
A PRACTICAL GUIDE TO FEDORA™ AND RED HAT® ENTERPRISE LINUX®

FIFTH EDITION

MARK G. SOBELL



PRENTICE
HALL

Upper Saddle River, NJ • Boston • Indianapolis • San Francisco
New York • Toronto • Montreal • London • Munich • Paris • Madrid
Capetown • Sydney • Tokyo • Singapore • Mexico City

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this book, and the publisher was aware of a trademark claim, the designations have been printed with initial capital letters or in all capitals.

The author and publisher have taken care in the preparation of this book, but make no expressed or implied warranty of any kind and assume no responsibility for errors or omissions. No liability is assumed for incidental or consequential damages in connection with or arising out of the use of the information or programs contained herein.

The publisher offers excellent discounts on this book when ordered in quantity for bulk purchases or special sales, which may include electronic versions and/or custom covers and content particular to your business, training goals, marketing focus, and branding interests. For more information, please contact:

U.S. Corporate and Government Sales
(800) 382-3419
corpsales@pearsontechgroup.com

For sales outside the United States, please contact:

International Sales
international@pearson.com

Visit us on the Web: informit.com/ph

Library of Congress Cataloging-in-Publication Data

Sobell, Mark G.

A practical guide to Fedora and Red Hat Enterprise Linux / Mark G.

Sobell.—5th ed.

p. cm.

Includes index.

ISBN 978-0-13-706088-7 (pbk.)

1. Linux. 2. Operating systems (Computers) I. Title.

QA76.76.O63S5945 2010

005.4'32—dc22

2009053421

Copyright © 2010 Mark G. Sobell

All rights reserved. Printed in the United States of America. This publication is protected by copyright, and permission must be obtained from the publisher prior to any prohibited reproduction, storage in a retrieval system, or transmission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise. For information regarding permissions, write to:

Pearson Education, Inc.
Rights and Contracts Department
501 Boylston Street, Suite 900
Boston, MA 02116
Fax: (617) 671-3447

ISBN-13: 978-0-13-706088-7

ISBN-10: 0-13-706088-2

Text printed in the United States at Edwards Brothers in Ann Arbor, Michigan.

First printing, February 2010

BRIEF CONTENTS

CONTENTS *xiii*

PREFACE *xxxvii*

1 WELCOME TO LINUX 1

PART I INSTALLING FEDORA AND RED HAT ENTERPRISE LINUX 21

2 INSTALLATION OVERVIEW 23

3 STEP-BY-STEP INSTALLATION 51

PART II GETTING STARTED WITH FEDORA AND RED HAT ENTERPRISE LINUX 87

4 INTRODUCTION TO FEDORA AND RED HAT ENTERPRISE LINUX 89

5 THE LINUX UTILITIES 147

6 THE LINUX FILESYSTEM 187

7 THE SHELL 223

PART III DIGGING INTO FEDORA AND RED HAT ENTERPRISE LINUX 253

8 LINUX GUIs: X AND GNOME 255

9 THE BOURNE AGAIN SHELL 279

10 NETWORKING AND THE INTERNET 357

PART IV SYSTEM ADMINISTRATION 401

- 11 SYSTEM ADMINISTRATION: CORE CONCEPTS 403
- 12 FILES, DIRECTORIES, AND FILESYSTEMS 467
- 13 DOWNLOADING AND INSTALLING SOFTWARE 497
- 14 PRINTING WITH CUPS 519
- 15 REBUILDING THE LINUX KERNEL 543
- 16 ADMINISTRATION TASKS 555
- 17 CONFIGURING AND MONITORING A LAN 595

PART V USING CLIENTS AND SETTING UP SERVERS 619

- 18 OPENSSSH: SECURE NETWORK COMMUNICATION 621
- 19 FTP: TRANSFERRING FILES ACROSS A NETWORK 643
- 20 **sendmail**: SETTING UP MAIL CLIENTS, SERVERS, AND MORE 669
- 21 NIS AND LDAP 695
- 22 NFS: SHARING FILESYSTEMS 727
- 23 SAMBA: INTEGRATING LINUX AND WINDOWS 749
- 24 DNS/BIND: TRACKING DOMAIN NAMES AND ADDRESSES 773
- 25 **iptables**: SETTING UP A FIREWALL 819
- 26 **APACHE (httpd)**: SETTING UP A WEB SERVER 841

PART VI PROGRAMMING TOOLS 885

- 27 PROGRAMMING THE BOURNE AGAIN SHELL 887
- 28 THE PERL SCRIPTING LANGUAGE 975

PART VII APPENDIXES 1021

- A REGULAR EXPRESSIONS 1023
- B HELP 1033
- C SECURITY 1043
- D THE FREE SOFTWARE DEFINITION 1063

GLOSSARY 1067

INDEX 1117

CONTENTS

PREFACE xxxvii

CHAPTER 1: WELCOME TO LINUX 1

- The GNU–Linux Connection 2
 - The History of GNU–Linux 2
 - The Code Is Free 4
 - Have Fun! 5
- The Linux 2.6 Kernel 5
- The Heritage of Linux: UNIX 5
- What Is So Good About Linux? 6
 - Why Linux Is Popular with Hardware Companies and Developers 7
 - Linux Is Portable 8
 - Standards 8
 - The C Programming Language 9
- Overview of Linux 10
 - Linux Has a Kernel Programming Interface 10
 - Linux Can Support Many Users 10
 - Linux Can Run Many Tasks 11
 - Linux Provides a Secure Hierarchical Filesystem 11
 - The Shell: Command Interpreter and Programming Language 12
 - A Large Collection of Useful Utilities 14
 - Interprocess Communication 14
 - System Administration 14

- Additional Features of Linux 14
 - GUIs: Graphical User Interfaces 15
 - (Inter)Networking Utilities 16
 - Software Development 16
- Conventions Used in This Book 16
- Chapter Summary 19
- Exercises 19

PART I INSTALLING FEDORA AND RED HAT ENTERPRISE LINUX 21

CHAPTER 2: INSTALLATION OVERVIEW 23

- The Desktop Live CD and the Install DVD 24
- Planning the Installation 24
 - Considerations 25
 - Requirements 25
 - Processor Architecture 26
 - Interfaces: Installer and Installed System 28
 - Which Are You Installing: Fedora or Red Hat Enterprise Linux? 28
 - Upgrading an Existing Fedora/RHEL System Versus Installing a Fresh Copy 29
 - Setting Up the Hard Disk 30
 - RAID 37
 - LVM: Logical Volume Manager 38
- The Installation Process 39
- The Medium: Where Is the Source Data? 40
- Downloading a CD/DVD (*FEDORA*) 41
 - The Easy Way to Download a CD ISO Image File 41
 - Finding a Mirror Site to Download From 42
 - Using BitTorrent to Download a CD/DVD ISO Image File 44
- Checking and Burning the CD/DVD 45
 - Checking the File 45
 - Burning the CD/DVD 46
- Rescue Selection of the Install DVD 46
- Gathering Information About the System 46
- Finding the Installation Manual 47
- More Information 48
- Chapter Summary 48
- Exercises 49
- Advanced Exercises 49

CHAPTER 3: STEP-BY-STEP INSTALLATION 51

- Running a Fedora Live Session 52
 - Booting the System 52

Installing Fedora/RHEL	55
Installing from a Live Session	55
Installing/Upgrading from the Install DVD	55
The Anaconda Installer	57
Firstboot: When You Reboot	66
Initializing Databases and Updating the System	67
Installation Tasks	68
Modifying Boot Parameters (Options)	68
Partitioning the Disk	71
LVs: Logical Volumes	73
Partitions	76
palimpsest: The GNOME Disk Utility (<i>FEDORA</i>)	78
Using the Kickstart Configurator	82
Setting Up a Dual-Boot System	82
The X Window System	84
gnome-display-properties: Configures the Display	84
More Information	85
Chapter Summary	85
Exercises	85
Advanced Exercises	86

PART II GETTING STARTED WITH FEDORA AND RED HAT ENTERPRISE LINUX 87

CHAPTER 4: INTRODUCTION TO FEDORA AND RED HAT ENTERPRISE LINUX 89

Curbing Your Power (Superuser/root Privileges)	90
A Tour of the Fedora/RHEL Desktop	90
Logging In on the System	91
Introduction	92
Launching Programs from the Desktop	93
Switching Workspaces	95
Setting Personal Preferences	96
Mouse Preferences	97
Working with Windows	98
Using Nautilus to Work with Files	98
The Update Applet	104
Changing Appearance (Themes)	105
Desktop Effects (<i>FEDORA</i>)	108
Session Management	108
Getting Help	108
Feel Free to Experiment	109
Logging Out	109

Getting the Most Out of the Desktop	109
GNOME Desktop Terminology	110
Opening Files	110
Panels	111
The Main Menu	114
Windows	115
The Object Context Menu	119
Updating, Installing, and Removing Software Packages	122
Updates (<i>FEDORA</i>)	122
Add/Remove Software	123
Where to Find Documentation	124
GNOME Help Browser	125
man: Displays the System Manual	125
apropos: Searches for a Keyword	127
info: Displays Information About Utilities	127
The <code>--help</code> Option	130
HOWTOs: Finding Out How Things Work	130
Getting Help with the System	131
More About Logging In	132
The Login Screen	133
What to Do If You Cannot Log In	134
Logging In Remotely: Terminal Emulators, <code>ssh</code> , and Dial-Up Connections	135
Logging In from a Terminal (Emulator)	135
Changing Your Password	136
Using Virtual Consoles	137
Working from the Command Line	138
Correcting Mistakes	138
Repeating/Editing Command Lines	140
Controlling Windows: Advanced Operations	141
Changing the Input Focus	141
Changing the Resolution of the Display	142
The Window Manager	142
Chapter Summary	143
Exercises	144
Advanced Exercises	145

CHAPTER 5: THE LINUX UTILITIES 147

Special Characters	148
Basic Utilities	149
ls: Lists the Names of Files	149
cat: Displays a Text File	149
rm: Deletes a File	150
less Is more: Display a Text File One Screen at a Time	150
hostname: Displays the System Name	151

Working with Files	151
cp: Copies a File	151
mv: Changes the Name of a File	152
lpr: Prints a File	153
grep: Searches for a String	153
head: Displays the Beginning of a File	154
tail: Displays the End of a File	154
sort: Displays a File in Order	155
uniq: Removes Duplicate Lines from a File	156
diff: Compares Two Files	157
file: Tests the Contents of a File	157
l (Pipe): Communicates Between Processes	158
Four More Utilities	159
echo: Displays Text	159
date: Displays the Time and Date	159
script: Records a Shell Session	160
unix2dos: Converts Linux and Macintosh Files to Windows Format	161
Compressing and Archiving Files	161
bzip2: Compresses a File	162
bunzip2 and bzip: Decompress a File	162
gzip: Compresses a File	163
tar: Packs and Unpacks Archives	163
Locating Commands	166
which and whereis: Locate a Utility	166
apropos: Searches for a Keyword	167
locate: Searches for a File	168
Obtaining User and System Information	168
who: Lists Users on the System	169
finger: Lists Users on the System	169
w: Lists Users on the System	171
Communicating with Other Users	172
write: Sends a Message	172
mesg: Denies or Accepts Messages	173
Email	174
Tutorial: Creating and Editing a File Using vim	174
Starting vim	175
Command and Input Modes	176
Entering Text	177
Getting Help	178
Ending the Editing Session	181
The compatible Parameter	181
Chapter Summary	181
Exercises	184
Advanced Exercises	185

CHAPTER 6: THE LINUX FILESYSTEM 187

- The Hierarchical Filesystem 188
- Directory Files and Ordinary Files 188
 - Filenames 189
 - The Working Directory 192
 - Your Home Directory 192
- Pathnames 193
 - Absolute Pathnames 193
 - Relative Pathnames 194
- Directory Commands 195
 - mkdir**: Creates a Directory 195
 - Important Standard Directories and Files 198
- Working with Directories 200
 - rmdir**: Deletes a Directory 200
 - Using Pathnames 201
 - mv, cp**: Move or Copy Files 201
 - mv**: Moves a Directory 202
- Access Permissions 202
 - ls -l**: Displays Permissions 203
 - chmod**: Changes Access Permissions 204
 - Setuid and Setgid Permissions 205
 - Directory Access Permissions 206
- ACLs: Access Control Lists 207
 - Enabling ACLs 208
 - Working with Access Rules 208
 - Setting Default Rules for a Directory 211
- Links 212
 - Hard Links 214
 - Symbolic Links 216
 - rm**: Removes a Link 218
- Chapter Summary 218
- Exercises 220
- Advanced Exercises 222

CHAPTER 7: THE SHELL 223

- The Command Line 224
 - Syntax 224
 - Processing the Command Line 227
 - Executing the Command Line 229
 - Editing the Command Line 229

Standard Input and Standard Output	230
The Screen as a File	230
The Keyboard and Screen as Standard Input and Standard Output	231
Redirection	232
Pipes	238
Running a Program in the Background	241
Filename Generation/Pathname Expansion	243
The ? Special Character	243
The * Special Character	244
The [] Special Characters	245
Builtins	247
Chapter Summary	248
Utilities and Builtins Introduced in This Chapter	249
Exercises	249
Advanced Exercises	251

PART III DIGGING INTO FEDORA AND RED HAT ENTERPRISE LINUX 253

CHAPTER 8: LINUX GUIs: X AND GNOME 255

X Window System	256
Using X	258
Desktop Environments/Managers	263
The Nautilus File Browser Window	264
The View Pane	265
The Side Pane	265
Control Bars	266
Menubar	267
The Nautilus Spatial View	270
GNOME Utilities	272
Font Preferences (<i>FEDORA</i>)	272
Pick a Font Window (<i>FEDORA</i>)	272
Pick a Color Window	273
Run Application Window	274
Searching for Files	274
GNOME Terminal Emulator/Shell	275
Chapter Summary	276
Exercises	277
Advanced Exercises	277

CHAPTER 9: THE BOURNE AGAIN SHELL 279

Background	280
Shell Basics	281
Startup Files	281
Commands That Are Symbols	284
Redirecting Standard Error	284
Writing a Simple Shell Script	286
Separating and Grouping Commands	290
Job Control	294
Manipulating the Directory Stack	296
Parameters and Variables	299
User-Created Variables	300
Variable Attributes	303
Keyword Variables	305
Special Characters	313
Processes	314
Process Structure	314
Process Identification	314
Executing a Command	316
History	316
Variables That Control History	316
Reexecuting and Editing Commands	318
The Readline Library	326
Aliases	332
Single Versus Double Quotation Marks in Aliases	333
Examples of Aliases	334
Functions	335
Controlling bash Features and Options	338
Command-Line Options	338
Shell Features	338
Processing the Command Line	342
History Expansion	342
Alias Substitution	342
Parsing and Scanning the Command Line	342
Command-Line Expansion	343
Chapter Summary	351
Exercises	353
Advanced Exercises	355

CHAPTER 10: NETWORKING AND THE INTERNET 357

- Types of Networks and How They Work 359
 - Broadcast Networks 360
 - Point-to-Point Networks 360
 - Switched Networks 360
 - LAN: Local Area Network 361
 - WAN: Wide Area Network 362
 - Internetworking Through Gateways and Routers 362
 - Network Protocols 365
 - Host Address 367
 - CIDR: Classless Inter-Domain Routing 371
 - Hostnames 372
- Communicate Over a Network 374
 - finger: Displays Information About Remote Users 374
 - Sending Mail to a Remote User 375
 - Mailing List Servers 376
- Network Utilities 376
 - Trusted Hosts 376
 - OpenSSH Tools 377
 - telnet: Logs In on a Remote System 377
 - ftp: Transfers Files Over a Network 379
 - ping: Tests a Network Connection 379
 - traceroute: Traces a Route Over the Internet 380
 - host and dig: Query Internet Nameservers 382
 - jwhois: Looks Up Information About an Internet Site 382
- Distributed Computing 383
 - The Client/Server Model 384
 - DNS: Domain Name Service 385
 - Ports 387
 - NIS: Network Information Service 387
 - NFS: Network Filesystem 387
 - Internet Services 388
 - Proxy Servers 391
 - RPC Network Services 391
- Usenet 392
- WWW: World Wide Web 395
 - URL: Uniform Resource Locator 396
 - Browsers 396
 - Search Engines 396
- Chapter Summary 397
- Exercises 398
- Advanced Exercises 399

PART IV SYSTEM ADMINISTRATION 401**CHAPTER 11: SYSTEM ADMINISTRATION: CORE CONCEPTS 403**

- System Administrator and Superuser 405
 - System Administration Tools 407
- Rescue Mode 411
 - Avoiding a Trojan Horse 412
 - Getting Help 413
- SELinux 414
 - More Information 415
 - config**: The SELinux Configuration File 415
 - getenforce**, **setenforce**, and **sestatus**: Work with SELinux 416
 - Setting the Targeted Policy with **system-config-selinux** 416
- The Upstart Event-Based **init** Daemon (*FEDORA*) 417
 - Definitions 418
 - Jobs 420
- System Operation 424
 - Runlevels 424
 - Booting the System 425
 - Init Scripts: Start and Stop System Services 426
 - Single-User Mode 430
 - Going to Multiuser Mode 431
 - Graphical Multiuser Mode 431
 - Logging In 431
 - Logging Out 433
 - Bringing the System Down 433
 - Crash 436
- System Administration Utilities 436
 - Fedora/RHEL Configuration Tools 437
 - Command-Line Utilities 438
- Setting Up a Server 441
 - Standard Rules in Configuration Files 441
 - rpcinfo**: Displays Information About **rpcbind** 443
 - The **xinetd** Superserver 445
 - Securing a Server 447
 - DHCP: Configures Hosts 451
- nsswitch.conf**: Which Service to Look at First 455
 - How **nsswitch.conf** Works 455
- PAM 458
 - More Information 459
 - Configuration Files, Module Types, and Control Flags 459
 - Example 462
 - Modifying the PAM Configuration 463
- Chapter Summary 464
- Exercises 464
- Advanced Exercises 465

CHAPTER 12: FILES, DIRECTORIES, AND FILESYSTEMS 467

- Important Files and Directories 468
- File Types 480
 - Ordinary Files, Directories, Links, and Inodes 481
 - Special Files 482
- Filesystems 485
 - mount: Mounts a Filesystem 487
 - umount: Unmounts a Filesystem 490
 - fstab**: Keeps Track of Filesystems 490
 - fsck: Checks Filesystem Integrity 492
 - tune2fs: Changes Filesystem Parameters 492
 - RAID Filesystem 494
- Chapter Summary 495
- Exercises 495
- Advanced Exercises 496

CHAPTER 13: DOWNLOADING AND INSTALLING SOFTWARE 497

- yum: Keeps the System Up-to-Date 498
 - Configuring yum 498
 - Using yum to Update, Install, and Remove Packages 500
 - yum Groups 503
 - Other yum Commands 504
 - yum-updatesd**: Runs yum Automatically 504
 - Upgrading a System with yum 505
 - Downloading rpm Package Files with yumdownloader 505
- Adding and Removing Software Packages 505
 - pirut: Adds and Removes Software Packages (*RHEL*) 505
- BitTorrent 507
- rpm: Red Hat Package Manager 510
 - Querying Packages and Files 511
 - Installing, Upgrading, and Removing Packages 512
 - Installing a Linux Kernel Binary 512
- Installing Non-rpm Software 513
 - The **/opt** and **/usr/local** Directories 513
 - GNU Configure and Build System 513
- Keeping Software Up-to-Date 515
 - Bugs 515
 - Errata 516
 - Red Hat Network (*RHEL*) 516
- wget: Downloads Files Noninteractively 517
- Chapter Summary 518
- Exercises 518
- Advanced Exercises 518

CHAPTER 14: PRINTING WITH CUPS 519

- Introduction 520
 - Prerequisites 520
 - More Information 521
 - Notes 521
- JumpStart I: Configuring a Local Printer 521
- system-config-printer: Configuring a Printer 522
 - Configuration Selections 522
 - Setting Up a Remote Printer 524
- JumpStart II: Setting Up a Local or Remote Printer Using the CUPS Web Interface 527
- Traditional UNIX Printing 530
- Configuring Printers 532
 - The CUPS Web Interface 532
 - CUPS on the Command Line 533
 - Sharing CUPS Printers 537
- Printing from Windows 538
 - Printing Using CUPS 538
 - Printing Using Samba 539
- Printing to Windows 540
- Chapter Summary 540
- Exercises 541
- Advanced Exercises 541

CHAPTER 15: REBUILDING THE LINUX KERNEL 543

- Preparing the Source Code 544
 - Locating the Kernel Source Code 544
 - Installing the Kernel Source Code 545
- Read the Documentation 546
- Configuring and Compiling the Linux Kernel 547
 - Cleaning the Source Tree 547
 - Configuring the Linux Kernel 547
 - Compiling the Kernel 549
 - Using Loadable Kernel Modules 549
- Installing the Kernel and Associated Files 550
- Rebooting the System 550
- Boot Loader 551
 - grub: The Linux Loader 551
- dmesg: Displays Kernel Messages 553
- Chapter Summary 553
- Exercises 554
- Advanced Exercises 554

CHAPTER 16: ADMINISTRATION TASKS	555
Configuring User and Group Accounts	556
system-config-users: Manages User Accounts	556
useradd: Adds a User Account	557
userdel: Removes a User Account	558
groupadd: Adds a Group	558
Backing Up Files	558
Choosing a Backup Medium	559
Backup Utilities	560
Performing a Simple Backup	562
dump, restore: Back Up and Restore Filesystems	563
Scheduling Tasks	565
cron and crontab: Schedule Routine Tasks	565
at: Runs Occasional Tasks	565
System Reports	566
vmstat: Reports Virtual Memory Statistics	566
top: Lists Processes Using the Most Resources	567
parted: Reports on and Partitions a Hard Disk	568
Keeping Users Informed	572
Creating Problems	572
Failing to Perform Regular Backups	573
Not Reading and Following Instructions	573
Failing to Ask for Help When Instructions Are Not Clear	573
Deleting or Mistyping a Critical File	573
Solving Problems	574
Helping When a User Cannot Log In	574
Speeding Up the System	575
lsof: Finds Open Files	576
Keeping a Machine Log	576
Keeping the System Secure	577
Log Files and Mail for root	577
Monitoring Disk Usage	578
logrotate: Manages Log Files	579
Removing Unused Space from Directories	581
Disk Quota System	582
rsyslogd: Logs System Messages	582
MySQL	584
More Information	585
Terminology	585
Syntax and Conventions	585
Prerequisites	585
Notes	586
Jumpstart: Setting Up MySQL	586
Options	587
The .my.cnf Configuration File	587
Working with MySQL	588

Chapter Summary 592
Exercises 593
Advanced Exercises 593

CHAPTER 17: CONFIGURING AND MONITORING A LAN 595

Setting Up the Hardware 596
 Connecting the Computers 596
 Gateways and Routers 597
 NIC: Network Interface Card 597
Configuring the Systems 598
NetworkManager: Configures Network Connections 599
 The NetworkManager Applet 599
The Network Configuration Window (`system-config-network`) 601
 Adding a Device 603
 Editing a Device 603
 Setting Up Networking for a Server 605
`iwconfig`: Configures a Wireless NIC 605
Setting Up Servers 606
Introduction to Cacti 607
 Configuring SNMP 608
 Setting Up LAMP 608
 Enabling the Cacti Poller 611
 Configuring Cacti 611
 Basic Cacti Administration 612
 Setting Up a Remote Data Source 614
More Information 617
Chapter Summary 617
Exercises 618
Advanced Exercises 618

PART V USING CLIENTS AND SETTING UP SERVERS 619

CHAPTER 18: OPENSSH: SECURE NETWORK COMMUNICATION 621

Introduction 622
About OpenSSH 622
 Files 622
 How OpenSSH Works 624
 More Information 624

OpenSSH Clients	625
Prerequisites	625
JumpStart: Using ssh and scp	625
Setup	626
ssh: Connects to or Executes Commands on a Remote System	627
scp: Copies Files from/to a Remote System	630
sftp: A Secure FTP Client	631
~/.ssh/config and /etc/ssh/ssh_config Configuration Files	631
sshd: OpenSSH Server	633
Prerequisites	633
Notes	633
JumpStart: Starting the sshd Daemon	633
Authorized Keys: Automatic Login	634
Command-Line Options	636
/etc/ssh/sshd_config Configuration File	636
Troubleshooting	637
Tunneling/Port Forwarding	638
Chapter Summary	641
Exercises	641
Advanced Exercises	642

CHAPTER 19: FTP: TRANSFERRING FILES ACROSS A NETWORK 643

Introduction	644
More Information	645
FTP Client	645
Prerequisites	645
JumpStart: Downloading Files Using ftp	646
Notes	649
Anonymous FTP	649
Automatic Login	649
Binary Versus ASCII Transfer Mode	650
ftp Specifics	650
FTP Server (vsftpd)	654
Prerequisites	654
Notes	654
JumpStart: Starting a vsftpd Server	655
Testing the Setup	655
vsftpd.conf: The vsftpd Configuration File	656
Chapter Summary	666
Exercises	667
Advanced Exercises	667

CHAPTER 20: **sendmail**: SETTING UP MAIL CLIENTS, SERVERS, AND MORE 669

- Introduction 670
 - Prerequisites 671
 - Notes 671
 - More Information 672
- JumpStart I: Configuring **sendmail** on a Client 672
- JumpStart II: Configuring **sendmail** on a Server 673
- How **sendmail** Works 674
 - Mail Logs 674
 - Aliases and Forwarding 675
 - Related Programs 676
- Configuring **sendmail** 677
 - The **sendmail.mc** and **sendmail.cf** Files 677
 - Other Files in **/etc/mail** 680
- Additional Email Tools 682
 - SpamAssassin 682
 - Configuring SpamAssassin 684
 - Webmail 686
 - Mailing Lists 688
 - Setting Up an IMAP or POP3 Server 689
- Authenticated Relaying 689
- Alternatives to **sendmail** 691
- Chapter Summary 692
- Exercises 692
- Advanced Exercises 693

CHAPTER 21: NIS AND LDAP 695

- Introduction to NIS 696
- How NIS Works 696
 - More Information 698
- Setting Up an NIS Client 699
 - Prerequisites 699
 - Notes 699
 - Step-by-Step Setup 699
 - Testing the Setup 701
 - yppasswd**: Changes NIS Passwords 702
- Setting Up an NIS Server 703
 - Prerequisites 703
 - Notes 704
 - Step-by-Step Setup 704
 - Testing 709
 - yppasswdd**: The NIS Password Update Daemon 709

LDAP	710
More Information	712
Setting Up an LDAP Server	713
Prerequisites	713
Note	713
Step-by-Step Setup	713
Other Tools for Working with LDAP	720
Evolution Mail	720
Konqueror	722
Chapter Summary	723
Exercises	724
Advanced Exercises	724

CHAPTER 22: NFS: SHARING FILESYSTEMS 727

Introduction	728
More Information	730
Setting Up an NFS Client	730
Prerequisites	730
JumpStart I: Mounting a Remote Directory Hierarchy	730
mount: Mounts a Directory Hierarchy	732
Improving Performance	734
/etc/fstab: Mounts Directory Hierarchies Automatically	735
Setting Up an NFS Server	736
Prerequisites	736
Notes	736
JumpStart II: Configuring an NFS Server Using system-config-nfs	737
Exporting a Directory Hierarchy	738
exports: Maintains the List of Exported Directory Hierarchies	742
Testing the Server Setup	743
automount: Automatically Mounts Directory Hierarchies	744
Chapter Summary	746
Exercises	746
Advanced Exercises	747

CHAPTER 23: SAMBA: INTEGRATING LINUX AND WINDOWS 749

Introduction	750
About Samba	751
Prerequisites	751
More Information	751
Notes	751
Samba Users, User Maps, and Passwords	752
JumpStart: Configuring a Samba Server Using system-config-samba	753
swat: Configures a Samba Server	755

Manually Configuring a Samba Server	759
Parameters in the smbd.conf File	760
The [homes] Share: Sharing Users' Home Directories	765
Accessing Linux Shares from Windows	765
Browsing Shares	765
Mapping a Share	766
Accessing Windows Shares from Linux	766
smbtree : Displays Windows Shares	766
smbclient : Connects to Windows Shares	767
Browsing Windows Networks	767
Mounting Windows Shares	767
Troubleshooting	768
Chapter Summary	770
Exercises	771
Advanced Exercises	771

CHAPTER 24: DNS/BIND: TRACKING DOMAIN NAMES AND ADDRESSES 773

Introduction to DNS	774
Nodes, Domains, and Subdomains	774
Zones	776
Queries	777
Servers	778
Resource Records	779
DNS Query and Response	782
Reverse Name Resolution	783
About DNS	785
How DNS Works	785
Prerequisites	785
More Information	786
Notes	786
JumpStart I: Setting Up a DNS Cache	787
JumpStart II: Setting Up a Domain Using system-config-bind	789
Notes	789
Using the BIND Configuration GUI Window	790
Setting Up a Domain Server	791
Adding Resource Records	792
Setting Up BIND	793
named.conf : The named Configuration File	794
Zone Files	796
A DNS Cache	797
DNS Glue Records	802
TSIGs: Transaction Signatures	803
Running BIND in a chroot Jail	804

Troubleshooting	805
A Full-Functioned Nameserver	807
A Slave Server	810
A Split Horizon Server	811
Chapter Summary	816
Exercises	816
Advanced Exercises	817
CHAPTER 25: iptables: SETTING UP A FIREWALL	819
How iptables Works	820
About iptables	822
More Information	822
Prerequisites	823
Notes	823
JumpStart: Building a Firewall Using system-config-firewall	824
Anatomy of an iptables Command	825
Building a Set of Rules	826
Commands	827
Packet Match Criteria	828
Display Criteria	828
Match Extensions	829
Targets	831
Copying Rules to and from the Kernel	832
system-config-firewall: Generates a Set of Rules	833
Sharing an Internet Connection Using NAT	835
Connecting Several Clients to a Single Internet Connection	836
Connecting Several Servers to a Single Internet Connection	838
Chapter Summary	839
Exercises	839
Advanced Exercises	839
CHAPTER 26: APACHE (httpd): SETTING UP A WEB SERVER	841
Introduction	842
About Apache	842
Prerequisites	843
More Information	843
Notes	844
JumpStart I: Getting Apache Up and Running	844
Modifying the httpd.conf Configuration File	845
Testing Apache	845
Putting Your Content in Place	846
JumpStart II: Setting Up Apache Using system-config-httpd	846

- Filesystem Layout 848
- Configuration Directives 850
 - Directives I: Directives You May Want to Modify as You Get Started 850
 - Contexts and Containers 854
 - Directives II: Advanced Directives 858
- The Fedora/RHEL `httpd.conf` File 870
 - Section 1: Global Environment 871
 - Section 2: Main Server Configuration 872
 - Section 3: Virtual Hosts 873
- Redirects 873
- Multiviews 874
- Server-Generated Directory Listings (Indexing) 874
- Virtual Hosts 874
- Troubleshooting 875
- Modules 876
 - Module List 876
 - `mod_cgi` and CGI Scripts 877
 - `mod_ssl` 877
 - Authentication Modules and `.htaccess` 880
 - Scripting Modules 881
- wealizer: Analyzes Web Traffic 881
- MRTG: Monitors Traffic Loads 882
- Error Codes 882
- Chapter Summary 883
- Exercises 884
- Advanced Exercises 884

PART VI PROGRAMMING TOOLS 885

CHAPTER 27: PROGRAMMING THE BOURNE AGAIN SHELL 887

- Control Structures 888
 - `if...then` 888
 - `if...then...else` 892
 - `if...then...elif` 895
 - `for...in` 901
 - `for` 902
 - `while` 904
 - `until` 908
 - `break` and `continue` 910
 - `case` 911
 - `select` 917
 - Here Document 919

- [click Games of State \(Tom Clancy's Op-Center, Book 3\) pdf](#)
- [download online Theology And Metaphysics In Nahj Al Balaghah](#)
- [read online Kama Sutra for free](#)
- [click Dao Companion to Japanese Confucian Philosophy \(Dao Companions to Chinese Philosophy, Volume 5\)](#)
- [click The World of Wal-Mart: Discounting the American Dream \(Routledge Series for Creative Teaching and Learning in Anthropology\) here](#)
- [Sitting with Koans: Essential Writings on Zen Koan Introspection here](#)

- <http://honareavalmusic.com/?books/Games-of-State--Tom-Clancy-s-Op-Center--Book-3-.pdf>
- <http://qolorea.com/library/Star-Trek--War-Stories-Book-2--Star-Trek--Corp-of-Engineers--Book-22-.pdf>
- <http://redbuffalodesign.com/ebooks/Getting-Started-with-Intel-Galileo.pdf>
- <http://diy-chirol.com/lib/Dao-Companion-to-Japanese-Confucian-Philosophy--Dao-Companions-to-Chinese-Philosophy--Volume-5-.pdf>
- <http://aneventshop.com/ebooks/The-World-of-Wal-Mart--Discounting-the-American-Dream--Routledge-Series-for-Creative-Teaching-and-Learning-in-An>
- <http://aircon.servicessingaporecompany.com/?lib/I-Hate-to-See-That-Evening-Sun-Go-Down--Collected-Stories.pdf>