
Linux Networking Cookbook

Carla Schroder

O'REILLY®

Beijing • Cambridge • Farnham • Köln • Paris • Sebastopol • Taipei • Tokyo

Table of Contents

Preface	xv
1. Introduction to Linux Networking	1
1.0 Introduction	1
2. Building a Linux Gateway on a Single-Board Computer	12
2.0 Introduction	12
2.1 Getting Acquainted with the Soekris 4521	14
2.2 Configuring Multiple Minicom Profiles	17
2.3 Installing Pyramid Linux on a Compact Flash Card	17
2.4 Network Installation of Pyramid on Debian	19
2.5 Network Installation of Pyramid on Fedora	21
2.6 Booting Pyramid Linux	24
2.7 Finding and Editing Pyramid Files	26
2.8 Hardening Pyramid	27
2.9 Getting and Installing the Latest Pyramid Build	28
2.10 Adding Additional Software to Pyramid Linux	28
2.11 Adding New Hardware Drivers	32
2.12 Customizing the Pyramid Kernel	33
2.13 Updating the Soekris comBIOS	34
3. Building a Linux Firewall	36
3.0 Introduction	36
3.1 Assembling a Linux Firewall Box	44
3.2 Configuring Network Interface Cards on Debian	45
3.3 Configuring Network Interface Cards on Fedora	48
3.4 Identifying Which NIC Is Which	50

3.5 Building an Internet-Connection Sharing Firewall on a Dynamic WAN IP Address	51
3.6 Building an Internet-Connection Sharing Firewall on a Static WAN IP Address	56
3.7 Displaying the Status of Your Firewall	57
3.8 Turning an iptables Firewall Off	58
3.9 Starting iptables at Boot, and Manually Bringing Your Firewall Up and Down	59
3.10 Testing Your Firewall	62
3.11 Configuring the Firewall for Remote SSH Administration	65
3.12 Allowing Remote SSH Through a NAT Firewall	66
3.13 Getting Multiple SSH Host Keys Past NAT	68
3.14 Running Public Services on Private IP Addresses	69
3.15 Setting Up a Single-Host Firewall	71
3.16 Setting Up a Server Firewall	76
3.17 Configuring iptables Logging	79
3.18 Writing Egress Rules	80
4. Building a Linux Wireless Access Point	82
4.0 Introduction	82
4.1 Building a Linux Wireless Access Point	86
4.2 Bridging Wireless to Wired	87
4.3 Setting Up Name Services	90
4.4 Setting Static IP Addresses from the DHCP Server	93
4.5 Configuring Linux and Windows Static DHCP Clients	94
4.6 Adding Mail Servers to dnsmasq	96
4.7 Making WPA2-Personal Almost As Good As WPA-Enterprise	97
4.8 Enterprise Authentication with a RADIUS Server	100
4.9 Configuring Your Wireless Access Point to Use FreeRADIUS	104
4.10 Authenticating Clients to FreeRADIUS	106
4.11 Connecting to the Internet and Firewalling	107
4.12 Using Routing Instead of Bridging	108
4.13 Probing Your Wireless Interface Card	113
4.14 Changing the Pyramid Router's Hostname	114
4.15 Turning Off Antenna Diversity	115
4.16 Managing dnsmasq's DNS Cache	117
4.17 Managing Windows' DNS Caches	120
4.18 Updating the Time at Boot	121

5. Building a VoIP Server with Asterisk	123
5.0 Introduction	123
5.1 Installing Asterisk from Source Code	127
5.2 Installing Asterisk on Debian	131
5.3 Starting and Stopping Asterisk	132
5.4 Testing the Asterisk Server	135
5.5 Adding Phone Extensions to Asterisk and Making Calls	136
5.6 Setting Up Softphones	143
5.7 Getting Real VoIP with Free World Dialup	146
5.8 Connecting Your Asterisk PBX to Analog Phone Lines	148
5.9 Creating a Digital Receptionist	151
5.10 Recording Custom Prompts	153
5.11 Maintaining a Message of the Day	156
5.12 Transferring Calls	158
5.13 Routing Calls to Groups of Phones	158
5.14 Parking Calls	159
5.15 Customizing Hold Music	161
5.16 Playing MP3 Sound Files on Asterisk	161
5.17 Delivering Voicemail Broadcasts	162
5.18 Conferencing with Asterisk	163
5.19 Monitoring Conferences	165
5.20 Getting SIP Traffic Through iptables NAT Firewalls	166
5.21 Getting IAX Traffic Through iptables NAT Firewalls	168
5.22 Using AsteriskNOW, "Asterisk in 30 Minutes"	168
5.23 Installing and Removing Packages on AsteriskNOW	170
5.24 Connecting Road Warriors and Remote Users	171
6. Routing with Linux	173
6.0 Introduction	173
6.1 Calculating Subnets with ipcalc	176
6.2 Setting a Default Gateway	178
6.3 Setting Up a Simple Local Router	180
6.4 Configuring Simplest Internet Connection Sharing	183
6.5 Configuring Static Routing Across Subnets	185
6.6 Making Static Routes Persistent	186
6.7 Using RIP Dynamic Routing on Debian	187
6.8 Using RIP Dynamic Routing on Fedora	191
6.9 Using Quagga's Command Line	192

6.10 Logging In to Quagga Daemons Remotely	194
6.11 Running Quagga Daemons from the Command Line	195
6.12 Monitoring RIPD	197
6.13 Blackholing Routes with Zebra	198
6.14 Using OSPF for Simple Dynamic Routing	199
6.15 Adding a Bit of Security to RIP and OSPF	201
6.16 Monitoring OSPFD	202
7. Secure Remote Administration with SSH	204
7.0 Introduction	204
7.1 Starting and Stopping OpenSSH	207
7.2 Creating Strong Passphrases	208
7.3 Setting Up Host Keys for Simplest Authentication	209
7.4 Generating and Copying SSH Keys	211
7.5 Using Public-Key Authentication to Protect System Passwords	213
7.6 Managing Multiple Identity Keys	214
7.7 Hardening OpenSSH	215
7.8 Changing a Passphrase	216
7.9 Retrieving a Key Fingerprint	217
7.10 Checking Configuration Syntax	218
7.11 Using OpenSSH Client Configuration Files for Easier Logins	218
7.12 Tunneling X Windows Securely over SSH	220
7.13 Executing Commands Without Opening a Remote Shell	221
7.14 Using Comments to Label Keys	222
7.15 Using DenyHosts to Foil SSH Attacks	223
7.16 Creating a DenyHosts Startup File	225
7.17 Mounting Entire Remote Filesystems with sshfs	226
8. Using Cross-Platform Remote Graphical Desktops	228
8.0 Introduction	228
8.1 Connecting Linux to Windows via rdesktop	230
8.2 Generating and Managing FreeNX SSH Keys	233
8.3 Using FreeNX to Run Linux from Windows	233
8.4 Using FreeNX to Run Linux from Solaris, Mac OS X, or Linux	238
8.5 Managing FreeNX Users	239
8.6 Watching Nxclient Users from the FreeNX Server	240
8.7 Starting and Stopping the FreeNX Server	241

8.8 Configuring a Custom Desktop	242
8.9 Creating Additional Nxclient Sessions	244
8.10 Enabling File and Printer Sharing, and Multimedia in Nxclient	246
8.11 Preventing Password-Saving in Nxclient	246
8.12 Troubleshooting FreeNX	247
8.13 Using VNC to Control Windows from Linux	248
8.14 Using VNC to Control Windows and Linux at the Same Time	250
8.15 Using VNC for Remote Linux-to-Linux Administration	252
8.16 Displaying the Same Windows Desktop to Multiple Remote Users	254
8.17 Changing the Linux VNC Server Password	256
8.18 Customizing the Remote VNC Desktop	257
8.19 Setting the Remote VNC Desktop Size	258
8.20 Connecting VNC to an Existing X Session	259
8.21 Securely Tunneling x11vnc over SSH	261
8.22 Tunneling TightVNC Between Linux and Windows	262
9. Building Secure Cross-Platform Virtual Private Networks with OpenVPN	265
9.0 Introduction	265
9.1 Setting Up a Safe OpenVPN Test Lab	267
9.2 Starting and Testing OpenVPN	270
9.3 Testing Encryption with Static Keys	272
9.4 Connecting a Remote Linux Client Using Static Keys	274
9.5 Creating Your Own PKI for OpenVPN	276
9.6 Configuring the OpenVPN Server for Multiple Clients	279
9.7 Configuring OpenVPN to Start at Boot	281
9.8 Revoking Certificates	282
9.9 Setting Up the OpenVPN Server in Bridge Mode	284
9.10 Running OpenVPN As a Nonprivileged User	285
9.11 Connecting Windows Clients	286
10. Building a Linux PPTP VPN Server	287
10.0 Introduction	287
10.1 Installing Poptop on Debian Linux	290
10.2 Patching the Debian Kernel for MPPE Support	291
10.3 Installing Poptop on Fedora Linux	293
10.4 Patching the Fedora Kernel for MPPE Support	294
10.5 Setting Up a Standalone PPTP VPN Server	295

10.6 Adding Your Poptop Server to Active Directory	298
10.7 Connecting Linux Clients to a PPTP Server	299
10.8 Getting PPTP Through an iptables Firewall	300
10.9 Monitoring Your PPTP Server	301
10.10 Troubleshooting PPTP	302
11. Single Sign-on with Samba for Mixed Linux/Windows LANs	305
11.0 Introduction	305
11.1 Verifying That All the Pieces Are in Place	307
11.2 Compiling Samba from Source Code	310
11.3 Starting and Stopping Samba	312
11.4 Using Samba As a Primary Domain Controller	313
11.5 Migrating to a Samba Primary Domain Controller from an NT4 PDC	317
11.6 Joining Linux to an Active Directory Domain	319
11.7 Connecting Windows 95/98/ME to a Samba Domain	323
11.8 Connecting Windows NT4 to a Samba Domain	324
11.9 Connecting Windows NT/2000 to a Samba Domain	325
11.10 Connecting Windows XP to a Samba Domain	325
11.11 Connecting Linux Clients to a Samba Domain with Command-Line Programs	326
11.12 Connecting Linux Clients to a Samba Domain with Graphical Programs	330
12. Centralized Network Directory with OpenLDAP	332
12.0 Introduction	332
12.1 Installing OpenLDAP on Debian	339
12.2 Installing OpenLDAP on Fedora	341
12.3 Configuring and Testing the OpenLDAP Server	341
12.4 Creating a New Database on Fedora	344
12.5 Adding More Users to Your Directory	348
12.6 Correcting Directory Entries	350
12.7 Connecting to a Remote OpenLDAP Server	352
12.8 Finding Things in Your OpenLDAP Directory	352
12.9 Indexing Your Database	354
12.10 Managing Your Directory with Graphical Interfaces	356
12.11 Configuring the Berkeley DB	358
12.12 Configuring OpenLDAP Logging	363

12.13 Backing Up and Restoring Your Directory	364
12.14 Refining Access Controls	366
12.15 Changing Passwords	370
13. Network Monitoring with Nagios	371
13.0 Introduction	371
13.1 Installing Nagios from Sources	372
13.2 Configuring Apache for Nagios	376
13.3 Organizing Nagios' Configuration Files Sanely	378
13.4 Configuring Nagios to Monitor Localhost	380
13.5 Configuring CGI Permissions for Full Nagios Web Access	389
13.6 Starting Nagios at Boot	390
13.7 Adding More Nagios Users	391
13.8 Speed Up Nagios with check_icmp	392
13.9 Monitoring SSHD	393
13.10 Monitoring a Web Server	397
13.11 Monitoring a Mail Server	400
13.12 Using Servicegroups to Group Related Services	402
13.13 Monitoring Name Services	403
13.14 Setting Up Secure Remote Nagios Administration with OpenSSH	405
13.15 Setting Up Secure Remote Nagios Administration with OpenSSL	406
14. Network Monitoring with MRTG	408
14.0 Introduction	408
14.1 Installing MRTG	409
14.2 Configuring SNMP on Debian	410
14.3 Configuring SNMP on Fedora	413
14.4 Configuring Your HTTP Service for MRTG	413
14.5 Configuring and Starting MRTG on Debian	415
14.6 Configuring and Starting MRTG on Fedora	418
14.7 Monitoring Active CPU Load	419
14.8 Monitoring CPU User and Idle Times	422
14.9 Monitoring Physical Memory	424
14.10 Monitoring Swap Space and Memory	425
14.11 Monitoring Disk Usage	426
14.12 Monitoring TCP Connections	428
14.13 Finding and Testing MIBs and OIDs	429
14.14 Testing Remote SNMP Queries	430

14.15 Monitoring Remote Hosts	432
14.16 Creating Multiple MRTG Index Pages	433
14.17 Running MRTG As a Daemon	434
15. Getting Acquainted with IPv6	437
15.0 Introduction	437
15.1 Testing Your Linux System for IPv6 Support	442
15.2 Pinging Link Local IPv6 Hosts	443
15.3 Setting Unique Local Unicast Addresses on Interfaces	445
15.4 Using SSH with IPv6	446
15.5 Copying Files over IPv6 with scp	447
15.6 Autoconfiguration with IPv6	448
15.7 Calculating IPv6 Addresses	449
15.8 Using IPv6 over the Internet	450
16. Setting Up Hands-Free Network Installations of New Systems	452
16.0 Introduction	452
16.1 Creating Network Installation Boot Media for Fedora Linux	453
16.2 Network Installation of Fedora Using Network Boot Media	455
16.3 Setting Up an HTTP-Based Fedora Installation Server	457
16.4 Setting Up an FTP-Based Fedora Installation Server	458
16.5 Creating a Customized Fedora Linux Installation	461
16.6 Using a Kickstart File for a Hands-off Fedora Linux Installation	463
16.7 Fedora Network Installation via PXE Netboot	464
16.8 Network Installation of a Debian System	466
16.9 Building a Complete Debian Mirror with apt-mirror	468
16.10 Building a Partial Debian Mirror with apt-proxy	470
16.11 Configuring Client PCs to Use Your Local Debian Mirror	471
16.12 Setting Up a Debian PXE Netboot Server	472
16.13 Installing New Systems from Your Local Debian Mirror	474
16.14 Automating Debian Installations with Preseed Files	475
17. Linux Server Administration via Serial Console	478
17.0 Introduction	478
17.1 Preparing a Server for Serial Console Administration	479
17.2 Configuring a Headless Server with LILO	483
17.3 Configuring a Headless Server with GRUB	485
17.4 Booting to Text Mode on Debian	487

17.5 Setting Up the Serial Console	489
17.6 Configuring Your Server for Dial-in Administration	492
17.7 Dialing In to the Server	495
17.8 Adding Security	496
17.9 Configuring Logging	497
17.10 Uploading Files to the Server	498
18. Running a Linux Dial-Up Server	501
18.0 Introduction	501
18.1 Configuring a Single Dial-Up Account with WyDial	501
18.2 Configuring Multiple Accounts in WyDial	504
18.3 Configuring Dial-Up Permissions for Nonroot Users	505
18.4 Creating WyDial Accounts for Nonroot Users	507
18.5 Sharing a Dial-Up Internet Account	508
18.6 Setting Up Dial-on-Demand	509
18.7 Scheduling Dial-Up Availability with cron	510
18.8 Dialing over Voicemail Stutter Tones	512
18.9 Overriding Call Waiting	512
18.10 Leaving the Password Out of the Configuration File	513
18.11 Creating a Separate pppd Logfile	514
19. Troubleshooting Networks	515
19.0 Introduction	515
19.1 Building a Network Diagnostic and Repair Laptop	516
19.2 Testing Connectivity with ping	519
19.3 Profiling Your Network with FPing and Nmap	521
19.4 Finding Duplicate IP Addresses with arping	523
19.5 Testing HTTP Throughput and Latency with httping	525
19.6 Using traceroute, tcptraceroute, and mtr to Pinpoint Network Problems	527
19.7 Using tcpdump to Capture and Analyze Traffic	529
19.8 Capturing TCP Flags with tcpdump	533
19.9 Measuring Throughput, Jitter, and Packet Loss with iperf	535
19.10 Using ngrep for Advanced Packet Sniffing	538
19.11 Using ntop for Colorful and Quick Network Monitoring	540
19.12 Troubleshooting DNS Servers	542
19.13 Troubleshooting DNS Clients	545
19.14 Troubleshooting SMTP Servers	546

19.15 Troubleshooting a POP3, POP3s, or IMAP Server	549
19.16 Creating SSL Keys for Your Syslog-ng Server on Debian	551
19.17 Creating SSL Keys for Your Syslog-ng Server on Fedora	557
19.18 Setting Up stunnel for Syslog-ng	558
19.19 Building a Syslog Server	560
A. Essential References	563
B. Glossary of Networking Terms	566
C. Linux Kernel Building Reference	590
Index	599