

## Table of Contents

<b>Preface .....</b>	<b>1</b>
Why People Like Linux .....	2
Organization of This Book .....	4
Conventions Used in This Book.....	5
How to Contact Us .....	6
Acknowledgments .....	7
<b>Chapter 1. Introduction to Linux .....</b>	<b>9</b>
1.1 About This Book .....	10
1.2 A Brief History of Linux .....	11
1.3 Who's Using Linux? .....	14
1.4 System Features.....	15
1.4.1 A Note on Linux Version Numbers .....	15
1.4.2 A Bag of Features.....	16
1.4.3 Kernel .....	17
1.5 Software Features.....	19
1.5.1 Basic Commands and Utilities .....	19
1.5.2 Text Processing and Word Processing .....	20
1.5.3 Commercial Applications.....	23
1.5.4 Programming Languages and Utilities.....	24
1.5.5 The X Window System .....	25
1.5.6 KDE and GNOME .....	26
1.5.7 Networking.....	26
1.5.8 Laptop Support.....	28
1.5.9 Interfacing with Windows and MS-DOS .....	28
1.5.10 Other Applications .....	29
1.6 About Linux's Copyright.....	30
1.7 Open Source and the Philosophy of Linux.....	31
1.7.1 Hints for Unix Novices .....	34
1.7.2 Hints for Unix Gurus.....	35
1.8 Sources of Linux Information .....	36
1.8.1 Online Documents.....	36
1.8.2 Books and Other Published Works .....	36
1.8.3 Usenet Newsgroups.....	37
1.8.4 Internet Mailing Lists .....	37
1.9 Getting Help .....	37
<b>Chapter 2. Preparing to Install Linux.....</b>	<b>41</b>
2.1 Distributions of Linux .....	41
2.1.1 Getting Linux via Mail Order or Other Hard Media.....	41
2.1.2 Getting Linux from the Internet .....	42
2.2 Preparing to Install Linux.....	43
2.2.1 Installation Overview .....	43
2.2.2 Repartitioning Concepts .....	44
2.2.3 Linux Partition Requirements .....	45
2.2.4 Repartitioning Your Drives .....	47
<b>Chapter 3. Installation and Initial Configuration.....</b>	<b>50</b>
3.1 Installing the Linux Software .....	50
3.1.1 Booting Linux .....	50
3.1.2 Drives and Partitions Under Linux.....	56

## Table of Contents

3.1.3 Creating Linux Partitions .....	58
3.1.4 Creating Swap Space.....	62
3.1.5 Creating the Filesystems .....	63
3.1.6 Installing the Software .....	63
3.1.7 Creating the Boot Floppy or Installing LILO.....	65
3.1.8 Additional Installation Procedures .....	66
3.2 Post-Installation Procedures .....	66
3.2.1 Creating a User Account .....	66
3.2.2 Getting Online Help .....	67
3.2.3 Editing /etc/fstab .....	68
3.2.4 Shutting Down the System.....	69
3.3 Running into Trouble .....	70
3.3.1 Problems with Booting the Installation Medium .....	71
3.3.2 Hardware Problems .....	72
3.3.3 Problems Installing the Software .....	77
3.3.4 Problems after Installing Linux.....	78
<b>Chapter 4. Basic Unix Commands and Concepts.....</b>	<b>82</b>
4.1 Logging In .....	83
4.2 Setting a Password .....	84
4.3 Virtual Consoles .....	84
4.4 Popular Commands .....	85
4.4.1 Directories .....	85
4.4.2 Listing Files.....	86
4.4.3 Viewing Files, More or Less .....	87
4.4.4 Symbolic Links .....	88
4.5 Shells .....	88
4.6 Useful Keys and How to Get Them to Work.....	90
4.7 Typing Shortcuts .....	91
4.7.1 Word Completion .....	91
4.7.2 Moving Around Among Commands.....	92
4.8 Filename Expansion .....	92
4.9 Saving Your Output .....	93
4.10 What Is a Command? .....	96
4.11 Putting a Command in the Background .....	97
4.12 Manual Pages .....	98
4.13 File Ownership and Permissions .....	100
4.13.1 What Permissions Mean.....	100
4.13.2 Owners and Groups.....	101
4.14 Changing the Owner, Group, and Permissions .....	103
4.15 Startup Files.....	105
4.16 Important Directories .....	107
4.17 Programs That Serve You .....	109
4.18 Processes .....	110
<b>Chapter 5. Essential System Management.....</b>	<b>114</b>
5.1 Maintaining the System.....	115
5.2 Booting the System .....	118
5.2.1 Using a Boot Floppy .....	118
5.2.2 Using LILO .....	120
5.3 System Startup and Initialization .....	126
5.3.1 Kernel Boot Messages.....	126

## Table of Contents

5.3.2 init, inittab, and rc Files.....	128
5.3.3 rc Files .....	130
5.4 Single-User Mode .....	132
5.5 Shutting Down the System.....	133
5.6 The /proc Filesystem .....	134
5.7 Managing User Accounts .....	136
5.7.1 The passwd File.....	137
5.7.2 Shadow Passwords .....	139
5.7.3 PAM and Other Authentication Methods.....	139
5.7.4 The Group File .....	140
5.7.5 Creating Accounts .....	142
5.7.6 Deleting and Disabling Accounts.....	143
5.7.7 Modifying User Accounts .....	144
<b>Chapter 6. Managing Filesystems, Swap Space, and Devices .....</b>	<b>145</b>
6.1 Managing Filesystems.....	145
6.1.1 Filesystem Types.....	145
6.1.2 Mounting Filesystems .....	148
6.1.3 Automounting Devices.....	153
6.1.4 Creating Filesystems .....	155
6.1.5 Checking and Repairing Filesystems .....	157
6.2 Managing Swap Space .....	160
6.2.1 Creating Swap Space.....	161
6.2.2 Enabling the Swap Space .....	162
6.2.3 Disabling Swap Space .....	163
6.3 Device Files.....	163
<b>Chapter 7. Upgrading Software and the Kernel .....</b>	<b>167</b>
7.1 Archive and Compression Utilities .....	167
7.1.1 Using gzip and bzip2.....	168
7.1.2 Using tar .....	170
7.1.3 Using tar with gzip and bzip2 .....	175
7.1.4 tar Tricks .....	177
7.2 Upgrading Software .....	178
7.2.1 Upgrading Libraries .....	179
7.2.2 Upgrading the Compiler.....	183
7.3 General Upgrade Procedure .....	184
7.3.1 Using RPM .....	184
7.3.2 Using dpkg and apt.....	188
7.3.3 Upgrading Other Software .....	193
7.4 Building a New Kernel.....	196
7.4.1 Obtaining Kernel Sources .....	198
7.4.2 Building the Kernel .....	199
7.5 Loadable Device Drivers.....	207
7.6 Loading Modules Automatically.....	211
<b>Chapter 8. Other Administrative Tasks.....</b>	<b>212</b>
8.1 Making Backups.....	212
8.1.1 Simple Backups.....	213
8.1.2 Incremental Backups .....	217
8.2 Scheduling Jobs Using cron .....	218
8.3 Managing System Logs.....	223

## Table of Contents

8.4 Managing Print Services .....	225
8.4.1 Checking Printer Hardware .....	227
8.4.2 Gathering Resources .....	229
8.4.3 Choosing Printer Software .....	229
8.4.4 Checking Print Utilities .....	230
8.4.5 Setting Up the Printcap File .....	232
8.4.6 Configuring Ghostscript .....	237
8.4.7 Print Filters .....	239
8.4.8 The nenscript Filter .....	241
8.4.9 Magic Filters: APSfilter and Alternatives .....	242
8.4.10 BSD Print System Elements: Files, Directories, and Utilities .....	243
8.4.11 Exercising the Printer Daemon .....	246
8.4.12 Controlling Printer Services with lpc .....	247
8.4.13 Printer Optimization .....	250
8.4.14 Printer System Troubleshooting .....	251
8.4.15 CUPS .....	253
8.5 Setting Terminal Attributes .....	254
8.6 What to Do in an Emergency .....	254
8.6.1 Repairing Filesystems .....	256
8.6.2 Accessing Damaged Files .....	257
8.6.3 Restoring Files from Backup .....	258
<b>Chapter 9. Editors, Text Tools, Graphics, and Printing .....</b>	<b>259</b>
9.1 Editing Files Using vi .....	259
9.1.1 Starting vi .....	259
9.1.2 Inserting Text and Moving Around .....	260
9.1.3 Deleting Text and Undoing Changes .....	261
9.1.4 Changing Text .....	262
9.1.5 Moving Commands .....	263
9.1.6 Saving Files and Quitting vi .....	263
9.1.7 Editing Another File .....	264
9.1.8 Including Other Files .....	264
9.1.9 Running Shell Commands .....	264
9.1.10 Global Searching and Replacing .....	265
9.1.11 Moving Text and Using Registers .....	266
9.1.12 Extending vi .....	267
9.2 The Emacs Editor .....	268
9.2.1 Firing It Up .....	268
9.2.2 Simple Editing Commands .....	269
9.2.3 Tutorial and Online Help .....	272
9.2.4 Deleting, Copying, and Moving Text .....	273
9.2.5 Searching and Replacing .....	274
9.2.6 Macros .....	275
9.2.7 Running Commands and Programming within Emacs .....	275
9.2.8 Tailoring Emacs .....	277
9.2.9 Regular Expressions .....	280
9.3 Text and Document Processing .....	281
9.3.1 Word Processors .....	282
9.3.2 TEX and LATEX .....	283
9.3.3 SGML, XML, and Docbook .....	288
9.3.4 groff .....	290

## Table of Contents

9.3.5 Texinfo .....	293
9.4 Graphics .....	299
9.4.1 ImageMagick.....	300
9.4.2 The GIMP .....	302
9.4.3 POVRAY .....	303
9.5 Configuring and Using Linux Audio .....	303
9.5.1 A Whirlwind Tour of Digital Audio .....	304
9.5.2 Audio Under Linux .....	307
9.5.3 Installation and Configuration.....	308
9.5.4 Linux Multimedia Applications.....	313
9.5.5 MP3 Players .....	314
9.5.6 References .....	315
9.6 Printing .....	315
9.6.1 How the Printing System Processes a Queued File.....	318
9.6.2 nenscript and enscript.....	320
<b>Chapter 10. Installing the X Window System.....</b>	<b>323</b>
10.1 X Concepts .....	324
10.2 Hardware Requirements.....	325
10.3 Installing XFree86.....	328
10.4 Configuring XFree86 .....	330
10.5 Running XFree86 .....	338
10.6 Running into Trouble .....	338
<b>Chapter 11. Customizing Your X Environment.....</b>	<b>340</b>
11.1 Basics of X Customization.....	341
11.1.1 xinit.....	341
11.2 The K Desktop Environment.....	344
11.2.1 General Features.....	344
11.2.2 Installing KDE.....	346
11.2.3 Using KDE .....	348
11.3 KDE Applications .....	353
11.3.1 konsole: Your Home Base.....	354
11.3.2 Clocks.....	357
11.3.3 KGhostview: Displaying PostScript.....	357
11.3.4 Reading Documentation with Konqueror .....	359
11.4 The GNOME Desktop Environment.....	360
11.4.1 Installing and Updating GNOME .....	360
11.4.2 Core Desktop Interface.....	361
11.5 GNOME Applications .....	366
11.5.1 Ximian Evolution: Mail, Calendar, and Contacts .....	366
11.5.2 Gnumeric Spreadsheet.....	369
11.5.3 gPhoto, the Digital Camera Tool.....	369
11.5.4 Abiword Word Processor .....	370
11.5.5 Additional Applications and Resources .....	371
11.6 Other X Applications .....	371
11.6.1 The X Resource Database .....	371
11.6.2 Emacs and Other Editors.....	374
<b>Chapter 12. Windows Compatibility and Samba.....</b>	<b>378</b>
12.1 Sharing Disks with MTools.....	379
12.1.1 mattrib .....	381

## Table of Contents

12.2 Sharing Partitions .....	383
12.2.1 Mounting Windows Shares .....	385
12.2.2 Using Samba to Serve SMB Shares .....	388
12.2.3 File Translation Utilities.....	395
12.3 Running MS-DOS and Windows Applications on Linux.....	397
<b>Chapter 13. Programming Languages .....</b>	<b>399</b>
13.1 Programming with gcc .....	399
13.1.1 Quick Overview .....	400
13.1.2 gcc Features.....	402
13.1.3 Basic gcc Usage .....	403
13.1.4 Using Multiple Source Files.....	404
13.1.5 Optimizing.....	405
13.1.6 Enabling Debugging Code .....	405
13.1.7 More Fun with Libraries .....	405
13.1.8 Using C++ .....	408
13.2 Makefiles .....	409
13.2.1 What make Does .....	409
13.2.2 Some Syntax Rules.....	412
13.2.3 Macros.....	412
13.2.4 Suffix Rules and Pattern Rules.....	414
13.2.5 Multiple Commands.....	415
13.2.6 Including Other makefiles .....	416
13.2.7 Interpreting make Messages.....	417
13.2.8 Autoconf, Automake, and Other Makefile Tools.....	417
13.3 Shell Programming.....	418
13.4 Using Perl.....	421
13.4.1 A Sample Program .....	422
13.4.2 More Features.....	424
13.4.3 Pros and Cons.....	427
13.5 Java.....	428
13.5.1 The Promise of Java, or Why You Might Want to Use Java .....	428
13.5.2 Getting Java for Linux.....	430
13.5.3 A Working Example of Java .....	430
13.6 Other Languages .....	432
<b>Chapter 14. Tools for Programmers .....</b>	<b>437</b>
14.1 Debugging with gdb .....	437
14.1.1 Tracing a Program.....	437
14.1.2 Examining a Core File.....	441
14.1.3 Debugging a Running Program.....	446
14.1.4 Changing and Examining Data .....	446
14.1.5 Getting Information.....	448
14.1.6 Miscellaneous Features .....	449
14.2 Programming Tools.....	453
14.2.1 Debuggers.....	453
14.2.2 Profiling and Performance Tools .....	453
14.2.3 Using strace .....	456
14.2.4 Using Valgrind .....	458
14.2.5 Interface Building Tools.....	460
14.2.6 Revision Control Tools — RCS.....	463
14.2.7 Revision Control Tools — CVS.....	466

## Table of Contents

14.2.8 Patching Files .....	470
14.2.9 Indenting Code .....	472
14.3 Integrated Development Environments.....	473
<b>Chapter 15. TCP/IP and PPP.....</b>	<b>475</b>
15.1 Networking with TCP/IP.....	475
15.1.1 TCP/IP Concepts .....	476
15.1.2 Hardware Requirements .....	482
15.1.3 Configuring TCP/IP with Ethernet.....	483
15.2 Dial-up PPP .....	493
15.2.1 Basic PPP Configuration for Modems .....	494
15.3 PPP over ISDN.....	500
15.3.1 Configuring Your ISDN Hardware .....	501
15.3.2 Setting Up Synchronous PPP .....	504
15.3.3 And If It Does Not Work?.....	507
15.3.4 Where to Go from Here? .....	507
15.4 ADSL .....	508
15.5 NFS and NIS Configuration.....	509
15.5.1 Configuring NFS .....	510
15.5.2 Configuring NIS .....	511
<b>Chapter 16. The World Wide Web and Electronic Mail.....</b>	<b>514</b>
16.1 The World Wide Web .....	514
16.1.1 Using Konqueror and Other Web Browsers .....	516
16.1.2 Configuring Your Own Web Server .....	519
16.2 Electronic Mail.....	525
16.2.1 The Postfix MTA .....	526
16.2.2 Getting the Mail to Your Computer with Fetchmail .....	535
16.2.3 Other Email Administrative Issues .....	536
16.2.4 Using KMail .....	537
16.2.5 Using Mozilla Mail & News .....	540
<b>Chapter 17. Basic Security .....</b>	<b>542</b>
17.1 A Perspective on System Security .....	542
17.2 Initial Steps in Setting Up a Secure System.....	544
17.2.1 Shutting Down Unwanted Network Daemons .....	544
17.2.2 Top 10 Things You Should Never Do .....	545
17.3 TCP Wrapper Configuration .....	547
17.3.1 Using TCP Wrappers with inetd .....	548
17.3.2 Using TCP Wrappers with xinetd .....	548
17.3.3 /etc/hosts.allow and /etc/hosts.deny .....	548
17.4 Firewalls: Filtering IP Packets .....	550
17.4.1 netfilter Basics .....	551
17.4.2 Developing IP Filtering Rulesets .....	555
17.4.3 IP Filter Management and Script Files.....	556
17.4.4 Sample netfilter Configurations .....	556
<b>Chapter 18. LAMP .....</b>	<b>561</b>
18.1 MySQL.....	563
18.2 PHP.....	569
18.2.1 Some Sample PHP .....	569
18.2.2 PHP4 as an Apache Module.....	572
18.3 The LAMP Server in Action .....	574

<b>Appendix A. Sources of Linux Information.....</b>	<b>576</b>
A.1 Linux Documentation Project .....	576
A.2 FTP Sites .....	577
A.3 World Wide Web Sites.....	577
A.3.1 General Documentation.....	577
A.3.2 Open Source Projects .....	578
A.3.3 Programming Languages and Tools.....	578
A.3.4 News and Information Sites .....	579
A.3.5 Linux Software Directories and Download Sites .....	579
A.3.6 Linux Distributions.....	579
A.3.7 Commercial Linux Software Companies .....	580
A.3.8 Internet RFCs and Other Standards.....	581
A.3.9 Miscellaneous .....	581
<b>Appendix B. Installing Linux on Digital/Compaq Alpha Systems .....</b>	<b>582</b>
B.1 Alpha History and Status.....	582
B.1.1 The Linux Port and Distributions .....	583
B.1.2 Chipsets .....	584
B.1.3 Sources of Information .....	584
B.1.4 Minimum Hardware .....	586
B.1.5 IDE/ATAPI Drive Support.....	586
B.1.6 Mice and Serial Ports.....	586
B.2 Preparations and General Procedure for Installation.....	586
B.2.1 Potential Incompatibilities and Hardware Problems .....	587
B.2.2 Installation Choices .....	588
B.3 Installing Linux.....	591
B.3.1 General Procedure .....	591
B.3.2 Preparing Software for Installation.....	592
B.3.3 Preparing Hardware for Installation .....	592
B.3.4 Setting Up the System Firmware to Start the Installation .....	593
B.3.5 Loading the Linux Boot Kernel.....	593
B.4 Tuning and Post-Installation Considerations.....	595
B.4.1 Kernel Tuning.....	595
B.4.2 Performance and Library Tuning .....	595
B.4.3 Binary Emulation.....	595
B.4.4 Graphical Browser Considerations .....	595
<b>Bibliography .....</b>	<b>597</b>
Linux Documentation Project Guides .....	597
Linux Documentation Project FAQs.....	598
Linux Documentation Project HOWTOs (Partial Listing) .....	598
General Linux Books .....	599
Unix and Unix Shells .....	599
Applications .....	599
The Internet .....	600
Networks and Communications .....	600
Programming and Linux Internals.....	601
System Administration.....	601
Security.....	601
<b>Colophon .....</b>	<b>603</b>