

Andrew Hudson  
Paul Hudson

DVD

**Ubuntu 8.04**

on DVD

+

Free Upgrade to  
**Ubuntu 8.10**

# Ubuntu

**UNLEASHED**

**SAMS**

**2008 Edition**

## Ubuntu Unleashed 2008 Edition

Copyright © 2009 by Sams Publishing

All rights reserved. No part of this book shall be reproduced, stored in a retrieval system, or transmitted by any means, electronic, mechanical, photocopying, recording, or otherwise, without written permission from the publisher. No patent liability is assumed with respect to the use of the information contained herein. Although every precaution has been taken in the preparation of this book, the publisher and author assume no responsibility for errors or omissions. Nor is any liability assumed for damages resulting from the use of the information contained herein.

ISBN-13: 978-0-672-32993-7

ISBN-10: 0-672-32993-X

Library of Congress Cataloging-in-Publication Data:

Hudson, Andrew, 1978-

Ubuntu unleashed 2008 edition : covering 8.04 and 8.10 / Andrew

Hudson, Paul Hudson. – 4th ed.

p. cm.

Includes index.

ISBN 978-0-672-32993-7 (pbk. w/dvd)

1. Ubuntu (Electronic resource) 2. Linux. 3. Operating systems

(Computers) I. Hudson, Paul, 1979- II. Title.

QA76.76.O63H81666 2008

005.4'32-dc22

2008021150

Printed in the United States of America

First Printing July 2008

### Trademarks

All terms mentioned in this book that are known to be trademarks or service marks have been appropriately capitalized. Sams Publishing cannot attest to the accuracy of this information. Use of a term in this book should not be regarded as affecting the validity of any trademark or service mark.

### Warning and Disclaimer

Every effort has been made to make this book as complete and as accurate as possible, but no warranty or fitness is implied. The information provided is on an “as is” basis. The authors and the publisher shall have neither liability nor responsibility to any person or entity with respect to any loss or damages arising from the information contained in this book or from the use of the CD or programs accompanying it.

### Bulk Sales

Sams Publishing offers excellent discounts on this book when ordered in quantity for bulk purchases or special sales. For more information, please contact:

**U.S. Corporate and Government Sales**

**1-800-382-3419**

**corpsales@pearsontechgroup.com**

For sales outside of the U.S., please contact:

**International Sales**

**international@pearson.com**

### Acquisitions Editor

Mark Taber

### Development Editor

Michael Thurston

### Managing Editor

Patrick Kanouse

### Senior Project Editor

San Dee Phillips

### Copy Editor

Paula Lowell

### Indexer

Tim Wright

### Proofreader

Leslie Joseph

### Technical Editor

Dallas Relford

### Publishing

#### Coordinator

Vanessa Evans

### Multimedia Developer

Dan Scherf

### Cover and Interior

#### Designer

Gary Adair

### Composition

Mark Shirar



The Safari® Enabled icon on the cover of your favorite technology book means the book is available through Safari Bookshelf. When you buy this book, you get free access to the online edition for 45 days. Safari Bookshelf is an electronic reference library that lets you easily search thousands of technical books, find code samples, download chapters, and access technical information whenever and wherever you need it.

To gain 45-day Safari Enabled access to this book:

- ▶ Go to <http://www.informit.com/onlineedition>
- ▶ Complete the brief registration form
- ▶ Enter the coupon code **4RK6-RX1J-CKQT-K6JJ-W5QU**

If you have difficulty registering on Safari Bookshelf or accessing the online edition, please e-mail [customer-service@safaribooksonline.com](mailto:customer-service@safaribooksonline.com).

# Introduction

Welcome to *Ubuntu Unleashed, 2008 Edition!* This book covers the free Linux distribution named Ubuntu and includes a fully functional and complete operating system produced by the Ubuntu Community, sponsored by Canonical Software. This book covers Ubuntu version 8.04 LTS, commonly known as the Hardy Heron.

Ubuntu directly descends from one of the oldest and most revered Linux distributions ever: Debian. Those of you who know nothing about Linux will likely not have heard of Debian; it is enough to know that it is considered to be one of the most stable and secure Linux distributions currently available. Ubuntu benefits directly from many contributions from free software developers across the world.

If you are new to Linux, you have made a great decision by choosing this book. Sams Publishing's *Unleashed* books offer an in-depth look at their subject, taking in both beginner and advanced users and moving them to a new level of knowledge and expertise. Ubuntu is a fast-changing distribution that can be updated at least twice a year. We have tracked the development of Ubuntu from early on to make sure that the information in this book mirrors closely the development of the distribution. A full copy of Ubuntu is included on the enclosed disc, making it possible for you to install Linux in less than an hour! No longer an upstart, Linux now has an enviable position in today's modern computing world. It can be found on machines as diverse as mobile phones and wristwatches, all the way up to supercomputers—in fact, Linux currently runs on more than half of the world's top 500 supercomputers.

Do not let the reputation of Linux discourage you, however. Most people who have heard of Linux think that it is found only on servers, looking after websites and email. Nothing could be further from the truth because Linux is making huge inroads in to the desktop market, too. Corporations are realizing the benefits of running a stable and powerful operating system that is easy to maintain and easy to secure. Add to that the hundreds of improvements in usability, and Linux becomes an attractive proposition that tempts many CIOs. The best part is that as large Linux vendors improve Linux, the majority of those improvements make it into freely available distributions, allowing you to benefit from the additions and refinements made. You can put Ubuntu to work today and be assured of a great user experience.

This book provides all the information that you need to get up and running with Ubuntu. It even tells you how to keep Ubuntu running in top shape and how to adapt Ubuntu to changes in your own needs. You can use Ubuntu at home, in the workplace, or, with permission, at your school or college. In fact, you might want to poke around your school's computer rooms: You will probably find that someone has already beaten you to the punch—Linux is commonly found in academic institutions. Feel free to make as many copies of the software as you want; because Ubuntu is freely distributable all over the world, no copyright lawyers are going to pound on your door.

After an introduction to Linux and Ubuntu, you will find out how to get started with Ubuntu, including installation and initial configuration. We also take you through installing software, managing users, and other common administrative tasks. For the more technically minded, we also cover some starting steps in programming across several languages—why not pick one and try it out? Throughout this book, you will also find information about multimedia applications, digital graphics, and even gaming (for after-hours when you are finished tinkering). After you make it through this book, you will be well equipped with the knowledge needed to use Linux successfully. We do assume that you are at least familiar with an operating system already (even if it is not with Linux) and have some basic computer knowledge.

## Licensing

Software licensing is an important issue for all computer users and can entail moral, legal, and financial considerations. Many consumers think that purchasing a copy of a commercial or proprietary operating system, productivity application, utility, or game conveys ownership, but this is not true. In the majority of cases, the *end user license agreement (EULA)* included with a commercial software package states that you have paid only for the right to use the software according to specific terms. This generally means you may not examine, make copies, share, resell, or transfer ownership of the software package. More onerous software licenses enforce terms that preclude you from distributing or publishing comparative performance reviews of the software. Even more insidious licensing schemes (and supporting legislation, especially in the United States) contain provisions allowing onsite auditing of the software's use!

This is not the case with the software included with this book. You are entirely free to make copies, share them with friends, and install the software on as many computers as you want—we encourage you to purchase additional copies of this book to give as gifts, however. Be sure to read the README file on the disc included with this book for important information regarding the included software and disk contents. After you install Ubuntu, go to <http://www.gnu.org/licenses/gpl.html> to find a copy of the GNU GPL. You will see that the GPL provides unrestricted freedom to use, duplicate, share, study, modify, improve, and even sell the software.

You can put your copy of Ubuntu to work right away in your home or at your place of business without worrying about software licensing, per-seat workstation or client licenses, software auditing, royalty payments, or any other type of payments to third parties. However, be aware that although much of the software included with Ubuntu is licensed under the GPL, some packages on this book's disc are licensed under other terms. There is a variety of related software licenses, and many software packages fall under a broad definition known as *open source*. Some of these include the Artistic License, the BSD License, the Mozilla Public License, and the Q Public License.

For additional information about the various GNU software licenses, browse to <http://www.gnu.org/>. For a definition of open-source and licensing guidelines, along with links to the terms of nearly three dozen open-source licenses, browse to <http://www.opensource.org/>.

## Who This Book Is For

This book is for anyone searching for guidance on using Ubuntu and primarily focuses on Intel-based PC platforms. Although the contents are aimed at intermediate to advanced users, even new users with a bit of computer savvy will benefit from the advice, tips, tricks, traps, and techniques presented in each chapter. Pointers to more detailed or related information are also provided at the end of each chapter.

If you are new to Linux, you might need to learn some new computer skills, such as how to research your computer's hardware, how to partition a hard drive, and (occasionally) how to use a command line. This book helps you learn these skills and shows you how to learn more about your computer, Linux, and the software included with Ubuntu. System administrators with experience using other operating systems can use the information in this book to install, set up, and run common Linux software services, such as the *Network File System (NFS)*, a *File Transfer Protocol (FTP)* server, and a web server (using Apache, among others).

## What This Book Contains

*Ubuntu Unleashed* is organized into seven parts, covering installation and configuration, Ubuntu on the desktop, system administration, programming and housekeeping, and a reference section. A disc containing the entire distribution is included so that you have everything you need to get started. This book starts by covering the initial and essential tasks required to get Ubuntu installed and running on a target system.

If you are new to Linux, and more specifically Ubuntu, first read the chapters in Part I, “Installation and Configuration.” You will get valuable information on the following:

- ▶ Detailed steps that walk you through installation
- ▶ Critical advice on key configuration steps to fully install and configure Linux to work with your system’s subsystems or peripherals, such as pointers, keyboards, modems, USB devices and power management
- ▶ Initial steps needed by new users transitioning from other computing environments
- ▶ Working with GNOME, the default desktop environment for Ubuntu

Part II, “Desktop Ubuntu,” is aimed at users who want to get productive with Ubuntu and covers the following:

- ▶ Discovering the many productivity applications that come with Ubuntu
- ▶ Surfing the Internet and working with email and newsgroups
- ▶ Using Ubuntu to listen to music and watch video
- ▶ Using Ubuntu to download and manipulate images from digital cameras
- ▶ Setting up local printers for Ubuntu
- ▶ Understanding the current state of gaming for Linux

Moving beyond the productivity and desktop areas of Ubuntu, Part III, “System Administration,” covers the following:

- ▶ Managing users and groups
- ▶ Automating tasks and using shell scripts
- ▶ Monitoring system resources and availability
- ▶ Backup strategies and software
- ▶ Network connectivity, including sharing folders and securing the network
- ▶ Internet connectivity via dial-up and broadband connections

Part IV, “Ubuntu as a Server” gives you the information you need to start building your own file, web and other servers for use in your home or office.

- ▶ Building and deploying web servers
- ▶ Database creation, management, and manipulation
- ▶ File and print servers
- ▶ Using FTP for serving files across the Internet and local networks
- ▶ Building and deploying email servers using Postfix and managing mailing lists
- ▶ Creating remote access gateways and services

- ▶ Configuring DNS for your network
- ▶ Using LDAP for storing information on users and security

Part V, “Programming Linux,” provides a great introduction to how you can extend Ubuntu capabilities even further using the development tools supplied with it. This part covers the following:

- ▶ Programming in Perl, using variables and scripting
- ▶ An introduction to the Python language
- ▶ Writing PHP scripts and linking them to databases
- ▶ C and C++ programming tools available with Ubuntu and how to use the GNU C Compiler (gcc)

Part VI, “Ubuntu Housekeeping,” looks at some of the more advanced skills you need to keep your system running in perfect condition, including the following:

- ▶ Securing your machine against attack from outsiders and viruses
- ▶ Performance tuning
- ▶ Command-line masterclass
- ▶ Advanced apt
- ▶ Kernel and module management and compilation

An extensive reference in Part VII, “Appendixes,” gives you scope to explore in even more depth some of the topics covered in this book as well as providing historical context to Ubuntu and installation resources.

## Conventions Used in This Book

A lot of documentation is included with every Linux distribution, and Ubuntu is certainly no exception. Although the intent of *Ubuntu Unleashed* is to be as complete as possible, it is impossible to cover every option of every command included in the distribution. However, this book offers numerous tables of various options, commands, and keystrokes to help condense, organize, and present information about a variety of subjects.

This edition is also packed full of screenshots to illustrate nearly all Ubuntu-specific graphical utilities—especially those related to system administration or the configuration and administration of various system and network services.

To help you better understand code listing examples and sample command lines, several formatting techniques are used to show input and ownership. For example, if the command or code listing example shows typed input, the input is formatted in boldface, as follows:

```
$ ls
```

If typed input is required, as in response to a prompt, the sample typed input also is in boldface, like so:

```
Delete files? [Y/n] y
```

All statements, variables, and text that should appear on your display use the same bold-face formatting. In addition, command lines that require root or super user access are prefaced with the `sudo` command, as follows:

```
$ sudo printtool &
```

Command-line examples that any user can run are prefaced with a dollar sign (`$`), like so:

```
$ ls
```

The following elements provide you with useful tidbits of information that relate to the discussion of the text:

#### NOTE

A note provides additional information you might want to make note of as you are working; augments a discussion with ancillary details; or points you to an article, a whitepaper, or another online reference for more information about a specific topic.

---

#### TIP

A tip can contain special insight or a timesaving technique, as well as information about items of particular interest to you that you might not find elsewhere.

---

#### CAUTION

A caution warns you about pitfalls or problems before you run a command, edit a configuration file, or choose a setting when administering your system.

---



### Sidebars Can Be Goldmines

Just because it is in a sidebar does not mean that you will not find something new here. Be sure to watch for these elements that bring in outside content that is an aside to the discussion in the text. You will read about other technologies, Linux-based hardware, and special procedures to make your system more robust and efficient.

---

Other formatting techniques used to increase readability include the use of italics for placeholders in computer command syntax. Computer terms or concepts are also italicized upon first introduction in text.

Finally, you should know that all text, sample code, and screenshots in *Ubuntu Unleashed* were developed using Ubuntu and open-source tools.

Read on to start learning about and using the latest version of Ubuntu. Experienced users will want to consider the new information in this edition when planning or considering upgrades. There are many different Linux distributions from different vendors, but many derive from, or closely mimic, the Debian distribution.

# CHAPTER 4

## Command Line Quickstart

The command line is one of the most powerful tools available for use with Ubuntu, and indeed Linux. Knowledge of the commands associated with it and also how to string them together will make your life with Ubuntu much easier.

This chapter looks at some of the basic commands that you need to know to be productive at the command line. You will find out how to get to the command line, and also get to grips with some of the commands used to navigate around the file system. Later on in this book is the Command Line Masterclass (Chapter 30), which explores the subject in more depth. The skills you learn in this chapter will give you confidence when you're called upon to work at the command line.

### What Is the Command Line?

Hang around Linux users for any length of time and it will not be long before you hear them speak in hushed tones about the command line or the terminal. Quite rightly too, as the command line offers a unique and powerful way to interact with Linux. However, for the most part you may never need to access the command line because Ubuntu offers a slew of graphical tools that enable you to configure most things on your system.

But sometimes things go wrong and you may not have the luxury of a graphical interface to work with. It is in these situations that a fundamental understanding of the command line and its uses can be a real life saver.

### IN THIS CHAPTER

- ▶ What Is the Command Line?
- ▶ Logging Into and Working with Linux
- ▶ Getting to the Command Line
- ▶ Using the Text Editors
- ▶ Working with Permissions
- ▶ Working as Root
- ▶ Reading Documentation
- ▶ Reference

**NOTE**

In Chapter 3, “Working with Gnome,” you learned about BulletProofX, a project whose goal it is to always provide a fallback if your X server fails. Under Ubuntu 8.04, this has been further improved, although there will still be some instances where even BulletProofX won’t save you.

Don’t be tempted to skip over this chapter as irrelevant; rather, work through the chapter and ensure that you are comfortable with the command line before moving on.

---

It is tempting to think of the command line as the product of some sort of black and arcane art, and in some ways it can appear to be extremely difficult and complicated to use. However, perseverance is key and by the end of this chapter you should at least be comfortable with using the command line and ready to move onto Chapter 30, “Command Line Masterclass.”

More importantly, though, you will be able to make your way around a command line–based system, which you are likely to encounter if you work within a server environment.

This chapter introduces you to a number of commands, including commands that enable you to do the following tasks:

- ▶ **Perform routine tasks**—Logging in and out, using the text console, changing passwords, listing and navigating directories
- ▶ **Implement basic file management**—Creating files and folders, copying or moving them around the file system, renaming and ultimately deleting them (if necessary)
- ▶ **Execute basic system management**—Shutting down or rebooting, reading man pages, and using text-based tools to edit system configuration files

The information in this chapter is valuable for individual users or system administrators who are new to Linux and are learning to use the command line for the first time.

**TIP**

Those of you who have used a computer for many years will probably have come into contact with MS-DOS, in which case being presented with a black screen will fill you with a sense of nostalgia. Don’t get too comfy; the command line in Linux is far superior to its distant MS-DOS cousin. Whereas MS-DOS skills are transferable only to other MS-DOS environments, the skills that you learn at the Linux command line can be transferred easily to other Unix-like operating systems, such as Solaris, OpenBSD, FreeBSD, and even Mac OS X, which allows you access to the terminal.

## User Accounts

One concept you will have to get used to is that of user-based security. By and large, only two types of users will access the system as actual users. The first type is the regular user, of which you created one when you started Ubuntu for the first time (see Chapter 1, “Installing Ubuntu”). These users can change anything that is specific to them, such as the wallpaper on the desktop, their personal preferences, and so on. Note that the emphasis should be on anything that is specific to them, as it prevents regular users from making system-wide changes that could affect other users.

To make system-wide changes, you need to use super-user privileges which you should have if your account was the first one specified (i.e. when you specified a user during the installation). With super-user privileges you basically have access to the entire system and can carry out any task, even destructive ones! In order to use your super-user privileges you need to prefix the command you wish to execute with the command `sudo`. When you hit enter (after typing the remaining command) you will be prompted for your password, which you should type in followed by the Enter key. Ubuntu will then carry out the command, but with super-user privileges.

An example of the destructive nature of working as the super-user can be found in the age-old example of `$sudo rm -rf /`, which erases all the data on your hard drive. You need to be especially careful when using your super-user privileges, otherwise you may make irreparable damage to your system.

Don't let this worry you, though, as the ability to work as the super-user is fundamental to a healthy Linux system. Without it you would not be able to install new software, edit system configuration files, or do any number of administration tasks. By the end of this chapter you will feel comfortable working with your super-user privileges and be able to adequately administer your system.

Ubuntu works slightly differently to other Linux distributions by giving users super-user privileges by default. If you work with any other Linux distro you will quickly come across the root user, which is a super-user account. So rather than having to type in `sudo` before every command, the root account can simply issue the command and not have to worry about entering a password. You can tell when you are working at a root prompt because you will see the pound sign (`#`). Within Ubuntu the root account is disabled by default in preference to giving super-user privileges to users. If you wish to enable the root account then issue the command `sudo passwd`. When prompted, enter your user password. You will then be asked for a new UNIX password; this will be the password for the root account, so make sure and remember it. You will also be prompted to repeat the password, in case you've made any mistakes. Once you've typed it in and pressed Enter, the root account will now be active. You'll find out how to switch to root later on.

An alternative way of getting a root prompt, without having to enable the root account, is to issue the command `sudo -i`. After entering your password you will find yourself at a root prompt (`#`). Do what you need to do and when you are finished, type `exit` and press Enter to return to your usual prompt.

As with most things, Ubuntu offers you a number of ways to access the command line. You can use the Terminal entry in Applications, Accessories, but by far the simplest way is to press `Ctrl + Alt + F1`. Ubuntu switches to a black screen and a traditional login prompt that resembles the following:

```
Ubuntu 8.04(Hardy) hardy-dev tty1
hardy-dev login:
```

### TIP

This is actually one of six virtual consoles that Ubuntu provides for your use. After you have accessed a virtual console, you can use the `Alt` key and `F1` through `F6` to switch to a different console. If you want to get back to the graphical interface, press `Alt + F7`. You can also switch between consoles by holding the `Alt` key and pressing either the left or the right cursor key to move down or up a console, such as `tty1` to `tty2`.

Ubuntu is waiting for you to log in as a user, so go ahead and enter your username and press the return key. Ubuntu then prompts you for your password, which you should enter. Note that Ubuntu does not show any characters while you are typing your password in. This is a good thing because it prevents any shoulder surfers from seeing what you've typed or the length of the password.

Hitting the Return key drops you to a shell prompt, signified by the dollar sign:

```
andrew@hardy-dev ~]$
```

This particular prompt tells me that I am logged in as the user `andrew` on the system `hardy-dev` and I am currently in my home directory (Linux uses the tilde as shorthand for the home directory).

### TIP

Navigating through the system at the command line can get confusing at times, especially when a directory name occurs in several different places. Fortunately, Linux includes a simple command that tells you exactly where you are in the file system. It's easy to remember because the command is just an abbreviation of present working directory, so type `pwd` at any point to get the full path of your location. For example, typing `pwd` after following these instructions shows `/home/yourusername`, meaning that you are currently in your home directory.

Using the `pwd` command can save you a lot of frustration when you have changed directory half a dozen times and have lost track.

Another way to quickly access the terminal is to go to Applications, Accessories and choose the Terminal entry. Ubuntu opens up `gnome-terminal`, which allows you to access

the terminal while remaining in Gnome. This time, the terminal appears as black text on a white background. Accessing the terminal this way, or by using the Ctrl + Alt + F1 method makes no difference because you are interacting directly with the terminal itself.

## Navigating Through the File System

Use the `cd` command to navigate through the Ubuntu file system. This command is generally used with a specific directory location or pathname, like this:

```
$ cd /etc/apt/
```

Under Ubuntu, the `cd` command can also be used with several shortcuts. For example, to quickly move up to the *parent* (higher-level) directory, use the `cd` command like this:

```
$ cd ..
```

To return to one's home directory from anywhere in the Linux file system, use the `cd` command like this:

```
$ cd
```

You can also use the `$HOME` shell environment variable to accomplish the same thing. Type this command and press Enter to return to your home directory:

```
$ cd $HOME
```

You can accomplish the same thing by using the tilde (`~`) like this:

```
$ cd ~
```

Don't forget the `pwd` command to remind you where you are within the file system!

Another important command to use is the `ls` command, which lists the contents of the current directory. It's commonly used by itself, but a number of options (or switches) available for `ls` give you more information. For instance, the following command returns a listing of all the files and directories within the current directory, including any hidden files (denoted by a `.` prefix) as well as a full listing, so it will include details such as the permissions, owner and group, size and last modified time and date:

```
$ ls -al
```

You can also issue the command

```
$ ls -R
```

which scans and lists all the contents of the sub-directories of the current directory. This might be a lot of information, so you may want to redirect the output to a text file so you can browse through it at your leisure by using the following:

```
$ ls -alR > listing.txt
```

**TIP**

The previous command sends the output of `ls -a1R` to a file called `listing.txt`, and demonstrates part of the power of the Linux command line. At the command line you are able to use files as inputs to commands, or generate files as outputs as shown. For more information about combining commands, see Chapter 30.

We've included a table showing some of the top-level directories that are part of a standard Linux distro in Table 4.1.

TABLE 4.1 Basic Linux Directories

Name	Description
/	The root directory
/bin	Essential commands
/boot	Boot loader files, Linux kernel
/dev	Device files
/etc	System configuration files
/home	User home directories
/initrd	Initial RAM disk boot support (used during boot time)
/lib	Shared libraries, kernel modules
/lost+found	Directory for recovered files (if found after a file system check)
/media	Mount point for removable media, such as DVDs and floppy disks
/mnt	Usual mount point for local, remote file systems
/opt	Add-on software packages
/proc	Kernel information, process control
/root	Super-user (root) home
/sbin	System commands (mostly root only)
/srv	Holds information relating to services that run on your system
/sys	Real-time information on devices used by the kernel
/tmp	Temporary files
/usr	Secondary software file hierarchy
/var	Variable data (such as logs); spooled files

Knowing these directories can aid you in partitioning in any future systems, letting you choose to put certain directories on their own distinct partition.

Some of the important directories in Table 4.1, such as those containing user and root commands or system configuration files, are discussed in the following sections. You use and edit files under these directories when you use Ubuntu.

Linux also includes a number of GNU commands you can use to search the file system. These include the following:

- ▶ `whereis command`—Returns the location of the command and its man page.
- ▶ `whatis command`—Returns a one-line synopsis from the command's man page.
- ▶ `locate file`—Returns locations of all matching file(s); an extremely fast method of searching your system because `locate` searches a database containing an index of all files on your system. However, this database (about 4MB in size and named `slocate.db`, under the `/var/lib/slocate` directory) is built daily at 4:20 a.m. by default, and does not contain pathnames to files created during the workday or in the evening. If you do not keep your machine on constantly, you can run the `updatedb` command either using `sudo` or by using the root account to manually start the building of the database.
- ▶ `apropos subject`—Returns a list of commands related to subject.

## Managing Files with the Shell

Managing files in your home directory involves using one or more easily remembered commands. If you have any familiarity with the now-ancient DOS, you recognize some of these commands (although their names are different from those you remember). Basic file management operations include paging (reading), moving, renaming, copying, searching, and deleting files and directories. These commands include the following:

- ▶ `cat filename`—Outputs contents of filename to display
- ▶ `less filename`—Allows scrolling while reading contents of filename
- ▶ `mv file1 file2`—Renames `file1` to `file2`
- ▶ `mv file dir`—Moves file to specified directory
- ▶ `cp file1 file2`—Copies `file1` and creates `file2`
- ▶ `rm file`—Deletes file
- ▶ `rmdir dir`—Deletes directory (if empty)
- ▶ `grep string file(s)`—Searches through files(s) and displays lines containing matching string

Note that each of these commands can be used with pattern-matching strings known as *wildcards* or *expressions*. For example, to delete all files in the current directory beginning with the letters `abc`, you can use an expression beginning with the first three letters of the desired filenames. An asterisk (`*`) is then appended to match all these files. Use a command line with the `rm` command like this:

```
$ rm abc*
```

Linux shells recognize many types of filenaming wildcards, but this is different from the capabilities of Linux commands supporting the use of more complex expressions. You learn more about using wildcards in Chapter 11, “Automating Tasks.”



**NOTE**

Learn more about using expressions by reading the `grep` manual pages (`man grep`).

**Working with Compressed Files**

Another file management operation is compression and decompression of files, or the creation, listing, and expansion of file and directory archives. Linux distributions usually include several compression utilities you can use to create, compress, expand, or list the contents of compressed files and archives. These commands include

- ▶ `bunzip2`—Expands a compressed file
- ▶ `bzip2`—Compresses or expands files and directories
- ▶ `gunzip`—Expands a compressed file
- ▶ `gzip`—Compresses or expands files and directories
- ▶ `tar`—Creates, expands, or lists the contents of compressed or uncompressed file or directory archives known as *tape archives* or *tarballs*

Most of these commands are easy to use. The `tar` command, however, has a somewhat complex (although capable) set of command-line options and syntax. Even so, you can quickly learn to use `tar` by remembering a few simple invocations on the command line. For example, to create a compressed archive of a directory, use `tar`'s `czf` options like this:

```
$ tar czf dirname.tgz dirname
```

The result is a compressed archive (a file ending in `.tgz`) of the specified directory (and all files and directories under it). Add the letter `v` to the preceding options to view the list of files added during compression and archiving. To list the contents of the compressed archive, substitute the `c` option with the letter `t`, like this:

```
$ tar tzf archive
```

Of course, if many files are in the archive, a better invocation (to easily read or scroll through the output) is

```
$ tar tzf archive | less
```

**TIP**

In the previous code example, we used a pipe character (`|`). Each pipe sends the output of the first command to the next command. This is another of the benefits of the command line under Linux—you can string several commands together to get the desired results.

To expand the contents of a compressed archive, use `tar`'s `zxf` options, like so:

```
$ tar zxf archive
```

The `tar` utility decompresses the specified archive and extracts the contents in the current directory.

## Use Essential Commands from the `/bin` and `/sbin` Directories

The `/bin` directory (about 5MB if you do a full install) contains essential commands used by the system for running and booting Linux. In general, only the root operator uses the commands in the `/sbin` directory. Many (though not all) these commands are *statically* linked which means that such commands do not depend on software libraries residing under the `/lib` or `/usr/lib` directories. Nearly all the other applications on your system are *dynamically* linked—meaning that they require external software libraries (also known as *shared* libraries) to run.

## Use and Edit Files in the `/etc` Directory

More than 10MB of system configuration files and directories reside under the `/etc` directory if you install all the software included with this book. Some major software packages, such as Apache, OpenSSH, and `xinetd`, have directories of configuration files under `/etc`. Other important system-related configuration files in `/etc` are

- ▶ `fstab`—The file system table is a text file listing each hard drive, CD-ROM, floppy, or other storage device attached to your PC. The table indexes each device's partition information with a place in your Linux file system (directory layout) and lists other options for each device when used with Linux (see Chapter 32, “Kernel and Module Management”). Nearly all entries in `fstab` can be manipulated by root using the `mount` command.
- ▶ `modprobe.d/`—This folder holds all the instructions to load kernel modules that are required as part of the system startup, and replaces the historic `modprobe.conf` file.
- ▶ `passwd`—The list of users for the system, along with user account information. The contents of this file can be changed by various programs, such as `useradd` or `chsh`.
- ▶ `shells`—A list of approved shells (command-line interfaces).

## Protect the Contents of User Directories—`/home`

The most important data on a Linux system resides in the user's directories, found under the `/home` directory. Segregating the system and user data can be helpful in preventing data loss and making the process of backing up easier. For example, having user data reside on a separate file system or mounted from a remote computer on the network might help shield users from data loss in the event of a system hardware failure.

## Use the Contents of the `/proc` Directory to Interact with the Kernel

The content of the `/proc` directory is created from memory and exists only while Linux is running. This directory contains special “files” that either extract information from or send information to the kernel. Many Linux utilities extract information from dynamically created directories and files under this directory, also known as a *virtual file system*. For example, the `free` command obtains its information from a file named `meminfo`:

```
$ free
```

	total	used	free	shared	buffers	cached
Mem:	1026320	822112	204208	0	41232	481412
-/+ buffers/cache:		299468	726852			
Swap:	2031608	0	2031608			

This information constantly changes as the system is used. You can get the same information by using the `cat` command to see the contents of the `meminfo` file:

```
$ cat /proc/meminfo
```

```
MemTotal:      1026320 kB
MemFree:       204200 kB
Buffers:       41252 kB
Cached:        481412 kB
SwapCached:    0 kB
Active:        307232 kB
Inactive:      418224 kB
HighTotal:     122692 kB
HighFree:      244 kB
LowTotal:      903628 kB
LowFree:       203956 kB
SwapTotal:     2031608 kB
SwapFree:      2031608 kB
Dirty:         0 kB
Writeback:     0 kB
AnonPages:     202804 kB
Mapped:        87864 kB
Slab:          21736 kB
SReclaimable:  12484 kB
SUnreclaim:    9252 kB
PageTables:    5060 kB
NFS_Unstable:  0 kB
Bounce:        0 kB
CommitLimit:  2544768 kB
Committed_AS:  712024 kB
VmallocTotal:  114680 kB
VmallocUsed:   6016 kB
VmallocChunk:  108148 kB
HugePages_Total:  0
HugePages_Free:  0
HugePages_Rsvd:  0
Hugepagesize:   4096 kB
```

The `/proc` directory can also be used to dynamically alter the behavior of a running Linux kernel by “echoing” numerical values to specific files under the `/proc/sys` directory. For example, to “turn on” kernel protection against one type of denial of service (DOS) attack

known as *SYN flooding*, use the `echo` command to send the number 1 (one) to the following `/proc` path:

```
$ sudo echo 1 >/proc/sys/net/ipv4/tcp_syncookies
```

Other ways to use the `/proc` directory include

- ▶ Getting CPU information, such as the family, type, and speed from `/proc/cpuinfo`.
- ▶ Viewing important networking information under `/proc/net`, such as active interfaces information under `/proc/net/dev`, routing information in `/proc/net/route`, and network statistics in `/proc/net/netstat`.
- ▶ Retrieving file system information.
- ▶ Reporting media mount point information via USB; for example, the Linux kernel reports what device to use to access files (such as `/dev/sda`) if a USB camera or hard drive is detected on the system. You can use the `dmesg` command to see this information.
- ▶ Getting the kernel version in `/proc/version`, performance information such as uptime in `/proc/uptime`, or other statistics such as CPU load, swap file usage, and processes in `/proc/stat`.

## Work with Shared Data in the `/usr` Directory

The `/usr` directory contains software applications, libraries, and other types of shared data for use by anyone on the system. Many Linux system administrators give `/usr` its own partition. A number of subdirectories under `/usr` contain manual pages (`/usr/share/man`), software package shared files (`/usr/share/name_of_package`, such as `/usr/share/emacs`), additional application or software package documentation (`/usr/share/doc`), and an entire subdirectory tree of locally built and installed software, `/usr/local`.

## Temporary File Storage in the `/tmp` Directory

As its name implies, the `/tmp` directory is used for temporary file storage; as you use Linux, various programs create files in this directory.

## Access Variable Data Files in the `/var` Directory

The `/var` directory contains subdirectories used by various system services for spooling and logging. Many of these variable data files, such as print spooler queues, are temporary, whereas others, such as system and kernel logs, are renamed and rotated in use. Incoming electronic mail is usually directed to files under `/var/spool/mail`.

Linux also uses `/var` for other important system services. These include the top-most File Transfer Protocol (FTP) directory under `/var/ftp` (see Chapter 18, “Remote File Serving with FTP”), and the Apache web server’s initial home page directory for the system, `/var/www/html`. (See Chapter 17, “Apache Web Server Management,” for more information on using Apache.)

## Logging In to and Working with Linux

You can access and use a Linux system in a number of ways. One way is at the console with a monitor, keyboard, and mouse attached to the PC. Another way is via a serial console, either by dial-up via a modem or a PC running a terminal emulator and connected to the Linux PC via a null modem cable. You can also connect to your system through a wired or wireless network, using the `telnet` or `ssh` commands. The information in this section shows you how to access and use the Linux system, using physical and remote text-based logins.

### NOTE

This chapter focuses on text-based logins and use of Linux. Graphical logins and using a graphical desktop are described in Chapter 3, “Working with Gnome.”

### Text-based Console Login

If you sit down at your PC and log in to a Linux system that has not been booted to a graphical login, you see a prompt similar to this one:

```
Ubuntu 8.04 (hardy) ubuntu tty1
login:
```

Your prompt might vary, depending on the version of Ubuntu you are using. In any event, at this prompt, type in your username and press Enter. When you are prompted for your password, type it in and press Enter.

### NOTE

Note that your password is not echoed back to you, which is a good idea. Why is it a good idea? Well, people are prevented from looking over your shoulder and seeing your screen input. It is not difficult to guess that a five-letter password might correspond to the user’s spouse’s first name!

### Logging Out

Use the `exit` or `logout` commands to exit your session. Type the command and press Enter. You are then returned to the login prompt. If you use virtual consoles, remember to exit each console before leaving your PC. (Otherwise, someone could easily sit down and use your account.)

## Logging In and Out from a Remote Computer

Although you can happily log in on your computer, an act known as a *local* login, you can also log in to your computer via a network connection from a remote computer. Linux-based operating systems provide a number of remote access commands you can use to log in to other computers on your local area network (LAN), wide area network (WAN), or the Internet. Note that not only must you have an account on the remote computer, but the remote computer must be configured to support remote logins—otherwise, you won't be able to log in.

### NOTE

See Chapter 14, “Networking” to see how to set up network interfaces with Linux to support remote network logins and Chapter 11 to see how to start remote access services (such as `sshd`).

The best and most secure way (barring future exploits) to log in to a remote Linux computer is to use the `ssh` or Secure Shell client. Your login and session are encrypted while you work on the remote computer. The `ssh` client features many different command-line options, but can be simply used with the name or IP address of the remote computer, like this:

```
[andrew@hardy-dev ~]$ ssh 192.168.0.41
```

```
The authenticity of host '192.168.0.41 (192.168.0.41)' can't be established.  
RSA key fingerprint is e1:db:6c:da:3f:fc:56:1b:52:f9:94:e0:d1:1d:31:50.  
Are you sure you want to continue connecting (yes/no)?
```

**yes**

The first time you connect with a remote computer using `ssh`, Linux displays the remote computer's encrypted identity key and asks you to verify the connection. After you type **yes** and press Enter, you are warned that the remote computer's identity (key) has been entered in a file named `known_hosts` under the `.ssh` directory in your home directory. You are also prompted to enter your password:

```
Warning: Permanently added '192.168.0.41' (RSA) \  
to the list of known hosts.  
andrew@192.168.0.41's password:  
andrew-$
```

After entering your password, you can then work on the remote computer. Again, everything you enter on the keyboard in communication with the remote computer is encrypted. Use the `exit` or `logout` commands to exit your session and return to the shell on your computer.

## Using Environment Variables

A number of in-memory variables are assigned and loaded by default when the user logs in. These variables are known as shell *environment variables*, which can be used by various commands to get information about your environment, such as the type of system you are running, your home directory, and the shell in use. Environment variables are used by Linux operating systems to help tailor the computing environment of your system, and include helpful specifications and setup, such as default locations of executable files and software libraries. If you begin writing shell scripts, you might use environment variables in your scripts. Until then, you only need to be aware of what environment variables are and do.

The following list includes a number of environment variables, along with descriptions of how the shell uses them:

- ▶ PWD—To provide the name of the current working directory, used by the `pwd` command (such as `/home/andrew/foo`)
- ▶ USER—To declare the user’s name, such as `andrew`
- ▶ LANG—To set language defaults, such as `English`
- ▶ SHELL—To declare the name and location of the current shell, such as `/bin/bash`
- ▶ PATH—To set the default location of executable files, such as `/bin`, `/usr/bin`, and so on
- ▶ TERM—To set the type of terminal in use, such as `vt100`, which can be important when using screen-oriented programs, such as text editors
- ▶ MACHINE—To declare system type, system architecture, and so on

### NOTE

Each shell can have its own feature set and language syntax, as well as a unique set of default environment variables. See Chapter 15, “Remote Access for SSH and Telnet,” for more information about using the different shells included with Ubuntu.

At the command line, you can use the `env` or `printenv` commands to display these environment variables, like so:

```
$ env
SSH_AGENT_PID=5761

SHELL=/bin/bash

DESKTOP_STARTUP_ID=

TERM=xterm
```

```
GTK_RC_FILES=/etc/gtk/gtkrc:/home/andrew/.gtkrc-1.2-gnome2

WINDOWID=56623199

USER=andrew

...
USERNAME=andrew

PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games

DESKTOP_SESSION=default

GDM_XSERVER_LOCATION=local

PWD=/usr/local

LANG=en_GB.UTF-8

GNOME_KEYRING_PID=5714

GDM_LANG=en_GB.UTF-8

SHLVL=1

HOME=/home/andrew

LOGNAME=andrew

XDG_DATA_DIRS=/usr/local/share:/usr/share:/usr/share/gdm/

...
LESSOPEN=| /usr/bin/lesspipe %s

WINDOWPATH=7

DISPLAY=:0.0

LESSCLOSE=/usr/bin/lesspipe %s %s

COLORTERM=gnome-terminal

XAUTHORITY=/home/andrew/.Xauthority

_=/usr/bin/env
```



```
OLDPWD=/usr/share/locale
```

This abbreviated list shows a few common variables. These variables are set by configuration or *resource* files contained in the `/etc`, `/etc/skel`, or user `/home` directory. You can find default settings for `bash`, for example, in `/etc/profile`, `/etc/bashrc`, `.bashrc`, or `.bash_profile` files installed in your home directory. Read the man page for `bash` for details about using these configuration files.

One of the most important environment variables is `$PATH`, which defines the location of executable files. For example, if, as a regular user, you try to use a command that is not located in your `$PATH` (such as the imaginary `command`), you will see something like this:

```
$ command
-bash: command: command not found
```

#### NOTE

If the command that you're trying to execute exists, but is not yet installed on your system, then Ubuntu will prompt you to install it, even giving you the correct command to do so.

However, you might know that `command` is definitely installed on your system, and you can verify this by using the `whereis` command, like so:

```
$ whereis command
command: /sbin/command
```

You can also run the command by typing its full pathname, or complete directory specification like this:

```
$ /sbin/command
```

As you can see in this example, the `command` command is indeed installed. What happened is that by default, the `/sbin` directory is not in your `$PATH`. One of the reasons for this is that commands under the `/sbin` directory are normally intended to be run only by root. You can add `/sbin` to your `$PATH` by editing the file `.bash_profile` in your home directory (if you use the `bash` shell by default, like most Linux users). Look for the following line:

```
PATH=$PATH:$HOME/bin
```

You can then edit this file, perhaps using the `vi` editor (discussed in this chapter), to add the `/sbin` directory like so:

```
PATH=$PATH:/sbin:$HOME/bin
```

Save the file. The next time you log in, the `/sbin` directory is in your `$PATH`. One way to use this change right away is to read in the new settings in `.bash_profile` by using the bash shell's `source` command like so:

```
$ source .bash_profile
```

You can now run commands located in the `/sbin` directory without the need to explicitly type the full pathname.

Some Linux commands also use environment variables, for example, to acquire configuration information (such as a communications program looking for a variable such as `BAUD_RATE`, which might denote a default modem speed).

To experiment with the environment variables, you can modify the `PS1` variable to manipulate the appearance of your shell prompt. If you are working with bash, you can use its built-in `export` command to change the shell prompt. For example, if your default shell prompt looks like

```
[andrew@laptop ~]$
```

You can change its appearance by using the `PS1` variable like this:

```
$ PS1='$OSTYPE r001z ->'
```

After you press Enter, you see

```
linux-gnu r001z ->
```

#### NOTE

See the bash man page for other variables you can use for prompt settings.

## Using the Text Editors

Linux distributions include a number of applications known as *text editors* that you can use to create text files or edit system configuration files. Text editors are similar to word processing programs, but generally have fewer features, work only with text files, and might or might not support spell checking or formatting. The text editors range in features and ease of use, but are found on nearly every Linux distribution. The number of editors installed on your system depends on what software packages you've installed on the system.

Some of the console-based text editors are

- ▶ `emacs`—The comprehensive GNU `emacs` editing environment, which is much more than an editor; see the section “Working with `emacs`” later in this chapter
- ▶ `joe`—Joe’s Own Editor, a text editor, which can be used to emulate other editors
- ▶ `nano`—A simple text editor similar to the `pico` text editor included with the `pine` email program
- ▶ `vim`—An improved, compatible version of the `vi` text editor (which we call `vi` in the rest of this chapter because it has a symbolic link named `vi` and a symbolically linked manual page)

Note that not all text editors described here are *screen oriented*. Some of the text editors for the X Window System, which provide a graphical interface, such as menu bars, buttons, scrollbars and so on, are

- ▶ `gedit`—A GUI text editor for GNOME
- ▶ `kate`—A simple KDE text editor
- ▶ `kedit`—Another simple KDE text editor

A good reason to learn how to use a text-based editor, such as `vi`, is that system maintenance and recovery operations generally never take place during X Window sessions (negating the use of a GUI editor). Many larger, more complex and capable editors do not work when Linux is booted to its single-user or maintenance mode. If anything does go wrong with your system, you probably won’t be able to get into the X Window system, making knowledge and experience of using both the command line and text editors such as `vi` important. Make a point of opening some of the editors and playing around with them; you never know—you might just thank me someday!

Another reason to learn how to use a text-based editor under the Linux console mode is so that you can edit text files through dial-up or network shell sessions because many servers do not host graphical desktops.

## Working with `vi`

The editor found on nearly every Unix and Linux system is, without a doubt, the `vi` editor, originally written by Bill Joy. This simple-to-use but incredibly capable editor features a somewhat cryptic command set, but you can put it to use with only a few commands. Although more experienced Unix and Linux users continue to use `vi` extensively during computing sessions, many newer users might prefer learning an easier-to-use text editor such as `pico` or GNU `nano`. Die-hard GNU fans and programmers definitely use `emacs`.

That said, learning how to use `vi` is a good idea. You might need to edit files on a Linux system with a minimal install, or a remote server without a more extensive offering of installed text editors. Chances are better than good that `vi` will be available.

You can start an editing session by using the `vi` command like this:

```
$ vi file.txt
```

The `vi` command works by using an insert (or editing) mode, and a viewing (or command) mode.

When you first start editing, you are in the viewing mode. You can use your cursor or other navigation keys (as shown later) to scroll through the text. To start editing, press the `i` key to insert text or the `a` key to append text. When finished, use the `Esc` key to toggle out of the insert or append modes and into the viewing (or command) mode. To enter a command, type a colon (`:`), followed by the command, such as `w` to write the file, and press `Enter`.

Although `vi` supports many complex editing operations and numerous commands, you can accomplish work by using a few basic commands. These basic `vi` commands are

- ▶ **Cursor movement**—`h`, `j`, `k`, `l` (left, down, up, and right)
- ▶ **Delete character**—`x`
- ▶ **Delete line**—`dd`
- ▶ **Mode toggle**—`Esc`, `Insert` (or `i`)
- ▶ **Quit**—`:q`
- ▶ **Quit without saving**—`:q!`
- ▶ **Run a shell command**—`:sh` (use `'exit'` to return)
- ▶ **Save file**—`:w`
- ▶ **Text search**—`/`

#### NOTE

Use the `vimtutor` command to quickly learn how to use `vi`'s keyboard commands. The tutorial takes less than 30 minutes, and it teaches new users how to start or stop the editor, navigate files, insert and delete text, and perform search, replace, and insert operations.

## Working with emacs

Richard M. Stallman's GNU `emacs` editor, like `vi`, is included with Ubuntu and nearly every other Linux distribution. Unlike other Unix and Linux text editors, `emacs` is much more than a simple text editor—it is an editing environment and can be used to compile

and build programs, act as an electronic diary, appointment book and calendar, compose and send electronic mail, read Usenet news, and even play games. The reason for this capability is that `emacs` contains a built-in language interpreter that uses the `Elisp` (`emacs LISP`) programming language. `emacs` is not installed in Ubuntu by default; instead you'll need to install it using `apt-get` or `synaptic`. The package you need is simply `emacs`.

You can start an `emacs` editing session like this `FIRST`:

```
$ emacs file.txt
```

### TIP

If you start `emacs` when using `X11`, the editor launches in its own floating window. To force `emacs` to display inside a terminal window instead of its own window (which can be useful if the window is a login at a remote computer), use the `-nw` command-line option like this: `emacs -nw file.txt`.

The `emacs` editor uses an extensive set of keystroke and named commands, but you can work with it by using a basic command subset. Many of these basic commands require you to hold down the `Ctrl` key, or to first press a *meta* key (generally mapped to the `Alt` key). The basic commands are listed in Table 4.2.

TABLE 4.2 Emacs Editing Commands

Action	Command
Abort	Ctrl+g
Cursor left	Ctrl+b
Cursor down	Ctrl+n
Cursor right	Ctrl+f
Cursor up	Ctrl+p
Delete character	Ctrl+d
Delete line	Ctrl+k
Go to start of line	Ctrl+a
Go to end of line	Ctrl+e
Help	Ctrl+h
Quit	Ctrl+x, Ctrl+c
Save As	Ctrl+x, Ctrl+w
Save file	Ctrl+x, Ctrl+s
Search backward	Ctrl+r
Search forward	Ctrl+s
Start tutorial	Ctrl+h, t
Undo	Ctrl+x, u

**TIP**

One of the best reasons to learn how to use emacs is that you can use nearly all the same keystrokes to edit commands on the bash shell command line. Another reason is that like vi, emacs is universally available on nearly every Unix and Linux system, including Apple's Mac OS X.

## Working with Permissions

Under Linux (and Unix), everything in the file system, including directories and devices, is a file. And every file on your system has an accompanying set of permissions based on ownership. These permissions form the basis for security under Linux, and designate each file's read, write, and execute permission for you, members of your group, and all others on the system.

You can examine the default permissions for a file you create by using the `umask` command, or as a practical example, by using the `touch` command and then the `ls` command's long-format listing like this:

```
$ touch file
$ ls -l file
-rw-r--r-- 1 andrew andrew 0 Feb 1 20:54 file
```

In this example, the `touch` command is used to quickly create a file. The `ls` command then reports on the file, displaying information (from left to right) in the first field of output (such as `-rw-r--r--` previously):

- ▶ **The type of file created**—Common indicators of the type of file are a leading letter in the output. A blank (which is represented by a dash in the preceding example) designates a plain file, `d` designates a directory, `c` designates a character device (such as `/dev/ttyS0`), and `b` is used for a block device (such as `/dev/sda`).
- ▶ **Permissions**—Read, write, and execute permissions for the owner, group, and all others on the system. (You learn more about these permissions later in this section.)
- ▶ **Number of links to the file**—The number one (1) designates that there is only one file, whereas any other number indicates that there might be one or more hard-linked files. Links are created with the `ln` command. A hard-linked file is an exact copy of the file, but it might be located elsewhere on the system. Symbolic links of directories can also be created, but only the root operator can create a hard link of a directory.
- ▶ **The owner**—The account that created or owns the file; you can change this designation by using the `chown` command.
- ▶ **The group**—The group of users allowed to access the file; you can change this designation by using the `chgrp` command.
- ▶ **File size and creation/modification date**—The last two elements indicate the size of the file in bytes and the date the file was created or last modified.

## Assigning Permissions

Under Linux, permissions are grouped by owner, group, and others, with read, write, and execute permission assigned to each, like so:

Owner	Group	Others
<code>rwx</code>	<code>rwx</code>	<code>rxw</code>

Permissions can be indicated by mnemonic or octal characters. Mnemonic characters are

- ▶ `r` indicates permission for an owner, member of the owner's group, or others to open and read the file.
- ▶ `w` indicates permission for an owner, member of the owner's group, or others to open and write to the file.
- ▶ `x` indicates permission for an owner, member of the owner's group, or others to execute the file (or read a directory).

In the previous example for the file named `file`, the owner, `andrew`, has read and write permission, as does any member of the group named `andrew`. All other users may only read the file. Also note that default permissions for files created by the root operator will be different because of `umask` settings assigned by the shell.

Many users prefer to use numeric codes, based on octal (base 8) values, to represent permissions. Here's what these values mean:

- ▶ 4 indicates read permission.
- ▶ 2 indicates write permission.
- ▶ 1 indicates execute permission.

In octal notation, the previous example file has a permission setting of `664` (read + write or `4 + 2`, read + write or `4 + 2`, read-only or `4`). Although you can use either form of permissions notation, octal is easy to use quickly after you visualize and understand how permissions are numbered.

### NOTE

In Linux, you can create groups to assign a number of users access to common directories and files, based on permissions. You might assign everyone in accounting to a group named `accounting`, for example, and allow that group access to accounts payable files while disallowing access by other departments. Defined groups are maintained by the root operator, but you can use the `newgrp` command to temporarily join other groups to access files (as long as the root operator has added you to the other groups). You can also allow or deny other groups' access to your files by modifying the group permissions of your files.

## Directory Permissions

Directories are also files under Linux. For example, again use the `ls` command to show permissions like this:

```
$ mkdir foo
$ ls -ld foo
drwxrwxr-x  2 andrew  andrew      4096 Jan 23 12:37 foo
```

In this example, the `mkdir` command is used to create a directory. The `ls` command and its `-ld` option is used to show the permissions and other information about the directory (not its contents). Here you can see that the directory has permission values of 775 (read + write + execute or 4 + 2 + 1, read + write + execute or 4 + 2 + 1, and read + execute or 4 + 1).

This shows that the owner and group members can read and write to the directory and, because of execute permission, also list the directory's contents. All other users can only list the directory contents. Note that directories require execute permission for anyone to be able to view their contents.

You should also notice that the `ls` command's output shows a leading `d` in the permissions field. This letter specifies that this file is a directory; normal files have a blank field in its place. Other files, such as those specifying a block or character device, have a different letter.

For example, if you examine the device file for a Linux serial port, you will see

```
$ ls -l /dev/ttyS0
crw-rw---- 1 root dialout 4, 64 Feb 1 19:49 /dev/ttyS0
```

Here, `/dev/ttyS0` is a character device (such as a serial communications port and designated by a `c`) owned by `root` and available to anyone in the `dialout` group. The device has permissions of `660` (read + write, read + write, no permission).

On the other hand, if you examine the device file for an IDE hard drive, you see

```
$ ls -l /dev/sda
brw-rw---- 1 root disk 8, 0 Feb 1 19:49 /dev/sda
```

In this example, `b` designates a block device (a device that transfers and caches data in blocks) with similar permissions. Other device entries you will run across on your Linux system include symbolic links, designated by `s`.

You can use the `chmod` command to alter a file's permissions. This command uses various forms of command syntax, including octal or a mnemonic form (such as `u`, `g`, `o`, or `a` and `rwx`, and so on) to specify a desired change. The `chmod` command can be used to add, remove, or modify file or directory permissions to protect, hide, or open up access to a file by other users (except for `root`, which can access any file or directory on a Linux system).



The mnemonic forms of `chmod`'s options (when used with a plus character, `+`, to add, or a minus sign, `-`, to take away) designate the following:

- ▶ `u`—Adds or removes user (owner) read, write, or execute permission
- ▶ `g`—Adds or removes group read, write, or execute permission
- ▶ `o`—Adds or removes read, write, or execute permission for others not in a file's group
- ▶ `a`—Adds or removes read, write, or execute permission for all users
- ▶ `r`—Adds or removes read permission
- ▶ `w`—Adds or removes write permission
- ▶ `x`—Adds or removes execution permission

For example, if you create a file, such as a `readme.txt`, the file will have default permissions (set by the `umask` setting in `/etc/bashrc`) of

```
-rw-rw-r-- 1 andrew andrew 12 Jan 2 16:48 readme.txt
```

As you can see, you and members of your group can read and write the file. Anyone else can only read the file (and only if it is outside your home directory, which will have read, write, and execute permission set only for you, the owner). You can remove all write permission for anyone by using `chmod`, the minus sign, and `aw` like so:

```
$ chmod -aw readme.txt
$ ls -l readme.txt
-r--r--r-- 1 andrew andrew 12 Jan 2 16:48 readme.txt
```

Now, no one can write to the file (except you, if the file is in your home or `/tmp` directory because of directory permissions). To restore read and write permission for only you as the owner, use the plus sign and the `u` and `rw` options like so:

```
$ chmod u+rw readme.txt
$ ls -l readme.txt
-rw----- 1 andrew andrew 12 Jan 2 16:48 readme.txt
```

You can also use the octal form of the `chmod` command, for example, to modify a file's permissions so that only you, the owner, can read and write a file. Use the `chmod` command and a file permission of `600`, like this:

```
$ chmod 600 readme.txt
```

If you take away execution permission for a directory, files might be hidden inside and may not be listed or accessed by anyone else (except the root operator, of course, who has access to any file on your system). By using various combinations of permission settings, you can quickly and easily set up a more secure environment, even as a normal user in your home directory.

## Understanding Set User ID and Set Group ID Permissions

Another type of permission is “set user ID”, known as *suid*, and “set group ID” (*sgid*) permissions. These settings, when used in a program, enable any user running that program to have program owner or group owner permissions for that program. These settings enable the program to be run effectively by anyone, without requiring that each user’s permissions be altered to include specific permissions for that program.

One commonly used program with *suid* permissions is the `passwd` command:

```
$ ls -l /usr/bin/passwd
-rwsr-xr-x 1 root root 29104 Nov 6 19:16 /usr/bin/passwd
```

This setting allows normal users to execute the command (as root) to make changes to a root-only accessible file, `/etc/passwd`.

You also can assign similar permission with the `chfn` command. This command allows users to update or change `finger` information in `/etc/passwd`. You accomplish this permission modification by using a leading 4 (or the mnemonic `s`) in front of the three octal values.

### NOTE

Other files that might have *suid* or *guid* permissions include `at`, `rcp`, `rlogin`, `rsh`, `chage`, `chsh`, `ssh`, `crontab`, `sudo`, `sendmail`, `ping`, `mount`, and several Unix-to-Unix Copy (UUCP) utilities. Many programs (such as games) might also have this type of permission to access a sound device.

Files or programs that have *suid* or *guid* permissions can sometimes present security holes because they bypass normal permissions. This problem is compounded if the permission extends to an executable binary (a command) with an inherent security flaw because it could lead to any system user or intruder gaining root access. In past exploits, this typically happened when a user fed a vulnerable command with unexpected input (such as a long pathname or option); the command would fail, and the user would be presented a root prompt. Although Linux developers are constantly on the lookout for poor programming practices, new exploits are found all the time, and can crop up unexpectedly, especially in newer software packages that haven’t had the benefit of peer developer review.

Savvy Linux system administrators keep the number of *suid* or *guid* files present on a system to a minimum. The `find` command can be used to display all such files on your system:

```
# find / -type f -perm +6000 -exec ls -l {} \;
```

**NOTE**

The `find` command is quite helpful and can be used for many purposes, such as before or during backup operations. See the section “Using Backup Software” in Chapter 13, “Backing Up.”

---

Note that the programs do not necessarily have to be removed from your system. If your users really do not need to use the program, you can remove the program’s execute permission for anyone. You have to decide, as the root operator, whether your users are allowed to, for example, mount and unmount CD-ROMs or other media on your system. Although Linux-based operating systems can be set up to accommodate ease of use and convenience, allowing programs such as `mount` to be `suid` might not be the best security policy. Other candidates for `suid` permission change could include the `chsh`, `at`, or `chage` commands.

## Working as Root

The root, or super-user account, is a special account and user on Unix and Linux systems. Super-user permissions are required in part because of the restrictive file permissions assigned to important system configuration files. You must have root permission to edit these files or to access or modify certain devices (such as hard drives). When logged in as root, you have total control over your system, which can be dangerous.

When you work in root, you can destroy a running system with a simple invocation of the `rm` command like this:

```
# rm -fr /
```

This command line not only deletes files and directories, but also could wipe out file systems on other partitions and even remote computers. This alone is reason enough to take precautions when using root access.

The only time you should run Linux as the super-user is when you are configuring the file system, for example, or to repair or maintain the system. Logging in and using Linux as the root operator isn’t a good idea because it defeats the entire concept of file permissions.

**NOTE**

The next couple of paragraphs assume that you have enabled the root account, as described at the start of this chapter.

---

Knowing how to run commands as root without logging in as root can help avoid serious missteps when configuring your system. Linux comes with a command named `su` that enables you to run one or more commands as root and then quickly returns you to normal user status. For example, if you would like to edit your system’s file system table (a

simple text file that describes local or remote storage devices, their type, and location), you can use the `su` command like this:

```
$ su -c "nano -w /etc/fstab"
```

Password:

After you press Enter, you are prompted for a password that gives you access to root. This extra step can also help you “think before you leap” into the command. Enter the root password, and you are then editing `/etc/fstab`, using the nano editor with line wrapping disabled.

## CAUTION

Before editing any important system or software service configuration file, make a backup copy. Then make sure to launch your text editor with line wrapping disabled. If you edit a configuration file without disabling line wrapping, you could insert spurious carriage returns and line feeds into its contents, causing the configured service to fail when restarting. By convention, nearly all configuration files are formatted for 80-character text width, but this is not always the case. By default, the `vi` and `emacs` editors don't use line wrap.

You can use `sudo` in the same way to allow you to execute one-off commands. The above example would look like this, using `sudo`:

```
$ sudo nano -w /etc/fstab
```

## Creating Users

When a Linux system administrator creates a user, an entry in `/etc/passwd` for the user is created. The system also creates a directory, labeled with the user's username, in the `/home` directory. For example, if you create a user named `bernice`, the user's home directory is `/home/bernice`.

## NOTE

In this chapter, you learn how to manage users from the command line. See Chapter 10, “Managing Users,” for more information on user administration with Ubuntu using graphical administration utilities, such as the graphical `users-admin` client.

Use the `useradd` command, along with a user's name, to quickly create a user:

```
$ sudo useradd andrew
```

After creating the user, you must also create the user's initial password with the `passwd` command:

```
$ sudo passwd andrew
```

Changing password for user andrew.

New password:

Retype new password:

passwd: all authentication tokens updated successfully.

Enter the new password twice. If you do not create an initial password for a new user, the user cannot log in.

You can view `useradd`'s default new user settings by using the command and its `-D` option, like this:

```
$ useradd -D
GROUP=100
HOME=/home
INACTIVE=-1
EXPIRE=
SHELL=/bin/bash
SKEL=/etc/skel
```

These options display the default group ID, home directory, account and password policy (active forever with no password expiration), the default shell, and the directory containing defaults for the shell.

The `useradd` command has many different command-line options. The command can be used to set policies and dates for the new user's password, assign a login shell, assign group membership, and other aspects of a user's account.

## Deleting Users

Use the `userdel` command to delete users from your system. This command removes a user's entry in the system's `/etc/passwd` file. You should also use the command's `-r` option to remove all the user's files and directories (such as the user's mail spool file under `/var/spool/mail`):

```
$ sudo userdel -r andrew
```

If you do not use the `-r` option, you have to manually delete the user's directory under `/home`, along with the user's `/var/spool/mail` queue.

## Shutting Down the System

Use the `shutdown` command to shut down your system. The `shutdown` command has a number of different command-line options (such as shutting down at a predetermined time), but the fastest way to cleanly shut down Linux is to use the `-h` or `halt` option, followed by the word `now` or the numeral zero (`0`), like this:

```
$ sudo shutdown -h now
```

or

```
$ sudo shutdown -h 0
```

To incorporate a timed shutdown and a pertinent message to all active users, use `shutdown`'s time and message options, like so:

```
$ sudo shutdown -h 18:30 "System is going down for maintenance this evening"
```

This example shuts down your system and provides a warning to all active users 15 minutes before the shutdown (or reboot). Shutting down a running server can be considered drastic, especially if there are active users or exchanges of important data occurring (such as a backup in progress). One good approach is to warn users ahead of time. This can be done by editing the system Message of the Day (MOTD) `motd` file, which displays a message to users after login. To create your custom MOTD, use a text editor and change the contents of `/etc/motd`. You can also make downtimes part of a regular schedule, perhaps to coincide with security audits, software updates, or hardware maintenance.

You should shut down Ubuntu for only a few very specific reasons:

- ▶ You are not using the computer and want to conserve electrical power.
- ▶ You need to perform system maintenance that requires any or all system services to be stopped.
- ▶ You want to replace integral hardware.

#### TIP

Do not shut down your computer if you suspect that one or more intruders has infiltrated your system; instead, disconnect the machine from any or all networks and make a backup copy of your hard drives. You might want to also keep the machine running to examine the contents of memory and to examine system logs.

## Rebooting the System

You should also use the `shutdown` command to reboot your system. The fastest way to cleanly reboot Linux is to use the `-r` option, and the word `now` or the numeral zero (`0`):

```
$ sudo shutdown -r now
```

or

```
$ sudo shutdown -r 0
```

Both rebooting and shutting down can have dire consequences if performed at the wrong time (such as during backups or critical file transfers, which arouses the ire of your system's users). However, Linux-based operating systems are designed to properly stop active system services in an orderly fashion. Other commands you can use to shut down and reboot Linux are the `halt` and `reboot` commands, but the `shutdown` command is more flexible.

## Reading Documentation

Although you learn the basics of using Ubuntu in this book, you need time and practice to master and troubleshoot more complex aspects of the Linux operating system and your distribution. As with any operating system, you can expect to encounter some problems or perplexing questions as you continue to work with Linux. The first place to turn for help with these issues is the documentation included with your system; if you cannot find the information you need there, check Ubuntu's website.

Linux, like Unix, is a self-documenting system, with man pages accessible through the man command. Linux offers many other helpful commands for accessing its documentation. You can use the apropos command—for example, with a keyword such as partition—to find commands related to partitioning, like this:

### \$ apropos partition

```
diskdumpfmt      (8) - format a dump device or a partition
fdisk            (8) - Partition table manipulator for Linux
GNU Parted [parted] (8) - a partition manipulation program
mpartition       (1) - partition an MSDOS hard disk
MPI_Cart_sub     (3) - Partitions a communicator into subgroups which form
                  lower-dimensional cartesian subgrids
partprobe       (8) - inform the OS of partition table changes
pvcreate        (8) - initialize a disk or partition for use by LVM
sfdisk          (8) - Partition table manipulator for Linux
```

To find a command and its documentation, you can use the whereis command. For example, if you are looking for the fdisk command, you can do this:

### \$ whereis fdisk

```
fdisk: /sbin/fdisk /usr/share/man/man8/fdisk.8.gz
```

## Using Man Pages

To learn more about a command or program, use the man command, followed by the name of the command. Man pages for Linux and X Window commands are within the /usr/share/man, /usr/local/share/man, and /usr/X11R6/man directories; so, for example, to read the rm command's man page, use the man command like this:

### \$ man rm

After you press Enter, the less command (a Linux command known as a *pager*) displays the man page. The less command is a text browser you can use to scroll forward and backward (even sideways) through the document to learn more about the command. Type the letter **h** to get help, use the forward slash to enter a search string, or press **q** to quit.

**NOTE**

Although nearly all the hundreds of GNU commands included with Linux each have a man page, you must use the `info` command to read detailed information about using a GNU command. For example, to learn even more about `bash` (which has a rather extensive manual page), use the `info` command like this:

```
$ info bash
```

Press the **n** and **p** keys to navigate through the document, or scroll down to a menu item on the screen and press Enter to read about a specific feature. Press **q** to quit reading.

**Related Ubuntu and Linux Commands**

The following programs and built-in shell commands are commonly used when working at the command line. These commands are organized by category to help you understand the command's purpose. If you need to find full information for using the command, you can find that information under the command's man page.

- ▶ **Managing users and groups**—`chage`, `chfn`, `chsh`, `edquota`, `gpasswd`, `groupadd`, `groupdel`, `groupmod`, `groups`, `mkpasswd`, `newgrp`, `newusers`, `passwd`, `umask`, `useradd`, `userdel`, `usermod`
- ▶ **Managing files and file systems**—`cat`, `cd`, `chattr`, `chmod`, `chown`, `compress`, `cp`, `dd`, `fdisk`, `find`, `gzip`, `ln`, `mkdir`, `mksfs`, `mount`, `mv`, `rm`, `rmdir`, `rpm`, `sort`, `swapon`, `swapoff`, `tar`, `touch`, `umount`, `uncompress`, `uniq`, `unzip`, `zip`
- ▶ **Managing running programs**—`bg`, `fg`, `kill`, `killall`, `nice`, `ps`, `pstree`, `renice`, `top`, `watch`
- ▶ **Getting information**—`apropos`, `cal`, `cat`, `cmp`, `date`, `diff`, `df`, `dir`, `dmesg`, `du`, `env`, `file`, `free`, `grep`, `head`, `info`, `last`, `less`, `locate`, `ls`, `lsattr`, `man`, `more`, `pinfo`, `ps`, `pwd`, `stat`, `strings`, `tac`, `tail`, `top`, `uname`, `uptime`, `vdir`, `vmstat`, `w`, `wc`, `whatis`, `whereis`, `which`, `who`, `whoami`
- ▶ **Console text editors**—`ed`, `jed`, `joe`, `mcedit`, `nano`, `red`, `sed`, `vim`
- ▶ **Console Internet and network commands**—`bing`, `elm`, `ftp`, `host`, `hostname`, `ifconfig`, `links`, `lynx`, `mail`, `mutt`, `ncftp`, `netconfig`, `netstat`, `pine`, `ping`, `pump`, `rdate`, `route`, `scp`, `sftp`, `ssh`, `tcpdump`, `traceroute`, `whois`, `wire-test`



## Reference

- ▶ <http://www.winntmag.com/Articles/Index.cfm?ArticleID=7420>—An article by a Windows NT user who, when experimenting with Linux, blithely confesses to rebooting the system after not knowing how to read a text file at the Linux console.
- ▶ <http://standards.ieee.org/regauth/posix/>—IEEE's POSIX information page.
- ▶ <http://www.itworld.com/Comp/2362/lw-01-government/#sidebar>—Discussion of Linux and POSIX compliance.
- ▶ <http://www.pathname.com/fhs/>—Home page for the Linux FHS, Linux Filesystem Hierarchy Standard.
- ▶ <http://www.tldp.org/>—Browse the HOWTO section to find and read The Linux Keyboard and Console HOWTO—Andries Brouwer's somewhat dated but eminently useful guide to using the Linux keyboard and console.
- ▶ <http://www.gnu.org/software/emacs/emacs.html>—Home page for the FSF's GNU emacs editing environment; you can find additional documentation and links to the source code for the latest version here.
- ▶ <http://www.vim.org/>—Home page for the vim (vi clone) editor included with Linux distributions. Check here for updates, bug fixes, and news about this editor.
- ▶ <http://www.courtesan.com/sudo/>—Home page for the sudo command. Check here for the latest updates, security features, and bug fixes.

# Index

## Symbols and Numerics

- &** (ampersand), shell background processing, 252–253
- \*** (asterisk), 566
  - shell pattern-matching searches, 250
  - wildcards, 463
- &&** (double ampersand) number comparison operators, 275
- ==** (double equal sign) string comparison operators, 272
- "** (double quotes), resolving variables in shell strings with embedded spaces, 264–265
- =** (equal sign)
  - string expression operators, 267
  - number comparison operators, 273
- !** (exclamation point)
  - logical comparison operators, 271
  - number comparison operators, 275
- !=** (is not equal) symbol (SQL), 506
- ?** (question mark)
  - shell pattern-matching searches, 250
- '** (single quotes), maintaining shell strings with unexpanded variables, 265–266
- !=** string expression operators, 267, 272
- #** run-parts lines (/etc/crontab files), 245
- #!** (shebang lines), 256–258, 539
- +** operator (Python), 566–567
- a** logical comparison operators, 271
- d** file comparison operators, 270, 274
- e** file comparison operators, 274
- eq** number comparison operators, 268
- f** file comparison operators, 270, 274
- le** number comparison operators, 268
- lt** number comparison operators, 269

- n string expression operators, 267
  - ne number comparison operators, 269
  - o file comparison operators, 274
  - o logical comparison operators, 271
  - qe number comparison operators, 268
  - qt number comparison operators, 269
  - r file comparison operators, 270, 274
  - s file comparison operators, 270
  - w file comparison operators, 270, 274
  - x file comparison operators, 270, 274
  - z file comparison operators, 274
  - z string expression operators, 267
  - .htaccess Apache Server configuration file
    - AllowOverrides configuration directive, 421
    - Options configuration directive, 420–421
  - .NET
    - advantages of, 625–626
    - Mono, compared, 625
  - /bin/netstat network configuration tool, 346–347
  - /configs subdirectory (/usr/src/linux-2.6 directory), 702
  - /etc/at.deny files, 244
  - /etc/crontab files, 245
  - /etc/cups directory, 186
  - /etc/dhcp3/dhcpd.conf file, DHCP server configuration, 354
  - /etc/dhcp3/dhcpd.leases files, 354
  - /etc/fstab file, 230
  - /etc/host.conf network configuration files, 349
  - /etc/hosts network configuration files, 347
  - /etc/init.d/apache2 script, starting/stopping Apache Server, 414–416
  - /etc/inittab files, determining runlevels, 237
  - /etc/modprobe.conf files, 340, 707
  - /etc/nsswitch.conf network configuration files, 348
  - /etc/printcap, manual editing, 187
  - /etc/resolv.conf network configuration files, 348
  - /etc/samba/smb.conf files, Samba manual configuration, 387–389
  - /etc/services network configuration files, 347
  - /etc/squid/squid.conf configuration file, 491
  - /etc/vsftpd.banned emails configuration file, 446
  - /etc/vsftpd.chroot list configuration file, 446
  - /etc/vsftpd.user list configuration file, 446
  - /sbin/ifconfig network configuration tool, 342–345
  - /sbin/route network configuration tool, 345–346
  - /usr directory, subdirectories, 56
  - /usr/src/linux-2.6 directory
    - /configs subdirectory, 702
    - arch directory, 704
    - Documentation directory, 703
    - kernel source code, 704
    - kernel testing programs, 704
    - scripts directory, 704
  - /usr/src/linux-2.6/ sound card documentation directory, 154, 177
  - /usr/src/linux-2.6/configs directory, 713
  - /usr/X11/man directory, 56
  - /var/log/vsftpd.log configuration file, 446
  - /var/log/xferlog files, 467–469
  - /var/spool/cron directories, 246
  - 00-INDEX files, 703
  - 1000BASE-T NIC (network interface cards), 336
  - 1000BASE-X NIC (network interface cards), 336
  - 1000BASE-X, 336
  - 100BASE-T NIC (network interface cards), 335
  - 10BASE-T NIC (network interface cards), 335
- ## A
- a2p filters, 557
  - AbiWord (GNOME Office), 146–147
  - abiword command, 151
  - ac command, 219, 231
  - accept command, 194

**access**

Apache Web server file systems, controlling, 422–425

Calc (OpenOffice.org), 141

environment variables, 92–95

login, 90

remote access, 91

text-based console, 90

Writer (OpenOffice.org), 138

**access control, configuring wu-ftpd servers, 449–452**

**access control directives (ftppass configuration file)**

anonymous user access, limiting, 449

host's server access, blocking, 450

invalid password entries, limiting number of, 451–452

number of users in classes, 451

permissions, restricting based on Group IDs, 450–451

user classes, defining, 449–450

**access permissions (files), changing, 669**

**access points, wireless network security, 643**

**ACID (Atomicity Consistency Isolation Durability), database compliance comparisons, 509**

**ACLs (access control lists), Squid proxy server, 491–495**

**ACPI (Advanced Configuration and Power Interface), Ubuntu power management, 43**

**actions (PHP loops), 594**

**Adblock Plus, 115**

**add-on postfixes/prefixes, 461**

**Add/Remove Applications, software management, 689**

**adding**

sudo command, 229

users, 218–219

**address-based virtual hosts, 432**

**administration tools, LDAP, 532–533**

**Administrator Mode button (kdm), 73**

**ADSL modems, 363**

**adsl-stop command, 365**

**Advanced Linux Sound Architecture (ALSA) sound card drivers, 154–177**

**afio backup software, 316**

**alias command, 459**

**aliases, myenv shell script, 254**

**allow directive (Apache Web server), 422–423**

**AllowOverrides configuration directive (Apache Web server), 421**

**Amanda backup application, 315**

**amdump command, 322**

**American Registry for Internet Numbers website, 329**

**ampersand (&), shell background processing, 252–253**

**AND statements (SQL), 506–507**

**anon mkdir write enable setting (vsftpd server anonymous access control), 445**

**anon other write enable setting (vsftpd server anonymous access control), 445**

**anon upload enable setting (vsftpd server anonymous access control), 445**

**anonymous access, controlling vsftpd servers, 446**

**anonymous enable setting (vsftpd server anonymous access control), 445**

**anonymous FTP servers, 439–440**  
configuring, 448

**Apache Group website, 408**

**Apache server**

installing

file locations, 412

from APT, 409

from APT, 410

quick start guide, 412

runtime configuration

configuration directives, DirectoryIndex, 419

- configuration directives, DocumentRoot, 418
- configuration directives, Listen, 417
- configuration directives, ServerAdmin, 418
- configuration directives, ServerName, 418
- configuration directives, ServerRoot, 417
- configuration directives, User, 417–418
- configuration directives, UserDir, 419
- configuration directives, 416–417, 420
- httpd.conf configuration file, 416
- MPM, 419
- security report websites, 409
- source code website, 410
- source code, building
  - via configure script, 411
  - via ln command, 411–412
  - via rpm command, 411–412
- starting/stopping
  - manually starting, 413–414
  - via /etc/init.d/apache2 script, 414–416
- upgrading file locations, 410

### Apache Software Foundation, 408

### Apache Web server

- development of, 407–408
- documentation websites, 408
- downloading, 409
- file system access control, 425
  - via allow/deny directives, 422–423
- file system authentication
  - AuthGroupFile directive, 425
  - AuthName directive, 425
  - AuthType directive, 425
  - AuthUserFile directive, 425
  - htpasswd command, 424
- Internet security, 422

- logging
  - common log format, 434
  - CustomLog directive, 435
- mod\_access module, 427
- mod\_alias module, 427
- mod\_asis module, 427
- mod\_auth module, 428
- mod\_auth\_anon module, 428
- mod\_auth\_dbm module, 428
- mod\_auth\_digest module, 428
- mod\_autoindex module, 429
- mod\_cgi module, 429
- mod\_dir module, 429
- mod\_env module, 429
- mod\_expires module, 429
- mod\_headers module, 429
- mod\_include module, 429
- mod\_info module, 430
- mod\_log\_config module, 430
- mod\_mime module, 430
- mod\_mime\_magic module, 430
- mod\_negotiation module, 430
- mod\_proxy module, 430
- mod\_rewrite module, 430
- mod\_setenvif module, 430
- mod\_sll module, 431
- mod\_speling module, 431
- mod\_status module, 431
- mod\_unique\_id module, 431
- mod\_userdir module, 431
- mod\_usertrack module, 431
- mod\_vhost\_alias module, 431
- mod\_vhost\_alias module, 432
- optimizing, 656–658
- runtime configuration
  - configuration directives, AllowOverrides, 421

- configuration directives, Group, 417–418
- configuration directives, Options, 420–421
- usage statistics, 407
- version information, 409
- virtual hosting
  - address-based hosts, 432
  - intranet websites, 433
  - name-based hosts, 432–434
- apache2ctl command, 437**
- append operator, 251**
- Application.Run() method, 633**
- applications, system-config-display, 57**
- Applications menu, software management, 689**
- APT (Advanced Package Tool)**
  - Apache Server, installing, 409–410
  - deb file storage, 696
  - software management, 694
    - day-to-day usage, 694–697
    - finding software, 697–698
- apt-cache search tool, 697**
- apt-get (command-line package-management tool), 699**
- apt-get command, 760**
- apt-get dist-upgrade command, 695**
- apt-get remove command, 696**
- apt-get-install command, 696**
- apt-get-update command, 694–696**
- aptitude command, 30**
- ar command, 622**
- arch directory (/usr/src/linux-2.6 directory), 704**
- archives, 86**
- ark backup tool, 313**
- ark command, 322**
- array functions (PHP)**
  - array keys(), 600
  - array unique(), 600
  - array values(), 600
  - arsort(), 600
  - asort(), 600
  - extract(), 601
  - krsort(), 600
  - ksort(), 600
  - shuffle(), 600
- arrays, 582–583**
  - Perl(), 540–541
- as command, 622**
- assessing backup needs, 303**
- assigning values**
  - to shell script variables, 258
  - to strings in Python, 564
- asterisk (\*), 85**
  - shell pattern-matching searches, 250
- at command, scheduling tasks, 242–244**
- ATAPI (AT Attachment Packet Interface), 46**
- atime files, disabling, 655**
- atomicity (ACID), database compliance comparisons, 509**
- atq command, viewing batch job numbers, 244**
- atrm command, deleting batch jobs, 244**
- Audio Format FAQ, 156, 177**
- authenticated FTP servers, 439–440**
- authentication, Apache Web server file systems, 423**
  - AuthGroupFile directive, 425
  - AuthName directive, 425
  - AuthType directive, 425
  - AuthUserFile directive, 425
  - htpasswd command, 424
- AuthGroupFile directive (Apache Web server), 425**
- AuthName directive (Apache Web server), 425**
- AuthType directive (Apache Web server), 425**
- AuthUserFile directive (Apache Web server), 425**
- autoconf command, 622**

**autoconfig utility (C/C++ programming language), 617**

**autohacking, 640**

**automating tasks**

scheduling tasks

at command, 242–244

batch command, 243–244

cron daemon, 245–247

shell scripts

#! (shebang lines), 256–258

built-in variables, 258, 263

commands as, 253

environment variables, 258

executing, 254–255

positional parameters, accessing/retrieving command line variables, 259–261

reasons for using, 253

special characters, list of, 263–264

storing for systemwide access, 255–256

testing, 262

trojan scripts, 255

user variables, 258

variables, accessing values, 259

variables, assigning values to, 258

variables, storing strings in, 259

writing, aliases, 254

writing, comments, 253

writing, text wrapping, 253

shells

/ (backslashes) as escape characters, 266

changing, 256

Fedora Core shells list, 247–248

job-control commands, 249

maintaining shell strings with unexpanded variables, 265–266

man pages, 248

resolving variables in strings with

embedded spaces, 264–265

shell command line, background processing, 252–253

shell command line, input/output redirection, 248, 251–252

shell command line, job-control commands, 249

shell command line, pattern-matching, 248, 250

shell command line, pipes, 248, 252

shell command line, positional parameters, 259–261

` (backticks), replacing strings with output, 266

system services

changing runlevels, 240

manually starting/stopping, 241–242

troubleshooting runlevels, 240–241

system services operation at bootup

booting to default runlevel, 237

booting to nondefault runlevel, 237–238

booting to runlevel, 236

controlling services via administrative tools, 239

init scripts, 238–239

initiating boot loading process, 234–235

loading Linux kernel, 235–236

**autoresponders (email), 485**

**avi files, 180**

**Axis Linux-based cameras website, 168**

## **B**

**background processing, 252–253**

**backgrounds (desktop), changing, 34**

**backing up, full backups with incremental backup strategy, 307**

**backports, 31**

**backreferencing, 606–607**

**backslashes (/) as escape characters, 266**

**backticks (`), replacing strings with output, 266****backups**

- as security, 643
- configuration files, 302
- consultants, 303
- data loss, reasons for, 302
- frequency of, determining, 303
- full backups, tar command-line backup software, 311
- hardware, 307
  - CD-RW drives, 308
  - FireWire (IEEE-1394) drives, 308
  - NAS, 309
  - tape drives, 309
  - USB drives, 308
- incremental backups
  - full backup strategies with, 306
  - tar command-line backup software, 311
- kernel, 712
- levels of, 305–306
- MBR, 320
- needs assessments, 303
- resources, availability of, 303
- restoring files from, 311–312
- software
  - afio, 316
  - Amanda backup application, 315
  - ark, 313
  - cdbackup, 316
  - File Roller, 312
  - flexbackup, 316
  - kdat, 313
  - tar, command-line options, 310
  - tar, find command, 311
  - tar, full backups, 311
  - tar, incremental backups, 311
  - tar, restoring files from backups, 311–312

sound practices, 304

**strategies**

- choosing, 307
- evaluating, 304–306
- home user strategies, 305
- inheriting, 305
- large enterprise strategies, 305
- mirroring data, 307
- principles of, 304
- RAID arrays, 307
- small enterprise strategies, 305
- small office strategies, 305

**badblocks command, file system optimization, 655****bak file extensions, 27****Balsa (GNOME Office), 147****Banshee, 161****bar operator (|), pipes, 252****Base (OpenOffice.org), 135****bash shells, 247–248**

comparison of expression

- file comparisons, 270–271
- logical comparisons, 271
- logical comparisons, 272
- number comparisons, 268–270
- string comparisons, 267–268

comparison of expression, 267

test command

- file comparisons, 270–271
- logical comparisons, 271–272
- number comparisons, 268–270
- string comparisons, 267–268

test command, 267

**batch command, scheduling tasks, 242–244****Beagle, searching Mono libraries, 631–634****beep codes, 235**



**Behlendorf, Brian, Apache Web server**  
development, 407  
    benchmarks, hard disk optimization, 652

**BIOS (Basic Input Output System)**  
    beep codes, 235  
    boot loading process, initiating, 234  
    hard disk optimization, 652

**bmp graphics file format, 166**

**Boot Loader, 13**

**boot loaders**  
    boot loading process, initiating, 235  
    GRUB  
        booting system services to nondefault  
        runlevel, 237-238  
        passwords, 238  
        system boots, 321

**boot loading process**  
    initiating, 234-235  
    via CD, 235

**booting systems from generic floppy disks,  
320-321**

**bootloaders, passwords, 643**

**Bootp protocol, 350**

**Brasero, 173-174**

**break keyword (Python), controlling loops, 572**

**break statements, 285**  
    loops (PHP), 595  
    switch/case blocks (PHP), 593

**Breezy Badger, 731**

**bridges, 339**  
    network security, 645

**broadcast addressing, 334**

**browsers, 114**

**brute-forcing, 375**

**Bsdfpt-ssl servers, 441**

**Bt series video chipsets (Brooktree), 178-179**

**BugTraq mailing list, 648**

**built-in shell commands, 109**

**built-in variables (shell scripts), 258, 263**  
    viewing, 263

**Bullet Proof X, 57**

**Bynari, 486**

**bzDisk directive, kernel compilation, 714**

**bzImage directive, kernel compilation, 714**

**bzip2 utility, 710**

## C

**C programming language**

**C# programs**  
    Mono, 628-629  
    website, 636

**C/C++ programming language**  
    development of, 613-614  
    gnc (GNU C compiler), 619-620  
    graphical development tools, 620-621  
    project management tools  
        autoconf utility, 617  
        debugging tools, 618-619  
        make command, 615-617  
        Subversion system, 617-618  
    project management tools, 614

**cable (networking)**  
    fiber optic, 338  
    UTP, 337

**Calc (OpenOffice.org), 134**

**cancel command, 194**

**Canonical Software, 730**

**capturing screen images, 168**

**caricatures, 213**

**case statements, 283-284**

**cat command, 88**

**cat shell command, 666-667**

**CD drives**  
    assignments, checking, 47  
    configuring, 46

- cd shell command, 667–668**
- CD-RW drives, 308**
  - assignments, checking, 47
  - configuring, 46
- cdbackup backup software, 316**
- cdrecord command, 175**
- cdrecord—scanbus command, 171**
- CDs**
  - boot loading process, 235
  - creating from command line, 175
  - uses for, 171
- certification, course websites, 761–762**
- cervisia command, 622**
- changing**
  - directories, cd shell command, 667–668
  - file access permissions, chmod shell command, 669
  - kernel symbolic links, 710
  - runlevels, 240
  - shells, 256
- chattr command, file system optimization, 655**
- checklists, inventory, 749**
- chfn command, 103**
- chgrp command, 212**
- chmod command, 101, 212**
- chmod shell command, 669**
- choosing backup strategies, 307**
- chown command, 212**
- chsh command, 286**
- classes**
  - defining in Python, 573
  - inheritance (Python), 575–577
  - instances, creating in Python, 573
  - methods, 573
  - object variables (Python), 574
- classes (networking), netmasks, 329–330**
- CLI (command line interpreter)**
  - basic commands list, 665–666
  - cat command, 666–667
  - cd command, 667–668
  - chmod command, 669
  - commands, combining, 684–685
  - cp command, 669
  - du command, 669–670
  - find command, 670–672
  - grep command, 673–674
  - less command, 674–676
  - ln command, 676–677
  - locate command, 677
  - ls command, 678–679
  - man command, 679
  - mkdir command, 680
  - mv command, 680
  - ps command, 680–681
  - reasons for using, 664–665
  - rm command, 681
  - screen command, 686–687
  - tail command, 682
  - top command, 682, 684
  - which command, 684
- client/server database model, 500**
- clients**
  - Glade client, 621
  - GNOME, 52
  - KDE monitoring, 298
  - KDevelop client, 620–621
- CNs (common names), 526**
  - multiple CN, 529
- code, symbolic debugging, 619**
- codecs, 180**
- color, changing on desktops, 35**
- column types (SQL), 503**
- column-level privileges (MySQL), 512**
- combining commands, 684–685**

## command line, 79–82

- /bin and /sbin directories, 87

- /home directory, 87

- /proc directory, 87–89

- /tmp directory, 89

- /usr directory, 89

- /var directory, 89–90

- basic commands list, 665–666

- cat command, 666–667

- cd command, 667–668

- chmod command, 669

- commands, combining, 684–685

- compressing, 86–87

- cp command, 669

- database clients, 518

- du command, 669–670

- editing, 87

- find command, 670–672

- grep command, 673–674

- less command, 674–676

- ln command, 676–677

- locate command, 677

- ls command, 678–679

- man command, 679

- managing, 85–86

- mkdir command, 680

- Mono tool, 626–627

- mv command, 680

- navigating, 83–85

- ps command, 680–681

- Python scripting

- conditional statements, conditional checks, 570

- dictionaries, defining, 569

- dictionaries, indexing, 569

- dictionaries, mutability, 569

- dictionaries, 569

- for loops, 570

- functions, defining, 572

- functions, 573

- infinite loops, 571

- installing, 561

- interactive interpreter, prompts, 562

- interactive interpreter, variable-handling, 562

- lists, built-in methods, 568

- lists, copying, 568

- lists, mutability, 567

- lists, 567

- loop blocks, 571

- loops, break keyword, 572

- loops, continue keyword, 572

- multiline loops, 571

- nested lists, 567

- number-handling, floating-point values, 563

- number-handling, integers, 563

- number-handling, large numbers, 564

- number-handling, number type conversions, 564

- number-handling, numeric operators, 563

- operator overloading, 567

- script execution, 562

- strings as immutable sequences, 564

- strings, assigning value to, 564

- strings, built-in methods, 566

- strings, concatenating, 566

- strings, indexing, 565

- strings, repeating, 566

- unofficial scripts/add-ons websites, 577

- while loops, 571

- Python programming

- OOP, class definitions, 573

- OOP, class inheritance, 575– 577

- OOP, class methods, 573
- OOP, class object variables, 574
- OOP, constructor/destructor, 575
- OOP, creating class instances, 573
- standard library modules, 577
- reasons for using, 664–665
- rm command, 681
- screen command, 686–687
- software management, APT, 694– 698
- tail command, 682
- top command, 682–684
  - Ubuntu updates, 28–30
- which command, 684

**command-line**

- command-line processing, Perl coding example, 556

**commands**

- abiword, 151
- accept, 194
- apropos subject, 85
- aptitude, 30
- ar, 622–622
- autoconf, 622
- built-in shell, 109
- bunzip2, 86
- bzip2, 86
- cancel, 194
- cat filename, 85
- cervisia, 622
- change, 231
- chfn, 231
- chgrp, 231
- chmod, 231
- chown, 231
- chpasswd, 231
- chsh, 218, 231
- combining, 684–685

- cp file1 file2, 85
- cvs, 622
- designer, 622
- disable, 194
- edquota, 230
- enable, 194
- epiphany, 469
- for writing shell scripts, 286
- ftp, 469
- ftpcopy, 469
- ftpcount, 464
- ftppcp, 469
- ftprestart, 464
- ftpsht, 464, 467
- ftpwho, 464–465
- gcc, 622
- gdb, 622
- gftp, 469
- gimp, 151
- glade-3, 622
- gnumeric, 151
- gpasswd, 214
- gprof, 619, 622
- greeting, 453
- grep string file(s), 85
- groupadd, 214
- groupdel, 214
- groupmod, 214
- groups, 231
- grpck, 214
- gunzip, 86
- gzip, 86
- kdevelop, 622
- konqueror, 469
- koshell, 151
- kspread, 151
- less filename, 85

- lftp, 469
- locate file, 85
- location, printing via top shell command, 684
- logname, 231
- lp, 194
- lpc, 194
- lpq, 194
- lprm, 194
- lpstat, 194
- make, 622
- mv file1 file2, 85
- nautilus, 470
- ncftp, 470
- newusers, 231
- oocalc, 151
- oaimpress, 151
- passive, 447
- passwd, 217, 231
- patch, 622
- planner, 151
- printenv, 92
- quotacheck, 230
- quotaoff, 230
- quotaon, 230
- repquota, 230
- rm file, 85
- rmdir dir, 85
- sftp, 470
- smbclient, 470
- splint, 622
- split, 618
- su, 231
- sudo, 231
- svn, 622
- tar, 86
- touch, 99
- useradd -D, 216
- useradd -G, 214
- useradd, 216, 231
- userdel, 217
- usermod -G, 214
- usermod, 217, 231
- vi, 97
- visudo, 227
- vsftpd, 470
- webcam, 470
- whatis, 85
- whereis, 85, 94
- comments**
  - in shell scripts, 253
  - PHP, 585
- commercial support, websites, 762**
- common log format (Apache Web server), 434**
- Common Unix Printing System, 185**
- CommuniGate Pro, 486**
- comparison of expressions**
  - pdksh shells versus bash shells
    - file comparisons, 270-271
    - logical comparisons, 271-272
    - number comparisons, 268-270
    - string comparisons, 267-268
  - tcsh shell
    - file comparisons, 274-275
    - logical comparisons, 275
    - number comparisons, 273
    - string comparisons, 272
- comparison operators (Perl)**
  - numeric comparison operators list, 542-543
  - string comparison operators list, 543
- compiled languages, 614**
- compiling kernel, 712**
  - BzDisk directive, 714

- bzImage directive, 714
  - multiple kernel versions, 710
  - retaining current kernel version, 713
  - speeding up, 713
  - troubleshooting, 721
  - zImage directive, 714
- Compiz window manager, 53–54**
- components, SANE, 165**
- compound operators (Perl), 543**
- compressing directories, tar command-line backup software, 317**
- CONCAT() function, 506**
- concatenating strings in Python, 566**
- conditional checks (Python conditional statements), 570**
- conditional statements**
  - Perl
    - if/else, 546
    - overview of, 545
    - unless, 546
  - PHP, 589– 592
  - Python conditional checks, 570
- conditions (PHP loops), 594**
- configuration files, creating backups, 302**
- configure script, building Apache Server source code, 411**
- configuring**
  - anonymous FTP servers, 448
  - Apache Server
    - configuration directives, AllowOverrides, 421
    - configuration directives, DirectoryIndex, 419
    - configuration directives, DocumentRoot, 418
    - configuration directives, Group, 417–418
    - configuration directives, Listen, 417
    - configuration directives, Options, 420–421
    - configuration directives, ServerAdmin, 418
    - configuration directives, ServerName, 418
    - configuration directives, ServerRoot, 417
    - configuration directives, User, 417–418
    - configuration directives, UserDir, 419
    - configuration directives, 416–417, 420
    - httpd.conf configuration file, 416
  - MPM, 419
  - disk quotas, 230–231
  - firewalls, 646
    - FTP servers, file-conversion actions, 460–462
  - kernel
    - make config utility, 714
    - make menuconfig utility, 715–716
    - make xconfig utility, 716–717
    - RAM disk images, 720
    - selecting kernel type, 705
    - subsections of, 717–720
  - MySQL
    - data directory ownership, 510
    - initializing data directories, 510
    - initializing grant tables, 510
    - root user passwords, 511
  - PostgreSQL
    - initializing data directories, 514–515
  - Squid proxy server
    - ACL, 491–495
    - client configuration, 490
    - examples of, 496–497
    - specifying client IP addresses, 495–496
  - vsftpd servers, 445–448
  - wu-ftpd servers
  - ftppass file command, 448–460
    - xinetd daemons, 444
  - Ubuntu
    - CD/DVD drive assignments, 46–47

- date/time resets, 44–46
- first updates, 28–30
- modems, 42–43
- power management, 43
- software repositories, 30, 33
- sudo command, 27
- troubleshooting, 26
- wireless networks, 48–49

**connected user information, displaying FTP servers, 464–465**

**Connection Type dialog box, 190**

**connections (FTP servers), allowing/denying, 463**

**consistency (ACID), database compliance comparisons, 509**

**console**

- basic commands list, 665–666
- cat command, 666–667
- cd command, 667–668
- chmod command, 669
- commands, combining, 684–685
- cp command, 669
- du command, 669–670
- find command, 670–672
- grep command, 673–674
- less command, 674–676
- ln command, 676–677
- locate command, 677
- ls command, 678–679
- man command, 679
- mkdir command, 680
- mv command, 680
- ps command, 680–681
- reasons for using, 664–665
- rm command, 681
- screen command, 686–687
- tail command, 682
- top command, 682–684
- which command, 684

**Console.WriteLine() method, 629**

**constants (PHP), 584**

**constructor methods in Python, 575**

**continue keyword (Python), controlling loops, 572**

**control structures, 547**

**controllerless modems, troubleshooting, 746**

**convert utility, 167**

**converting number types in Python, 564**

**copying**

- directory structures, tar command-line backup software, 317

**files**

- cp command, 318
- cp shell command, 669
- mc command-line file management software, 318–319
- tar command-line backup software, 316–317
- to remote servers, 374

**lists, 568**

**MBR, 320**

**multiple files between servers, 374–375**

**remote files to remote servers, 374**

**cp command, 322**

**configuration file backups, 302**

**copying files, 318**

**cp shell command, 669**

**CPAN (Comprehensive Perl Archive Network), 551–552**

**modules, installing in Perl, 553–554**

**cpio command, 322**

**CPU (central processing unit), troubleshooting, 748**

**crackers, 640**

**CREATE DATABASE statement (PostgreSQL), 516**

**CREATE DATABASE statement (MySQL), 511**

**CREATE statements (SQL), 504**

**CREATE USER statement (PostgreSQL), 516**

**createdb command (PostgreSQL), 524**

**createuser command (PostgreSQL), 524**

**cron daemon**

repeatedly running tasks, 245–247

scheduling tasks, 242

**crontab files, editing, 246–247**

**CrossOver Office, 150**

**CUPS (Common UNIX Printing System), 185**

network printing

enabling on LAN, 397–399

printer entries, creating, 400

SMB printing, 398

**cupsd daemon, 187**

**current directory, listing files via ls shell command, 678–679**

**customizing Ubuntu**

desktop backgrounds, 34

desktop color, 35

input devices

keyboard layouts, 40–41

keyboard shortcuts, 40

mouse configurations, 41

Preferred Applications, 37–38

Removable Drives and Media, 39

**CustomLog directive (Apache Web server), 435**

**cvs command, 622**

## D

**daemons**

cupsd, 187

mail, 485

smbd

smbclient command, 391

smbstatus command, 390

xinetd daemons, configuring for wu-ftpd, 444

**Dapper Drake, 731**

**data directories (MySQL)**

initializing, 510

ownership of, 510

**data directories (PostgreSQL), initializing, 514–515**

**data integrity, database comparisons, 509**

**data locking, database comparisons, 508**

**data loss, reasons for, 302**

**data mirroring, 307**

**data pilots, 143**

**data storage in RDBMS, 501**

**database administrators (DBAs), responsibilities of**

data integrity, 500

database client installation/maintenance, 499

database security, 500

**database clients**

as middleware, 520

command-line clients, 518

local GUI database access, 520

MySQL

command-line client, 521–522

graphical clients, 523

PostgreSQL command-line client, 523

SSH database access, 518–520

web database access, 520–521

**database-level privileges (MySQL), 512**

**databases**

access/permission issues, 518

client/server model, 500

comparisons

ACID compliance, 509

data locking, 508

procedural languages, 510

speed, 507

SQL subqueries, 509

triggers, 510



- comparisons, 507
- flat file, 500
- MySQL
  - adding user accounts, 512
  - creating, 511–512
  - data directory ownership, 510
  - granting/revoking privileges, 512–513
  - initializing data directories, 510
  - initializing grant tables, 510
  - installing, 510–511
  - root user passwords, 511
- PostgreSQL
  - creating database users, 516
  - creating databases, 515
  - deleting database users, 517
  - exiting psql command-line client, 517
  - granting/revoking privileges, 517–518
  - initializing data directories, 514–515
  - installing, 513
  - RPM distribution, 513
  - starting postmaster program, 515
- RDBMS
  - data storage, 501
  - SQL basics, 503–507
  - table relations, 501, 503
- RDBMS, 501
- date command, resetting date settings, 45**
- date/time resets, 44**
  - date command, 45
  - hwclock command, 45
  - time-admin client, 46
- DBAs (database administrators), responsibilities of, 499–500**
- dd command, 322**
- de Icaza, Miguel, 52**
- deb files, storing, 696**
  - Debian Linux distribution, 728
- debugging tools**
  - C/C++ programming language, 618–619
  - symbolic debugging, 619
- declarations (PHP loops), 594**
- defining**
  - classes in Python, 573
  - dictionaries, 569
  - Python functions, 572
- deleting**
  - batch jobs, 244
  - directories via rm shell command, 681
  - files via rm shell command, 681
  - PostgreSQL database users, 517
- denial of service (DOS) attacks, 88**
- deny directive (Apache Web server), 422–423**
- dependency checking, 615**
- deployment**
  - applying inventories, 749–752
  - business applications, 738–741
  - checklists, 740–742
  - installations, 742–743
  - planning, 738
  - system considerations, 741–742
  - troubleshooting, 746–748
  - user considerations, 742
- depmod command, modular kernel management, 706**
- description field (ftpconversions file), 462**
- designer command, 622**
- desktop environments**
  - GNOME
    - File Roller, 312
    - optimizing, 656
  - KDE
    - ark backup tool, 313
    - kdat backup tool, 313
    - Konqueror web browser, configuring for Squid proxy server, 490
    - optimizing, 656

**desktops**

- background, changing, 34
- color, changing, 35
- GNOME, 53

**destructor methods in Python, 575****development releases (kernel) versus stable kernels, 709****device drivers, 704****devices.txt files, 703****df command, 249****dhclient, configuration options, 353****dhclient command, 369****DHCP (Dynamic Host Configuration Protocol), 334**

- activating at boot time, 352
- advantages/disadvantages of, 352
- DHCP Server, 354
- dhcpd.conf files, 355–357
- identifying information pairs, 351
- IP address registration, 352
- LAN, 356
- leases, 351
- NT servers, 356
- server configuration, 354–356

**DHCP Handbook website, The, 357****DHCP Server, 354****dhcpd.conf files, 355–357****Dia (OpenOffice.org), 135****dial-up Internet connections, configuring manually, 365–368****dictionaries in Python, 569****die function (Perl), 555****directives (configuration), Apache Server runtime configuration**

- AllowOverrides, 421
- DirectoryIndex, 419
- DocumentRoot, 418
- Group, 417–418

## Listen, 417

## ServerAdmin, 418

## ServerName, 418

## ServerRoot, 417

## User, 417–418

## UserDir, 419

**directories, 85**

- cd shell command, changing, 667–668
- creating via mkdir shell command, 680
- deleting via rm shell command, 681
- files
- listing via ls shell command, 678–679
- structures, copying, 317
- tar command-line backup software, compressing, 317

**DirectoryIndex configuration directive (Apache Server), 419****dirlist enable setting (vsftpd server default settings), 448****dirmmessage enable setting (vsftpd server default settings), 448****disable command, 194****disabling**

- atime (files), file system optimization, 655
- multiple login feature, 66
- SSH1 in SSH servers, 373

**disaster recovery plans, 647–648****disk quotas, 229–231****disk usage, printing, 669–670****display banners, 455****Display Settings main screen (system-config-display client), 64****displaying**

- connected user information, 464–465
- kernel version information, 709

**distribution systems, 359****DivX files, 180****dmesq command, troubleshooting Ubuntu configurations, 26**

**DN (distinguished names), 526–526**  
**do...until loops (Perl), 549**  
**do...while loops (Perl), 549, 595**  
**Documentation directory (/usr/src/linux-2.6 directory), 703**  
**DocumentRoot configuration directive (Apache Server), 418**  
**documents, HOWTO, 734**  
**Don Becker's Linux Ethercard Status, Diagnostic and Setup Utilities website, 341**  
**dotted decimal format, 329**  
**double ampersand (&&) number comparison operators, 275**  
**double equal sign (==) string comparison operators, 272**  
**double pipe (||) number comparison operators, 275**  
**double quotes ("), shell strings with embedded spaces, resolving variables in, 264–265**  
**download enable setting (vsftpd server default settings), 448**  
**downloading Apache Web server, 409**  
**Draw (OpenOffice.org), 135**  
**drives**

- CD**
  - checking assignments, 47
  - configuring, 46
- CD-RW**
  - checking assignments, 47
  - configuring, 46
- DVD**
  - checking assignments, 47
  - configuring, 46
- Removable Drives and Media, 39**

- dropdb command (PostgreSQL), 524**
- dropuser command (PostgreSQL), 517, 524**
- DSL (Digital Subscriber Line)**
- configuring access, 362
- PPPoE, 363**
  - configuring manual connections, 363–364

- du shell command, 669–670**
- dumb gateways, 339**
- dummy interfaces, 327**
  - durability (ACID), database compliance comparisons, 509
- DVD drives**
  - assignments, checking, 47
  - configuring, 46
  - Ubuntu installations, 13
- DVD+RW/-RW drives, 177, 308**
- DVDs**
  - creating from command line, 176
  - formats of, 176
- dynamic IP addresses, 361**

## E

- e2fsck command, file system optimization, 655**
- echo command, 249**
- editing**
  - /etc/modprobe.conf files, 340
  - crontab files, 247
  - FTP server files, 446
  - httpd.conf Apache Server configuration file
    - DirectoryIndex configuration directive, 419
    - DocumentRoot configuration directive, 418
    - Group configuration directive, 417–418
    - Listen configuration directive, 417
    - ServerAdmin configuration directive, 418
    - ServerName configuration directive, 418
    - ServerRoot configuration directive, 417
    - User configuration directive, 417–418
    - UserDir configuration directive, 419
  - httpd.conf Apache Server configuration file, 417
  - printer settings, 192
  - system jobs, 245–246

**elinks, 437**

**emacs, 728**

**emacs, 96**

**email**

autoresponders, 485

daemons, 485

Evolution, 531

maildir email directory format, 473

mbox email directory format, 474

MDA, 474

choosing, 483

Fetchmail, 479–483

Procmail, 483–484

Spamassassin, 484

Squirrelmail, 484

virus scanners, 484

MTA

choosing, 474

Exim, 473

Postfix, 472, 475–478

Qmail, 473

Sendmail, 473

MUA, 474–475

pine directory format, 474

reading as root, 479

sending/receiving

overview of, 471

via Perl, 553–554

Thunderbird, 532

**enable command, 194**

**encryption, wireless networks, 49**

**endless loops, 277–278**

**env command, 92**

**environment variables (shell scripts), 258**

**epiphany command, 469**

**equal sign (=), string expression operators, 267**

**error checking, Mono, 630–631**

**escape characters**

/ (backslashes) as, 266

' (single quotes) as, 265

**escape sequences, PHP, 585–586**

**ethereal tool, 296**

**evaluating backup strategies, 304–305**

full backup strategies, on periodic basis, 306

full backup strategies, with incremental backups, 306

mirroring data, 307

RAID arrays, 307

simple backup strategies, 306

**Evolution (GNOME Office), 147**

**Evolution email client, 531**

**Exchange Server (Microsoft), alternatives to, 485–487**

**exclamation points (!)**

logical comparison operators, 271

number comparison operators, 275

**executing shell scripts, 254– 255**

**execution operators (PHP), 591**

**Exim MTA (mail transport agent), 473**

**exit statements, 285**

**exiting psql command-line client (PostgreSQL), 517**

**expressions, 85, 248**

comparison of expressions

pdksh shells versus bash shells, file comparisons, 270–271

pdksh shells versus bash shells, logical comparisons, 271–272

pdksh shells versus bash shells, number comparisons, 268–270

pdksh shells versus bash shells, string comparisons, 267–268

tcsh shells, file comparisons, 274–275

tcsh shells, logical comparisons, 275

tcsh shells, number comparisons, 273

tcsh shells, string comparisons, 272

external commands (ftpconversion file), 461  
external computer attacks, defining, 640  
extract() array function, 601  
extraversion level (kernel), 709

## F

faxes, 403  
fclose() file function, 603–604  
FDDI (Fiber Distributed Data Interface) networks, 336  
Feisty Fawn, 731  
Fetchmail MDA (mail delivery agents), 479  
    configuring  
        global options, 480  
        mail server options, 481  
        user accounts, 481–483  
    installing, 479  
fiber optic cable, 338  
fiber optic NICs (network interface cards), 336  
fields  
    /var/log/xferlog, 468–469  
    ftpwho command, 464  
file command, determining file compression methods, , 698  
file comparisons (comparison of expression), 270–275  
file extensions, bak, 27  
file functions (PHP)  
    fclose(), 603–604  
    file\_get\_contents(), 602  
    file\_handles, 603  
    file\_put\_contents(), 602  
    filesize(), 603  
    fopen(), 602–603  
    fread(), 603  
    fwrite(), 603  
file\_get\_contents() file function, 602  
file\_handles, 603

file\_put\_contents() file function, 602  
File Roller, 312  
file sharing  
    NFS  
        client configuration, 384–385  
        installing, 382  
        server configuration, 383–384  
        starting/stopping, 382  
    Samba  
        configuring via SWAT, 392–394  
        connection status reports, 390  
        installing, 386  
        manual configuration via /etc/samba/smb.conf files, 387–389  
        mounting shares, 391–392  
        SMB protocol, 385  
        starting smbd daemon, 390–391  
        SWAT, 385  
        testing via testparm command, 390  
file systems  
    optimizing  
        badblocks command, 655  
        disabling atime, 655  
        e2fsck command, 655  
        tune2fs command, 654  
        sync command, 654  
File Transfer Protocol (FTP), 439  
file-conversion actions, configuring FTP servers, 460–462  
filenaming wildcards, 85  
files  
    /etc/fstab, 230  
    access permissions, changing, 669  
    assigning, 100  
    contents, printing, 666–667  
    copying  
        cp command, 318  
        cp shell command, 669

- mc command-line file management software, 318-319
- tar command-line backup software, 316-317
- current directory, listing in, 678-679
- deleting via rm shell command, 681
- directories, 101-102
- FTP server files, editing, 446
- header files, 614
- include file, 614
- linking ln shell command, 676-677
- moving via mkdir shell command, 680
- multiple files, copying between servers, 374-375
- paging through output, less shell command, 674- 676
- permissions, 99
- printing last lines via tail shell command, 682
- remote files, copying to remote servers, 374
- restoring from backup, tar command-line backup software, 311- 312**
- searches
  - find shell command, 670-672
  - locate shell command, 677
  - suid/sgid, 103-104
- filesize() file function, 603**
- find command, tar command-line backup software, 311**
- find shell command, 670-672**
- find2per utility, 557**
- finger information fields, 220**
- Firefox web browser, Squid proxy server configuration, 490**
- firewalls**
  - configuring, 646
  - hosts as, 332
- FireWire (IEEE-1394) drives, 308**
- Flash plug-in (Macromedia), 181**
- flat file databases, 500**
- flexbackup backup software, 316**
- floating-point numeric values in Python, 563**
- floppy disks, system boots, 320-321**
- fopen() file function, 602- 603**
- for loops, 594**
  - Perl, 547
  - Python, 570-571
- for statements, 276-277**
- foreach loops, 594**
  - Perl, 547
- formatting spreadsheets (OpenOffice.org), 142**
- forwarding email with aliases, Postfix MTA, 478**
- fread() file function, 603**
- free command, 249**
- Free Software Foundation, 728**
- FROM clauses, SELECT statements, 505**
- FTP (File Transfer Protocol), 439**
  - administration via Wu-FTP servers
    - counting number of connections, 465
    - displaying connected user information, 464-465
      - scheduling server downtime, 466
      - viewing server transaction logs, 467
    - allowing/denying connections via ftpshosts file commands, 463
    - commands list, 469
    - example of, 462-463
  - installing, 441-442
  - servers
    - administration commands, 464-469
    - allowing/denying connections, 463
    - anonymous servers, 439-440, 448
    - authenticated servers, 439-440
    - Bsdfstp-ssl servers, 441
    - choosing, 439-440

- connected user information, 464–465
- editing files, 446
- file-conversion actions, 460–462
- NcFTPD servers, 440–441
- packages, 440
- vsftpd servers, 440, 445–448
- wu-ftpd servers, 448–460
- users, 442–444
  - vsftpd servers, default settings, 448
  - xinetd daemons, configuring for wu-ftpd servers, 444
- ftp command, 373, 469
- FTP sites, ftp.kernel.org, 709**
- ftppass file, 449**
  - configuring wu-ftpd servers, 448–460
- ftpconversions Wu-FTPd server configuration files, 448**
- ftpcopy command, 469**
- ftpcount command, 464**
- ftpcp command, 469**
- ftphosts configuration file for allowing or denying users listing (20.3), 463**
- ftphosts file, allowing/denying FTP server connections, 463**
- ftphosts Wu-FTPd server configuration files, 448**
- ftprestart command, 464–467**
- ftpsht command, 464**
  - FTP servers, scheduling downtime, 466
  - magic cookies, 467
- ftpusers file, ftpaccess configuration file, 450**
- ftpwho -V Command Output listing (20.4), 465**
- ftpwho command, displaying connected user information, 464–465**
- full backups, 306–307**
  - tar command-line backup software, 311
- function time, tracking, 619**
- functions. See also functions (PHP)**
  - as class methods in Python, 573

- Perl
  - die, 555
  - use, 552
- Python, defining, 572–573
- shell scripts and, 286
- functions (PHP)**
  - array functions, 600
  - file functions
    - fclose(), 603–604
    - file get contents(), 602
    - file handles, 603
    - file put contents(), 602
    - filesize(), 603
    - fopen(), 602
    - fopen(), 603
    - fread(), 603
    - fwrite(), 603
  - isset(), 604
  - PCRE functions
    - preg match all(), 606
    - preg match(), 605
    - preg replace(), 606
  - string functions
    - str replace(), 597
    - strlen(), 596
    - strpos(), 599–600
    - substr(), 598
    - trim(), 597
  - unset(), 604
  - var dump(), 605
  - var dump(), 606
- fwrite() file function, 603**

## G

- games**
  - Battle for Wesnoth, 204
  - Doom 3, 200

- installing, 199
- overview of, 197–198
- Quake 4, 202
- Unreal Tournament 2004, 201–202
- video drivers, installing, 198–199
- Windows, playing with Cedega, 204–205
- Wolfenstein: Enemy Territory, 203
- gcc (GNU C compiler), 613, 619–722**
- gdb command (C/C++ programming language), 619, 622**
- gdm (GNOME display manager), configuring, 66–67, 71**
- gdmsetup client, 66**
- Gecko rendering engine, 115**
- GetCodecs, 180**
- gftp command, 469**
- Ghostscript, versions of, 189**
- gif graphics file format, 166**
- gigabit ethernet, 336**
- gimp command, 151**
- GKrellM tool, 296**
- Glade client, 621**
- glade-3 command, 622**
- Glade, 621**
  - global-level privileges (MySQL), 512
- GNOME (GNU Network Object Model Environment) desktop environment, 52**
  - configuring, 53–54
  - File Roller, 312
  - Glade client, 621
  - mailing lists, 767
  - optimizing, 656
- GNOME office, 146–149**
- gnome-app-install (GUI package manager), 699**
- gnome-nettool tool, 296**
- gnome-panel-screenshot utility, 168**
- gnome-system-monitor tool, 297**
- gnome-volume-properties, 39**
- GNU commands, 85**
- GNU Compiler Collection (gcc), 613**
- GNU General Public License, 727**
- Gnumeric (GNOME Office), 147**
- gnumeric command, 151**
- gocr optical character recognition client, 165**
- Google BrowserSync, 115**
- Google website, 761**
  - kernel errors, troubleshooting, 722
  - troubleshooting Ubuntu configurations, 26
- GPL (GNU General Public License), 727**
- gprof (profile) command (C/C++ programming language), 619, 622**
- Gracenote CDDB Music Recognition Service, 172**
- GRANT statement (PostgreSQL), 517**
- GRANT statement (SQL), 512– 513**
- grant tables (MySQL), initializing, 510**
- granting privileges**
  - MySQL, 512–513
  - PostgreSQL, 517–518
- Graph view, 298**
- graphical database clients (MySQL), 523**
- graphical development tools, C/C++ programming tools, 620–621**
- graphics**
  - converting, 167
  - digital cameras, 168
  - file formats, 167
  - F-Spot, 169– 170
  - GIMP (GNU Image Manipulation Program), 147
  - GTK (Gimp Tool Kit) widget set, 146
  - handheld, 168
  - man pages, 167
  - menu navigation, 164
  - scanners, 164–166
  - screen images, capturing, 168
  - websites, 183



graphics drivers, installing, 33

greater than ( ) number comparison operators, 273

Green, Andy, Telnet servers, 372

greeting command, hiding FTP version information, 453

grep command, 249

grep shell command, 673–674

grep string file(s) command, 85

greplog shell script, 261–262

Group configuration directive (Apache Server), 417–418

growisofs command, 177

GRUB (Grand Unified Bootloader)

- installing, 13
- passwords, 238
- system boots, 321
- system services, booting to nondefault runlevel, 237–238

gs client, 186

gs command, 189

gThumb, 169

Gtk#, creating GUIs, 634–635

guides (Linux), 763

GUIs, creating, 634–635

Gutsy Gibbon, 731

gv command, 189

gzip command, 322

gzip packages, 710

## H

hackers, 640

hard disks, optimizing

- benchmarks, 652
- BIOS adjustments, 652
- file system adjustments, 654–655
- hdparm command, 653

hard links, 676

## hardware

applying inventories, 749–752

backups

- CD-RW drives, 308
- DVD+RW/-RW drives, 308
- FireWire (IEEE-1394) drives, 308
- NAS, 309
- tape drives, 309

backups, 307

hard drive storage, 744

legacy hardware, 744

requirements, 743–744

testing compatibility, 745–746

troubleshooting, 746–748

Ubuntu installation requirements, 12

Hardware tab (system-config-display client), 64

hashes (Perl), 540–541

hdparm command, hard disk optimization, 653

hdx=ide-scsi command, hard disk optimization, 652

header files, 614

here operator, 251

hidden processes, viewing, 298

Hoary Hedgehog, 731

home user backup strategies, 305

Horde, 487

hosting file systems, 756–757

HOWTO documents, 734

- DVD+RW/+R/-R[W], 176
- LILO configuration, 722
- Network Boot and Exotic Root, 643

HTML, PHP, 607–608

htpasswd command (Apache Web server), creating user files, 424

httpd, 437

httpd.conf Apache Server configuration file, editing, 416

- DirectoryIndex configuration directive, 419
- DocumentRoot configuration directive, 418

- Group configuration directive, 417–418
- Listen configuration directive, 417
- ServerAdmin configuration directive, 418
- ServerName configuration directive, 418
- ServerRoot configuration directive, 417
- User configuration directive, 417–418
- UserDir configuration directive, 419

**hubs, uplink ports, 338**

**hwclock command, resetting time settings, 45**

## I

- IBM Linux commercial support website, 762
- IDE drives as SCSI drive emulators, 172
- ide.txt files, 703
- idebus=xx command, hard disk optimization, 652
- identifying information pairs (DHCP), 351
- idex=autotune command, hard disk optimization, 652
- idex=dma command, hard disk optimization, 652
- if statements, 281–282
- if/else conditional statements (Perl), 546
- ifconfig command
- loopback interface availability, 326
- ifconfig command, 329, 342–345, 358, 369
- lftp command, 469
- ImageMagick, 167
- immutable sequences, strings as (Python), 564
- implementing disk quotas, 230
- Impress (OpenOffice.org), 135
- in-line kernels, 705
- include file, 614
- include keyword (PHP), 596
- incremental backups, 307
  - full backup strategies with, 306
  - tar command-line backup software, 311
- indexing**
  - dictionaries, 569
  - strings in Python, 565
- infinite loops, 593**
  - in Python, 571
- information service/information technology (IS/IT) environments, 729**
- inheritance (classes) in Python, 575–577**
- inheriting backup strategies, 305**
- inheriting the environment, 225**
- init scripts, 238–239**
- initdb program, Postgre SQL data directory permissions, 515**
- initializing network hardware, 339**
  - editing /etc/modprobe.conf files, 340
  - manually loading kernel modules, 341
- initiating boot loading process, 234–235**
- input devices**
  - keyboards
    - layouts, 40–41
    - shortcuts, 40
  - mouse configurations, 41
- input strings, grep shell command, 673–674**
- input/output redirection, 248–252**
- InputDevice section (xorg.conf configuration file), 60**
- INSERT statements (SQL), 504–505**
- insmod command, modular kernel management, 706**
- installing**
  - Apache Server
    - file locations, 412
    - from APT, 409–410
  - Apache Web server, 409
  - CD-ROMs, 753–754
  - CPAN modules in Perl, 553–554
  - FTP software, 441–443
  - GIMP, 164

- graphics drivers, 33
- GRUB, 13
- MySQL, 510–511
- OpenOffice.org, 136
- partitioning, 754–757
- PostgreSQL, 513
- precompiled kernels, 708
- preparing for, 750–753
- Python, 561
- Squid proxy server, 490
- Tripwire security tool, 644
- Ubuntu

- CD installations, 13
- distribution options, 12
- DVD installations, 13
- first updates, 20–22
- GRUB, 13
- hardware requirements, 12
- partition strategies, 12–13
- partitioning options, 17
- passwords, 18–19
- step-by-step guide, 14–20

**integers in Python, 563**

**Intel-based Linux distribution websites, 764**

**interactive interpreter (Python), 562**

**interfaces**

- GUIs, creating, 634–635
- Konqueror, 115

**internal computer attacks, 639–640**

**internal network websites, Apache Web server virtual hosting, 433**

**Internet. See also Internet connectivity**

- email, 115
- email, 120
- Evolution, 116–118
- Firefox, 114–115, 122
- Instant Messaging (with Pidgin), 123–125

- IRC, 124–126

- KMail, 120–121

- Liferea, 122

- overview of, 113

- Pan news client newsreaders, 128–130

- RSS readers, 120

- Thunderbird, 118

- Usenet newsgroups, 127–128

- videoconferencing (with Edge), 130–131

**Internet connectivity**

- AOL, Linux, 360

- dial-up connections, configuring manually, 365–368

- DSL

- configuring access, 362

- PPPoE, 363–364

- ISP

- assigning, 361

- dynamic IP addresses, 361

- Linux support, 360

- static IP addresses, 361

- troubleshooting, 368

**Internet Relay Chat (IRC) clients, 225**

**intranet websites, Apache Web server virtual hosting, 433**

**IP (Internet Protocol), 328**

**IP addresses**

- DHCP, 352

- dynamic, 361

- Squid proxy server, 495–496

- static, 361

**IP masquerading, 331**

**IPP (Internet Printing Protocol), 185**

**IPv4 (Internet Protocol version 4) addressing, 329–331**

**IPv6 (Internet Protocol version 6) addressing, 331**

**IRC (Internet Relay Chat), 225, 767–768**

**IS/IT (information service/information technology) environments, 729**

**ISC (Internet Software Consortium) website, 354**

**isolation (ACID), database compliance comparisons, 509**

**ISPs (Internet service providers)**

ADSL modems, 363

assigning, 361

dynamic IP addresses, 361

Linux support, 360

static IP addresses, 361

**isset() function, 604**

**iteration statements**

break, 285

case, 283–284

exit, 285

for, 276–277

if, 281–282

repeat, 280

select, 280

shift, 281

until, 279–280

while, 277–279

**iwconfig command, 369**

wireless networks, 357–358

**iwlist command, wireless network, 357**

**iwspy command, wireless network, 357**

## J

**job numbers (batch tasks), viewing, 244**

**job-control commands, 249**

**joe, 96**

**joining strings in Python, 566**

**Joy, Bill, 96**

**jpg graphics file format, 166**

## K

kdat backup tool, 313

**KDE desktop environment, 77**

ark backup tool, 313

kdat backup tool, 313

Konqueror web browser, configuring for Squid proxy server, 490

mailing lists, 767

optimizing, 656

**KDevelop client, 620–621**

**kdevelop command, 622**

**kdf tool, 299**

**kdm (KDE display manager), configuring, 72**

**kernel**

#! (shebang lines), 256–258

backups, 712

C programming language, 614

compiling, 712

bzDisk directive, 714

bzImage directive, 714

retaining current kernel version, 713

speeding up, 713

troubleshooting, 721

zImage directive, 714

configuring

make config utility, 714

make menuconfig utility, 715–716

make xconfig utility, 716–717

RAM disk images, 720

subsections of, 717–720

development of, 702

developmental releases, 709

device drives, 704

in-line kernels, 705

Linux kernel, security, 639

managing modules, 707

modular kernels, 705

- `/etc/modprobe.conf` files, 707
- loading modules, 708
- managing, 706–707
- modules, loading manually, 341
- monolithic kernels, 705
- multiple versions, compiling, 710
- optimizing, 655–656
- overview of, 702
- patched kernels, 708–710
  - multiple kernel versions, 711
  - patching methods, 711
- PID, 235
- precompiled kernels, installing, 708
- recompiling, 708
- runtime errors, troubleshooting, 722
- SCSI disk drivers, 705
- source code in `/usr/src/linux-2.6` directory, 704
- source tree makefiles, 702
- sources, obtaining
  - bzip2 utility, 710
  - gzip packages, 710
- sources, obtaining, 709
- stable kernels, 709
- symbolic links, changing, 710
- testing programs in `/usr/src/linux-2.6` directory, 704
- type of, selecting, 705
- versions of, 708
  - displaying version information, 709
- numbering system, 709
- kernel-parameters.txt files, 703**
- key-based logins, 375–376**
- keyboards**
  - layouts, 40–41
  - shortcuts, 40
- keys function, Perl hashes, 541**
- keywords, reserved SQL keywords, 504**

- kibitz command, 286**
- kill-SIGHUP command, 495**
- KOffice, 149**
- konqueror command, 437, 469**
- Konqueror web browser (KDE), configuring for Squid proxy server, 490**
- KOrganizer scheduling program (KOffice), 150**
- koshell command, 151**
- ksh shell, 247**
- ksort() array function, 600**
- KSpread (KOffice), 149**
- kspread command, 151**
- ksysguard tool, 299**
- KWord (KOffice), 149**

## L

### LANs

- DHCP, 356
- network printing, enabling, 397–398
- security, 332

### laptops

- Linux informational websites, 765
- WinModem configurations, 42–43

### large enterprise backup strategies, 305

### last statements (Perl), 548

### LDAP (Lightweight Directory Access Protocol)

- adding people to, 528–530
- CN, 526
  - multiple CN, 529
- DN, 526–527
- email clients
  - Evolution, 531
  - managing, 532–533
  - Thunderbird, 532
- functions of, 525
- ldapadd command, 529
- ldapsearch command, 530

- LDIF, 528
- nonspecific searches, 527
- OpenLDAP, 525
  - file permissions, 530
  - management tools, 532–533
- phpLDAPadmin administration tool, 533
- root users
  - assigning passwords to, 527
  - defining, 526
  - server configuration, 526–527
  - slapasswd tool, 527
- ldapadd command, 529**
- ldapsearch command, 530**
- LDIF (LDAP Data Interchange Format), 528**
- leases, 351**
- legacy printers, troubleshooting, 403–404**
- less command, 108**
- less shell command, 674–676**
- less than () number comparison operators, 273**
- lftp command, 469**
- libraries, Mono, 631–635**
- licq, 124**
- LILO configuration, HOWTO document websites, 722**
- linkers, 614**
- linking files with shell command, 676–677**
- links**
  - hard links, 676
  - symlinks, 676–677
- Linux**
  - distribution websites, 764**
  - guides, 763
  - kernel
    - #! (shebang lines), 256–258
  - C programming language, 614
    - optimizing, 655–656
  - security, sysctl command, 639
  - overview of, 727–728
  - reasons to use, 729–730
  - software modem support, 366
  - versions, 728
  - viruses, security, 646
- Linux Documentation Project website, 763**
- Linux Foundation website, 727**
- Linux Laptop website, 765**
- Linux Zaurus PDA websites, 765**
- Listen configuration directive (Apache Server), 417**
- listing**
  - files in current directory, 678–679
  - processes, 680–681
- listings**
  - 20.1 (Shadow password file ftp user entry), 442
  - 20.3 (ftphosts Configuration File for Allowing or Denying Users), 463
  - 20.4 (ftpwho -V Command Output), 465
  - 20.5 (Sample /var/log/xferlog File with Inbound and Outbound Logging), 469
  - purging log files, 554
- lists**
  - built-in methods, 568
  - copying, 568
  - in Python, 567
  - mutability, 567
  - nested lists, 567
  - operator overloading, 567
- In command, 676–677**
  - Apache Server source code, building, 411–412
- loading modules, 708**
- localhost interfaces**
  - checking availability of, 326
  - manual configuration, 326–327
- localhost interfaces, 326**

**locate shell command, 677**

**locking data, database comparisons, 508**

**LogFormat statement (Apache Web server), variables of, 434–435**

**logging**

in Apache Web server

common log format, 434

CustomLog directive, 435

Perl system logging, 538

**logical comparisons (comparison of expression), 271–275**

**login retry delay, configuring, 71**

**logs, purging (Perl coding example), 554–555**

**lokkit command, firewall configuration, 646**

**long integers in Python, 564**

**Long Term Support (LTS) badge, 731**

**loop blocks, in Python, 571**

**loopback addressing, 330**

**loopback interfaces, 326**

**looping in Python**

break keyword, 572

continue keyword, 572

for loops, 570

infinite loops, 571

loop blocks, 571

multiline loops, 571

while loops, 571

**looping constructs (Perl)**

do...until loops, 549

do...while loops, 549

for loops, 547

foreach loops, 547

last statements, 548

next statements, 548

redo statements, 548–549

until loops, 548

while loops, 548

**loops (endless), 277–278**

**loops (PHP)**

actions, 594

break statements, 595

conditions, 594

declarations, 594

do...while loops, 595

for loops, 594

foreach loops, 594

infinite loops, 593

while loops, 593

**losing data, reasons for, 302**

**lp command, 194**

**lpc command, 194**

**lpq command, 194**

**lprm command, 194**

**lpstat command, 194**

**ls command, 101**

**ls shell command, 678–679**

**lsmod command, modular kernel management, 706–707**

**LTS (Long Term Support) badge, 731**

**LUG (Linux Users Groups), 762**

**lun (logical unit number), 172**

## M

**magic cookies, 455**

ftpshut command, 467

list of, 453–454

**mail, sending in Perl, 552–553**

**maildir directory format (email), 473**

**mailing lists**

GNOME, 767

KDE, 767

Ubuntu Project, 767

**mailing lists, 735, 767**

**Mailscanner virus scanner website, 484**

- Mail::Sendmail module (Perl), 553–554**
- Main() method, 628**
- major version section (kernel), 709**
- make bzimage command, kernel compilation, 714**
- make clean command, kernel compilation, 714**
- make command (C/C++ programming language), 615–617**
- make command, 622, 722**
- make config utility, kernel configuration, 714**
- make dep command, kernel compilation, 713**
- make install command, kernel compilation, 714**
- make menuconfig utility, kernel configuration, 715–716**
- make modules command, kernel compilation, 714**
- make modules\_install command, kernel compilation, 714**
- make utility, documentation website, 704**
- make xconfig utility, kernel configuration, 716–720**
- makefiles, 617, 702**
  - targets, creating, 615–616
- malicious code, trojan scripts, 255**
- man shell command, 679**
- managing**
  - /etc/passwd file, 220–221
  - creating user accounts, 209–213
  - groups, 213–214
  - LDAP, 532–533
  - modifying batches, 224
  - modular kernels, 706–708
  - passwords, 220
  - power, ACPI, 43
  - shadow, 221–223
  - software
    - Add/Remove Applications, 689
    - APT, 694–698
    - Synaptic, 691–692
    - tarballs, 698
    - Update Manager, 693
    - system policies, 220
    - tools, 214–218
    - users, 216–224
- manual pages, reading via man shell command, 679**
- manual system service, starting/stopping, 241–242**
- manually starting Apache Server, 413–414**
- MARC (Mailing listARCHives) website, troubleshooting kernel errors, 722**
- masquerading Postfix MTA, 477**
- mastering (DVDs), 176**
- Math (OpenOffice.org), 135**
- math operators (Perl), 544**
- max clients setting (vsftpd server default settings), 448**
- max per ip setting (vsftpd server default settings), 448**
- mbx directory format (email), 474**
- MBR (Master Boot Record)**
  - backups, 320
  - boot loading process, initiating, 235
  - copying, 320
  - restoring, 320
- mc (Midnight Commander) command-line file management software, copying files, 318–319**
- mc command, 286**
- MDA (Mail Delivery Agents) , 474**
  - choosing, 483
  - Fetchmail
    - configuring, global options, 480
    - configuring, mail server options, 481
    - configuring, user accounts, 481–483
    - installing, 479
  - Procmail, 483–484
  - Spamassassin, 484
  - Squirrelmail, 484
  - virus scanners, 484



**methods**

- Application.Run(), 633
- class methods in Python, 573
- Console.WriteLine(), 629
- constructor methods in Python, 575
- destructor methods in Python, 575
- in lists, 568
- Main(), 628
- Run(), 633
- SendAsync(), 633
- string methods in Python, 566
- WriteLine(), 629

**Microsoft Exchange Server, alternatives to, 485–487**

**Microsoft Exchange Server/Outlook Client, 486**

**middleware, database clients as, 520**

**mini-CD Linux distribution websites, 764**

**minor version section (kernel), 709**

**mirroring data, 307**

**mkbootdisk command, 722**

**mkdir command, 101**

**mkdir shell command, 680**

**mkinitrd command, 722**

**mkisofs command, 174–175**

**modems, detecting/configuring**

- serial-port modems, 42

- WinModem laptop configurations, 42–43

**modifying**

- su command, 225–226

- system fonts, 36

- visual effects, 37

**modinfo command, modular kernel management, 706**

**modprobe command**

- manually loading kernel modules, 341

- modular kernel management, 706

**modular kernels, 705**

- /etc/modprobe.conf files, 707

- loading modules, 708

- managing, 706–707

**modules**

- loading, 708

**Perl**

- installing from CPAN, 553–554

- Mail::Sendmail, 553–554

- standard modules list, accessing, 552

- Python standard library modules, 577

**mod\_access module (Apache Web server), 427**

**mod\_alias module (Apache Web server), 427**

**mod\_asis module (Apache Web server), 427**

**mod\_auth module (Apache Web server), 428**

**mod\_auth\_anon module (Apache Web server), 428**

**mod\_auth\_dbm module (Apache Web server), 428**

**mod\_auth\_digest module (Apache Web server), 428–429**

**mod\_cgi module (Apache Web server), 429**

**mod\_dir module (Apache Web server), 429**

**mod\_env module (Apache Web server), 429**

**mod\_expires module (Apache Web server), 429**

**mod\_headers module (Apache Web server), 429**

**mod\_include module (Apache Web server), 429**

**mod\_info module (Apache Web server), 430**

**mod\_log\_config module (Apache Web server), 430**

**mod\_mime module (Apache Web server), 430**

**mod\_mime\_magic module (Apache Web server), 430**

**mod\_negotiation module (Apache Web server), 430**

**mod\_proxy module (Apache Web server), 430**

**mod\_rewrite module (Apache Web server), 430**

**mod\_setenvif module (Apache Web server), 430**

- mod\_speling module (Apache Web server), 431**
- mod\_ssl module (Apache Web server), 431**
- mod\_status module (Apache Web server), 431**
- mod\_unique\_id module (Apache Web server), 431**
- mod\_userdir module (Apache Web server), 431**
- mod\_usertrack module (Apache Web server), 431**
- mod\_vhost\_alias module (Apache Web server), 431-432**
- monitoring users, 219-220**
- monitors, modifying, 62**
- Mono**
  - advantages of, 625-626
  - C# programs, 628-629
  - command-line tools, 626-627
  - error checking, 630-631
  - GUIs, creating, 634-635
  - libraries, searching, 631-635
  - MonoDevelop, 627-628
    - website, 636
  - parameters, printing out, 629
  - references, 636
  - variables, creating, 629- 630
  - website, 636
- MonoDevelop, 627-628**
  - monolithic kernels, 705**
  - motherboards, troubleshooting, 747**
  - website, 636
- mount command, mounting Samba shares, 391-392**
- mouse configurations, 41**
- mov files, 180**
- moving files via mkdir shell command, 680**
- Mozilla Thunderbird, 118**
- MP3 files, 156, 177**
- MPEG files, 156, 177, 180**
- MPlayer, 182**
- MPM (multiprocessing modules), Apache Server configuration, 419**
- mpm\_common MPM (multiprocessing module), Apache Server configuration, 419**
- MS-DOS environments, 80**
- MTA (mail transport agents)**
  - choosing, 474
  - Exim, 473
  - mbox email directory format, 474
  - pine directory format, 474
  - Postfix
    - configuring, 476-477
    - forwarding email with aliases, 478
    - masquerading, 477
    - message delivery intervals, setting, 477-478
    - relaying mail, 478
    - smart hosts, 477
  - Postfix, 472
  - Qmail, maildir email directory format, 473
  - Sendmail, 473
- MUA (mail user agent), 474-475**
- multisession CDs, creating, 175**
- multicast addressing, 334**
- multicasting mode (NIC), 343**
- multidimensional arrays, 582**
- multimedia**
  - formats, 156, 177
  - hardware, 180
  - preformatted DVDs, 177
  - related commands, 182
  - sound cards, 177
  - storage capacity, 176
  - TV/video, 178
  - websites, 182-183
- multimedia applications**
  - capturing screen images, 168
  - CDs/DVDs, burning, 170-172

- creating from command line, 174–177
  - creating with graphical clients, 172
  - DVD/video players, 182
  - file formats, 180–181
  - formatting, 156–157, 177
  - GIMP, 163–164
  - modifying volume, 155, 177
  - personal video recorders, 181–182
  - Rhythmbox, 162
  - scanners, 166–167
  - sound cards, 154, 177
  - TV hardware, 178–180
  - video, 178
  - viewing, 181
- multimedia applications, 153**
- multiple files, copying between servers, 374–375**
- multiple kernel versions**
- compiling, 710
  - patching, 711
- multiple login feature, disabling, 66**
- multiple terminals, screen shell command, 686–687**
- mutability**
- lists, 567
  - Python dictionaries, 569
- mv shell command, 680**
- myenv shell script**
- aliases, 254
  - executing, 254–255
  - systemwide access, storing for, 255–256
- MySQL**
- access/permission issues, 518
  - CONCAT() function, 506
  - data directories, 510
  - database clients
    - command-line clients, 518
    - graphical clients, 523
    - local GUI database access, 520
    - MySQL command-line client, 521–522
    - SSH database access, 518–521
  - databases, creating, 511–512
  - grant tables, initializing, 510
  - installing, 510–511
  - optimizing
    - measuring key buffer usage, 658–659
    - query caches, 660–661
    - query optimization, 661
    - read buffers, 661–661
  - PostgreSQL comparisons
    - ACID compliance, 509
    - data locking, 508
    - procedural languages, 510
    - speed, 507
    - SQL subqueries, 509
    - triggers, 510
  - privileges
    - column-level privileges, 512
    - database-level privileges, 512
    - global-level privileges, 512
    - granting/revoking, 512–513
    - table-level privileges, 512
  - root user passwords, 511
  - user accounts, adding, 512
- mysql command (MySQL), 524**
- MySQL command-line client, 521–522**
- mysqladmin command (MySQL), 524–524**
- MySQL database creation, 512
- MySQLGUI, website, 523**
- mysql\_install\_db command, MySQL configuration, 510–511**

## N

- name-based virtual hosts, 432–434**
- nano command, 96, 286**
- NAS (Network Attached Storage), 309**
- NAT (network address translation), 332**

**nautilus command, 470**  
**Nautilus, 172**  
**navigating directories, 84**  
**ncftp command, 470**  
**NcFTPd servers, 440–441**  
**needs assessments (backups), 303**  
**Nessus, system vulnerability assessments, 641–642**  
**nested lists, 567**  
**NetBoot, 235**  
**netmasks, 334**  
     network classes, 330  
**netpbm tools, 167**  
**netstat network configuration tool, 346–347**  
**network configuration files**  
     /etc/host.conf, 349  
     /etc/hosts, 347  
     /etc/nsswitch.conf, 348  
     /etc/resolv.conf, 348  
     /etc/services, 347  
**network configuration tools**  
     ifconfig, 342–345  
     netstat, 346–347  
     network-admin, 342, 351, 369  
         activating/deactivating dial-up  
         Internet connections, 366–368  
     route, 345–346  
**Network Manager, configuring wireless networks, 48–49**  
**network printers, 397**  
     CUPS GUI, 399–400  
     LAN, enabling on, 397–398  
     SMB printing, 398  
**network storage, 309**  
**network-admin network configuration tool, 342, 351, 369**  
     dial-up Internet connections,  
         activating/deactivating, 366, 368

**networking**  
     bridges, 339  
     broadcast addressing, 334  
     cable  
         fiber optic cable, 338  
         UTP, 337  
     connections, troubleshooting, 339  
     DHCP  
         activating at boot time, 352  
         activating at installation, 352  
         advantages/disadvantages of, 352  
         DHCP server, 354  
         dhcpd.conf files, 355–357  
         identifying information pairs, 351  
         leases, 351  
         server configuration, 354–356  
     disaster recovery plans, 647–648  
     distribution systems, 359  
     FDDI, 336  
     hubs, 338  
     initializing hardware  
         editing /etc/modprobe.conf files, 340  
         manually loading kernel module, 341  
     initializing hardware, 339  
     multicast addressing, 334  
     netmasks, 334  
     NIC, 335  
         100BASE-T, 335  
         10BASE-T, 335  
         1000BASE-T, 336  
         1000BASE-X, 336  
         fiber optic, 336  
         token rings, 335  
     routers, 339  
     security  
         backups, 643  
         bridges, 645

- firewalls, 646
- passwords, 643
- physical security, 643
- Tripwire security tool, 644–645
- updates, 648
- subnetting, 333
- switches, 338
- TCP/IP, 328
  - classes, 329–330
  - IP masquerading, 331
  - IPv4 addressing, 329–331
  - IPv6 addressing, 331
  - ports, 332
- unicast addressing, 334
- uplink ports, 338
- web resources, 369
- wireless, 336
  - advantages of, 359
  - choosing available protocols, 359–360
- configuring, 48–49
- encryption, 49
  - support for, 357–358

New Printer toolbar button, 190

**next statements (Perl), 548**

**NFS (Network File System)**

- client configuration, 384–385
- installing, 382
- server configuration, 383–384
- starting/stopping, 382

**NIC (network interface cards)**

- 100BASE-T, 335
- 10BASE-T, 335
- 1000BASE-T, 336
- 1000BASE-X, 336
- fiber optic, 336
- multicasting mode, 343
- promiscuous mode, 343, 645
- token rings, 335
- troubleshooting, 341

- nice command, 292
- Nmap, 642
- NT servers, DHCP, 356
- number comparisons (comparison of expression), 268–273
- number type conversions in Python, 564
- numeric comparison operators (Perl), list of, 542–543
- numeric operators in Python, 563

## O

- object variables, class object variables (Python), 574
- OCR (optical character recognition), 165
- octets, 329
- one-liner Perl code examples, 556
- oocalc command, 151
- oog files, 156, 177
- ooimpress command, 151
- OOP (Object-Oriented Programming)**
  - Python
    - class definitions, 573
    - class methods, 573
    - classes, creating instances of, 573
    - classes, inheritance, 575–577
    - classes, object variables, 574
    - constructor/destructor methods, 575
- oowriter command, 151
- Open Sound System (OSS) sound card drivers, 154, 177**
- Open-Xchange, 486**
- OpenLDAP, 525**
  - file permissions, 530
  - management tools, 532–533
- OpenOffice.org**
  - Calc, 140–144
  - configuring, 136–137
  - development of, 135–136
  - office tools, 144–149

overview of, 134  
 spelling/hyphenation dictionaries, 137  
 Writer, 137–140

### OpenSSH, 440

servers, 372  
 tools, wireless network security, 643

### operator overloading, 567

### operators (PHP), 589. *See also* operators (Perl)

execution operators, 591  
 list of, 587–588  
 ternary operators, 591

### operators (Perl)

comparison operators  
   numeric comparison operators list,  
   542–543  
   string comparison operators list, 543  
 compound operators, 543  
 math operators, 544  
 miscellaneous operators, 544

### optical character recognition (OCR), 165

### optimizing

Apache web server, 656–658

#### file systems

badblocks command, 655  
 disabling atime, 655  
 e2fsck command, 655  
 tune2fs command, 654

GNOME desktop environment, 656

#### hard disks

benchmarks, 652  
 BIOS adjustments, 652  
 file system adjustments, badblocks  
 command, 655  
 file system adjustments, disabling atime,  
 655  
 file system adjustments, e2fsck  
 command, 655  
 file system adjustments, tune2fs  
 command, 654

hdparm command, 653

KDE desktop environment, 656

Linux kernel, 655–656

### MySQL

measuring key buffer usage, 658–659  
 query caches, 660–661  
 query optimization, 661  
 read buffers, 661  
 table caches, 661  
 SQL statements, 661

### Options configuration directive (Apache Web server), 420–421

### options field (ftpconversions file), 462

### OR statements (SQL), 506–507

### Oracle Collaboration Suite, 486

### output redirection, 248–252

### overclocking, 748

## P

### packages

dvd+rw-tools, 176  
 FTP servers, 440

### packet writing, DVD burning, 177

### paging through file output, less shell command, 674–676

### PAM (Pluggable Authentication Modules), 223

### partitioning, Ubuntu installation options, 12–13, 17

### passive command, 447

### passwords

bootloaders, 643  
 brute-forcing, 375  
 FTP users, 442  
 GRUB, 238  
 LDAP root users, assigning to, 527  
 MySQL root users, 511  
 PostgreSQL database users, creating, 516  
 Ubuntu installation, 18–19

**patch command, 622**

**patch command, 711**

**patched kernels, 708– 711**

**pattern-matching, 248–250**

**pci=biosirq command, hard disk optimization, 652**

**PCRE (Perl-Compatible Regular Expressions), functions**

preg match all(), 606

preg match(), 605

preg replace(), 606

**pcregrep utility, 557**

pcx graphics file format, 166

**pdksh shells, 247**

comparison of expression

file comparisons, 270–271

logical comparisons, 271–272

number comparisons, 268– 270

string comparisons, 267–268

comparison of expression, 267

select statements, 280

test command

file comparisons, 270–271

logical comparisons, 271–272

number comparisons, 268–270

string comparisons, 267–268

test command, 267

**PEAR::DB (PHP), 608– 610**

**performance tuning**

Apache Web server, 656–658

file systems

badblocks command, 655

disabling atime, 655

e2fsck command, 655

tune2fs command, 654

GNOME desktop environment, 656

hard disks

benchmarks, 652

BIOS adjustments, 652

file system adjustments, badblocks command, 655

file system adjustments, disabling atime, 655

file system adjustments, e2fsck command, 655

file system adjustments, tune2fs command, 654

hdparm command, 653

KDE desktop environment, 656

Linux kernel, 655– 656

MySQL

measuring key buffer usage, 658–659

query caches, 660–661

query optimization, 661

read buffers, 661

table caches, 661

SQL statements, 661

**Perl**

#! (she-bang), 539

appeal of, 537

code examples

command-line processing, 556

one-liners, 556

posting to Usenet, 555–556

purging logs, 554–555

sending email, 553–554

command-line errors, 539

conditional statements

if/else, 546

overview of, 545

unless, 546

development of, 537

functions

die, 555

use, 552

- looping constructs
  - do...until loops, 549
  - do...while loops, 549
  - for loops, 547
  - foreach loops, 547
  - last statements, 548
  - next statements, 548
  - redo statements, 548–549
  - until loops, 548
  - while loops, 548
- modules
  - installing CPAN modules, 553–554
  - Mail::Sendmail, 553–554
  - standard modules list, accessing, 552
- operators
  - comparison operators, 542–543
  - compound operators, 543
  - math operators, 544
  - miscellaneous operators, 544
- perldoc command, 540
- perlfunc document, accessing, 540
- regular expressions, 549–550
- sendmail command, 552–553
- shell access, 550–551
- simple programming example, 538–540
- string constants, 545
- system logging, 538
- variables
  - arrays, 540–541
  - hashes, 540–541
  - scalars, 540
  - special variables, 541
- versions of, 538
- perlcc (Perl compiler), 557**
- perldoc (Perl documentation reader utility) , 540, 557**
- perlfunc document, accessing, 540**
- permission control directives (ftpassess configuration file)**
  - allow users to change file permissions, 457
  - allowing users to compress files, 458
  - allowing users to rename files, 458
  - assigning users file-delete permissions, 458
  - assigning users file-overwrite permissions, 458
  - assigning/denying tar command usage permissions, 458–459
  - user-created upload file permissions, 459
  - Wu-FTPd server configuration, 457–459
- permissions**
  - file access permissions, changing via chmod shell command, 669
  - OpenLDAP files, 530
- pgaccess command (PostgreSQL), 524**
- pg\_ctl command (PostgreSQL), 524**
- Photoshop (Adobe), comparing to GIMP, 164**
- PHP**
  - array functions
    - array keys(), 600
    - array unique(), 600
    - array values(), 600
    - arsort(), 600
    - asort(), 600
    - extract(), 601
    - krsort(), 600
    - ksort(), 600
    - shuffle(), 600
  - arrays, 582–583
  - backreferencing, 606–607
  - comments, 585
  - conditional statements, 589–592
  - constants, 584
  - development of, 579
  - entering/exiting, 580



escape sequences, 585–586

file functions

fclose(), 603–604

file\_get\_contents(), 602

file handles, 603

file\_put\_contents(), 602

filesize(), 603

fopen(), 602–603

fread(), 603

fwrite(), 603

functions

isset(), 604

unset(), 604

var\_dump(), 605–606

HTML forms, handling, 607–608

include keyword, 596

loops

actions, 594

break statements, 595

conditions, 594

declarations, 594

do...while loops, 595

for loops, 594

foreach loops, 594

infinite loops, 593

while loops, 593

manual page URL, 607

operators

execution operators, 591

list of, 587–588

ternary operators, 591

operators, 589

PCRE functions

preg\_match\_all(), 606

preg\_match(), 605

preg\_replace(), 606

PEAR::DB (PHP), 608–610

references, 584

resources, 582

string functions

str\_replace(), 597

strlen(), 596

strpos(), 599–600

substr(), 598

trim(), 597

strings

defining, 587

variable substitution, 587

switch/case blocks, 592–593

variables, 580

arrays, 582–583

resources, 582

types of, 581

variable substitution, 587

**phpgroupware, 487**

**phpLDAPadmin administration tool, 533**

**PHPProjekt, 487**

**physical security, 643**

**PIDs (process IDs), 235, 290**

Squid proxy server, 492

**pine directory format (email), 474**

**pipes, 248, 252**

**Planner (OpenOffice.org), 135**

**planner command, 151**

**Pluggable Authentication Modules (PAM), 223**

**png graphics file format, 166**

**podcasts, 162**

**poff command, disconnecting dial-up connections, 365**

**pon command, configuring dial-up connections manually, 365**

**ports**

TCP/IP, 332

uplink, 338

- positional arguments, 258**
- positional parameters, 259–261**
- Postfix MTA (mail transport agent), 472**
  - configuring, 476–477
  - forwarding email with aliases, 478
  - masquerading, 477
  - message delivery intervals, setting, 477–478
  - relaying mail, 478
  - smart hosts, 477
- PostgreSQL**
  - access/permission issues, 518
  - data directories, initializing, 514–515
  - data locking website, 508
  - database clients
    - command-line clients, 518
    - local GUI database access, 520
    - PostgreSQL command-line client, 523
    - SSH database access, 518–520
    - web database access, 520–521
  - database users
    - creating, 516
    - deleting, 517
  - databases, creating, 515
  - installing, 513
  - MySQL comparisons
    - ACID compliance, 509
    - data locking, 508
    - procedural languages, 510
    - speed, 507
    - SQL subqueries, 509
    - triggers, 510
  - postmaster program, starting, 515
  - privileges, granting/revoking, 517–518
  - psql command-line client, exiting, 517
  - RPM distribution, 513
  - website, 513
  - || (double pipe) string concatenation function, 506
  - PostgreSQL command-line client, 523**
  - postmaster program (PostgreSQL), starting, 515**
  - posts to Usenet, Perl coding example, 555–556**
  - power management (Ubuntu), configuring, 43**
  - PowerPC-based Linux distribution websites, 764**
  - ppd (PostScript Printer Description) files, 185**
  - PPP (Point-to-Point Protocol), dial-up Internet connections, 365**
  - pppconfig command, configuring dial-up Internet connections manually, 365**
  - PPPoE (Point-to-Point Protocol over Ethernet), configuring manual connections, 363–364**
  - precompiled kernels, 708**
  - Preferred Applications, 37–38**
  - prefork MPM (multiprocessing module)**
    - Apache Server configuration, 419
  - preg match all() PCRE function, 606**
  - preg match() PCRE function, 605**
  - preg replace() PCRE function, 606**
  - prelogin banners, 453**
  - print/fax/scan devices, troubleshooting, 403**
  - printenv command, 92**
  - Printer model dialog box (system-config-printer tool), 190**
  - Printer Name dialog box, 190**
  - printers. See also printing**
    - commands, 404
    - driver/printer support cross-reference websites, 191
    - troubleshooting
      - legacy printers, 403–404
      - print/fax/scan devices, 403
      - USB printers, 403–404
  - printing**
    - command location via top shell command, 684
    - configuring, 187–189

- disk usage, `du` shell command, 669–670
- file contents, `cat` shell command, 666–667
- GUI-based printers, 187
- last lines of files, via `tail` shell command, 682
- local printers, 189, 192
- Mono parameters, 629
- network printers
  - CUPS GUI, 399–400
  - LAN, enabling on, 397–398
  - SMB printing, 398
- overview of, 185–187
- references, 195
- resource usage, via `top` shell command, 682–684

**privileges**

- MySQL
  - column-level privileges, 512
  - database-level privileges, 512
  - global-level privileges, 512
  - granting/revoking in, 512–513
  - table-level privileges, 512
- PostgreSQL, granting/revoking in, 517–518

**procedural language, database comparisons, 510**

**Process Listing view, 297**

**processes, listing via `ps` shell command, 680–681**

**Procmail MDA (mail delivery agents), 483–484**

**productivity applications, 133–134**

**productivity suites**

- related commands, 151
- websites, 152

**programming languages, C/C++**

- development of, 613–614
- graphical development tools, 620–621
- project management tools, 614–619

**project management tools, C/C++ programming language, 614**

- autoconfig, 617
- debugging tools, 618–619
- make command, 615–617
- Subversion system, 617–618

**Project Planner (GNOME Office), 149**

**promiscuous mode (NIC), 343, 645**

**prompts, interactive interpreter (Python), 562**

**protocols, FTP, 439**

**proxy servers**

- defining, 489
- Squid
  - ACL, 491–495
  - client configuration, 490
  - configuration examples, 496–497
  - installing, 490
  - kill-SIGHUP command, 495
  - specifying client IP addresses, 495–496
- uses of, 489

**ps command, 290**

**ps shell command, 680–681**

**psql client program, PostgreSQL database creation, 516**

**psql command (PostgreSQL), 524**

**psql command-line client, exiting, 517**

**purging logs, Perl coding example, 554–555**

**pwd command, 83**

**PXE, 235**

**Python**

- \* operator, 566
- + operator, 566–567
- conditional statements, conditional checks, 570
- dictionaries, 569
- for loops, 570
- functions, defining, 572–573
- infinite loops, 571

- installing, 561
- interactive interpreter, 562
- lists
  - built-in methods, 568
  - copying, 568
  - mutability, 567
  - nested lists, 567
  - operator overloading, 567
- loop blocks, 571
- loops
  - break keyword, 572
  - continue keyword, 572
  - multiline, 571
- number-handling
  - floating-point values, 563
  - integers, 563
  - large numbers, 564
  - number type conversions, 564
  - numeric operators, 563
- OOP
  - class definitions, 573
  - class methods, 573
  - classes, creating instances of, 573
  - classes, inheritance, 575–577
  - classes, object variables, 574
  - constructor/destructor methods, 575
- scripts, executing, 562
- standard library modules, 577
- strings
  - assigning value to, 564
  - built-in methods, 566
  - concatenating, 566
  - immutable sequences, 564
  - indexing, 565
  - repeating, 566
- unofficial scripts/add-ons websites, 577
- van Rossum, Guido, 561

- while loops, 571
- Qmail MTA (mail transport agent), 473**
- qt files, 180**
- query caches, MySQL optimization, 660–661**
- question mark (?), shell pattern-matching searches, 250**
- queues (print), creating, 190–193**

## R

- RAID arrays, 307**
- RAM disk images (kernel), 720**
- RARP (Reverse Address Resolution Protocol), 334**
- raw files, 156, 177**
- rc.sysinit script, 236**
- rcp command, SSH servers, 373**
- RDBMS (Relational Database Management Systems)**
  - data storage, 501
  - SQL
    - commands, whitespace, 504
    - CREATE statements, 504
    - creating tables, 503
    - creating tables, 504
    - INSERT statements, 504–505
    - inserting data into tables, 504–505
    - reserved keywords, 504
    - retrieving data from databases, 505–507
    - SELECT statements, 505
    - table relations, 501–503
- reading man pages, 108–109**
  - man shell command, 679
- recipes (Procmail), 483**
- recompiling kernel, 708**
- recovery mode, booting into, 322**
- recovery plans, 647–648**
- redirection, 248–252**

- redo statments (Perl), 548–549
- references (PHP), 584
- regular expressions, 430, 549–550
- relational databases, 501
- relaying email, Postfix MTA, 478
- remote access
  - key-based logins, 375–376
  - SSH servers
    - configuring, 372–373
    - disabling SSH1, 373
    - ftp command, 373
    - rcp command, 373
    - scp command, 374
    - sftp command, 374–375
    - ssh-keygen command, 375–376
  - Telnet servers, configuring, 371
  - VNC, 378
  - XDMCP, 377
- remote clients, X Window System support, 55
- remote files, copying to other remote servers, 374
- remote servers
  - copying files to, 374
  - security, 375–376
- Removable Drives and Media, 39
- removable storage media, 308
- removing modules, 707
- renice command, 292, 298
- repeat statements, 280
- repeating strings in Python, 566
- repositories (software), configuring, 30–33
- rescue disc, 320
- reserved SQL keywords, 504
- resetting date/time, 44
  - date command, 45
  - hwclock command, 45
  - time-admin client, 46
- resource usage, printing via top shell command, 682–684
- resources (PHP), 582
- restoring
  - files from backups, tar command-line backup software, 311–312
  - MBR, 320
- Restricted Drivers Manager, 199
- retrieving data from SQL databases, 505–507
- return on investment (ROI), 729
- REVOKE statement (PostgreSQL), 517–518
- REVOKE statement (SQL), 513
- revoking privileges
  - MySQL, 512–513
  - PostgreSQL, 517–518
- RhythmBox, 157–161
- ripping music tracks, 171
- rm shell command, 681
- rmmod command, modular kernel management, 706
- ROI (return on investment), 729
- root account, 104
  - creating, 105–106
  - deleting, 106
  - rebooting, 107
  - remote server security, 376
  - system shutdown, 106–107
- root privileges, granting, 227
- root users
  - in LDAP
    - assigning passwords to, 527
    - defining, 526
    - passwords, 511
- route network configuration tool, 345– 346
- routers, 339
- rpm command, Apache Server source code, building, 411–412
- rsh shell, 247

**Run() method, 633**

**run-parts command, 245**

**runlevels, 234–236**

changing, 240

default runlevels, booting to, 237

defining, 236

nondefault runlevels, booting to, 237–238

troubleshooting, 240–241

**runtime errors (kernel), troubleshooting, 722**

## S

**s2p filters, 557**

**Samba**

connection status reports, 390

installing, 386

manual configuration via  
/etc/samba/smb.conf files

[global] section, 388

[homes] section, 388

[printers] section, 389

manual configuration via  
/etc/samba/smb.conf files, 387–388

mounting shares, 391–392

SMB protocol, 385

smbd daemon, starting

smbclient command, 391

smbstatus command, 390

SWAT, 385

configuring via, 392–394

testing via testparm command, 390

**Sample /var/log/xferlog File with Inbound and Outbound Logging listing (20.5), 469**

**scalars (Perl), 540**

**scanbus command, 171**

**Scanner Access Now Easy (SANE), 165**

**scanners, 403**

**schedulers, 186**

**scheduling tasks**

at command, 242–244

batch command, 243–244

cron daemon, 245–247

**scheduling tasks, 242**

**Schwartzian Transforms, 556**

**scp command, 322, 374**

**screen grabs, 168**

**screen shell command, 686–687**

**scripts directory (/usr/src/linux-2.6 directory), 704**

**SCSI disk drivers, 705**

**Seamonkeychat, 124**

**searching**

files

find shell command, 670–672

index searches via locate shell  
command, 677

input strings, grep shell command,  
673–674

Mono libraries, Beagle, 631–634

pattern-matching, 248–250

Web

Google website, 761

tips for, 760

**security**

Apache Web server

Internet security, 422

security report websites, 409

autohacking, 640

backups, 643

bootloaders, passwords, 643

bridges, 645

data integrity, database comparisons, 509

data locking, database comparisons, 508

disaster recovery plans, 647–648

external computer attacks, defining, 640

firewalls, 646

internal computer attacks, defining,  
639–640

- key-based logins, 375–376
- LAN, 332
- Linux
  - virus protection, 646
  - sysctl command, 639
- networks, physical security, 643
- NICs, Promiscuous mode, 645
- passwords
  - bootloaders, 643
  - brute-forcing, 375
  - MySQL root users, 511
  - PostgreSQL database user creation, 516
- remote servers, root accounts, 376
- remote servers, 375–376
- tcpdump command, Promiscuous mode, 645
- Tripwire security tool, 644–645
- updates, 648
- virus scanners, 646
- vulnerability assessments
  - Nessus, 641–642
  - Nmap, 642
- wireless networks, 642
  - access points, 643
  - encryption, 49
  - OpenSSH tools, 643
  - war driving, 643
- Security Focus website, 648**
- SELECT statements (SQL), 505**
- select statements, 280**
- selecting**
  - backup strategies, 307
  - kernel type, 705
  - partitioning schemes, 756
- SendAsync() method, 633**
- sending email via Perl, 553–554**
- sendmail command (Perl), 552–553**
- Sendmail MTA (mail transport agent), 473**
- sequences, slices of, 565**
- serial-port modems, detecting/configuring, 42**
- ServerAdmin configuration directive (Apache Server), 418**
- ServerName configuration directive (Apache Server), 418**
- ServerRoot configuration directive (Apache Server), 417**
- servers**
  - anonymous FTP servers, configuring, 448
  - FTP servers
    - administration commands, 464–469
    - Bsdfstp-ssl servers, 441
    - choosing, 439–440
    - connected user information, 464–465
    - file-conversion actions, 460–462
    - NcFTPd servers, 440–441
    - packages, 440
  - LDAP, configuring, 526–527
  - remote, security, 375–376
  - SSH servers
    - configuring, 372–373
    - disabling SSH1, 373
    - ftp command, 373
    - rcp command, 373
    - scp command, 374
    - sftp command, 374–375
    - ssh-keygen command, 375–376
    - versus Telnet servers, 372
  - Telnet servers
    - configuring, 371
    - versus SSH servers, 372
  - vsftpd servers, 440
    - anonymous access control, 446
    - configuring, 445–448
  - Web, 407
    - Sun ONE, 436
    - Zeus, website, 436
    - Zope, website, 436

wu-ftpd servers

configuring, 448–460

xinetd daemon configuration, 444

**session writing, DVD burning, 176**

**Settings dialog box, 192**

**sftp command, 374–375, 470**

**sh shell, 247**

**Shadow Password File ftp User Entry listing (20.1), 442**

**shadow passwords, FTP users, 442–443**

**shar command, 286**

**SharpDevelop, 636**

**shebang lines (#!), 256, 258, 539**

**shell commands. See also shell command line;**

**shell scripts; shells**

basic commands list, 665–666

cat command, 666–667

cd command, 667–668

chmod command, 669

commands, combining, 684–685

cp command, 669

du command, 669–670

find command, 670–672

grep command, 673–674

less command, 674–676

ln command, 676–677

locate command, 677

ls command, 678–679

man command, 679

mkdir command, 680

mv command, 680

ps command, 680–681

rm command, 681

screen command, 686–687

tail command, 682

top command, 682, 684

which command, 684

**shell command line**

background processing, 252–253

input/output redirection, 248–252

job-control commands, 249

pattern-matching, 248–250

pipes, 248–252

positional parameters, accessing/retrieving  
command line variables, 259–261

**shell scripts**

#! (shebang lines), 256–258

built-in variables, viewing, 258, 263

commands as, 253

environment variables, 258

executing, 254–255

functions in, 285–286

positional parameters, accessing/retrieving  
command line variables, 259–261

reasons for using, 253

special characters, list of, 263–264

startx command, 253

tasks, automating, 261–262

testing, 262

trojan scripts, 255

user variables, 258

variables

accessing values, 259

assigning values to, 258

storing strings in, 259

writing

aliases, 254

comments, 253

text wrapping, 253

**shells**

bash

comparison of expression, 267

test command, file comparisons,  
270–271

test command, logical comparisons,  
271–272



- test command, number comparisons, 268, 270
- test command, string comparisons, 267–268
- test command, 267
- bash, 247–248
- break statements, 285
- case statements, 283–284
- changing, 256
- endless loops, 277–278
- escape characters, / (backslashes) as, 266
- exit statements, 285
- Fedora Core shells list, 247–248
- for statements, 276–277
- if statements, 281–282
- job-control commands, 249
- ksh, 247
- man pages, 248
- pdksh, 247
  - comparison of expression, 267
  - select statements, 280
  - test command, 267
  - test command, file comparisons, 270–271
  - test command, logical comparisons, 271–272
  - test command, number comparisons, 268–270
  - test command, string comparisons, 267–268
- positional arguments, 258
- repeat statements, 280
- rsh, 247
- select statements, 280
- sh, 247
- shell command line
  - background processing, 252–253
  - input/output redirection, 248–252
  - job-control commands, 249
  - pattern-matching, 248–250
  - pipes, 248–252
- shift statements, 281
- strings
  - embedded spaces, resolving variables in, 264–265
  - unexpanded variables, maintaining, 265–266
- tcsh
  - repeat statements, 280
  - test command, file comparisons, 274–275
  - test command, logical comparisons, 275
  - test command, number comparisons, 273
  - test command, string comparisons, 272
- tcsh, 247
- until statements, 279–280
- while statements, 277–279
- zsh, 247
  - ˆ (backticks), replacing strings with output, 266
- shift statements, 281**
- shortcuts (keyboards), 40**
- shred command, 676**
- shuffle() array function, 600**
- shutdown command, 460**
- shutdown files, list of magic cookies, 460**
- shutting down Ubuntu, 24**
- simple backup strategies, 306**
- single quotes ('), maintaining shell strings with unexpanded variables, 265–266**
- Skolnick, Cliff, 407**
- slappasswd tool, 527**
  - Slashdot.org website, 657
- slices (sequences), 565**
- copying lists in Python, 568**
- small enterprise backup strategies, 305**
- small office backup strategies, 305**

- small office/home office (SOHO), 729**
- smart gateways, 339**
  - smart hosts, Postfix MTA, 477
- SMB (Session Message Blocking) protocol, 385**
  - printing, 398
- smbclient command, Samba connections, 391**
- smbclient command, 470**
- smbd daemon, starting, 390–391**
- smbstatus command, Samba connection status reports, 390**
- SMPs (symmetric multiprocessors), 731**
- SMTP, MDA, 474**
- sockets, 346**
- soft links, 676**
- software**
  - backups
    - afio, 316
    - Amanda backup application, 315
    - ark, 313
    - cdbbackup, 316
    - File Roller, 312
    - flexbackup, 316
    - kdat, 313
    - tar, command-line options, 310
    - tar, find command, 311
    - tar, full backups, 311
    - tar, incremental backups, 311
    - tar, restoring files from backups, 311–312
    - tar, 310
  - FTP software, installing, 441–442
  - managing
    - Add/Remove Applications, 689
    - APT, 694–698
    - Synaptic, 691–692
    - tarballs, 698
    - Update Manager, 693
  - repositories, configuring, 30–33
  - software modems, Linux support, 366
  - SOHO (small office/home office), 729**
  - source code**
    - checking, 618
    - kernel source code in /usr/src/linux-2.6 directory, 704
  - source tree (kernel), makefiles, 702**
  - Spamassassin MDA (mail delivery agents), 484**
  - speed, database comparisons, 507**
  - splint command (C/C++ programming language), 618, 622**
  - split() method, Python lists, 569**
  - SQL (Structured Query Language)**
    - != (is not equal) symbol, 506
    - AND statements, 506–507
    - commands, whitespace, 504
    - CREATE statements, 504
    - databases, retrieving data from, 505–507
    - INSERT statements, 504–505
    - OR statements, 506–507
    - reserved keywords, 504
    - statements, optimizing, 661
    - subqueries, database comparisons, 509
    - tables
      - creating, 503–504
        - inserting data, 504–505
      - WHERE statements, 506
  - Squid proxy server**
    - ACL, 491–495
    - client configuration, 490
    - client IP addresses, specifying, 495–496
    - configuration examples, 496–497
    - installing, 490
    - kill-SIGHUP command, 495
  - Squirrelmail MDA (mail delivery agents), 484**
  - SSH servers**
    - configuring, 372–373
    - ftp command, 373

- rcp command, 373
- scp command, 374
- sftp command, 374–375
- ssh-keygen command, 375–376
- SSH1, disabling, 373
- versus Telnet servers, 372
- ssh-keygen command, SSH servers, 375– 376**
- stable kernels versus kernel development releases, 709**
- Stallman, Richard M., 97, 728**
- starting**
- starting/stopping**
  - Apache Server
    - /etc/init.d/apache2 script, 414–416
    - manually starting, 413–414
    - postmaster program (PostgreSQL), 515
    - system services, manually starting/
      - stopping, 241–242
- startx command, 253**
- statements**
  - conditional statements (PHP), 589–591
- static IP addresses, 361**
- stereotypes, 213**
- storing**
  - data in RDBMS, 501
  - deb files, APT, 696
  - shell scripts for systemwide access,
    - 255–256
  - strings in shell script variables, 259
- str replace() string function, 597**
- string comparisons (comparison of expression), 267–272, 543**
- string constants (Perl), 545**
- string functions (PHP)**
  - str replace(), 597
  - strlen(), 596
  - strpos(), 599–600
  - substr(), 598
  - trim(), 597
- strings**
  - assigning value to, 564
  - built-in methods, 566
  - concatenating, 566
  - immutable sequences, 564
  - indexing, 565
  - PHP
    - defining in, 587
    - variable substitution, 587
  - repeating, 566
  - searches, grep shell command, 673–674
  - storing in shell script variables, 259
- strip postfixes, 461**
- strip prefixes, 461**
- strlen() string function, 596–600**
- StumbleUpon, 115**
- sublevel number section (kernel), 709**
- Subnet masks, 334**
- subnetting, 333**
- subqueries (SQL), database comparisons, 509**
- substr() string function, 598**
- Subversion system (C/C++ programming language), 617–618**
- sudo command, Ubuntu configurations, 27**
- sudo command, 105**
- summarizing data (Calc), 143**
- Sun ONE Web server, 436**
- support (commercial), websites, 762**
- svg graphics file format, 166**
  - svn command, 622
- SWAT (Samba Web Administration Tool), 385**
  - Samba configurations, 392–394
- switch/case blocks (PHP)**
  - break statements, 593
- switch/case blocks (PHP), 592**
- switches**
  - gcc (GNU C compiler), 619
  - uplink ports, 338

**symbolic debugging, 619**  
**symbolic links (kernel), changing, 710**  
**symlinks, 676–676**  
**symmetric multiprocessors (SMPs), 731**  
**SYN flooding, 89**  
     SYN Stealth scans (Nmap), 642  
**Synaptic, 699**  
     installed packages list, viewing, 761  
     software management, 691–692  
**sync command, file system synchronization, 654**  
**sysctl command, 722**  
     Linux kernel optimization, 655–656  
     Linux kernel security, 639  
**sysrq.txt files, 703**  
**system boots, from generic floppy disks, 320–321**  
**system fonts, modifying, 36**  
**system jobs**  
     /etc/crontab files, 245  
     editing, 245–246  
**system logging directives (ftppaccess configuration file) , 538**  
     logging all user-issued commands, 456–457  
     logging security violations, 457  
     redirecting logging records, 456  
**system rescue, 320**  
**system services**  
     bootup, operation at  
         booting to default runlevel, 237  
         booting to nondefault runlevel, 237–238  
         booting to runlevel, 236  
         controlling services via administrative tools, 239  
         init scripts, 238–239  
         initiating boot loading process, 234–235  
         loading Linux kernel, 235–236  
     runlevels, changing, 240

**system-config-display application, 57**  
**system-config-display client, X Window system configuration, 64**  
**system-config-printer tool, 189–190, 194**  
**system-config-printer utility, 188**  
**system-config-printer-tui program, 187**  
**system-config-printer-tui tool, 194**  
**system-monitoring tools**  
     console-based monitoring, 289–291  
     disk quotas, 296  
     disk space, 295  
     graphical processes, 296–299  
     KDE, 298–299  
     kill command, 291–292  
     priority scheduling, 292–294  
     viewing memory, 294  
     watch command, 294  
     websites, 299

## T

**table caches, MySQL optimization, 661**  
**table-level privileges (MySQL), 512**  
**tables**  
     RDBMS, relations in, 501–503  
     SQL tables  
         creating, 503–504  
         inserting data, 504–505  
**tail shell command, 682**  
**tape archives, 86**  
**tape drive backups, 309**  
**tar command-line backup software**  
     compressing directories, 317  
     copying directory structures, 317  
     copying files, 316–317  
     find command, 311  
     full backups, 311  
     incremental backups, 311

- options, 310

- restoring files from backups, 311–312

**tar command, 309–311, 322**

**tar streams, 317**

**tarballs, 86, 698**

**targets, creating makefiles, 615–616**

**tasks, automating**

- batch job numbers, viewing, 244

scheduling tasks

- at command, 242–244

- batch command, 243–244

- cron daemon, 245–247

scheduling tasks, 242

shell scripts, 261–262

- #! (shebang lines), 256–258

- built-in variables, viewing, 263

- commands as, 253

- environment variables, 258

- executing, 254–255

- positional parameters, accessing/retrieving command line variables, 259–261

- reasons for using, 253

- special characters, list of, 263–264

- storing for systemwide access, 255–256

- testing, 262

- trojan scripts, 255

- user variables, 258

- variables, accessing values, 259

- variables, assigning values to, 258

- variables, storing strings in, 259

- writing, aliases, 254

- writing, comments, 253

- writing, text wrapping, 253

shells

- ˆ (backticks), replacing strings with output, 266

- / (backslashes) as escape characters, 266

- changing, 256

- Fedora Core shells list, 247–248

- job-control commands, 249

- maintaining shell strings with unexpanded variables, 265–266

- man pages, 248

- resolving variables in strings with embedded spaces, 264–265

- shell command line, background processing, 252–253

- shell command line, input/output redirection, 248–252

- shell command line, job-control commands, 249

- shell command line, pattern-matching, 248–250

- shell command line, pipes, 248–252

- shell command line, positional parameters, 259–261

system services operation at bootup

- booting to default runlevel, 237

- booting to nondefault runlevel, 237–238

- booting to runlevel, 236

- changing runlevels, 240

- controlling services via administrative tools, 239

- init scripts, 238

- init scripts, 239

- initiating boot loading process, 234–235

- loading Linux kernel, 235–236

- manually starting/stopping, 241–242

- troubleshooting runlevels, 240–241

system services operation at bootup, 234

**Taylor, David, 154, 177**

**TCP/IP (Transport Control Protocol/Internet Protocol), networking, 328**

- classes, 329–330

- IP masquerading, 331

- IPv4 addressing, 329–331

- IPv6 addressing, 331

- ports, 332

**tcpdump command, Promiscuous mode, 645**

**tcsh shell, 247**

comparison of expression

file comparisons, 274–275

logical comparisons, 275

number comparisons, 273

string comparisons, 272

repeat statements, 280

test command

file comparisons, 274–275

logical comparisons, 275

number comparisons, 273

string comparisons, 272

**telinit command, changing runlevels, 240**

**Telnet servers**

configuring, 371

versus SSH servers, 372

**terminal client, 56**

**terminal multiplexers, 686**

**terminals, screen shell command, 686–687**

**ternary operators (PHP), 591**

**test command**

file comparisons, 270–275

logical comparisons, 271–275

number comparisons, 268–273

string comparisons, 267–272

test command, 267

**testing**

programs (kernel) in /usr/src/linux-2.6 directory, 704

shell scripts, 262

**testparm command, testing Samba, 390**

**text editors**

emacs, 98–99

vi, 95–97, 557

**text wrapping, shell scripts, 253**

**Thunderbird email client, 532**

**tif graphics file format, 166**

**time command, 292**

**time-admin client, changing time/date settings, 46**

**time/date resets**

date command, 45

hwclock command, 45

time-admin client, 46

**time/date resets, 44**

**timewarp, 219**

**TiVo, 182**

**token ring NIC (network interface cards), 335**

**tools**

Mono, 626–627

netpbm, 167

system-config-printer, 189–190

**top command, 293**

**top shell command, 682–684**

**Torvalds, Linus, 702, 727**

**touch command, 99**

**tracking function time, 619**

**Transmeta, Inc., 727**

**triggers, database comparisons, 510**

**trim() string function, 597**

**Tripwire security tool, 644–645**

**Trojan horses, 644**

**trojan scripts, 255**

**troubleshooting**

Internet connections, 368

kernel compilation, 721

kernel runtime errors, 722

network connections, 339

NIC, 341

printers

legacy printers, 403–404

print/fax/scan devices, 403

USB printers, 403–404

runlevels, 240–241

Ubuntu configurations, 26

**tune2fs command, file system optimization, 654**

**Tuxmobil-Mobile Unix website, 765**

**twm (Tab Window Manager), 76**

**typecasting, Python number type conversion, 564**

**types field (ftpconversions file), 462**

## U

### Ubuntu

64-bit, 733

configuring

CD/DVD drive configurations, 46–47

date/time resets, 44–46

first updates, 28–30

modems, 42–43

power management, 43

software repositories, 30–33

sudo command, 27

troubleshooting, 26

wireless networks, 48–49

customizing

desktop backgrounds, 34

desktop color, 35

input devices, 40–41

mouse configurations, 41

preferred applications, 37–38

Removable Drives and Media, 39

documentation, 733–735

for business, 731–732

for home use, 732–733

history of, 730

installing

CD-based installations, 13

distribution options, 12

DVD-based installations, 13

first updates, 20–22

GRUB, 13

hardware requirements, 12

partitioning options, 12–13, 17

passwords, 18–19

step-by-step guide, 14–20

networking in, 329

overview of, 730

PPC, 733

shutting down, 24

versions, 731

### Ubuntu Project

mailing lists, 767

website, 763

**Ubuntu rescue disc, 320**

**UDP (Universal Datagram Protocol), 328**

**unexpanded variables (shells), 265–266**

**unicast addressing, 334**

**University of Helsinki, Finland, 727**

**Unix backup levels, 305–306**

**unless conditional statements (Perl), 546**

**unset() function, 604**

**until loops (Perl), 548**

**until statements, 279–280**

### Update Manager

package updates, 699

software management, 693

Ubuntu first updates, 20–22

**updates, 20–23**

network security, 648

software management, 693

### upgrading

**Apache Server file locations, 410**

to other Ubuntu versions, 33

**uplink ports, 338**

**USB (Universal Serial Bus)**

- printers, troubleshooting, 403–404
- scanners, 166
- troubleshooting, 747

**use function (Perl), 552****Usenet**

- newsgroups websites, 766
- posts to (Perl coding example), 555–556

**user accounts, 81**

- Fetchmail, configuring in, 481–483
- MySQL, adding to, 512

**User configuration directive (Apache Server), 417–418****user information**

- FTP servers, displaying, 464–465
- wu-ftpd servers, configuring, 452–455

**user information directives (ftppass configuration file)**

- displaying administrator email address, 455
- displaying files, 453–455
- displaying prelogin banners, 452
- last modification date notifications, 455–456

**user jobs**

- /var/spool/cron directories, 246
- running, 245

**user variables (shell scripts), 258****useradd command, 105****UserDir configuration directive (Apache Server), 419****users**

- FTP users, 442–444
- granting, 224–229

**UTP (Unshielded Twisted Pair) cable, 337****V****values function, Perl hashes, 541****van Rossum, Guido, 561****var dump() function, 605–606****variable substitution (PHP), 587****variables**

- class object variables in Python, 574
- interactive interpreter (Python), handling in, 562
- Mono, creating, 629–630
- Perl variables
  - arrays, 540–541
  - hashes, 540–540
  - special variables, 541
- PHP variables, 580
  - arrays, 582–583
  - resources, 582
  - types of, 581
  - variable substitution, 587
- shell scripts
  - built-in, 258–263
  - built-in, viewing, 263
  - environment, 258
  - storing strings in, 259
    - unexpanded variables, 265–266
  - user, 258
  - values, accessing, 259
  - values, assigning, 258

**Vaults of Parnassus website, 577****vi command, 286****vi text editor, 557****video cards, X Window System updates, 61****VideoLAN HOWTO, 182****viewing**

- batch job numbers, 244
- built-in variables, 263

**vim, 96****virtual file systems, 87****virtual hosts, Apache Web server**

- address-based hosts, 432



- intranet websites, 433
- name-based hosts, 432–434

**virus scanners, 484, 646**

**visual effects, modifying, 37**

**visudo command, 227**

**vmstat tool, 294**

**VNC (Virtual Network Computing), 378**

**vncviewer tool, 296**

**vsftpd command, 470**

**vsftpd servers**

- anonymous access, controlling, 446
- configuring, 445–448

**vsftpd, 470, 440**

**vulnerability assessments (security)**

- Nessus, 641–642
- Nmap, 642

## W

**w command, 249**

**Wall, Larry, 622**

**wallpaper, changing, 34**

**war driving, 643**

**wav files, 156, 177**

**weaknesses, assessing (security)**

- Nessus, 641–642
- Nmap, 642

**Web searches**

- Google website, 761
- tips for, 760

**Web servers**

- Apache
  - building source code, via configure script, 411
  - building source code, via In command, 411–412
  - building source code, via rpm command, 411–412
  - development of, 407–408

documentation websites, 408

downloading, 409

file system access control, 422–425

file system authentication, 423–425

installing, file locations, 412

installing, from APT, 409–410

installing, 409

Internet security, 422

logging, common log format, 434

logging, CustomLog directive, 435

logging, 434

mod\_access module, 427

mod\_alias module, 427

mod\_asis module, 427

mod\_auth module, 428

mod\_auth\_anon module, 428

mod\_auth\_dbm module, 428

mod\_auth\_digest module, 428

mod\_autoindex module, 429

mod\_cgi module, 429

mod\_dir module, 429

mod\_env module, 429

mod\_expires module, 429

mod\_headers module, 429

mod\_include module, 429

mod\_info module, 430

mod\_log\_config module, 430

mod\_mime module, 430

mod\_mime\_magic module, 430

mod\_negotiation module, 430

mod\_proxy module, 430

mod\_rewrite module, 430

mod\_setenvif module, 430

mod\_sll module, 431

mod\_speling module, 431

mod\_status module, 431

mod\_unique\_id module, 431

- mod\_userdir module, 431
- mod\_usertrack module, 431
- mod\_vhost\_alias module, 431
- mod\_vhost\_alias module, 432
  - optimizing, 656–658
- quick start guide, 412
- runtime configuration, configuration directives, 416–421
- runtime configuration, httpd.conf configuration file, 416
- runtime configuration, MPM, 419
- security report websites, 409
- source code website, 410
- starting/stopping, manually starting, 413–414
- starting/stopping, ./etc/init.d/apache2 script, 414–416
- upgrading, file locations, 410
- usage statistics, 407
- version information, 409
- via allow/deny directives, 422–423
- virtual hosting, address-based hosts, 432–433
- virtual hosting, name-based hosts, 432–434
- Sun ONE, 436
- Zeus, website, 436
- Zope, website, 436
- webcam command, 470**
- welcome.msg files, 454**
- WEP encryption, 49**
- whatis command, 85**
- WHERE clauses, SELECT statements, 505**
- WHERE statements (SQL), 506**
- whereis command, 85, 94**
- which shell command, 684**
- while loops, 593**
  - Perl, 548
  - Python, 571
- while statements, 277–279**
- whitespace, SQL commands, 504**
- wildcards, 85, 250**
- window managers, modifying, 73–76**
- Windows, productivity applications, 150–151**
- Wine, 150–151**
- WinModems, laptop configurations, 42–43**
- wireless networking, 336**
  - advantages of, 359
  - choosing available protocols, 359–360
  - configuring, 48–49
  - encryption, 49
  - security, 642
    - access points, 643
    - OpenSSH tools, 643
  - support for
    - iwconfig command, 357–358
    - iwlist command, 357
    - iwpriv command, 357
    - iwspy command, 357
  - war driving, 643
- wish command, 257**
- WITH PASSWORD segment (CREATE USER statement), 516**
- worker MPM (multiprocessing module), Apache Server configuration, 419**
- WPA Personal encryption, 49**
- WriteLine() method, 629**
- Writer (OpenOffice.org), 134**
  - options, 139
  - styles and formatting, 139–140
- writing shell scripts**
  - aliases, 254
  - comments, 253
  - text wrapping, 253

### **wu-ftpd servers**

- access control, configuring, 449–452
- ftppass file command, 448–460
- permission control, configuring, 457–459
- system logging, configuring, 456–457
- user information, configuring, 452–455
- xinetd daemons, configuring for, 444

## **X-Y-Z**

### **X Window System**

- applying, 56–57
- components list, 57–58
- components of, 57
- configuring, 62
- display managers, 56
- displayconfig-gtk client, 63–64
- distributed processing, 55
- distribution components, 56
- elements of, 55–59, 62
- hard drive requirements, 56
- Module section, 59
- Monitor section, 60
- overview of, 55
- references, 78
- ServerLayout section, 58
- starting, 64
- via display managers, 65
  - websites, 765
- xorg.conf file, 64

### **X-Chat, 124–125**

**x-x, shell pattern-matching searches, 250**

### **X.Org Foundation, 728**

### **X11, 51**

**xdm display manager, applying, 73**

**XDMCP (X Display Manager Control Protocol), 68, 71, 377**

**Xfce desktop, 78, 656**

**Xine, 182**

**xinetd daemons, configuring for wu-ftpd servers, 444**

### **xorg.conf files**

- Device section, 60–61
- Files section, 58
- InputDevice section, 59
- Module section, 59–60
- Screen section, 61–62
- X Window System configuration, 64

**Xsane scanners, 165–166**

### **Zeus Web server**

- website, 436

### **zImage directive**

- kernel compilation, 714

### **Zope Web server**

- website, 436

**zsh shell, 247**