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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 a Fedora or Red Hat Enterprise Linux (RHEL) system. In 28 chapters, this book takes you from installing a Fedora or RHEL 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 other 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 Fedora™ and Red Hat® Enterprise Linux®, Fifth Edition, gives you a broad understanding of many facets of Linux, from installing Fedora/RHEL through using and customizing it. No matter what your background, this book delivers 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.

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

- An all-new chapter on the Perl programming language (Chapter 28; page 975)
- Coverage of the MySQL relational database, which has been added to Chapter 16 (page 584)
- Coverage of the Cacti network monitoring tool, which has been added to Chapter 17 (page 607)
- Updated chapters to reflect the Fedora 12 and Red Hat Enterprise Linux 5.4 releases

Overlap If you read *A Practical Guide to Linux® Commands, Editors, and Shell Programming, Second Edition,* you will notice some overlap between that book and the one you are reading now. The first chapter; the chapters on the utilities, the filesystem, and Perl; 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 not in *A Practical Guide to Linux® Commands, Editors, and Shell Programming, Second Edition,* include Chapters 2 and 3 (installation), Chapters 4 and 8 (Fedora/RHEL 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 Linux and Mac OS X 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 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 FEDORA 12 ON A DVD

A Practical Guide to Fedora™ and Red Hat® Enterprise Linux®, Fifth Edition, includes a DVD that you can use to install or upgrade to Fedora 12. Chapter 2 helps you get ready to install Fedora. Chapter 3 provides step-by-step instructions for installing Fedora from this DVD. This book guides you through learning about, using, and administrating Fedora or RHEL.

WHAT IS NEW IN THIS EDITION?

The fifth edition of *A Practical Guide to Fedora™ and Red Hat® Enterprise Linux®* covers Fedora 12 and Red Hat Enterprise Linux version 5.4. Chapters 2 and 3 describe the process of booting into a live session and installing from live media.

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There is a new section on MySQL in Chapter 16 and new coverage of Cacti in Chapter 17. All of the changes—both large and small—that have been made to Fedora/RHEL since the previous edition of this book was published have been incorporated into the explanations and examples.

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 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 Fedora™ and Red Hat® Enterprise Linux®, Fifth Edition, is structured with the following features:

- In this book, the term "Fedora/RHEL" refers to both **Fedora** and **Red Hat Enterprise Linux**. Features that apply to only one operating system or the other are marked as such using these indicators: *FEDORA* or *RHEL*.
- **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 that 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.
- This book provides resources for **finding software** on the Internet. It also explains how to **download** and **install** software using yum, BitTorrent, and, for Red Hat Enterprise Linux, Red Hat Network (RHN).
- The **glossary** defines more than 500 common terms.

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- 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 describes in detail many important **GNU tools**, including the GNOME desktop, the Nautilus File Browser, the parted and palimpsest 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 Red Hat Web site, the Fedora Project Web site, and other locations on the Internet.
- Many **useful URLs** (Internet addresses) point to 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 xliii) describes what each chapter covers. Finally, the table of contents provides more detail. This book:

Installation

- Describes how to download Fedora ISO image files from the Internet and burn both Fedora Desktop Live Media CD/DVDs and Fedora Install Media CD/DVDs.
- Helps you plan the layout of the system's hard disk and assists you in using Disk Druid or the GNOME palimpsest disk utility to partition the hard disk.
- Explains how to set up a dual-boot system so you can install Fedora or RHEL on a Windows system and boot either operating system.
- Explains how to use the Logical Volume Manager (LVM2) to set up, grow, and migrate logical volumes, which are similar in function to traditional disk partitions.
- Discusses booting into a live Fedora session and installing Fedora from that session.
- Describes in detail how to install Fedora/RHEL from a DVD, CD, a hard disk, or over a network using FTP, NFS, or HTTP.
- Covers boot command-line parameters (*FEDORA*), responses to the **boot:** prompt (*RHEL*), and working with **Anaconda**, Fedora/RHEL's installation program.

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Working with Fedora/RHEL

- 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 (bash) 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 bash 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 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.

System administration

- Explains how to use the Fedora/RHEL 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.
- Describes how to use the following tools to download software and keep a system current:
  - yum—Downloads and installs software packages from the Internet, keeping a system up-to-date and resolving dependencies as it processes the packages. You can run yum manually or set it up to run automatically every night.
  - **BitTorrent**—Good for distributing large amounts of data such as the Fedora installation DVD and the live media CD/DVD. The more people who use BitTorrent to download a file, the faster it works.
  - up2date—The Red Hat Enterprise Linux tool for keeping system software current.

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- Covers graphical system administration tools, including the many tools available from the GNOME Main menu.
- Explains system operation, including the boot process, init scripts, rescue mode, 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), automatically mounted filesystems, filesystem integrity checks, filesystem utilities, and fine-tuning of filesystems.
- Explains how to set up and use the **Cacti** network monitoring tool to graph system and network information over time.
- Covers backup utilities, including tar, cpio, dump, and restore.
- 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 (the **httpd** Web server), iptables (firewall), and more.
- Presents a complete section on SELinux (Security Enhanced Linux), including instructions for using system-config-selinux to configure SELinux.
- Covers the use of system-config-firewall to 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 protect a server system.
- Explains how to use TCP wrappers to control who can access a server.
- Covers controlling servers using the **xinetd** superserver.

Clients and servers

- Explains how to set up and use the most popular Linux servers, providing a chapter on each: Apache, Samba, OpenSSH, **sendmail**, DNS, NFS, FTP, NIS and LDAP, and iptables (all of which are included with Fedora/RHEL).
- 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.

Programming

- Provides an all-new chapter on the Perl programming language and a full chapter covering shell programming using bash, including many examples.

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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 16) section details the typefaces and terminology used in this book.

Part I Part I, "Installing Fedora and Red Hat Enterprise Linux," discusses how to install both Fedora and RHEL. **Chapter 2** presents an overview of the process of installing Fedora and RHEL, 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 either Fedora or Red Hat Enterprise Linux; it covers installing from a CD/DVD, in a live session, from a local hard disk, and over the network using FTP, NFS, or HTTP. It also shows how to customize your graphical desktop (GUI).

Part II Part II, "Getting Started with Fedora and Red Hat Enterprise Linux," familiarizes you with Fedora/RHEL, 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 "Conventions Used in This Book" (page 16), 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/Fedora/RHEL documentation.

Part III Part III, "Digging into Fedora and Red Hat Enterprise 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

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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 working with **root** privileges (working as Superuser), SELinux (Security Enhanced Linux), system operation, 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 yum, BitTorrent, and RHEL's up2date utility. **Chapter 14** explains how to set up the CUPS printing system so you can print on the local system as well as on 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 installing and running MySQL. **Chapter 17** explains how to set up a local area network (LAN), including both hardware (including wireless) and software setup. It also discusses using Cacti to monitor a network.

Part V Part V goes into detail about setting up and running servers and connecting to them with clients. The chapters in this part of the book cover the following clients/servers:

- **OpenSSH**—Set up an OpenSSH server and use sh, 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 **sendmail** 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 distribute information and authenticate users over a network.
- **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.
- **iptables**—Share a single Internet connection between systems on a LAN and set up a firewall to protect local systems.
- **Apache**—Set up an HTTP server that serves Web pages, which browsers can then display.

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Part VI Part VI covers two important programming tools that are used extensively in Fedora/RHEL 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 and a comprehensive 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 many interesting Linux pages.

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