

# PREFACE

---

**The book** Whether you are an end user, a system administrator, or a little of both, this book explains with step-by-step examples how to get the most out of an Ubuntu Linux system. In 27 chapters, this book takes you from installing an Ubuntu system through understanding its inner workings to setting up secure servers that run on the system.

**The audience** This book is designed for a wide range of readers. It does not require you to have programming experience, although having some experience using a general-purpose computer, such as a Windows, Macintosh, UNIX, or another Linux system is certainly helpful. This book is appropriate for

- **Students** who are taking a class in which they use Linux
- **Home users** who want to set up and/or run Linux
- **Professionals** who use Linux at work
- **System administrators** who need an understanding of Linux and the tools that are available to them
- **Computer science students** who are studying the Linux operating system
- **Technical executives** who want to get a grounding in Linux

**Benefits** *A Practical Guide to Ubuntu Linux*<sup>®</sup> gives you a broad understanding of many facets of Linux, from installing Ubuntu Linux through using and customizing it. No matter what your background, this book provides the knowledge you need to get on with your work. You will come away from this book understanding how to use Linux, and this book will remain a valuable reference for years to come.

- Overlap** If you read *A Practical Guide to Linux® Commands, Editors, and Shell Programming*, you will notice some overlap between that book and the one you are reading now. The first chapter, the chapters on the utilities and the filesystem, and the appendix on regular expressions are very similar in the two books, as are the three chapters on the Bourne Again Shell (bash). Chapters that appear in this book but do not appear in *A Practical Guide to Linux® Commands, Editors, and Shell Programming* include Chapters 2 and 3 (installation), Chapters 4 and 8 (Ubuntu Linux and the GUI), Chapter 10 (networking), all of the chapters in Part IV (system administration) and Part V (servers), and Appendix C (security).
- Differences** While this book explains how to use Linux from a graphical interface and from the command line (a textual interface), *A Practical Guide to Linux® Commands, Editors, and Shell Programming* works exclusively with the command line. It includes full chapters on the vi and emacs editors, as well as chapters on the gawk pattern processing language and the sed stream editor. In addition, it has a command reference section that provides extensive examples of the use of more than 80 of the most important Linux utilities. You can use these utilities to solve problems without resorting to programming in C.

---

## THIS BOOK INCLUDES UBUNTU GUTSY GIBBON (7.10) ON A LIVE/INSTALL DVD

This book includes a live/install DVD that holds the Gutsy Gibbon (7.10) release of Ubuntu Linux. You can use this DVD to run a live Ubuntu session that displays the GNOME desktop without making any changes to your computer: Boot from the DVD, run an Ubuntu live session, and log off. Your system remains untouched: When you reboot, it is exactly as it was before you ran the Ubuntu live session. Alternatively, you can install Ubuntu from the live session. Chapter 2 helps you get ready to install Ubuntu. Chapter 3 provides step-by-step instructions for installing Ubuntu from this DVD. This book guides you through learning about, using, and administering an Ubuntu Linux session.

- DVD features** The included DVD incorporates all the features of the live/install Desktop CD as well as the Alternate and Server CDs. It also includes all software packages supported by Ubuntu. You can use it to perform a graphical or textual (command line) installation of either a graphical or a textual Ubuntu system. If you do not have an Internet connection, you can use the DVD as a software repository and install any supported software packages from it.

---

## FEATURES OF THIS BOOK

This book is designed and organized so you can get the most out of it in the shortest amount of time. You do not have to read this book straight through in page order. Instead, once you are comfortable using Linux, you can use this book as a reference:

Look up a topic of interest in the table of contents or index and read about it. Or think of the book as a catalog of Linux topics: Flip through the pages until a topic catches your eye. The book includes many pointers to Web sites where you can get additional information: Consider the Internet an extension of this book.

*A Practical Guide to Ubuntu Linux*<sup>®</sup> is structured with the following features:

- **Optional sections** enable you to read the book at different levels, returning to more difficult material when you are ready to delve into it.
- **Caution boxes** highlight procedures that can easily go wrong, giving you guidance *before* you run into trouble.
- **Tip boxes** highlight ways you can save time by doing something differently or situations when it may be useful or just interesting to have additional information.
- **Security boxes** point out places where you can make a system more secure. The **security appendix** presents a quick background in system security issues.
- Concepts are illustrated by **practical examples** throughout the book.
- **Chapter summaries** review the important points covered in each chapter.
- **Review exercises** are included at the end of each chapter for readers who want to further hone their skills. Answers to even-numbered exercises are available at [www.sobell.com](http://www.sobell.com).
- The **glossary** defines more than 500 common terms.
- The chapters that cover servers include **JumpStart** sections that get you off to a quick start using clients and setting up servers. Once a server is up and running, you can test and modify its configuration as explained in the rest of the chapter.
- This book provides resources for **finding software** on the Internet. It also explains how to **download** and **install** software using Synaptic, **aptitude**, the GNOME Add/Remove Applications window, and BitTorrent. It details controlling automatic updates using the Update Notifier and the Update Manager window.
- This book describes in detail many important **GNU tools**, including the GNOME desktop, the Nautilus File Browser, the **parted** and **gparted** partition editors, the **gzip** compression utility, and many command line utilities that come from the GNU project.
- Pointers throughout the text provide help in obtaining **online documentation** from many sources, including the local system, the Ubuntu Web site, and other locations on the Internet.
- Many **useful URLs** point to Web sites where you can obtain software, security programs and information, and more.
- The **comprehensive index** helps you locate topics quickly and easily.

## KEY TOPICS COVERED IN THIS BOOK

This book contains a lot of information. This section distills and summarizes its contents. In addition, “Details” (starting on page xli) describes what each chapter covers. Finally, the table of contents provides more detail. This book:

- |                           |  |
|---------------------------|--|
| Installation              | <ul style="list-style-type: none"><li>• Describes how to download Ubuntu Linux ISO images from the Internet and burn the Ubuntu live/install Desktop CD, the DVD, or the Ubuntu Alternate or Server installation CD.</li><li>• Helps you plan the layout of the system’s hard disk. It includes a discussion of partitions, partition tables, and mount points, and assists you in using the <code>ubiquity</code> or <code>gparted</code> graphical partitioner or the Ubuntu textual partitioner to partition the hard disk.</li><li>• Explains how to set up a dual-boot system so you can install Ubuntu Linux on a Windows system and boot either operating system.</li><li>• Describes in detail how to install Ubuntu Linux from a live/install Desktop CD or the live/install DVD using the <code>ubiquity</code> graphical installer. It also explains how to use the textual installer found on the Alternate CD, the Server CD, and the DVD. The graphical installer is fast and easy to use. The textual installer gives you more options and works on systems with less RAM (system memory).</li><li>• Covers testing an Ubuntu CD/DVD for defects, setting boot command line parameters (boot options), and creating a RAID array.</li><li>• Covers the details of installing and customizing the X.org version of the X Window System either graphically using the Screen and Graphics Preferences window or manually with a text editor.</li></ul> |
| Working with Ubuntu Linux | <ul style="list-style-type: none"><li>• Introduces the GNOME desktop (GUI) and explains how to use desktop tools, including the Top and Bottom panels, panel objects, the Main menu, object context menus, the Workspace Switcher, the Nautilus File Browser, and the GNOME Terminal emulator.</li><li>• Explains how to use the Appearance Preferences window to add and modify themes to customize your desktop to please your senses and help you work more efficiently.</li><li>• Details how to set up 3D desktop visual effects that take advantage of Compiz Fusion.</li><li>• Covers the Bourne Again Shell (<code>bash</code>) in three chapters, including an entire chapter on shell programming that includes many sample shell scripts. These chapters provide clear explanations and extensive examples of how <code>bash</code> works both from the command line in day-to-day work and as a programming language to write shell scripts.</li></ul>   |

System  
administration

- Explains the textual (command line) interface and introduces more than 30 command line utilities.
- Presents a tutorial on the vim textual editor.
- Covers types of networks, network protocols, and network utilities.
- Explains hostnames, IP addresses, and subnets, and explores how to use `host` and `dig` to look up domain names and IP addresses on the Internet.
- Covers distributed computing and the client/server model.
- Explains how to use ACLs (Access Control Lists) to fine-tune user access permissions.
- Explains how to use the Ubuntu graphical and textual (command line) tools to configure the display, DNS, NFS, Samba, Apache, a firewall, a network interface, and more. You can also use these tools to add users and manage local and remote printers.
- Goes into detail about using `sudo` to allow specific users to work with `root` privileges (become Superuser) and customizing the way `sudo` works by editing the `sudoers` configuration file. It also explains how you can unlock the `root` account if necessary.
- Describes how to use the following tools to download and install software to keep a system up-to-date and to install new software:
  - ◆ The **Software Sources** window controls which Ubuntu and third-party software repositories Ubuntu downloads software packages from and whether Ubuntu downloads updates automatically. You can also use this window to cause Ubuntu to download and install security updates automatically.
  - ◆ If you do not have an Internet connection, you can use the **Software Sources** window to set up the DVD included with this book as a software repository. You can then install any software packages that Ubuntu supports from this repository.
  - ◆ Based on how you set up updates in the Software Sources window, the **Update Notifier** pops up on the desktop to let you know when software updates are available. Click the Update Notifier to open the Update Manager window, from which you can download and install updates.
  - ◆ The **Add/Remove Applications** window provides an easy way to select, download, and install a wide range of software packages.
  - ◆ **Synaptic** allows you to search for, install, and remove software packages. It gives you more ways to search for packages than does the Add/Remove Applications window.

- ◆ **APT** downloads and installs software packages from the Internet (or the included DVD), keeping a system up-to-date and resolving dependencies as it processes the packages. You can use APT from a graphical interface (Synaptic) or from several textual interfaces (e.g., `aptitude` and `apt-get`).
- ◆ **BitTorrent** is a good choice for distributing large amounts of data such as the Ubuntu installation DVD and CDs. The more people who use BitTorrent to download a file, the faster it works.
- Covers graphical system administration tools, including the many tools available from the GNOME Main menu.
- Explains system operation, including the boot process, `init` scripts, recovery (single-user) and multiuser modes, and steps to take if the system crashes.
- Describes how to use and program the new Upstart `init` daemon, which replaces the System V `init` daemon.
- Describes files, directories, and filesystems, including types of files and filesystems, `fstab` (the filesystem table), and automatically mounted filesystems, and explains how to fine-tune and check the integrity of filesystems.
- Covers backup utilities, including `tar`, `cpio`, `dump`, and `restore`.
- Describes compression/archive utilities, including `gzip`, `bzip2`, `compress`, and `zip`.
- Explains how to customize and build a Linux kernel.
- Security
  - Helps you manage basic system security issues using `ssh` (secure shell), `vsftpd` (secure FTP server), Apache (Web server), `iptables` (firewalls), and more.
  - Covers using `firestarter` to share an Internet connection over a LAN, run a DHCP server, and set up a basic firewall to protect the system.
  - Provides instructions on using `iptables` to share an Internet connection over a LAN and to build advanced firewalls.
  - Describes how to set up a `chroot` jail to help protect a server system.
  - Explains how to use TCP wrappers to control who can access a server.
- Clients and servers
  - Explains how to set up and use the most popular Linux servers, providing a chapter on each: Apache, Samba, OpenSSH, `exim4`, DNS, NFS, FTP, `firestarter` and `iptables`, and NIS (all of which are supported by Ubuntu Linux).
  - Describes how to set up a CUPS printer server.
  - Describes how to set up and use a DHCP server either by itself or from `firestarter`.
- Programming
  - Provides a full chapter covering shell programming using `bash`, including many examples.

## DETAILS

- Chapter 1 **Chapter 1** presents a brief history of Linux and explains some of the features that make it a cutting-edge operating system. The “Conventions Used in This Book” (page 17) section details the typefaces and terminology this book uses.
- Part I Part I, “Installing Ubuntu Linux,” discusses how to install Ubuntu Linux. **Chapter 2** presents an overview of the process of installing Ubuntu Linux, including hardware requirements, downloading and burning a CD or DVD, and planning the layout of the hard disk. **Chapter 3** is a step-by-step guide to installing Ubuntu Linux from a CD or DVD, using the graphical or textual installer. It also shows how to set up the X Window System and customize your desktop (GUI).
- Part II Part II, “Getting Started with Ubuntu Linux,” familiarizes you with Ubuntu Linux, covering logging in, the GUI, utilities, the filesystem, and the shell. **Chapter 4** introduces desktop features, including the Top and Bottom panels and the Main menu; explains how to use the Nautilus File Browser to manage files, run programs, and connect to FTP and HTTP servers; covers finding documentation, dealing with login problems, and using the window manager; and presents some suggestions on where to find documentation, including manuals, tutorials, software notes, and HOWTOs. **Chapter 5** introduces the shell command line interface, describes more than 30 useful utilities, and presents a tutorial on the vim text editor. **Chapter 6** discusses the Linux hierarchical filesystem, covering files, filenames, pathnames, working with directories, access permissions, and hard and symbolic links. **Chapter 7** introduces the Bourne Again Shell (bash) and discusses command line arguments and options, redirecting input to and output from commands, running programs in the background, and using the shell to generate and expand filenames.

### Experienced users may want to skim Part II

**tip** If you have used a UNIX or Linux system before, you may want to skim or skip some or all of the chapters in Part II. Part I has two sections that all readers should take a look at: “Conventions Used in This Book” (page 17), which explains the typographic and layout conventions used in this book, and “Where to Find Documentation” (page 124), which points out both local and remote sources of Linux and Ubuntu documentation.

- Part III Part III, “Digging into Ubuntu Linux,” goes into more detail about working with the system. **Chapter 8** discusses the GUI (desktop) and includes a section on how to run a graphical program on a remote system and have the display appear locally. The section on GNOME describes several GNOME utilities, including the new Deskbar applet, and goes into more depth about the Nautilus File Browser. **Chapter 9** extends the bash coverage from Chapter 7, explaining how to redirect error output, avoid overwriting files, and work with job control, processes, startup files, important shell builtin commands, parameters, shell variables, and aliases. **Chapter 10** explains networks, network security, and the Internet and discusses types of networks, subnets, protocols, addresses, hostnames, and various network utilities. The section on distributed computing describes the client/server model and some of the servers you can use on a network. **Chapter 11** goes into greater depth about shell programming

using `bash`, with the discussion enhanced by extensive examples. Details of setting up and using clients and servers are reserved until Part V.

Part IV Part IV covers system administration. **Chapter 12** discusses core concepts such as the use of `sudo`, working with `root` privileges, system operation, `chroot` jails, TCP wrappers, general information about how to set up a server, DHCP, and PAM. **Chapter 13** explains the Linux filesystem, going into detail about types of files, including special and device files; the use of `fsck` to verify the integrity of and repair filesystems; and the use of `tune2fs` to change filesystem parameters. **Chapter 14** explains how to keep a system up-to-date by downloading software from the Internet and installing it, including examples of using APT programs such as `aptitude`, `apt-get`, and `apt-cache`. It also covers the `dpkg` software packaging system and the use of some `dpkg` utilities. Finally, it explains how to use BitTorrent from the command line to download files. **Chapter 15** explains how to set up the CUPS printing system so you can print on both local and remote systems. **Chapter 16** details customizing and building a Linux kernel. **Chapter 17** covers additional administration tasks, including setting up user accounts, backing up files, scheduling automated tasks, tracking disk usage, and solving general problems. **Chapter 18** explains how to set up a local area network (LAN), including both hardware (including wireless) and software configuration.

Part V Part V goes into detail about setting up and running servers and connecting to them with clients. Where appropriate, these chapters include JumpStart sections that get you off to a quick start in using clients and setting up servers. The chapters in Part V cover the following clients/servers:

- **OpenSSH** Set up an OpenSSH server and use `ssh`, `scp`, and `sftp` to communicate securely over the Internet.
- **FTP** Set up a `vsftpd` secure FTP server and use any of several FTP clients to exchange files with the server.
- **Mail** Configure `exim4` and use Webmail, POP3, or IMAP to retrieve email; use SpamAssassin to combat spam.
- **NIS** Set up NIS to facilitate system administration of a LAN.
- **NFS** Share filesystems between systems on a network.
- **Samba** Share filesystems and printers between Windows and Linux systems.
- **DNS/BIND** Set up a domain nameserver to let other systems on the Internet know the names and IP addresses of local systems they may need to contact.
- **firestarter and iptables** Share a single Internet connection between systems on a LAN, run a DHCP server, and set up a firewall to protect local systems.
- **Apache** Set up an HTTP server that serves Web pages that browsers can display. This chapter includes many suggestions for increasing Apache security.



Part VI Part VI includes appendixes on regular expressions, helpful Web sites, system security, and free software. This part also includes an extensive glossary with more than 500 entries plus a comprehensive index.

---

## SUPPLEMENTS

The author's home page ([www.sobell.com](http://www.sobell.com)) contains downloadable listings of the longer programs from this book as well as pointers to many interesting and useful Linux sites on the World Wide Web, a list of corrections to the book, answers to even-numbered exercises, and a solicitation for corrections, comments, and suggestions.

---

## THANKS

First and foremost, I want to thank Mark L. Taub, Editor-in-Chief, Prentice Hall, who provided encouragement and support through the hard parts of this project. Mark is unique in my 25 years of book writing experience: an editor who works with the tools I write about. Because Mark runs Ubuntu on his home computer, we shared experiences as I wrote this book. Mark, your comments and direction are invaluable; this book would not exist without your help. Thank you, Mark T.

Molly Sharp of ContentWorks worked with me day-by-day during production of this book providing help, listening to my rants, and keeping everything on track. Thanks to Jill Hobbs, Copyeditor, who made the book readable, understandable, and consistent; and Linda Seifert, Proofreader, who made each page sparkle.

Thanks also to the folks at Prentice Hall who helped bring this book to life, especially Julie Nahil, Full-Service Production Manager, who oversaw production of the book; John Fuller, Managing Editor, who kept the large view in check; Marie McKinley, Marketing Manager; Noreen Regina, Editorial Assistant, who attended to the many details involved in publishing this book, including keeping the review team on schedule (no small task); Heather Fox, Publicist; Dan Scherf, Media Developer; Sandra Schroeder, Design Manager; Chuti Prasertsith, Cover Designer; and everyone else who worked behind the scenes to make this book come into being.

I am also indebted to Denis Howe, Editor of *The Free On-line Dictionary of Computing* (FOLDOC). Denis has graciously permitted me to use entries from his compilation. Be sure to look at this dictionary ([www.foldoc.org](http://www.foldoc.org)).

A big "thank you" to the folks who read through the drafts of the book and made comments that caused me to refocus parts of the book where things were not clear or were left out altogether: David Chisnall, Swansea University; Scott Mann, Aztek Networks; Matthew Miller, Senior Systems Analyst/Administrator, BU Linux Project, Boston University Office of Information Technology; George

Vish II, Senior Education Consultant, Hewlett-Packard; Thomas Achtemichuk, Mansueto Ventures; John Dong, Ubuntu Forum Council Member/Backports Team Leader; Scott James Remnant, Ubuntu Development Manager and Desktop Team Leader; Daniel R. Arfsten, Pro/Engineer Drafter/Designer; Chris Cooper, Senior Education Consultant, Hewlett-Packard Education Services; Sameer Verma, Associate Professor of Information Systems, San Francisco State University; Valerie Chau, Palomar College and Programmers Guild; James Kratzer; Sean McAllister; Nathan Eckenrode, New York Ubuntu Local Community Team; Christer Edwards; Nicolas Merline; and Michael Price.

Thanks also to the following people who helped with my previous Linux books, which provided a foundation for this book: Chris Karr, Northwestern University; Jesse Keating, Fedora Project; Carsten Pfeiffer, Software Engineer and KDE Developer; Aaron Weber, Ximian; Cristof Falk, Software Developer at CritterDesign; Steve Elgersma, Computer Science Department, Princeton University; Scott Dier, University of Minnesota; Robert Haskins, Computer Net Works; Lars Kellogg-Stedman, Harvard University; Jim A. Lola, Principal Systems Consultant, Privateer Systems; Eric S. Raymond, Cofounder, Open Source Initiative; Scott Mann; Randall Lechlitner, Independent Computer Consultant; Jason Wertz, Computer Science Instructor, Montgomery County Community College; Justin Howell, Solano Community College; Ed Sawicki, The Accelerated Learning Center; David Mercer; Jeffrey Bianchine, Advocate, Author, Journalist; John Kennedy; and Jim Dennis, Starshine Technical Services.

Thanks also to Dustin Puryear, Puryear Information Technology; Gabor Liptak, Independent Consultant; Bart Schaefer, Chief Technical Officer, iPost; Michael J. Jordan, Web Developer, Linux Online; Steven Gibson, Owner, SuperAnt.com; John Viega, Founder and Chief Scientist, Secure Software; K. Rachael Treu, Internet Security Analyst, Global Crossing; Kara Pritchard, K & S Pritchard Enterprises; Glen Wiley, Capital One Finances; Karel Baloun, Senior Software Engineer, Looksmart; Matthew Whitworth; Dameon D. Welch-Abernathy, Nokia Systems; Josh Simon, Consultant; Stan Isaacs; and Dr. Eric H. Herrin II, Vice President, Herrin Software Development. And thanks to Doug Hughes, long-time system designer and administrator, who gave me a big hand with the sections on system administration, networks, the Internet, and programming.

More thanks go to consultants Lorraine Callahan and Steve Wampler; Ronald Hiller, Graburn Technology; Charles A. Plater, Wayne State University; Bob Palowoda; Tom Bialaski, Sun Microsystems; Roger Hartmuller, TIS Labs at Network Associates; Kaowen Liu; Andy Spitzer; Rik Schneider; Jesse St. Laurent; Steve Bellenot; Ray W. Hiltbrand; Jennifer Witham; Gert-Jan Hagensnaars; and Casper Dik.

*A Practical Guide to Ubuntu Linux*<sup>®</sup> is based in part on two of my previous UNIX books: *UNIX System V: A Practical Guide* and *A Practical Guide to the UNIX System*. Many people helped me with those books, and thanks here go to Pat Parseghian; Dr. Kathleen Hemenway; Brian LaRose; Byron A. Jeff, Clark Atlanta University; Charles Stross; Jeff Gitlin, Lucent Technologies; Kurt Hockenbury; Maury Bach, Intel

Israel; Peter H. Salus; Rahul Dave, University of Pennsylvania; Sean Walton, Intelligent Algorithmic Solutions; Tim Segall, Computer Sciences Corporation; Behrouz Forouzan, DeAnza College; Mike Keenan, Virginia Polytechnic Institute and State University; Mike Johnson, Oregon State University; Jandelyn Plane, University of Maryland; Arnold Robbins and Sathis Menon, Georgia Institute of Technology; Cliff Shaffer, Virginia Polytechnic Institute and State University; and Steven Stepanek, California State University, Northridge, for reviewing the book.

I continue to be grateful to the many people who helped with the early editions of my UNIX books. Special thanks are due to Roger Sippl, Laura King, and Roy Harrington for introducing me to the UNIX system. My mother, Dr. Helen Sobell, provided invaluable comments on the original manuscript at several junctures. Also, thanks go to Isaac Rabinovitch, Professor Raphael Finkel, Professor Randolph Bentson, Bob Greenberg, Professor Udo Pooch, Judy Ross, Dr. Robert Veroff, Dr. Mike Denny, Joe DiMartino, Dr. John Mashey, Diane Schulz, Robert Jung, Charles Whitaker, Don Cragun, Brian Dougherty, Dr. Robert Fish, Guy Harris, Ping Liao, Gary Lindgren, Dr. Jarrett Rosenberg, Dr. Peter Smith, Bill Weber, Mike Bianchi, Scooter Morris, Clarke Echols, Oliver Grillmeyer, Dr. David Korn, Dr. Scott Weikart, and Dr. Richard Curtis.

Finally, thanks to Peter and his family for providing nourishment and a very comfortable place to work. I spent many hours reading the manuscript at JumpStart, Peter's neighborhood coffee and sandwich shop. If you are in the neighborhood (24th & Guerrero in San Francisco), stop by and say "Hi."

I take responsibility for any errors and omissions in this book. If you find one or just have a comment, let me know ([mgs@sobell.com](mailto:mgs@sobell.com)) and I will fix it in the next printing. My home page ([www.sobell.com](http://www.sobell.com)) contains a list of errors and credits those who found them. It also offers copies of the longer scripts from the book and pointers to interesting Linux pages on the Internet.

*Mark G. Sobell  
San Francisco, California*

