches” έåέ åιåέιφðåιι åóóåέåβåð).

freebsd-firewire (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-firewire>)

FireWire (iLink, IEEE 1394)

Άðð ç εβόδå åβιåέ åέå ççι óðæΠóççç ççð ó÷-ååβåçðð έåέ ðειðιβççðð åñιð ððιóðóðΠιåðιð FireWire (åιùóðι έåέ ùð IEEE 1394 Π iLink) åέå ðι FreeBSD. Ó÷-åðέέÛ εÝιåδå åβιåέ ðå ðñιωððå, ιέ óðóέåðÝð åέåγέιð έåέ ðå ðñιωιειεÛ ðιωð, εÛñðåð, ðñιåññãñåβð έåέ chipsets, έåέ ç åñ÷-έóåέðιιέέΠ έåέ ç ðειðιβççç ðιω έðåέåå åέå ççι óùóðΠ ððιóðΠñέιç ðιωð.

freebsd-fs (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-fs>)

ÓðóðΠιåðå åñ÷-åβιι

ÓðæçðΠðåέð ó÷-åðέέÝð ιå ðå óðóðΠιåðå åñ÷-åβιι ðιω FreeBSD. Άβιåέ ιέå ðå÷-ιέέΠ εβόδå έåέ óðæçðιγίφåέ ιιñι åðóçñÛ ðå÷-ιέέÛ εÝιåδå.

freebsd-gecko (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-gecko>)

Gecko Rendering Engine

ÓðæçðΠðåέð ó÷-åðέέÝð ιå åóåññãÝð ðιω ÷-ñçóέιñðιειγί ççι ιç÷-åιΠ Gecko óðι FreeBSD.

Ç óðæΠóççç åðέέåιðñβιåðåέ ðå åóåññãÝð ççð ÓðεειåΠð ðιι Ports ðιω ÷-ñçóέιñðιειγί ççι ιç÷-åιΠ Gecko, έåέ åέåέέιðåñå ççι ååέåðÛóðåçç, åιÛððωιç έåέ ððιóðΠñέιç ðιωð óðι FreeBSD.

freebsd-geom (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-geom>)

GEOM

ÓðæçðΠðåέð ó÷-åðέέÝð ιå ðι GEOM έåέ ðåññιιέåð ðειðιεβðåέð. Άβιåέ ιέå ðå÷-ιέέΠ εβόδå έåέ óðæçðιγίφåέ ιιñι åðóçñÛ ðå÷-ιέέÛ εÝιåδå.

freebsd-gnome (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-gnome>)

*GNOME*

ΌαζόΠόάέο ό÷άόέΥò ιά οι δάνέαÜέει **GNOME** αέα όόόΠιάόά FreeBSD. Άβιάέ ιέα όά÷ιέέΠ έβόόά έάέ όδαζοιγίόάέ ιüfi άόόζñÜ όά÷ιέέÜ èΥιάόά.

freebsd-ipfw (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ipfw>)

*IP Firewall*

ΆοδΠ ζ έβόόά άβιάέ αέα όά÷ιέέΥò όδαζόΠόάέο θιό άοιηγί όii άδίαό÷άέάόii όιό έπαέέα IP firewall όοi FreeBSD. Άβιάέ ιέα όά÷ιέέΠ έβόόά έάέ όδαζοιγίόάέ ιüfi άόόζñÜ όά÷ιέέÜ èΥιάόά.

freebsd-ia64 (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ia64>)

*ΙάόάοiñÜ όiό FreeBSD όόζι άñ÷έόάέόiέέΠ IA64*

Δñüέάέόάέ αέα ιέα όά÷ιέέΠ έβόόά, αέα Üόñά θιό äiόεάγiόi άiάñáÜ όόζι ιάόάοiñÜ όiό FreeBSD όόζι θέαόóüñiá IA-64 όζò Intel, αέα iά άiάóΥñiόi θñiáεΠιάόά Π iά όδαζόΠóιόi άiάέέάέόέέΥò έγύάέó. ¶iόñά θiό άiάέάóΥñiόáέ iά δñááéiëiόèΠóιόi όζi όá÷ιέέΠ όδαΠόζόζ άβιάέ άδβόζò äóδñüóääéóá.

freebsd-isdn (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-isdn>)

*ÁiÜδóδiζ όiό ISDN*

ΆοδΠ ζ έβόόά άβιάέ αέα Üόñá θiό όδαζοιγί όζi άiÜδóδiζ όζò óθiόóΠñéiζò ISDN όοi FreeBSD.

freebsd-java (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-java>)

*ÁiÜδóδiζ όζò Java*

ΆοδΠ ζ έβόόά άβιάέ αέα Üόñá θiό όδαζοιγί όζi άiÜδóδiζ όζiάiόέέΠi άóáñiñäΠi Java αέα όi FreeBSD έάέ όζi ιάόάοiñÜ έάέ óθiόΠñζόζ óii JDKs.

freebsd-jobs (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-jobs>)

*ΑΠόζόζ έάέ δñiόóiñÜ áñááóβáð*

Άóóüð άβιάέ Υiάð ÷Πñü αέα äçiόβáðόζ άiáéiέiΠóáüi αέα δñiόóiñÜ έάέ αΠόζόζ áñááóβáð θiό ó÷άðβαάόάέ iá όi FreeBSD, έάέθð έάέ áéiñááóέέΠi ó÷άóέέΠi iá όi FreeBSD. Ái αέα δáñÜääéñiá άiάαζóÜóá áñááóβá ó÷άóέέΠ iá όi FreeBSD, Π δñiόóΥñáðá iέα èΥόζ áñááóβáð ó÷άóέέΠ iá όi FreeBSD, áóóü άβιάέ όi óóóóü iΥñiό αέα iά όζ áéáóçiβóáðá. Ç έβόόά áóδΠ áái άβιάέ αέα ááiέéÜ èΥiάóá áñááóβáð, αέα óá iθiβá óδÜñ÷άέ δέçèΠñá áðu Üέéáð έβóóáð όói Άέάάβέδοi.

ΆóδΠ ζ έβóóá, üðüð έάέ ié óðüéiέéðáð έβóóáð όiό FreeBSD.org, áéáiΥñiόáέ δááéüiόiá. ρóέ, δñΥðáé iá άβóóá óáóΠð αέα όζi όiθiéáóβá έάέ όζi áóiáóüóζóá όçéáñááóβáð Π áiΠéáέáð όόζi iáóiiβέçόζ.

Όi iΠiόiá óáð éá δñΥðáé iá ÷ñçóéiθiéáβ iüfi áié÷óÜ δñüóóðá — éáóÜ δñiόβiçόζ áðëü éáβiáñi, ái έάέ ááóέέΠð iññóΠð Portable Document Format (PDF), HTML, έάέ iáñééÜ Üέéá άβιάέ áθiááéóÜ áðu θiέéiγýð ÷ñΠóóáð. ÊéáέóóÜ δñüóóðá üðüð όi Microsoft Word (.doc) éá áθiññéóéiγi áðu όii áéáéñiέóóΠ όζò έβóóáð.

freebsd-kde (<http://freebsd.kde.org/mailman/listinfo/kde-freebsd>)

*KDE*

ΌαζόΠόάέο θiό άοiηγί όi **KDE** óá óóóΠιάόά FreeBSD. Άβιάέ ιέα όά÷ιέέΠ έβόόά έάέ όδαζοιγίόάέ ιüfi άόόζñÜ όά÷ιέέÜ èΥιάόά.

frebsd-hackers (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-hackers>)

*Όά ÷ ίέέΥδ όδæçðÞóáέδ*

Άβίάέ Υίάδ ÷ þññð áέα όά ÷ ίέέΥδ όδæçðÞóáέδ ό ÷ άδέέΥδ ιά όν FreeBSD. ΆδðÞ άβίάέ ç έýñέα όά ÷ ίέέÞ έβόόά. Άβίάέ áέα Ûόñά δνó άίάδóóóíοί άίάññÛ όν FreeBSD, áέα ίά άίάóÝññοί δññæÞιάόά Þ ίά όδæçðÞοίοί άίάέάέδέέΥδ έýóάέδ. ¶όñά δνó άίάέάóÝññíόάέ ίά δάñάέιέιòèÞοίοί όçί όά ÷ ίέέÞ όδæÞδççç άβίάέ άδðññóääέδά. Άβίάέ ίέα όά ÷ ίέέÞ έβόόά έάέ όδæçοίýíόάέ ìññí άδóδçñÛ όά ÷ ίέέÛ èÝιάόά.

frebsd-hardware (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-hardware>)

*ΆάίέέÞ όδæÞδççç áέα δέέέñ èé άίάñðÞιάόά δδñέιάέόδÞι όδν FreeBSD*

ΆάίέέΥδ όδæçðÞóáέδ áέα όýδνð δέέέý δνó έάέοιòññίý όδν FreeBSD, áέÛοιñά δññæÞιάόά έάέ δññòÛόάέδ ό ÷ άδέέÛ ιά όν έέ ίά άññÛόόάá Þ ίά άδνóýääόά.

frebsd-hubs (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-hubs>)

*Mirror sites*

ΆίάέιέíÞóáέδ έάέ όδæçðÞóáέδ áέα Ûόñά δνó όδνóçññίý mirror sites όν FreeBSD.

frebsd-isp (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-isp>)

*ÈÝιάόά áέα Δάññ ÷ άβð ÕδçñάόέÞι Άέάάέέδóýνó*

ΆδðÞ ç έβόόά άβίάέ áέα όδæÞδççç έάñÛόνι ό ÷ άδέέÞι ιά Δάññ ÷ άβð ÕδçñάόέÞι Άέάάέέδóýνó (ISPs) δνó ÷ ñçóέññδνέíý FreeBSD. Άβίάέ ίέα όά ÷ ίέέÞ έβόόά έάέ όδæçοίýíόάέ ìññí άδóδçñÛ όά ÷ ίέέÛ èÝιάόά.

frebsd-mono (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-mono>)

*ΆόάñññÛÝδ Mono έάέ C# όδν FreeBSD*

ΆδðÞ ç έβόόά άβίάέ áέα όδæÞδççç έάñÛόνι ό ÷ άδέέÞι ιά όν όýόççιά άíÛδóçð άόάñññáÞι Mono όδν FreeBSD. Δñññέάέόάέ áέα ίέα όά ÷ ίέέÞ έβόόά. Δññññæáόάέ áέα ðνέíñáÞδνóά άό ÷ ðæáβόάέ άίάññÛ ιά όçί άíÛδóçç Þ όç ίάόάóññÛ άόάñññáÞι Mono Þ C# όδν FreeBSD. Ç όδæÞδççç άóññÛ όçί άδβέδóç δññæçñÛόνι ç όçί άýñάόç άίάέάέδέέèÞι έýóάñ. ¶όñά δνó άίάέάóÝññíόάέ ίά δάñάέιέιòèÞοίοί όçί όά ÷ ίέέÞ όδæÞδççç άβίάέ άδβόçç άδðññóääέδά.

frebsd-openoffice (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-openoffice>)

*OpenOffice.org*

ΌδæçðÞóáέδ ό ÷ άδέέΥδ ιά όçί ίάόάóññÛ έάέ όδνðñççç όν **OpenOffice.org** έάέ όν **StarOffice**.

frebsd-performance (<http://lists.FreeBSD.org/mailman/listinfo/frebsd-performance>)

*ΌδæçðÞóáέδ áέα όçί ñýνέέόç έάέ όçί άάέδέόδνδνβççç όν FreeBSD*

ΆδðÞ ç έβόόά όδÛñ ÷ áέ áέα ίά δάñÝ ÷ áέ Ýιά ìÝññð ùδνó ίέ hackers, ðέ áέα ÷ áέñέόδÝδ, έάέ ùοίέ Ûέέñέ άίάέάóÝññíόάέ, ίά όδæçοίýí èÝιάόά ό ÷ άδέέÛ ιά όçί άδñññόç όν FreeBSD. ΆδññάέέδÛ èÝιάόά άβίάέ ðέ όδæçðÞóáέδ δνó άίάóÝññíόάέ όά άάέάόάόδÛόάέδ FreeBSD δνó όδñέάέíόάέ όά ίάάÛέñ òññοι, Ý ÷ ðνó δññæÞιάόά άδñññόçð, Þ όδÛññοί όν FreeBSD όόά ùñέα όν. Óνέέόççññά άίάδέóýέάέδά ίά άñάóññί όçç έβόόά ùοίέ άίάέάóÝññíόάέ ίά άάέδèÞοίοί όçί άδñññόç όν FreeBSD. Άβίάέ ðβά όά ÷ ίέέÞ έβόόά δνó άδάδèýíάόάέ όά Ýνδάέñνð ÷ ñÞóόάδ όν FreeBSD, hackers, Þ áέα ÷ áέñέόδÝδ δνó άίάέάóÝññíόάέ ίά èÛññοί όν FreeBSD άñÞάñññ έάέ άίέúδέόδν. Άάñ δñññέάέόάέ áέα ίέα έβόόά άññðÞóáñ ðέ άδάíðÞóáñ δνó ðδñάβ ίά άíδέέάόάόδÞóάέ όçί ðάέÝόç όçð όάέìçññβóçð, áέèÛ Ýιά ìÝññð áέα όδνέάέóññÝδ Þ áέα άδάíðÞóáέδ όά άίάδÛνóççά èÝιάόά ό ÷ άδέέÛ ιά όçί άδñññόç.

freebsd-pf (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-pf>)

*Οδηγός για την αντιστοίχιση πακέτων φίλτρου πυρρός*

Οδηγός για την αντιστοίχιση πακέτων φίλτρου πυρρός (pf) firewall system ομίλου FreeBSD. Ο οδηγός περιλαμβάνει πληροφορίες σχετικά με το πλαίσιο ALTQ QoS framework.

freebsd-platforms (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-platforms>)

*Ανακοίνωση του FreeBSD σχετικά με την Intel δέσφωση*

Ανακοίνωση του FreeBSD σχετικά με την αντιστοίχιση πακέτων φίλτρου πυρρός ομίλου FreeBSD σχετικά με την Intel δέσφωση. Περιλαμβάνει πληροφορίες σχετικά με το πλαίσιο ALTQ QoS framework.

freebsd-policy (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-policy>)

*Ελάττωση της πολιτικής (policy) στο Core του FreeBSD*

Ανακοίνωση σχετικά με την αντιστοίχιση πακέτων φίλτρου πυρρός ομίλου FreeBSD σχετικά με την Intel δέσφωση. Περιλαμβάνει πληροφορίες σχετικά με το πλαίσιο ALTQ QoS framework.

freebsd-ports (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ports>)

*Οδηγός για τα "ports"*

Οδηγός για τα "ports" ομίλου FreeBSD (/usr/ports), σχετικά με τα ports, είναι η διαδικασία για την εγκατάσταση των ports. Περιλαμβάνει πληροφορίες σχετικά με το πλαίσιο ALTQ QoS framework.

freebsd-ports-bugs (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-ports-bugs>)

*Οδηγός για τα "ports" bugs*

Οδηγός για τα "ports" bugs ομίλου FreeBSD (/usr/ports) σχετικά με τα bugs των ports. Περιλαμβάνει πληροφορίες σχετικά με το πλαίσιο ALTQ QoS framework.

freebsd-proliant (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-proliant>)

*Οδηγός για την αντιστοίχιση πακέτων φίλτρου πυρρός HP ProLiant*

Οδηγός για την αντιστοίχιση πακέτων φίλτρου πυρρός ομίλου FreeBSD σχετικά με την HP ProLiant. Περιλαμβάνει πληροφορίες σχετικά με το πλαίσιο ALTQ QoS framework.

freebsd-python (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-python>)

*Python ομίλου FreeBSD*

Οδηγός για την αντιστοίχιση πακέτων φίλτρου πυρρός ομίλου FreeBSD σχετικά με την Python. Περιλαμβάνει πληροφορίες σχετικά με το πλαίσιο ALTQ QoS framework.



Αόθρ ρ εβόθα άβίαι έα όιό ÷ ñΠόθάό όιό FreeBSD-STABLE. ΔάνέΥ ÷ άέ θñιέάριέΠόάέό έα ίΥά ÷ άñάέόρñέόέέÛ θιό θñιέέέόάέ ίά άίόύιάόùέριύί όί -STABLE έαέ όά ιθιβά άίά ÷ ñΥίùò ίά άδρñάÛόιόί όιό ÷ ñΠόθάό όιό. Άθβόθό θάνέΥ ÷ άέ ιάραβáo έα όά άΠιáόά θιό θñΥθάέ ίά áειριέΠόάόά Πόά ίά θάñαιάβίáόά όί -STABLE. Έά θñΥθάέ ίά áάñάάσάβόá όά áóθρ όρ εβόθα, άί áειριέΠόάόά όί “STABLE”. Άβίαι έα όá ÷ ίέεΠ εβόθα έαέ όάρξόιριόάέ ìúñ áóόόçñÛ όá ÷ ίέέÛ èΥιáόá.

freebsd-standards (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-standards>)

Όθιιιθούό ίá όá θñιόθόá C99 & POSIX

Αόθρ ρ εβόθα άβίαι έα όá ÷ ίέέΥò όάρξόΠόάέό ό ÷ άόέέÛ ίá όρ όθιιιθούό όιό FreeBSD ίá όá θñιόθόá C99 έαέ POSIX.

freebsd-usb (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-usb>)

ΌάεΠόρξό άέά όρ όθιόθΠñέιç όιό áéáýéiò USB όί FreeBSD

Αόθρ ρ εβόθα άβίαι έα όá ÷ ίέέΥò όάρξόΠόάέό ό ÷ άόέέÛ ίá όρ όθιόθΠñέιç όιό áéáýéiò USB όί FreeBSD.

freebsd-user-groups (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-user-groups>)

ÏñάÛιúό όùι όóèüüàì ÷ ñçόθí

Αόθρ ρ εβόθα άβίαι έα όιόό όóίόιιέόóΥò όùι άθεiΥñιόό όιθέεΠí όóèèüüàì ÷ ñçόθí άέά όάεΠόρξό έαÛúòι ίáόáý όιόό έαέ ίá έÛθιέi ίΥéiò όρ ñÛááό Core. Αόθρ ρ εβόθα έá θñΥθάέ ίá άίáóΥñáέ ìúñ óέó όóίáίόΠόáέό έáέ όρ ññάÛιúόç projects θιό άίáóΥñιiόáέ όá θάνέόóúόáñιόό áδù Ýíá όóèèüüàì ÷ ñçόθí.

freebsd-vendors (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-vendors>)

ΔùέçóΥò

ÏñάÛιúόç όάρξόΠόáùι ίáόáý όιό FreeBSD Project έáέ όùι ΔùέçόΠí éiáέóιέéiç έáέ óèééiç ό ÷ άόέéiç ίá όí FreeBSD.

freebsd-virtualization (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-virtualization>)

ΌάεΠόρξό áéÛüñìü όá ÷ ίέéΠí áéèiéèièiθβçόóò θιό óθιόόçñβæiíóáé áδù όí FreeBSD.

Ïέá εβόθα έáέ όç όάεΠόρξό όùι áéÛüñìü όá ÷ ίέéΠí áéèiéèièiθβçόóò θιό óθιόόçñβæiíóáé áδù όí FreeBSD. Άδù όç ίέá ίáñέÛ áóóέÛæáέ óóçí óèiθβçόç όùι ááóέéΠí éáéóιθñáéΠí áéèÛ έáέ όçθí θñιόéΠéç iΥúñ áóίáóιόΠόáùι. Άδù όç ίá Ûèèç, ié ÷ ñΠόθáό έá Ý ÷ ióι ίέá ñÛáá όάρξόΠόáùι üθιό iθiñiγí ίá αρξόιρι áìΠéáέά όá θáñβθóóóç θñιάεçιÛóùι, Π ίá όάρξόιρι óέó áέέΥò όιό ÷ ñΠόáέó.

freebsd-wip-status (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-wip-status>)

ΈáóÛόόáόç áñááóéΠí όá áiΥééiç όί FreeBSD

Όόç εβόθα áóθρ iθiñáβόá ίá áíáéiéiΠόáóá όç ίá Ýiáñiç έáέ όçθí θñiιáì éÛθιέáó áñááóáó όáó θιό ό ÷ áóβæáóáé ίá όí FreeBSD. Óá içiγiáóá όá áóθρ όç εβόθα áéÝá ÷ iíóáé. Óθiβóóáóáé ίá óóáβæááó όι iΠióíá óáó ίá θáñáéΠθóç ίέá θεi óιθέéΠ óáó εβόθα όιό FreeBSD, έáέ áθéΠó ίá éiéñiθiéΠόáóá όι iΠióíá óáó όá áóθρ όç εβόθα. Ïá όiθi óñiθi áóóùι, iθiñáβóá áθβόóò ίá óάρξόΠόáóá έáέ όçθí áñááóáóá óáó óóçθí óiθééΠ εβόθα, έáéΠó ç óάεΠόρξόç óá άóθρ όç εβόθα ááí áθéóñÝθáóáé.

Άάβόá όá áñ ÷ áβá όçó εβόθáό έáέ ίá θÛñáóá ίέá έáÝá όçó iñòΠó όùι içióιÛóùι θιό iθiñáβóá ίá óóáβæááóá.

Ïέá θáñβéçόç όùι θáñéá ÷ ñΥiúι όçó εβóθáό áíáÝ ÷ áóáé ίá αçiíóéáýáóáé έáóÛ óáéóÛ áéáóóΠiáóá óόç áééóóáéΠ óiθiéáóβá όió FreeBSD, ùò iΥñiθi óùι Áíáóñiñí ΈáóÛόόáόçóò (Status Reports) <sup>1</sup>. Óóçθí βáέá óiθiéáóβá, iθiñáβóá áθβόóò ίá áñáβóá θáñéóóúóáñá θáñáááβáíáόá έáέ θñiçáγiáíáó άíáóñÝò.

freebsd-xen (<http://lists.FreeBSD.org/mailman/listinfo/freebsd-xen>)

ÓðæÞðçóç ãέα ðç ðððáññÛ ðñð FreeBSD óðñ Xen — ðñðññβçóç έέα ÷ñÞóç

Δññέάέðάέ άέα ðέα έβððά ðñð άóðέÛæάέ óðç ðððáññÛ ðñð FreeBSD óðñ Xen. Ç έβñçóç óά άððÞ ðç έβððά άíáñ Ýíáðάέ ðá ðññάέ ðέêñÞ, έέα Ýðóέ ðá ÷ñçóέññðñέçèðñ ðññóñ ãέα ðá ÷έέÝð ððæçðÞðάέð ó ÷άðέέÛ ðá ðñ ð ÷άέάóññ έέα ðç ðñðññβçóç, ðññ έέα ðá ðññάέÞñáðά άάέάðÛððάóçð έέα άέα ÷áññέóçð.

### C.1.4 ÖéèðñÛñέóñά óðέð Έβððάð ÇέάèðññέέéñÝ Óá ÷ðñññáβñð

Ïέ έβððάð çέάèðññέέéñÝ ðá ÷ðñññáβñð ðñð FreeBSD ðéèðñÛññíðάέ ðá ðñέάðññýð ðññðñðð ãέα ðá áðñçýáññðñ ðç ðáέáññÞ spam, έβñ, έέα Ûέέññ áñáðέéçýçðññ ðç ðññÛðññ. Òñ ðéèðñÛñέóñά ðñð ðáñέáñÛðáðάέ óá áððÞ ðç ðáññðçóá, áðñðáέáß Ýíá ðñññ ðññð ðññ ððññέέβñ ðññðññ ðñð έáñáÛñññá ãέα ðç ðñññððáðá ðññ έέóðññ çέάèðññέέéñÝ ðá ÷ðñññáβñð.

Óðέð έβððάð áðέðñÝðññάέ ðñññ ððáέáññέññÝññέ ðçðññέ óðçññÝñññ áñ ÷áβññ. ¼έα ðá óðçññÝñññ áñ ÷áβá ðá ðçðññ MIME ðñð ááñ áñβðéáðάέ óðç ðáñáέÛðñ έβððά, áέáññÛñññάέ ðñññ áέáññçèáß ðñ ðññññá óðέð έβððάð.

- 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

**Óçññáβñóç:** ðáññέÝð έβððάð ððññáß ðá áðέðñÝðñññ óðçññÝñññ áñ ÷áβá έέα Ûέέññ ðçðññ MIME, áέέÛ ðé ðáñáðÛññ ðçðññέ έó ÷ññññ óðέð ðáññέóóñðáññáð έβððάð.

ÁÛñ ðñ έáβññññ áññð ðç ðñññáðñð ðáññέÝ ÷áðάέ ðññññ ðá ðññðÞ HTML ðñññ έέα áðññý έáέñÝññð, ðñ ðññññ HTML έá áðáέñáέáß. ÁÛñ Ýíá ðññññá ðáññέÝ ÷έ ðññññ HTML, έá ðððáðñáððáß óá áðέññ έáβññññ.

## C.2 Usenet Newsgroups

Áέðñð áðññ áñññ newsgroups ðñð áó ÷ñññññάέ ðá ðñ FreeBSD, ððÛñ ÷ñññ ðññέÛ áέñññá óðá ðñññá ðñññáðάέ óðæÞðçóç ãέα ðñ FreeBSD Þ Ûέέá èÝñáðá ðñð áñáá ÷ññññ ðññέáðÝññññ ðññð ÷ñññððð ðñð. Áέα èÛðñέá áðññ áððÛ ðá newsgroups, ððññáβñá ðá èÛññáð áññáÞðçóç ðá èÝññέð-έέáέέÛ óðέð ðáέέÝð áçññóέáçýóáέð

([http://minnie.tuhs.org/BSD-info/bsdnews\\_search.html](http://minnie.tuhs.org/BSD-info/bsdnews_search.html)), ÷ Ûñç óðçí òðçñáóá ðï ðñïóÝñáé ï Warren Toomey <wkt@cs.adfa.edu.au>.

### C.2.1 Newsgroups Ó÷áôéëÛ ìá òï 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) (Óôá ÆññáíáéÛ)
- fr.comp.os.bsd (news:fr.comp.os.bsd) (Óôá ÆáééééÛ)
- it.comp.os.freebsd (news:it.comp.os.freebsd) (Óôá ÉôáééééÛ)
- tw.bbs.comp.386bsd (news:tw.bbs.comp.386bsd) (Óá ÐáñááïóéáéÛ ÊéíÝæééá)

### C.2.2 ηëéä ÅíáéáöÝñïá 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 Óýóôçíá 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)



•

Australia

- <http://www.au.FreeBSD.org/>
- <http://www2.au.FreeBSD.org/>

•

Austria

- <http://www.at.FreeBSD.org/> (IPv6)
- <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/>



- Hong Kong
  - <http://www.hk.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/>
  
- 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/>



- <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/>

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#### 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)

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Ukraine

- <http://www.ua.FreeBSD.org/>
- <http://www2.ua.FreeBSD.org/>
- <http://www5.ua.FreeBSD.org/>
- <http://www4.ua.FreeBSD.org/>

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United Kingdom

- <http://www1.uk.FreeBSD.org/>
- <http://www3.uk.FreeBSD.org/>

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USA

- <http://www2.us.FreeBSD.org/>
- <http://www4.us.FreeBSD.org/> (IPv6)
- <http://www5.us.FreeBSD.org/> (IPv6)

## C.4 Άέάöèýíóáéò Çèâêñîíéêîý Ôá ÷ öäñîñâβîö

Íé áéüèüöèâð ãþðáéð ÷ ñçóðþí δάνÝ ÷ ðìí óðá ìÝèç ðìðð áéáöèýíóáéò çèâêñîíéêîý ôá ÷ öäñîñâβîö ðìö ó ÷ áðβæííóáé ìá ðì FreeBSD. Í áéá ÷ áéñéóððò ðìö áíáö Ýñâðáé δάνáéÛðù, áéáöçñâβ ðì áééáβüìá íá áíáéáéÝ óáé ôçí áéáyèðìóç, áí ãβíáé éáðÛ ÷ ñçόç ôçð ìá ððìéäβðìðâ ðñüðì.

| ÔñÝáò               | Õðçñâóßáò    | ΰüóç × ñçóðþí              | Άέá ÷ áéñéóððò                       |
|---------------------|--------------|----------------------------|--------------------------------------|
| ukug.uk.FreeBSD.org | Ìüñ ðñìðèçόç | <ukfreebsd@uk.FreeBSD.org> | Lee Johnston<br><lee@uk.FreeBSD.org> |

## **Óçïáέπόάέò**

1. <http://www.freebsd.org/news/status/>

# ḌáñŪñôçíá D. ÊëáéäéŪ PGP

Óõí ḌáñŪñôçíá áõõü, èá àñáßòá òá àçüóéá PGP êëáéäéŪ òüí officers éáé òüí ìáëþí òçò ñŪááò áíŪḌòõíçò òüõ FreeBSD. Ìḏñáßòá íá òá ÷ñçóéíüḏíéÞòáòá áéá íá àéÝáñáòá ìéá øçòéáéÞ òḏñáñáòÞ Þ áéá íá óòáßèáòá êñòḏòñáñáòçíÝñí email òá éŪḏíéí ìÝéíð òçò ñŪááò. Ìḏñáßòá íá éáòááŪóáòá òçí ḏéÞñç èßòóá áḏü êëáéäéŪ ÷ñçóòþí òüõ FreeBSD.org, áḏü òçí òüḏñéáòáá <http://www.FreeBSD.org/doc/pgpkeyring.txt>.

## D.1 Officers

### D.1.1 ÌŪáá ÁóöŪëáéáò <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 ÌŪááò 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 ÌŪááò 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 ÌÝëç òçò ÌŪááò 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@obsecurity.org>
sub 2048g/03A41C45 2000-01-14 [expires: 2006-01-14]
```

## D.3 ÍÝèç ôçò ìiÜááò ÁíÜðôõîçò

### D.3.1 Ariff Abdullah <ariff@FreeBSD.org>

```
pub 1024D/C5304CDA 2005-10-01
 Key fingerprint = 5C7C 6BF4 8293 DE76 27D9 FD57 96BF 9D78 C530 4CDA
uid Ariff Abdullah <skywizard@MyBSD.org.my>
uid Ariff Abdullah <ariff@MyBSD.org.my>
uid Ariff Abdullah <ariff@FreeBSD.org>
sub 2048g/8958C1D3 2005-10-01
```

### D.3.2 Thomas Abthorpe <tabthorpe@FreeBSD.org>

```
pub 2048R/A473C990 2010-05-28
 Key fingerprint = D883 2D7C EB78 944A 69FC 36A6 D937 1097 A473 C990
uid Thomas Abthorpe (FreeBSD Committer) <tabthorpe@FreeBSD.org>
uid Thomas Abthorpe <thomas@goodking.ca>
uid Thomas Abthorpe <tabthorpe@goodking.org>
sub 2048R/8CA60EE0 2010-05-28
```

### D.3.3 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 2048R/1A1ABC84 2010-03-23
 Key fingerprint = E352 0E14 9D05 3533 C33A 67DB 5CC6 86F1 1A1A BC84
uid Douglas Barton <dougb@dougbarton.us>
uid Douglas Barton <dougb@FreeBSD.org>
```

```
uid [jpeg image of size 6140]
sub 3072R/498795B4 2010-03-23
Key fingerprint = C0BE C1E3 8DC8 D7F4 8E6C 732B 0C14 D9CF 4987 95B4
```

### D.3.19 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 AACF 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 Jayachandran C. <jchandra@FreeBSD.org>

```
pub 1024D/3316E465 2010-05-19
 Key fingerprint = 320B DB08 4FE3 BCFD 60AF E4DB F486 015F 3316 E465
uid Jayachandran C. <jchandra@freebsd.org>
sub 2048g/1F7755F9 2010-05-19
```

### D.3.39 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.3.40 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.3.41 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.3.42 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.3.43 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.3.44 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.3.45 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.3.46 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.3.47 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.3.48 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.3.49 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.3.50 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.3.51 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.3.52 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.3.53 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.3.54 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.3.55 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.3.56 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.3.57 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.3.58 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.3.59 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.3.60 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.3.61 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.3.62 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.3.63 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.3.64 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.3.65 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.3.72 Brendan Fabeny <bf@FreeBSD.org>**

```
pub 2048R/9806EBC1 2010-06-08 [expires: 2012-06-07]
 Key fingerprint = 2075 ADD3 7634 A4F9 5357 D934 08E7 06D9 9806 EBC1
uid b. f. <bf@freebsd.org>
sub 2048R/1CD0AD79 2010-06-08 [expires: 2012-06-07]
```

### **D.3.73 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.3.74 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.3.75 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.3.76 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.3.77 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.3.78 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 Mário Sergio Fujikawa Ferreira (lioux) <lioux@FreeBSD.org>
uid Mário Sergio Fujikawa Ferreira <lioux@uol.com.br>
sub 4096g/BB7D80F2 2006-02-23 [expires: 2007-02-23]
```

### D.3.79 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.3.80 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.3.81 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.3.82 Bernhard Fröhlich <decke@FreeBSD.org>

```
pub 1024D/CF5840D4 2008-01-07 [expires: 2015-05-05]
 Key fingerprint = 47F6 BDF1 DF9E 81E2 2C54 8A06 E796 7A5A CF58 40D4
uid Bernhard Fröhlich <decke@FreeBSD.org>
uid Bernhard Fröhlich <decke@bluelife.at>
sub 2048g/4E51CE79 2008-01-07
```

### D.3.83 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.3.84 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.3.85 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.3.86 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.3.87 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.3.88 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.3.89 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.3.90 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.3.91 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.3.92 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.3.93 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.3.94 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.3.95 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.3.96 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.3.97 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.3.98 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.3.99 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.3.100 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.3.101 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.3.102 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.3.103 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.3.104 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.3.105 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.3.106 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.3.107 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.3.108 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.3.109 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.3.110 Chin-San Huang <chinsan@FreeBSD.org>

```
pub 1024D/350EECF8 2006-10-04
 Key fingerprint = 1C4D 0C9E 0E68 DB74 0688 CE43 D2A5 3F82 350E ECFA
uid Chin-San Huang (lab) <chinsan@chinsan2.twbbs.org>
uid Chin-San Huang (FreeBSD committer) <chinsan@FreeBSD.org>
uid Chin-San Huang (Gmail) <chinsan.tw@gmail.com>
sub 2048g/35F75A30 2006-10-04
```

### D.3.111 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.3.112 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.3.113 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.3.114 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.3.115 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.3.116 Trevor Johnson <trevor@FreeBSD.org>**

```
pub 1024D/3A3EA137 2000-04-20 Trevor Johnson <trevor@jpj.net>
 Key fingerprint = 7ED1 5A92 76C1 FFCB E5E3 A998 F037 5A0B 3A3E A137
sub 1024g/46C24F1E 2000-04-20
```

### **D.3.117 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.3.118 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.3.119 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 Karthausen <joe@uk.FreeBSD.org>
uid [revoked] Josef Karthausen <josef@bsdì.com>
uid [revoked] Josef Karthausen <joe@pavilion.net>
sub 2048g/1178B692 2000-10-19
```

### D.3.120 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.3.121 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@obsecularity.org>
sub 2048g/03A41C45 2000-01-14 [expires: 2006-01-14]
```

### D.3.122 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@iclub.nsu.ru>
sub 1024g/6585039B 2003-04-29
```

### D.3.123 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.3.124 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.3.125 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.3.126 Johann Kois <jkois@FreeBSD.org>

```
pub 1024D/DD61C2D8 2004-06-27 Johann Kois <J.Kois@web.de>
 Key fingerprint = 8B70 03DB 3C45 E71D 0ED4 4825 FEB0 EBEF DD61 C2D8
uid Johann Kois <jkois@freebsd.org>
sub 1024g/568307CB 2004-06-27
```

### D.3.127 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.3.128 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.3.129 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.3.130 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.3.131 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.3.132 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.3.133 Ana Kukec <anchie@FreeBSD.org>

```
pub 2048R/510D23BB 2010-04-18
 Key fingerprint = 0A9B 0ABB 0E1C B5A4 3408 398F 778A C3B4 510D 23BB
uid Ana Kukec <anchie@FreeBSD.org>
sub 2048R/699E4DDA 2010-04-18
```

### D.3.134 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.3.135 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.3.136 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.3.137 René Ladan <rene@FreeBSD.org>

```
pub 1024D/E5642BFC 2008-11-03
 Key fingerprint = ADBC ECCD EB5F A6B4 549F 600D 8C9E 647A E564 2BFC
uid Rene Ladan <rene@freebsd.org>
sub 2048g/C54EA560 2008-11-03
```

### D.3.138 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.3.139 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.3.140 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.3.141 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.3.142 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.3.143 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.3.144 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.3.145 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.3.146 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.3.147 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.3.148 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.3.149 Andrey V. Elsukov <ae@FreeBSD.org>**

```
pub 2048R/10C8A17A 2010-05-29
 Key fingerprint = E659 1E1B 41DA 1516 F0C9 BC00 01C5 EA04 10C8 A17A
uid Andrey V. Elsukov <ae@freebsd.org>
uid Andrey V. Elsukov <bu7cher@yandex.ru>
sub 2048R/0F6D64C5 2010-05-29
```

### **D.3.150 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.3.151 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.3.152 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.3.153 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>
```



### **D.3.157 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.3.158 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.3.159 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.3.160 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.3.161 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.3.162 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.3.163 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.3.164 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.3.165 Remko Lodder <remko@FreeBSD.org>

```
pub 2048R/6EB8C8C8 2010-05-28 [expires: 2012-05-27]
 Key fingerprint = D692 91F9 F4EF D363 7F3F 4D17 9C75 DF7B 6EB8 C8C8
uid Remko Lodder (Remko Lodder's Key) <remko@FreeBSD.org>
sub 2048R/011C6AA0 2010-05-28 [expires: 2012-05-27]
```

### D.3.166 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.3.167 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.3.168 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.3.169 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.3.170 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.3.171 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.3.172 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.3.173 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.3.174 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.3.175 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.3.176 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.3.177 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.3.178 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.3.179 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.3.180 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.3.181 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.3.182 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.3.183 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.3.184 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.3.185 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.3.186 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.3.187 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.3.188 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.3.189 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.3.190 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.3.191 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.3.192 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.3.193 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.3.194 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.3.195 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.3.196 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.3.197 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.3.198 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.3.199 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.3.200 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.3.201 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.3.202 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.3.203 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.3.204 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.3.205 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.3.206 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.3.207 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.3.208 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.3.209 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.3.210 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@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>  
 uid Peter Pentchev <roam-guest@alioth.debian.org>  
 uid Peter Pentchev <ppentchev@alumni.princeton.edu>  
 sub 4096R/D0B337AA 2009-10-16

### **D.3.211 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.3.212 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.3.213 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.3.214 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.3.215 Giuseppe Pilichi <jacula@FreeBSD.org>**

```
pub 4096R/8B9F4B8B 2006-03-08
 Key fingerprint = 31AD 73AE 0EC0 16E5 4108 8391 D942 5F20 8B9F 4B8B
uid Giuseppe Pilichi (Jacula Modyun) <jacula@FreeBSD.org>
uid Giuseppe Pilichi (Jacula Modyun) <jaculamodyun@gmail.com>
uid Giuseppe Pilichi (Jacula Modyun) <gpilch@gmail.com>
uid Giuseppe Pilichi (Jacula Modyun) <jacula@gmail.com>
sub 4096R/FB4D05A3 2006-03-08
```

### D.3.216 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.3.217 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.3.218 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.3.219 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.3.220 Alejandro Pulver <alepulver@FreeBSD.org>

```
pub 1024D/945C3F61 2005-11-13
Key fingerprint = 085F E8A2 4896 4B19 42A4 4179 895D 3912 945C 3F61
uid Alejandro Pulver (Ale's GPG key pair) <alepulver@FreeBSD.org>
uid Alejandro Pulver (Ale's GPG key pair) <alejandro@varnet.biz>
sub 2048g/6890C6CA 2005-11-13
```

### **D.3.221 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.3.222 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.3.223 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.3.224 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.3.225 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.3.226 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.3.227 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.3.228 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.3.229 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.3.230 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.3.231 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.3.232 Craig Rodrigues <rodrirc@FreeBSD.org>**

```
pub 1024D/3998479D 2005-05-20
 Key fingerprint = F01F EBE6 F5C8 6DC2 954F 098F D20A 8A2A 3998 479D
uid Craig Rodrigues <rodrirc@freebsd.org>
uid Craig Rodrigues <rodrirc@crodrigues.org>
sub 2048g/AA77E09B 2005-05-20
```

### **D.3.233 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.3.234 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.3.235 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.3.236 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.3.237 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.3.238 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.3.239 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.3.240 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.3.241 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.3.242 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.3.243 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.3.244 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.3.245 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.3.246 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.3.247 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.3.248 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.3.249 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.3.250 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.3.251 Ashish SHUKLA <ashish@FreeBSD.org>**

```
pub 4096R/E74FA4B0 2010-04-13
 Key fingerprint = F682 CDCC 39DC 0FEA E116 20B6 C746 CFA9 E74F A4B0
uid Ashish SHUKLA <wahjava@gmail.com>
uid Ashish SHUKLA <wahjava@googlemail.com>
uid Ashish SHUKLA <wahjava.ml@gmail.com>
uid Ashish SHUKLA <wahjava@members.fsf.org>
uid Ashish SHUKLA <wahjava@perl.org.in>
uid Ashish SHUKLA <wahjava@users.sourceforge.net>
uid Ashish SHUKLA <wah.java@yahoo.com>
uid Ashish SHUKLA <wah_java@hotmail.com>
uid Ashish SHUKLA <ashish.shukla@airtelmail.in>
uid Ashish SHUKLA <wahjava@member.fsf.org>
uid [jpeg image of size 4655]
uid Ashish SHUKLA (FreeBSD Committer Address) <ashish@FreeBSD.ORG>
sub 4096R/F20D202D 2010-04-13
```

### **D.3.252 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.3.253 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.3.254 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.3.255 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.3.256 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.3.257 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.3.258 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.3.259 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 <csxbs@comp.leeds.ac.uk>
uid Ben Smithurst <ben@scientia.demon.co.uk>
sub 1024g/347071FF 2001-07-11
```

### **D.3.260 Dag-Erling C. Smørgrav <des@FreeBSD.org>**

```
pub 1024D/64EBE220 2006-11-11 [expires: 2011-05-31]
 Key fingerprint = 3A1C 8E68 952C 3305 6984 6486 30D4 3A6E 64EB E220
uid Dag-Erling Smørgrav <des@des.no>
uid Dag-Erling Smørgrav <des@freebsd.org>
uid [jpeg image of size 3315]
```

sub 2048g/920C3313 2006-11-11 [expires: 2011-05-31]

### **D.3.261 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.3.262 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.3.263 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.3.264 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.3.265 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.3.266 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.3.267 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.3.268 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.3.269 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.3.270 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.3.271 Ryan Stone <rstone@FreeBSD.org>**

```
pub 1024D/3141B73A 2010-04-13
 Key fingerprint = 4A6D DC04 DDC5 0822 2687 A086 FD3F 16CB 3141 B73A
uid Ryan Stone (FreeBSD) <rstone@freebsd.org>
sub 2048g/A8500B5F 2010-04-13
```

### **D.3.272 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.3.273 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.3.274 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.3.275 Gregory Sutter <gsutter@FreeBSD.org>

```
pub 1024D/845DFEED 2000-10-10 Gregory S. Sutter <gsutter@zer0.org>
 Key fingerprint = D161 E4EA 4BFA 2427 F3F9 5B1F 2015 31D5 845D FEDD
uid Gregory S. Sutter <gsutter@freebsd.org>
uid Gregory S. Sutter <gsutter@daemonnews.org>
uid Gregory S. Sutter <gsutter@pobox.com>
sub 2048g/0A37BBCE 2000-10-10
```

### D.3.276 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.3.277 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.3.278 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.3.279 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.3.280 Sahil Tandon <sahil@FreeBSD.org>

```
pub 2048R/C016D977 2010-04-08
 Key fingerprint = 6AD2 BA99 8E3A 8DA6 DFC1 53CF DBD0 6001 C016 D977
uid Sahil Tandon <sahil@tandon.net>
uid Sahil Tandon <sahil@FreeBSD.org>
sub 2048R/F7776FBC 2010-04-08
```

### D.3.281 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.3.282 Romain Tartière <romain@FreeBSD.org>

```
pub 3072R/5112336F 2010-04-09
 Key fingerprint = 8234 9A78 E7C0 B807 0B59 80FF BA4D 1D95 5112 336F
uid Romain Tartière <romain@blogreen.org>
uid Romain Tartière (FreeBSD) <romain@FreeBSD.org>
sub 3072R/C1B2B656 2010-04-09
sub 3072R/8F8125F4 2010-04-09
```

### D.3.283 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.3.284 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.3.285 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.3.286 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.3.287 Lars Thegler <lth@FreeBSD.org>**

pub 1024D/56B0CA08 2004-05-31 Lars Thegler <lth@FreeBSD.org>  
Key fingerprint = ABAA F98C EA78 1C8D 6FDD CB27 1CA9 5A63 56B0 CA08  
uid Lars Thegler <lars@thegler.dk>  
sub 1024g/E8C58EF3 2004-05-31

### **D.3.288 David Thiel <lth@FreeBSD.org>**

pub 1024D/A887A9B4 2006-11-30 [expires: 2011-11-29]  
Key fingerprint = F08F 6A12 738F C9DF 51AC 8C62 1E30 7CBE A887 A9B4  
uid David Thiel <lth@FreeBSD.org>  
sub 2048g/B9BD92C5 2006-11-30 [expires: 2011-11-29]

### **D.3.289 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.3.290 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.3.291 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.3.292 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.3.293 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.3.294 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.3.295 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.3.296 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.3.297 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.3.298 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.3.299 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.3.300 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.3.301 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.3.302 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.3.303 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.3.304 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.3.305 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.3.306 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.3.307 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.3.308 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.3.309 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.3.310 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.3.311 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.3.312 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.3.313 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.3.314 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.3.315 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.3.316 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.3.317 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
```









## Challenge Handshake Authentication Protocol

Ἡ εἰσαγωγή εἰς τὸ δῆμιον ἀποδείκνυται ἀπὸ τὴν ἀποστολὴν ἀποδείξεως, ἢ ἀπὸ τὴν ἀποστολὴν ἀποδείξεως, ἢ ἀπὸ τὴν ἀποστολὴν ἀποδείξεως.

## Classical IP over ATM

## Clear To Send

Ἡ εἰσαγωγή εἰς τὴν RS232C εἰς τὴν ἀποστολὴν ἀποδείξεως εἰς τὴν ἀποστολὴν ἀποδείξεως.

Ἡ εἰσαγωγή εἰς τὴν ἀποστολὴν ἀποδείξεως: Request To Send.

## Common Object File Format

## Concurrent Versions System

Ἡ εἰσαγωγή εἰς τὴν ἀποστολὴν ἀποδείξεως εἰς τὴν ἀποστολὴν ἀποδείξεως (version control system). Ἡ εἰσαγωγή εἰς τὴν ἀποστολὴν ἀποδείξεως εἰς τὴν ἀποστολὴν ἀποδείξεως εἰς τὴν ἀποστολὴν ἀποδείξεως. Ἡ εἰσαγωγή εἰς τὴν ἀποστολὴν ἀποδείξεως εἰς τὴν ἀποστολὴν ἀποδείξεως εἰς τὴν ἀποστολὴν ἀποδείξεως.

## D

### DAC

Ἡ εἰσαγωγή εἰς τὴν ἀποστολὴν ἀποδείξεως: Discretionary Access Control

### DDB

Ἡ εἰσαγωγή εἰς τὴν ἀποστολὴν ἀποδείξεως: Debugger

### DES

Ἡ εἰσαγωγή εἰς τὴν ἀποστολὴν ἀποδείξεως: Data Encryption Standard

### DHCP

Ἡ εἰσαγωγή εἰς τὴν ἀποστολὴν ἀποδείξεως: Dynamic Host Configuration Protocol

### DNS

Ἡ εἰσαγωγή εἰς τὴν ἀποστολὴν ἀποδείξεως: Domain Name System



## Domain Name System

Οι πληροφορίες του ιαόαδνΥθαέ οι άδάρΥαφύοοι, οδιάρεέεü uññá ÈÙèà ιç ÷ άΠιαδιδò (hostname), üδùδ δ. ÷. οι mail.example.net, όοçi άñέèìçδóέέΠ äéáyèδιδίόç Internet διδò οιδò άίόέόδιδέ ÷ άβ éάé οι άίΥδιδάι.

## Dynamic Host Configuration Protocol

Ίά όύόόçιά äδιδίέέΠδ άίΥèáόçδ äéáδèýιδóüí IP. ÈÙèà δδιδιδάέόδΠδ (host) ιδιδñάβ ίά æçδΠόάé ίéá äéáyèδιδίόç IP άδιδι Υιδίί άιδδçñάδçδΠ DHCP. Ç άίΥèáόç δçδ äéáyèδιδίόç èΥñáδóáé éáé “lease”.

## E

### ECOFF

Άάβδóá: Extended COFF

### ELF

Άάβδóá: Executable and Linking Format

### ESP

Άάβδóá: Encapsulated Security Payload

### Encapsulated Security Payload

### Executable and Linking Format

### Extended COFF

## F

### FADT

Άάβδóá: Fixed ACPI Description Table

### FAT

Άάβδóá: File Allocation Table

### FAT16

Άάβδóá: File Allocation Table (16-bit)



## H

### HTML

Άλλα: HyperText Markup Language

### HUP

Άλλα: HangUp

### HangUp

## HyperText Markup Language

Το πρόγραμμα δημιουργίας (markup language) διο - δημιουργεί έγγραφα (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

Ο Υποστηρικτής 4 του πρωτοκόλλου IP, χρησιμοποιεί 32 bits για τον αριθμό διεύθυνσης. Ο Υποστηρικτής 4 του πρωτοκόλλου IP είναι ο παλιός υποστηρικτής, ενώ ο υποστηρικτής 6 του πρωτοκόλλου IP είναι ο νέος υποστηρικτής.

Απόδοση: IP Version 6.

### IP Version 6

Ο Υποστηρικτής 6 του πρωτοκόλλου IP, χρησιμοποιεί 128 bits για τον αριθμό διεύθυνσης. Ο Υποστηρικτής 6 του πρωτοκόλλου IP είναι ο παλιός υποστηρικτής, ενώ ο υποστηρικτής 4 του πρωτοκόλλου IP είναι ο νέος υποστηρικτής.

## Input/Output

### Intel's ASL compiler

Ο υποστηρικτής του Intel για τον ASL ονομάζεται AML.

### Internet Message Access Protocol

Είναι το πρωτόκολλο που χρησιμοποιείται για την αποστολή και την λήψη email. Ο υποστηρικτής του είναι ο υποστηρικτής 3 του πρωτοκόλλου Post Office Protocol.

Απόδοση: Post Office Protocol Version 3.

### Internet Printing Protocol

### Internet Protocol

Οι διεύθυνσεις IP είναι αριθμοί, οι οποίοι χρησιμοποιούνται για την αποστολή και την λήψη δεδομένων στο Internet. Ο υποστηρικτής του είναι ο υποστηρικτής 4 του πρωτοκόλλου TCP/IP. Ο υποστηρικτής 6 του πρωτοκόλλου IP είναι ο παλιός υποστηρικτής, ενώ ο υποστηρικτής 4 του πρωτοκόλλου IP είναι ο νέος υποστηρικτής. Δείτε το RFC 791 (<ftp://ftp.rfc-editor.org/in-notes/rfc791.txt>).

### Internet Service Provider

Είναι ο πάροχος υπηρεσιών στο Internet.



## L

### LAN

Äâβðâ: Local Area Network

### LOR

Äâβðâ: Lock Order Reversal

### LPD

Äâβðâ: Line Printer Daemon

### Line Printer Daemon

### Local Area Network

Äβêðī ðīō ÷ ñçóéīīðīéâβðâé óá íéá ðīðéêð ðāñéī ÷ ð, ð. ÷. āñáóâβī, óðβðé ê.ī.ê.

### Lock Order Reversal

Ī ððñÞíáð ðīō FreeBSD ÷ ñçóéīīðīéâβ Ýíá āñéèü áðü resource locks āéá íá äéá ÷ äéñβæâðâé ôçí ðñüóââóç óðéð äéÜöīñâð ðçāÝð ðīō. Íáð ìç ÷ áíéóìüð äéÜāíüóçð ðñīāēçīÜðüī ìá áððÜ óá locks, ì ðīβīð éÝāâðâé witness(4), ðāñééâìäÜíáðâé óðīðð ðāñéñāíáðéééýð ððñÞíáð (äééÜ áóáéñâβðâé áðü ðīðð ððñÞíáð ðüī óðäéñÞī äéäüóâüī) êé äéÝā ÷ äé éáðÜ ôçí Þñá éäéóīðñââð ðīō ððñÞíá ðçí ðééáíüôçðá ðñīāēçīÜðüī deadlock. (Ī ìç ÷ áíéóìüð witness(4) âβíáé āáóééÜ āñéâðÜ óóíôçñçóééüð óðīðð äéÝā ÷ ðð ðīō êÜíáé, ððüðâ âβíáé ðééáíüī êÜðīéá áðü óá äéáāíüóðééÜ ìçíýíáðÜ ðīō íá âβíáé ððñāñēééÜ.) Íá äéáāíüóðééü ìÞíòíá áðü ðī ìç ÷ áíéóìü äððü óçíâβíáé üðé “áí âβóðâ āñéâðÜ Üðð ÷ íé, Ýíá deadlock ìðññâβ íá óðíââβ óðī óçíâβī áððü”.

Óá ðñāñíáðééÜ LOR, óðīÞèùð, äéññèÞííðâé ññÞāññá, ððüðâ íá äéÝā ÷ äðâ ôç <http://lists.FreeBSD.org/mailman/listinfo/freebsd-current> éáé ôç óâëβâá ðüī LOR ðīō âβíáé āíüóðÜ ìÝ ÷ ñé óÞñññá (<http://sources.zabbadoz.net/freebsd/lor.html>) ðñéí óðâβèâðâ ìÞíòíá óâ êÜðīéá áðü êéð êβóðâð çéâêðñīéééý óá ÷ ðāñññâβīð.

## M

### MAC

Äâβðâ: Mandatory Access Control

### MADT

Äâβðâ: Multiple APIC Description Table

### MFC

Äâβðâ: Merge From Current

**MFP4**

Άβδα: Merge From Perforce

**MFS**

Άβδα: Merge From Stable

**MIT**

Άβδα: Massachusetts Institute of Technology

**MLS**

Άβδα: Multi-Level Security

**MOTD**

Άβδα: Message Of The Day

**MTA**

Άβδα: Mail Transfer Agent

**MUA**

Άβδα: Mail User Agent

**Mail Transfer Agent**

Ιέα ἀσάνιτθ δίο ÷ ηςόειιθιέαβδαέ αέα οςί ιαδαοιηέ email. Εάοέ δάνηιός, οι MTA ἀδιθαεργόα οιπία οιο ἀάόεεργ οοοδπιαοιο οιο BSD. Οπιανά, οι sendmail δανέεαηαίιαδαέ οοι ἀάόεευ ογόογια αεεέ οδηñ÷ιθί έαέ θρεεέέ Üεεά MTAs, ιθδò δά postfix, qmail έαέ Exim.

**Mail User Agent**

Ιέα ἀσάνιτθ αέα ος αέα÷αβηέος, αηηιθός ιςιθιέουι ςεάεθηιέεθδ αεεεηαηάοβαδ έαέ οςί ἀδιόθιεθ ἀθαίθθραυι οά αδδέ.

**Mandatory Access Control**

**Massachusetts Institute of Technology**

**Merge From Current**

ς οδã÷πιαόςθ θ ιαδαοιηέ αηυδ ÷ ανάέδςηέοδέεργ θ ιεάδ αεηηεθςδ αδυ οιθ έεηαι αηθδδθςδ -CURRENT οά Υία Üεει έεηαι (οοιθεδò Υία αδυ οιοδ έεηαιθδ -STABLE).

### Merge From Perforce

Ο ορισμός της διαδρομής P για τον έλεγχο των αλλαγών στο Perforce ορίζεται ως εξής:

Αλλαγή: Perforce.

### Merge From Stable

Ο ορισμός της διαδρομής FreeBSD για τον έλεγχο των αλλαγών στο -CURRENT branch είναι η διαδρομή -STABLE. Για να γίνει η αντιστροφή από το -CURRENT στο -STABLE είναι απαραίτητο να γίνει η αντιστροφή από το -CURRENT.

Για να γίνει η αντιστροφή από το -STABLE branch στο -CURRENT branch είναι απαραίτητο να γίνει η αντιστροφή από το -STABLE branch στο -CURRENT branch.

Αλλαγή: Merge From Current.

### Message Of The Day

Για την ημέρα της ανακοίνωσης ορισμένων αλλαγών στο FreeBSD ορίζεται η διαδρομή -CURRENT branch. Για να γίνει η αντιστροφή από το -CURRENT στο -STABLE είναι απαραίτητο να γίνει η αντιστροφή από το -CURRENT στο -STABLE.

### Multi-Level Security

### Multiple APIC Description Table

## N

### NAT

Αλλαγή: Network Address Translation

### NDISulator

Αλλαγή: Project Evil

### NFS

Αλλαγή: Network File System

### NTFS

Αλλαγή: New Technology File System

### NTP

Αλλαγή: Network Time Protocol

## Network Address Translation

Ἡ Network Address Translation (NAT) ἐπιτρέπει σὲ ἕνα ἰδιωτὴ ἀποστολέα IP ἀποστολέα (client) νὰ ἐπικοινωνήσει μετὰ ἕνα ἰδιωτὴ ἀποστολέα IP (gateway), ὁποῖος εἶναι ἡ ἀποστολέα ἰδιωτὴ ἀποστολέα IP. Ὁ NAT μετατρέφει τὸ ἀποστολέα IP τοῦ ἀποστολέα εἰς τὸ ἀποστολέα IP τοῦ ἀποστολέα ἰδιωτὴ ἀποστολέα IP.

## Network File System

### New Technology File System

Ἡ New Technology File System (NTFS) εἶναι ἡ ἀποστολέα ἰδιωτὴ ἀποστολέα IP τοῦ ἀποστολέα ἰδιωτὴ ἀποστολέα IP. Ὁ NTFS εἶναι ἡ ἀποστολέα ἰδιωτὴ ἀποστολέα IP τοῦ ἀποστολέα ἰδιωτὴ ἀποστολέα IP.

## Network Time Protocol

Ἡ Network Time Protocol (NTP) εἶναι ἡ ἀποστολέα ἰδιωτὴ ἀποστολέα IP τοῦ ἀποστολέα ἰδιωτὴ ἀποστολέα IP.

# O

## OBE

*Ἀπόδοση:* Overtaken By Events

## ODMR

*Ἀπόδοση:* On-Demand Mail Relay

## OS

*Ἀπόδοση:* Operating System

## On-Demand Mail Relay

## Operating System

Ἡ Operating System (OS) εἶναι ἡ ἀποστολέα ἰδιωτὴ ἀποστολέα IP τοῦ ἀποστολέα ἰδιωτὴ ἀποστολέα IP. Ὁ OS εἶναι ἡ ἀποστολέα ἰδιωτὴ ἀποστολέα IP τοῦ ἀποστολέα ἰδιωτὴ ἀποστολέα IP.

## Overtaken By Events

× ηζοείιθιεάβδσάε αέα ία δάνεάνϋφσάε ίέα θνιρδσείιιιίαιζ σέεσάβ (ιθδθδ ίέα Αίάσινϋ θνιρδσείιιιιιιιιι ρ ίέα σβδζός αέα εϋθιεί ίΎι ÷ ανσέδσπσόόέεϋ) θιθ σσί εσ ÷ σάε δεΎι ρ σσί Ύ ÷ σέ σίβσ εϋσϋ εϋθιεσδ θνιρδσείιιιιιιιιι σέεσάβδ σόι FreeBSD, σέεσάΎδ σσί εϋθιεί θνιρδσείι, σδσάβδ οι ρ ÷ σδέεϋ σέεεϋ εσνσνσβδσάε δεΎι ίσδσνσσίΎι, εεδ.

## **P**

### **p4**

Άσβδσ: Perforce

### **PAE**

Άσβδσ: Physical Address Extensions

### **PAM**

Άσβδσ: Pluggable Authentication Modules

### **PAP**

Άσβδσ: Password Authentication Protocol

### **PC**

Άσβδσ: Personal Computer

### **PCNSFD**

Άσβδσ: Personal Computer Network File System Daemon

### **PDF**

Άσβδσ: Portable Document Format

### **PID**

Άσβδσ: Process ID

### **POLA**

Άσβδσ: Principle Of Least Astonishment

### **POP**

Άσβδσ: Post Office Protocol

### **POP3**

Άσβδσ: Post Office Protocol Version 3

### **PPD**

Άσβδσ: PostScript Printer Description

**PPP**

Άλλα: Point-to-Point Protocol

**PPPoA**

Άλλα: PPP over ATM

**PPPoE**

Άλλα: PPP over Ethernet

**PPP over ATM**

**PPP over Ethernet**

**PR**

Άλλα: Problem Report

**PXE**

Άλλα: Preboot eXecution Environment

**Password Authentication Protocol**

**Perforce**

Το σύστημα της Perforce Software (<http://www.perforce.com/>) έχει τη δική της βάση κώδικα CVS. Ας ελπίσουμε ότι η Perforce θα είναι διαθέσιμη στο FreeBSD.

Εάν χρειάζεστε να εγκαταστήσετε το Perforce στο FreeBSD, τότε θα πρέπει να χρησιμοποιήσετε το πακέτο `perforce-current`.

**Personal Computer**

**Personal Computer Network File System Daemon**

**Physical Address Extensions**

Το σύστημα της Perforce Software (<http://www.perforce.com/>) έχει τη δική της βάση κώδικα CVS. Ας ελπίσουμε ότι η Perforce θα είναι διαθέσιμη στο FreeBSD.



## Problem Report

Ιέα δάνεάνάοP εÜθιέρο άβαιοδ θνιαιεPιαοίö öi ιθίβι ανΎεçέα öóη δçääβι έπαέέα P öççí öáέιçñβüöç öü FreeBSD. Άάβöá öi Üñèñì ÁñÜóηóáo ÁίáoηñΎò ΔñηάεçìÜöüì áέα öi FreeBSD ([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)).

## Process ID

ΐáo άνέέüüö öüö áίáñññβæάέ íá ηηάάέü öñüöθi ιέα áέάñááoöá öüö ööóöPιαöüö έάέ íáo άδέöñΎöáέ íá ανÜóηöìά öá άööP.

## Project Evil

Ì θñáñíáoέéüö öβöëüö öüö NDISulator öüö Ύάñáöá ì Bill Paul, ì ιθίβüö öi ηüüíáoá Ύöóέ áέα íá άάβíáέ öüöí áδάβöéí άβíáέ (άδü öέéüöüöééPö Üθiöçö) íá öðÜñ÷άέ ç áíÜáέç áέα éÜöé öΎöíéí. Öü NDISulator άβíáέ Ύíá áέάééü Üñèñüíá öüíááoüöçöáo öi ιθίβi άδέöñΎöáέ öá íäçáíýö ööóéáöPí áέéöýüö öýöüö Microsoft Windows™ NDIS miniport íá ÷ñçöéüüöéçéçéçí öüí FreeBSD/i386. Áööüö άβíáέ öüíPεüö ì ηüñö öñüöüö íá ÷ñçöéüüöéçéçéçí éÜñöáö áέéöýüö öüí ιθίβüí íé íäçáñβ ááí άβíáέ áέαéΎöéíé öá ηñöP áέáýéáññö P áñé÷öüý éüéöüéééçí. Άάβöá έάέ öi άñ÷άβi src/sys/compat/ndis/subr\_ndis.c áέα δάνεöóüöäññö éäöüñΎñáéäö.

# R

## RA

Άάβöá: Router Advertisement

## RAID

Άάβöá: Redundant Array of Inexpensive Disks

## RAM

Άάβöá: Random Access Memory

## RD

Άάβöá: Received Data

## RFC

Άάβöá: Request For Comments

## RISC

Άάβöá: Reduced Instruction Set Computer

## RPC

Άάβöá: Remote Procedure Call

**RS232C**

Άβδδ: Recommended Standard 232C

**RTS**

Άβδδ: Request To Send

**Random Access Memory**

**Revision Control System**

To *Revision Control System* (RCS) άβιάέ Υία άδü ðά δάέέüðάñά óóóðΠιάðά ðü ðεüðüέüüü “Υέää÷ü äέäüüóäüü” äέά άðέÜ äñ÷άβά. ΆðέðñΥðäέ ðçü äðüèΠέäðóç, áüÜέðçóç, äñ÷άέüèΥðçóç, éáðääñäðΠ, áüääüññέóç éäέ óðä÷Πüäðóç ðüèääðéΠü äέäüüóäüü äέά éÜèä äñ÷άβü. Öü RCS äðüðäéäβðäέ άδü ðüèèÜ üέéñÜ äñääéääβä ðü óðüññäÜäüüóäέ üäðäüü ðüðð. Ääü äέäéΥðäέ üñέóüΥüä άδü ðά ÷äñäéðçñέóðééÜ ðüð ðäñΥ÷üðäέ άδü ðéü üüóΥñüä óóóðΠüäðä äéΥä÷ü äέäüüóäüü, äéèÜ äβüäέ ðüèü äýèüèü óðçü ääéäðÜóðäóç éäέ ñýèüέóç éäέ ðüèü äðéü óðç ÷ñΠðç äέά üέéñü äñέèü äéää÷üüüüüü äñ÷άβüü. Öü RCS äéäðβèäðäέ ðñäéðééÜ äέά éÜèä ääéðüññäééü ðü ääóβæäðäέ óðéð äñ÷Υð ääéðüññäβäð ðü UNIX.

Άβδδä Åðβðçð: Concurrent Versions System, Subversion.

**Received Data**

üä éäéΠäéü Π äéñüäΥέðçð ðüð RS232C óðü üðüβü äβüäðäέ éΠçç ääññΥüüü.

Άβδδä Åðβðçð: Transmitted Data.

**Recommended Standard 232C**

üä ðñüðððü äέά äðéèüèüüüüüü üäðäüü óäéñéäéΠü óðóéäðéΠü.

**Reduced Instruction Set Computer**

üέä ðñüóΥääέóç óðç ó÷ääβäóç äðäüññääóðéΠü ðüð äðéüðüèäβ ðü äβäüð ðüü ääéðüññäééΠü ðüð üðüññäβ üä äéðäéΥðäέ ðü ðééèü Πððä üä üä äβüäέ éäðÜ ðü äüüäðüü ääüèüüü óéüðüü. Äððü üäçääβ óä ÷äüçèüðäñç éäðäüÜèùç äüüññäéäð, ÷ñçóéüüðüèäβ ééäüðäñüð çüéääüüüüüüü éäέ óä üñέóüΥüäð ðäñéðððäéð äðéððä÷Üüäé éäéýðäñç äðüüüóç éäέ äðüçüüüüüüü ððéüüüüüüü éΠäééä. ðäñäääβäüüüüüüü äðäüññääóðéΠü RISC ðäñééäüüüüüüüü ðüð Alpha, SPARC, ARM éäέ PowerPC.

**Redundant Array of Inexpensive Disks**

**Remote Procedure Call**

**repcopy**

Āāβōā: Repository Copy

**Repository Copy**

Āāōēāβād āíōēāñāōP āñ ÷ āβūí īYóá óā Yía āðīēāōPñēī CVS.

× ùñβō òç äéāēēāóβā ðīō repcopy, áí Yía āñ ÷ āβī ÷ ñāēŪæāóáē íá āíōēāñāōāβ P íá íāōáōāñēāβ óā Yía Ūēēī óçīāβī īYóá óōī āðīēāōPñēī, ī committer ēā ðñYðāē íá āēōāēYóáē òçī āíōīēP cvs add āēá íá ðīðīēāōPóāē ðī āñ ÷ āβī óóçī íYá ðīō èYóç ēáē Yðāēóá òçī āíōīēP cvs rm óōī ðāēēū āñ ÷ āβī āēá íá ðī āēāñŪøāē.

Ōī íāēīYēðçíā áōðPð òçð íāēuāīō āβíāē ūōē āāí āíōēāñŪōāóáē ðī éóōīñēēū (íē ēáóá ÷ ùñPóāēð óōī āñ ÷ āβī ēáóāāñāōPð ðīō CVS) óóç íYá èYóç. ÊāēPð ðī FreeBSD Project ēāññāβ ðīēy ÷ ñPóēíāð áóōYð ðēð ðēçñīōīñβād, āβíāóáē óō ÷ íŪ ÷ ñPóç òçð äéāēēāóβād repcopy. ÊáóŪ òç äéāēēāóβā áóðP, ī āēá ÷ āēñēóóPð ðīō āðīēāóçñβīō āíōēāñŪōāē óā āñ ÷ āβā āðāōēāβād óóç íYá èYóç ðīō āðīēāóçñβīō, āíóβ íá ÷ ñçóēīðīēPóāē ðī ðñūāñāíā cvs(1).

**Request For Comments**

Íá óyñēī āāāñŪōūí ðīō ðāñēāñŪōīōí óā ðñūōððā, óā ðñūðūēīēēā ēáē óēð ēīēðYð äēāñāáóβād ðīō äēYðīōí òç ēāēōīōñāβā ðīō Internet. Āāβōā ðī [www.rfc-editor.org](http://www.rfc-editor.org) (<http://www.rfc-editor.org/>).

× ñçóēīðīēāβóáē āðβóçð ùð āāíēēūð ūñīð ūóáí ēŪðīēīð ðñīðāβíāē íēá äēēāāP ēáē ðāñēíYíāē ó ÷ ūēēá ó ÷ āðēēŪ íā áóðP.

**Request To Send**

Íá óPíā óōī RS232C ðīō æçðŪāē áðū ðī āðñāēñōóíYíí óyóóçíā íá óōíā ÷ βóāē òç íāðŪāīōç ðūí āāāñYíúí.

Āāβōā Āðβóçð: Clear To Send.

**Router Advertisement**

**S**

**SCI**

Āāβōā: System Control Interrupt

**SCSI**

Āāβōā: Small Computer System Interface

**SG**

Āāβōā: Signal Ground

**SMB**

Āāβōā: Server Message Block

**SMP**

Άλλα: Symmetric MultiProcessor

**SMTP**

Άλλα: Simple Mail Transfer Protocol

**SMTP AUTH**

Άλλα: SMTP Authentication

**SSH**

Άλλα: Secure Shell

**STR**

Άλλα: Suspend To RAM

**SVN**

Άλλα: Subversion

**SMTP Authentication**

**Server Message Block**

**Signal Ground**

Το σήμα γείωσης είναι η RS232 που χρησιμοποιείται για να συνδεθεί ο υπολογιστής με το δίκτυο.

**Simple Mail Transfer Protocol**

**Secure Shell**

**Small Computer System Interface**

**Subversion**

Οι Subversion είναι ουσιαστικά ένα σύστημα για να διαχειριστείτε τα CVS αλλά και να έχετε την δυνατότητα να διαχειριστείτε τα CVS.

Άλλα Άλλα: Concurrent Versions System.

## Suspend To RAM

## Symmetric MultiProcessor

## System Control Interrupt

# T

## TCP

Ἄλλοτε: Transmission Control Protocol

## TCP/IP

Ἄλλοτε: Transmission Control Protocol/Internet Protocol

## TD

Ἄλλοτε: Transmitted Data

## TFTP

Ἄλλοτε: Trivial FTP

## TGT

Ἄλλοτε: Ticket-Granting Ticket

## TSC

Ἄλλοτε: Time Stamp Counter

## Ticket-Granting Ticket

## Time Stamp Counter

Ἡ ἀριθμολογία αἰετῶν ἔχει ἀποδοθεῖ ἡ ἀριθμολογία αἰετῶν τῆς Pentium, ἡ ἡμερομηνία ἀποδοθεῖ ἡ ἀριθμολογία αἰετῶν τῆς Pentium, ἡ ἡμερομηνία ἀποδοθεῖ ἡ ἀριθμολογία αἰετῶν τῆς Pentium.

## Transmission Control Protocol

Ἡ ἀριθμολογία αἰετῶν ἔχει ἀποδοθεῖ ἡ ἀριθμολογία αἰετῶν τῆς Pentium, ἡ ἡμερομηνία ἀποδοθεῖ ἡ ἀριθμολογία αἰετῶν τῆς Pentium.

## Transmission Control Protocol/Internet Protocol

Το σύνολο των πρωτοκόλλων που αποτελούν το TCP/IP, είναι ένα από τα πιο σημαντικά πρωτόκολλα του Internet. Το Internet είναι ένα δίκτυο που χρησιμοποιεί το TCP/IP.

## Transmitted Data

Το σύνολο των δεδομένων που αποστέλλονται μέσω RS232C ή άλλου είδους αβίαστού αγωγού.

Άλλο όνομα: Received Data.

## Trivial FTP

# U

## UDP

Άλλο όνομα: User Datagram Protocol

## UFS1

Άλλο όνομα: Unix File System Version 1

## UFS2

Άλλο όνομα: Unix File System Version 2

## UID

Άλλο όνομα: User ID

## URL

Άλλο όνομα: Uniform Resource Locator

## USB

Άλλο όνομα: Universal Serial Bus

## Uniform Resource Locator

Είναι ένα σύνολο αρίθμητων αρίθμων (από 0 έως 255) που χρησιμοποιούνται για τον προσδιορισμό του Internet, είναι ένα σύνολο αρίθμων που χρησιμοποιούνται για τον προσδιορισμό του Internet.

## Unix File System Version 1

Είναι ένα από τα πιο σημαντικά πρωτόκολλα του UNIX, είναι το Berkeley Fast File System.

## Unix File System Version 2

Ιέα άδΥέδαός όν UFS1, ς ίθιβά δνδύάιόάίβόδςάά όόι FreeBSD 5-CURRENT. Όι UFS2 δνιόέΥόάέ άάβέδαδ ίδείε 64 bit δάνιπίδαδ Υόόέ όι όνΥάιά όν 10. ΆέάέΥόάέ άέυιά όδύόδΠνέίς άέόάάίΥύι άν÷άβύί έάέ Υέάά δνιςάιΥία ÷άνάέδςνέόόέέΥ.

## Universal Serial Bus

ΐά δνύόδδύ όέέίϑ δν ÷νςόέιιθιέάβδαέ άέά όςί άέάόύίάάός ίάάΥέιθ δέΠειθδ δάνέόάñάέάέΠί όθιέιάέόθΠί, ÷νςόέιιθιέΠίδαδ ίέα όδδύθιέςίΥίς άέάδάθΠ.

## User ID

ΐάδ ίιίαάέέυδ άνέέιυδ θν άίαόβέάδαέ όά έΥέά ÷νΠόδς άύυδ όθιέιάέόδΠ έάέ ÷νςόέιιθιέάβδαέ άέά όςί άίαάΠνέός όύί δύνύί έάέ όύί άέάέέυιΥδύί θν Υ ÷νι άέ ÷νςέάβ όά άόόύί.

## User Datagram Protocol

ΐά άδέυ έάέ ίς άίέυθέόόι δνδύέιέει δν ÷νςόέιιθιέάβδαέ άέά όςί άίόάέέάΠ άάάñΥύι όά Υία άβέόόι TCP/IP. Όι UDP άάί δάνΥ ÷άέ Υέάά÷ι έάέ άέυñέδός έάέΠί ύδύδ όι TCP.

# V

## VPN

Άάβδα: Virtual Private Network

## Virtual Private Network

Ιέα ίΥέιάδ όν ÷νςόέιιθιέάβ Υία άςύόέί άβέόόι άδέέίέύίβάδ (ύδύδ όι Internet), άέά ίά δάνΥ ÷άέ άδñάέñόόιΥίς δνύόάάός όά Υία όιθέέυ άβέόόι, ύδύδ όι LAN ίέαδ άδέ ÷άβñςόδ.

# Εἰςὕβᾶά

Άδου οἱ ἀεᾶεβι ἀβιάε οἱ ἀδῖοΎεαοία οçð ñāāééPð āñāáóβᾶð ᾶεάοἰῖóŪαῖ ᾶεᾶεἰῖóβῖ οçð “ñŪāáð Ôᾶεἰçñβῖóçð οἰῖ FreeBSD”. Άδου οἱ εᾶβἰᾶἡ ᾶñŪððçēᾶ óᾶ ἰἡñòP SGML, óγῖοῖῖᾶ ἰᾶ οἰ DocBook DTD εᾶέ Ύ÷ᾶέ ἰἡñοἰῖῖεçèᾶβ ᾶðῖ οçἰ SGML óᾶ ῖῖεΎð ᾶεᾶῖᾶᾶðééΎð ἰἡñóΎð ῖᾶἡῖóβᾶóçð ÷ñçóεἰῖῖεβῖóᾶð οçἰ ᾶóᾶἡᾶP **Jade**, ἰεᾶ ἰç ÷ᾶἰP DSSSL ᾶἡé ÷οἰΎ εβᾶέεᾶ. ×ñçóεἰῖῖεβῖçéᾶἰ óᾶ DSSSL stylesheets οἰῖ Norm Walsh ἰᾶ Ύἰᾶ ᾶῖéðéΎἰἰ ᾶῖβῖᾶἰ ὀñῖῖῖῖβçóçð ᾶεᾶ ἰᾶ ᾶβῖῖῖῖ óéð ἰᾶçᾶβᾶð ῖᾶἡῖóβᾶóçð óóçἰ **Jade**. Ç Ύἰððç ἰἡñòP ᾶóðἰΎ οἰῖ εᾶεἰΎἡῖ ᾶᾶἰ εᾶ ὀῖPñ ÷ᾶ ÷ῖñβð οçἰ ᾶεβῖóᾶ óῖἰé ÷ᾶéἰᾶóβᾶð T<sub>E</sub>X οἰῖ Donald Knuth, οἰ L<sup>A</sup>T<sub>E</sub>X οἰῖ Leslie Lamport, P οἰ macro package **JadeTeX** οἰῖ Sebastian Rahtz.