

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 28 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 including the `bash` and Perl scripting languages
- **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*®, *Third Edition*, 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.

New in this edition This edition includes many updates to the previous edition:

- Coverage of the MySQL relational database, which has been added to Chapter 16 (page 628).
- An all-new section on the Cacti network monitoring tool, which has been added to Chapter 17 (page 647).
- Coverage of the gufw firewall, which has been added to Chapter 25 (page 874).
- Updated chapters to reflect the Ubuntu 10.04 LTS (Lucid Lynx; maintained until 2013).
- Four indexes to make it easier to find what you are looking for quickly. These indexes locate tables (page numbers followed by the letter **t**, definitions (italic page numbers), and differentiate between light and comprehensive coverage (light and standard fonts).
 - ◆ The JumpStart index (page 1183) lists all the JumpStart sections in this book. These sections help you set up servers and clients as quickly as possible.
 - ◆ The File Tree index (page 1185) lists, in hierarchical fashion, most files mentioned in this book. These files are also listed in the main index.
 - ◆ The Utility index (page 1189) locates all utilities mentioned in this book. A page number in a **light font** indicates a brief mention of the utility while the regular font indicates more substantial coverage.
 - ◆ The revised Main index (page 1195) is designed for ease of use.

Overlap If you have read the second edition of *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 file-system; the appendix on regular expressions; and the Glossary 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, Second Edition* works exclusively with the command line and covers Mac OS X in addition to Linux. It includes full chapters on the **vim** and **emacs** editors, as well as chapters on the **gawk** pattern processing language, the **sed** stream editor, and the **rsync** secure copy utility. In addition, it has a command reference section that provides extensive examples of the use of 100 of the most

important Linux and Mac OS X utilities. You can use these utilities to solve problems without resorting to programming in C.

THIS BOOK INCLUDES UBUNTU LUCID LYNX (10.04 LTS) ON A LIVE/INSTALL DVD

This book includes a live/install DVD that holds the Lucid Lynx (10.04) 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 system.

DVD features The included DVD incorporates all the features of the live/install Desktop CD as well as many of the features of 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 least 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 in an 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 obtain additional information: Consider the Internet to be an extension of this book.

A Practical Guide to Ubuntu Linux®, Third Edition, 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 can be found at www.sobell.com.
- The **glossary** defines more than 500 commonly encountered 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 each of these chapters.
- This book provides resources for **finding software** on the Internet. It also explains how to **download** and **install** software using Synaptic, aptitude, the Ubuntu Software Center window, and BitTorrent. It details controlling automatic updates using the Update Manager window.
- This book describes in detail many important **GNU tools**, including the GNOME desktop, the Nautilus File Browser, the parted, palimpsest, 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 multiple **comprehensive indexes** help 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 xlvi) describes what each chapter covers. Finally, the table of contents provides more detail. This book:

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|---------------------------|---|
| Installation | <ul style="list-style-type: none">• 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.• 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>, <code>palimpsest</code>, or <code>gparted</code> graphical partition editor or the Ubuntu textual partition editor to examine and partition the hard disk.• Explains how to set up a dual-boot system so you can install Ubuntu Linux on a Windows system and boot either operating system.• 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).• Covers testing an Ubuntu CD/DVD for defects, setting boot command-line parameters (boot options), and creating a RAID array. |
| Working with Ubuntu Linux | <ul style="list-style-type: none">• 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.• 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.• Details how to set up 3D desktop visual effects that take advantage of Compiz Fusion.• 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 in which to write shell scripts.• Explains the textual (command-line) interface and introduces more than 30 command-line utilities.• Presents a tutorial on the <code>vim</code> textual editor.• Covers types of networks, network protocols, and network utilities.• Explains hostnames, IP addresses, and subnets, and explores how to use <code>host</code> and <code>dig</code> to look up domain names and IP addresses on the Internet.• Covers distributed computing and the client/server model. |

System
administration

- 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 Manager** window appears on the desktop to let you know when software updates are available. You can download and install updates from the Update Manager window.
 - ◆ The **Ubuntu Software Center** 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 Ubuntu Software Center 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.

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- 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.
 - Explains how to set up and use the Cacti network monitor tool to graph system and network information over time, including installing and setting up the LAMP (Linux, Apache, MySQL, and PHP) stack.
 - Provides instructions on installing and setting up a MySQL relational database.
 - 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.
 - Describes how to use the textual uncomplicated firewall (**ufw**) and its graphical interface (**gufw**) to protect the system.
 - Covers the use of **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**, **gufw** and **iptables**, and **NIS/LDAP** (all of which are supported by Ubuntu Linux).
 - Describes how to set up a CUPS printer server.
 - Explains how to set up and use a MySQL relational database.
 - Describes how to set up and use a DHCP server either by itself or from **firestarter**.
- Programming
- Provides a chapter on the Perl programming language and 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 19) section details the typefaces and terminology used in this book.
- 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.
- 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. Two sections that all readers should take a look at are: “Conventions Used in This Book” (page 19), which explains the typographic and layout conventions used in this book, and “Where to Find Documentation” (page 136), 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 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. Details of setting up and using clients and servers are reserved until Part V.

- Part IV Part IV covers system administration. **Chapter 11** discusses core concepts such as the use of `sudo`, working with `root` privileges, system operation including a discussion of the Upstart `init` daemon, `chroot` jails, TCP wrappers, general information about how to set up a server, DHCP, and PAM. **Chapter 12** 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 13** explains how to keep a system up-to-date by downloading software from the Internet and installing it, including examples that use APT programs such as `aptitude`, `apt-get`, and `apt-cache` to perform these tasks. 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 14** explains how to set up the CUPS printing system so you can print on both local and remote systems. **Chapter 15** details customizing and building a Linux kernel. **Chapter 16** covers additional administration tasks, including setting up user accounts, backing up files, scheduling automated tasks, tracking disk usage, solving general problems, and setting up a MySQL relational database. **Chapter 17** explains how to set up a local area network (LAN), including both hardware (including wireless) and software configuration, and how to set up Cacti to monitor the network.
- Part V Part V goes into detail about setting up and running servers and connecting to them using 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.
 - **Email**—Configure `exim4` and use Webmail, POP3, or IMAP to retrieve email; use SpamAssassin to combat spam.
 - **NIS and LDAP**—Set up NIS to facilitate system administration of a LAN and LDAP to maintain databases.
 - **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, ufw, gufw, and iptables**—Set up a firewall to protect local systems, share a single Internet connection between systems on a LAN, and run a DHCP server.

- **Apache**—Set up an HTTP server that serves Web pages, which browsers can then display. This chapter includes many suggestions for increasing Apache security.
- Part VI Part VI covers two important programming tools that are used extensively in Ubuntu system administration and general-purpose programming. **Chapter 27** continues where Chapter 9 left off, going into greater depth about shell programming using `bash`, with the discussion enhanced by extensive examples. **Chapter 28** introduces the popular, feature-rich Perl programming language, including coverage of regular expressions and file handling.
- Part VII Part VII 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 the JumpStart index, the File Tree index, the Utility index, and a comprehensive traditional index.

SUPPLEMENTS

The author's home page (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.

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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) and I will fix it in the next printing. My home page (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.

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