Chapter 1

An Overview of Fedora and Red Hat Enterprise Linux

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Linux was a phenomenon waiting to happen. The computer industry suffered from a rift. In the 1980s and 1990s, people had to choose between inexpensive, market-driven PC operating systems from Microsoft and expensive, technology-driven operating systems such as UNIX. Free software was being created all over the world, but lacked a common platform to rally around. Linux has become that common platform.

For several years, Red Hat Linux was the most popular commercial distribution of Linux. In 2003, Red Hat, Inc. changed the name of its distribution from Red Hat Linux to Fedora Core (later changing the name to simply Fedora) and moved its commercial efforts toward its Red Hat Enterprise Linux products. It then set up Fedora to be:

- Sponsored by Red Hat
- Supported by the Linux community
- Inclusive of high-quality, cutting-edge open source technology
- A proving ground for software slated for commercial Red Hat deployment and support

Red Hat Enterprise Linux, on the other hand, became the basis for Red Hat's fully supported product line, geared toward big companies with the need to set up and manage many Linux

systems. After taking its software through about a year and a half of Fedora releases (about once every six to nine months), a commercial Red Hat Enterprise Linux (RHEL) product line is released that includes:

- Subscription service to RHEL that offers stable, tested software (mostly the same software in Fedora that has gone through rigorous testing)
- Multiple support programs, ranging from an online knowledge base to assistance with custom deployment, engineering, and software development
- Official documentation, training, and certification programs

Fedora itself has become a respected and active Linux distribution that thousands of people use worldwide as a desktop, server, or programming workstation. It is the best way to get the latest Linux software that is being built on a foundation for enterprise-quality systems.

Using Fedora is a great way to get a head start learning the features of upcoming RHEL releases. The latest Fedora Linux operating system (referred to as Fedora 10) is included on the DVD that comes with this book. The book also includes a Fedora Live CD with a desktop Linux system that you can use to try out Fedora, and then install directly to your hard disk when you are ready.

Introducing Fedora 10 and Red Hat Enterprise Linux

With the split between community (Fedora) and commercial (Red Hat Enterprise Linux) versions of what was Red Hat Linux, Red Hat has created a model that can suit the fast-paced changes in the open source software world, while still meeting the demands for a well-supported commercial Linux distribution.

Many technology professionals choose Red Hat Enterprise Linux because of its reputation for solid performance. With the Fedora Project, Red Hat has created an environment where open source developers can bring high-quality software packages to a freely distributed, community-oriented Linux system.

More than 9800 individual software packages (compared to just over 600 in Red Hat Linux 6.2) are included in the single, massive Fedora 10 software repository. These packages contain features that would cost you thousands of dollars to duplicate if you bought them as separate commercial products. These features let you:

- Connect your computers to a LAN or the Internet.
- Create documents and publish your work on paper or on the Web.
- Work with multimedia content to manipulate images, play music files, view video, and even master and burn your own CDs and DVD.
- Play games individually or over a network.

- Communicate over the Internet using a variety of Web tools for browsing, chatting, transferring files, participating in newsgroups, and sending and receiving e-mail.
- Protect your computing resources by having Fedora or RHEL act as a firewall or a router to protect against intruders coming in through public networks.
- Configure a computer to act as a network server, such as a print server, Web server, file server, mail server, news server, and a database server.

This is just a partial list of what you can do with Fedora or RHEL. Using this book as your guide, you will find that there are many more features built into Fedora and RHEL as well.

Support for new video cards, network cards, printers, and storage devices is being added every day. Linux programmers around the world are no longer the only ones creating hardware drivers. Every day more hardware vendors are creating their own Linux drivers, so they can sell products to the growing Linux market. New applications are being created to cover everything from personal productivity tools to programs that access massive corporate databases.

Remember that old Pentium computer in your closet? Don't throw it away! Just because a new release of Fedora is out doesn't mean that you need all new hardware for it to run. Support for many old computer components get carried from one release to the next. With a Minimal install, you could use Fedora as a router (to route data between your LAN and the Internet), firewall (to protect your network from outside intrusion), or file server (to store shared files on your LAN) — with maybe an Ethernet card or an extra hard disk added.

At this point, you may feel that Linux is something you want to try out. This brings us to the basic question: What is Linux?

What Is Linux?

Linux is a free operating system that was created by Linus Torvalds when he was a student at the University of Helsinki in 1991. Torvalds started Linux by writing a *kernel* — the heart of the operating system — partly from scratch and partly by using publicly available software. (For the definition of an operating system and a kernel, see the sidebar "What Is an Operating System?" later in this chapter.) Torvalds then released the system to his friends and to a community of "hackers" on the Internet and asked them to work with it, fix it, and enhance it. It took off.

> **NOTE:** I make the distinction here between hackers (who just like to play with computers) and crackers (who break into computer systems and cause damage).

Today, there are thousands of software developers around the world contributing software to the free and open source software (FOSS) community that feeds the Linux initiative. Because the source code for the software is freely available, anyone can work on it, change it, or

enhance it. Developers are encouraged to pass their fixes and improvements back into the community so that Linux can continue to grow and improve.

On top of the Linux kernel effort, the creators of Linux also drew on a great deal of system software and applications that are now bundled with Linux distributions from the GNU project (GNU stands for "GNU is Not UNIX"), which is directed by the Free Software Foundation (`http://www.gnu.org`). There is a vast amount of software that can be used with Linux, making it an operating system that can compete with or surpass features available in any other operating system in the world.

If you have heard Linux described as a free version of UNIX, there is good reason for it. Although much of the code for Linux started from scratch, the blueprint for what the code would do was created to follow POSIX (Portable Operating System Interface for UNIX) standards. POSIX is a computer industry operating system standard that every major version of UNIX complied with. In other words, if your operating system was POSIX-compliant, it was UNIX. Today, Linux has formed its own standards and services organizations to help interoperability among Linux systems, including the Linux Foundation, which supports such efforts as the Linux Standard Base (`http://www.linux-foundation.org/en/LSB`).

Linux's Roots in UNIX

Linux grew within a culture of free exchange of ideas and software. Like UNIX — the operating system on which Linux is based — the focus was on keeping communications open among software developers. Getting the code to work was the goal and the Internet was the primary communications medium. Keeping the software free and redistributable was a means to that goal. What, then, were the conditions that made the world ripe for a computer system such as Linux?

In the 1980s and 1990s, while Microsoft flooded the world with personal computers running DOS (Disk Operating System) and Windows operating systems, power users demanded more from an operating system. They ached for systems that could run on networks, support many users at once (multiuser), and run many programs at once (multitasking). DOS and Windows didn't cut it.

UNIX, on the other hand, grew out of a culture where technology was king and marketing people were, well, hard to find. Bell Laboratories in Murray Hill, New Jersey, was a think tank where ideas came first and profits were somebody else's problem. A quote from Dennis Ritchie, co-creator of UNIX and designer of the C programming language, in a 1980 lecture on the evolution of UNIX, sums up the spirit that started UNIX. He was commenting on both his hopes and those of his colleagues for the UNIX project after a similar project called Multics had just failed:

> *What we wanted to preserve was not just a good environment in which to do programming, but a system around which a fellowship could form. We knew from experience that the essence of communal computing as supplied by*

> *remote-access, time-shared machines, is not just to type programs into a terminal instead of a keypunch, but to encourage close communication.*

In that spirit, the first source code of UNIX was distributed free to universities. Like Linux, the availability of UNIX source code made it possible for a diverse population of software developers to make their own enhancements to UNIX and share them with others.

What Is an Operating System?

An operating system is made up of software instructions that lie between the computer hardware (disks, memory, ports, and so on) and the application programs (word processors, Web browsers, spreadsheets, and so on). At the center is the kernel, which provides the most basic computing functions (managing system memory, sharing the processor, opening and closing devices, and so on). Associated with the kernel are a variety of basic services needed to operate the computer, including:

- **File systems** — The file system provides the structure in which information is stored on the computer. Information is stored in files, primarily on hard disks inside the computer, but also on removable media such as CDs and DVDs. Files are organized within a hierarchy of directories. The Linux file system holds the data files that you save, the programs you run, and the configuration files that set up the system.
- **Device drivers** — These provide the interfaces to each of the hardware devices connected to your computer. A device driver enables a program to write to a device without needing to know details about how each piece of hardware is implemented. The program opens a device, sends and receives data, and closes a device.
- **User interfaces** — An operating system needs to provide a way for users to run programs and access the file system. Linux has both graphical and text-based user interfaces. GNOME and KDE provide graphical user interfaces, whereas shell command interpreters (such as bash) run programs by typing commands and options.
- **System services** — An operating system provides system services, many of which can be started automatically when the computer boots. In Linux, system services can include processes that mount file systems, start your network, and run scheduled tasks. In Linux, many services run continuously, enabling users to access printers, Web pages, files, databases, and other computing assets over a network.

Without an operating system, an application program would have to know the details of each piece of hardware, instead of just being able to say, “open that device and write a file there.”

By the early 1980s, UNIX development moved from the organization in Murray Hill to a more commercially oriented development laboratory in Summit, New Jersey (a few miles down the road). During that time, UNIX began to find commercial success as the computing system of choice for applications such as AT&T's telephone switching equipment, for supercomputer applications such as modeling weather patterns, and for controlling NASA space projects.

Major computer hardware vendors licensed the UNIX source code to run on their computers. To try to create an environment of fairness and community to its OEMs (original equipment manufacturers), AT&T began standardizing what these different ports of UNIX had to be able to do to still be called UNIX. To that end, compliance with POSIX standards and the AT&T UNIX System V Interface Definition (SVID) were specifications UNIX vendors could use to create compliant UNIX systems. Those same documents also served as road maps for the creation of Linux.

Elsewhere, the UNIX source code that had been distributed to universities had taken on a life of its own. The Berkeley Software Distribution (BSD) began life in the late 1970s as patches to the AT&T UNIX source code from students and staff at the University of California at Berkeley. Over the years, the AT&T code was rewritten and BSD became freely distributed, with offshoot projects such as FreeBSD, OpenBSD, and NetBSD still available.

Linux has been described as a UNIX-like operating system that reflects a combination of SVID, POSIX, and BSD compliance. Linux continues to aim toward POSIX compliance, as well as compliance with standards set by the new owner of the UNIX trademark, The Open Group (`http://www.unix.org`). Much of the direction of Linux today comes from the Linux Foundation (`http://www.linux-foundation.org`), which was founded in 2007 by a merger of the Free Standards Group and the Open Source Development Labs.

Common Linux Features

No matter what version of Linux you use, the piece of code common to all is the Linux kernel. Although the kernel can be modified to include support for the features you want, every Linux kernel can offer the following features:

- **Multiuser** — Not only can you have many user accounts available on a Linux system, you can also have multiple users logged in and working on the system at the same time. Users can have their own environments arranged the way they want: their own home directory for storing files and their own desktop interface (with icons, menus, and applications arranged to suit them). User accounts can be password-protected, so that users can control who has access to their applications and data.
- **Multitasking** — In Linux, it is possible to have many programs running at the same time, which means that not only can you have many programs going at once, but that the Linux operating system can itself have programs running in the background. Many of these system processes make it possible for Linux to work as a server, with these background processes listening to the network for requests to log in to your system, view

a Web page, print a document, or copy a file. These background processes are referred to as *daemons*.

- **Hardware support** — You can configure support for almost every type of hardware that can be connected to a computer. There is support for floppy disk drives, CD-ROMs, removable disks (such as DVDs and USB flash drives), sound cards, tape devices, video cards, and most anything else you can think of. As device interfaces, such as USB and FireWire, have been added to computers, support for those devices has been added to Linux as well.

  For Linux to support a hardware device, Linux needs a driver, a piece of software that interfaces between the Linux kernel and the device. Drivers are available in the Linux kernel to support hundreds of computer hardware components that can be added or removed as needed.

NOTE: Most hardware manufacturers don't provide Linux drivers with their peripheral devices and adapter cards. Although most popular hardware will be supported eventually in Linux, it can sometimes take a while for a member of the Linux community to write a driver. Also, some outdated hardware may not be updated to work with the latest Linux kernels.

- **Networking connectivity** — To connect your Linux system to a network, Linux offers support for a variety of local area network (LAN) cards, modems, and serial devices. In addition to LAN protocols, such as Ethernet (both wired and wireless), all the most popular upper-level networking protocols can be built-in. The most popular of these protocols is TCP/IP (used to connect to the Internet). Other protocols, such as IPX (for Novell networks) and X.25 (a packet-switching network type that is popular in Europe), are also available.
- **Network servers** — Providing networking services to the client computers on the LAN or to the entire Internet is what Linux does best. A variety of software packages are available that enable you to use Linux as a print server, file server, FTP server, mail server, Web server, news server, or workgroup (DHCP or NIS) server.

To make a Linux distribution useful, components need to be added on top of the Linux kernel. For humans to access a Linux system, they can enter commands to a shell or use graphical interfaces to open menus, windows, and icons. Then you need actual applications to run. In particular, a useful Linux desktop system includes the following:

- **Graphical user interface (X Window System)** — The powerful framework for working with graphical applications in Linux is referred to as the X Window System (or simply X). X handles the functions of opening X-based graphical user interface (GUI) applications and displaying them on an X server process (the process that manages your screen, mouse, and keyboard).

  On top of X, you use an X-based desktop environment to provide a desktop metaphor and window manager to provide the look-and-feel of your GUI (icons, window frames, menus, and colors, or a combination of those items called *themes*). There are a few

desktop environments and and even more desktop managers to choose from. (Fedora and RHEL focus on the GNOME and KDE desktop environments, but also have several other desktop environments and window managers available.)

- **Application support** — Because of compatibility with POSIX and several different application programming interfaces (APIs), a wide range of free and open source software is available for Linux systems. Compatibility with the GNU C libraries is a major reason for the wide-ranging application support. Often, making an open source application available to a particular version of Linux can be done by simply recompiling the source code to run on that Linux version.

Primary Advantages of Linux

When compared to different commercially available operating systems, Linux's best assets are its price, its reliability, and the freedom it gives you. With the latest 2.6 Linux kernel, you can also argue that scalability is one of its greatest assets. The reliability of Linux includes its built-in security features and architecture, both of which make Linux much more secure than Windows.

Most people know that its initial price is free (or at least under $50 when it comes in a box or with a book). However, when people talk about Linux's affordability, they are usually thinking of its total cost, which includes no (or low) licensing fees, the ability to reuse any of the code as you choose, and the capability of using inexpensive hardware and compatible free add-on applications. Although commercial operating systems tend to encourage upgrading to more powerful hardware, Linux doesn't require that (although faster hardware and larger disks are nice to have).

In terms of reliability, the general consensus is that Linux is comparable to many commercial UNIX systems but more reliable than most desktop-oriented operating systems. This is especially true if you rely on your computer system to stay up because it is a Web server or a file server. (You don't have to reboot every time you change something, unless you've replaced the kernel itself.)

This reliability also extends into the realm of safety. While there have been exploits aimed at Linux software, Linux users are for the most part safe from the culture of malware and viruses that plague Windows users. With so many people peering at the Linux source code, a benefit of its freedom, mistakes are often fixed in record time. Large-scale Linux deployments don't need to install anti-virus software, a situation you would never allow with Windows in a corporate setting. Furthermore, when people install anti-virus software on Linux, it is usually to scan files and e-mail messages for Windows viruses, to help the distraught users of Windows.

Because you can get the source code, you are free to change any part of the Linux system, along with any open source software that comes with it, in any way that you choose. Unlike many self-contained commercial products, open source software tends to be built in pieces that

are meant to interact with other pieces, so you are free to mix and match components to suit your tastes. As I mentioned earlier, Linux is a culture that encourages interoperability. For example, if you don't like a window manager, you can plug in a different one because so many were built to operate within the same framework.

Another advantage of using Linux is that help is always available on the Internet. There is probably someone out there in a Linux newsgroup or mailing list willing to help you get around your problem. Because the source code is available, if you need something fixed you can even patch the code yourself! On the other hand, I've seen commercial operating system vendors sit on reported problems for months without fixing them. Remember that the culture of Linux is one that thrives on people helping other people.

What Are Red Hat Enterprise Linux and Fedora?

Having directories of source code floating extraneously around the Internet was not a bad way for hackers to share software. However, for Linux to be acceptable to a less technical population of computer users, it needed to be simple to install and use. Likewise, businesses that were thinking about committing their mission-critical applications to a computer system would want to know that this system had been carefully tested and well supported.

To those ends, several companies and organizations began gathering and packaging Linux software together into usable forms called *distributions.* The main goal of a Linux distribution is to make the hundreds (or even thousands) of unrelated software packages that make up Linux work together as a cohesive whole. Popular Linux distributions include Debian, Ubuntu, openSUSE, SUSE Linux Enterprise, Slackware, Damn Small Linux, Gentoo, and Mandriva. For many years, the most popular commercial distribution was Red Hat Linux.

In September 2003, Red Hat, Inc. changed its way of doing business. That change resulted in the formation of the Red Hat–sponsored Fedora Project to take the development of Red Hat Linux technology into the future. But what does that mean to individuals and businesses that have come to rely on Red Hat Linux?

Red Hat forms the Fedora Project

With the latest Fedora and Red Hat Enterprise Linux distributions, the promises Red Hat made to the open source community and to Red Hat's commercial customers have begun to solidify. The Red Hat Enterprise Linux product offering is looking like a solid, reliable system for mass deployment of Linux in large organizations. With the Fedora Project merging its Fedora Core and Fedora Extras repositories, a massive number of high-quality software packages is available to Fedora users.

A few years ago, things didn't look so rosy.

The announcement of the Fedora Project by Red Hat, Inc. at first prompted more questions than answers about the future direction of the company and its flagship Red Hat Linux product. In fact, it seemed that nothing named Red Hat Linux even existed anymore. Instead, what *was* Red Hat Linux would be reflected by Linux distributions coming from two paths:

- **Fedora Project** (`http://www.fedoraproject.org`) — An open source project, beginning from a Red Hat Linux 9 base, that produces its own Linux distribution. While the project is sponsored by Red Hat, Inc., there is no official support for the Linux distribution (simply called Fedora) that the project produces.
- **Red Hat Enterprise Linux** (`http://www.redhat.com/rhel`) — An official set of commercial Linux products from Red Hat, Inc. that are offered on an annual subscription basis. Red Hat backs up its Enterprise product line with technical support, training, and documentation.

The primary results of the Fedora Project are sets of binary and source code packages (distributed as DVD or CD images) containing the Linux distribution referred to as Fedora. Before its name was changed to Fedora, that distribution was being tested simply as the next in the series of Red Hat Linux distributions (presumably, Red Hat Linux 10). The software packages included on the DVD and CD that come with this book are distributed as the official tenth release of that software: Fedora 10.

The name change from Red Hat Linux to Fedora Core (and later to just Fedora) wasn't the only difference between Fedora and Red Hat Enterprise Linux, however. Red Hat, Inc. also changed its association with Fedora in the following ways:

- **No boxed sets** — Red Hat decided to not sell Fedora through retail channels. The ever-shortening release cycle was making it difficult to manage the flow of boxed sets to and from retail channels every few months, and Red Hat believed that early adopters of Linux technology were clever enough to get the software themselves.
- **Short guaranteed update cycle** — Critical fixes and security patches will be available for each Fedora release for a much shorter period of time than on RHEL products. As a result, users will have to upgrade or reinstall the system more often.
- **No technical support offerings** — There are no technical support programs available from Red Hat for Fedora. Even so, by sponsoring the Fedora project, you get a form of free support as Red Hat staffers fix bugs and integrate the latest Linux technology.
- **No Red Hat documentation** — The set of manuals that came with the previous Red Hat Linux product was not brought over to Fedora. Instead, a series of small task-oriented documents are being collected for the project in article format. The Fedora Documentation project (`http://fedoraproject.org/wiki/DocsProject`) is, however, following a path to release Red Hat documentation under an open source licence so that the Fedora Project can develop and distribute that documentation.

By not creating a whole support industry around Fedora, that project is free to produce software release on a much shorter schedule (usually a six-month release cycle). This allows Fedora users to always have the latest software features and fixes included with a recent version of the operating system. But the Fedora Project is more than just the Fedora Linux release. It is really a collection of projects (`http://fedoraproject.org/wiki/Projects`) that also includes the following:

- **One Laptop Per Child (OLPC)** — The Fedora Project is working with Red Hat, Inc. and the OLPC project (`http://www.laptop.org`) to provide laptops to children around the world. Fedora software is being used as the foundation for the software part of OLPC.
- **Fedora Ambassadors and Marketing** — Focuses on spreading the word about Fedora to the world. Ambassadors have been assigned to different parts of the U.S. and to countries around the world to represent Fedora to their areas. The marketing project is helping to encourage presentations, developer conferences, and other initiatives to publicize Fedora.
- **Fedora Live CD Tools** — The Fedora Live CD initiative centers on a set of tools under the name livecd-creator. Using livecd-creator, the Fedora Project produces its own official Fedora live CDs. A live CD provides a means of running a Linux system on a computer without installing it to hard disk. It offers a great way to try out Fedora without disturbing anything installed on your hard disk. Because livecd-creator is itself an open source project, you can use the tools to create your own live CDs. Many advances to the live CD technology have occurred in this release of Fedora, including liveUSB versions and integration with kickstart files.
- **Fedora Artwork** — Creates the graphics used with Fedora (backgrounds, logos, login screens, and so on), primarily using tools that are distributed with Fedora.
- **Fedora Documentation** — Besides seeking to release Red Hat documentation under an open source license and maintaining it publicly with the Fedora Project, the Fedora Documentation Project is pursuing other initiatives. Those include assigning beat writers (to cover various software topics) and editors (to clean up and manage documentation contributions).

For information on the status of these and other Fedora projects, you can refer to the Fedora Weekly News (`http://fedoraproject.org/wiki/FWN`). If you are interested in contributing to any of the Fedora projects, the Fedora Projects page mentioned earlier is a good place to start. The Fedora Engineering Steering Committee (FESCo) provides oversight and guidelines for which projects to accept into Fedora. See `http://fedoraproject.org/wiki/Development/SteeringCommittee` for more on FESCo.

Third-party repositories for Fedora containing software packages that Red Hat won't distribute due to licensing or patent issues have also grown and stabilized lately. (See the descriptions of software repositories in Chapter 5.)

As the end-user forum of choice for Fedora users, Red Hat has endorsed the FedoraForum.org (`http://www.fedoraforum.org`) site. That site already has more than 118,000 members and over 1,300,000 posts you can search for answers to your questions.

Red Hat shifts to Red Hat Enterprise Linux

The major shift of attention to Red Hat Enterprise Linux as the focus of Red Hat, Inc.'s commercial efforts has been on the horizon for some time. Some characteristics of Red Hat Enterprise Linux are:

- **Longer release intervals** — Instead of offering releases every 6 months or so, Enterprise software has closer to an 18-month update cycle. Customers can be assured of a longer support cycle without having to upgrade to a later release.
- **Multiple support options** — Customers will have the choice of purchasing different levels of support. All subscriptions will include the Update Module, which allows easy access to updates for Red Hat Enterprise Linux systems. The Management Module lets customers develop custom channels and automate management of multiple systems. The Monitoring Module allows customers to monitor and maintain an entire infrastructure of systems.
- **Documentation and training** — Manuals and training courses will center on the Red Hat Enterprise Linux distribution.

Red Hat Enterprise Linux products include offerings for both server and desktop operating systems. The base RHEL server system is designed for small server deployment, while RHEL Advanced Platform aims at large installations that can benefit from features such as storage virtualization and high-availability clustering. Standard desktop and workstation versions of RHEL Desktop are available.

Each system in the Red Hat Enterprise Linux family is meant to be compatible with the others. There are Basic, Standard, and Premium editions of these Enterprise systems. While Basic offers only software downloads, standard and premium editions offer hard copy documentation and additional technical support.

For a detailed look at RHEL product features, see Appendix C.

Choosing between Fedora and Enterprise

If you bought this book to try out Linux for the first time, rest assured that what you have on the DVD and CDs with this book is a solid, battle-tested operating system. There is still a lot of overlap between Fedora and Red Hat Enterprise Linux. However, many of the newest features of Fedora 10 provide a way to test out much of the software that is slated to go in later editions of Red Hat Enterprise Linux.

Although Fedora may not be right for everyone, Fedora is great for students, home users, most small businesses, and anyone just wanting to try out the latest Linux technology. Larger businesses should seriously consider the implications on support, training, and future upgrade paths before choosing whether to go the Fedora route or sign on with Red Hat Enterprise Linux. Also, businesses should be willing to deal with more frequent upgrades, because release and support cycles are much shorter with Fedora than with RHEL.

Despite its lack of formal support, however, Fedora is being used today in many businesses, schools, and homes around the world. In whatever way you plan to ultimately use Fedora, it is without a doubt a good way to learn and use the latest Linux technology as it is released to the Linux community and before it makes its way to Red Hat Enterprise Linux.

Many companies and organizations don't choose between Fedora and RHEL, but instead offer a mixed environment. The most critical servers may run Red Hat Enterprise Linux, with a full support contract with Red Hat. In the same location, Fedora may be used for desktop systems or office print and file servers. Organizations that want the stability of RHEL without the cost can use CentOS (which is a rebuild of RHEL code). As someone learning to use Fedora with this book, you can likewise scale your use of this technology as far as you want to go.

Why Choose Fedora or Red Hat Enterprise Linux?

To distinguish itself from other versions of Linux, each distribution adds some extra features. Because many power features included in most Linux distributions come from established open source projects (such as Apache, Samba, KDE, and so on), often enhancements for a particular distribution exist to make it easier to install, configure, and use Linux. Also, because there are different software packages available to do the same jobs (such as window managers or a particular server type), a distribution can distinguish itself by which packages it chooses to include and feature with its default installations.

Fedora is continuing the Red Hat Linux tradition by offering many features that set it apart from other Linux distributions. Those features include:

- **Cutting-edge Linux technology** — In Fedora 10, major features include the KDE 4 Desktop, Firefox 3, OpenOffice.org 3, new Ext4 file system support, and the latest Linux kernel.
- **Software packaging** — Red Hat, Inc. created the RPM Package Management (RPM) method of packaging Linux. RPMs allow less technically savvy users to easily install, search, manage, and verify Linux software. With RPM tools, you can install from CD, hard disk, over your LAN, or over the Internet. It's easy to track which packages are installed or to look at the contents of a package. Because RPM is available to the Linux community it has become one of the de facto standards for packaging Linux software.

  Tools such as yum and PackageKit, which are built to take advantage of RPM technology, have been added to Fedora to extend your ability to install and update packages. Those tools can point to online repositories, so the latest software packages are often only a click away.

CROSS-REFERENCE: Chapter 5 describes how to install RPM packages and use yum repositories.

- **Easy installation** — The Fedora installation software (called *anaconda*) provides easy steps for installing Linux. During installation, anaconda also helps you take the first few steps toward configuring Linux. You can choose which packages to install and how to

partition your hard disk. You can even get your desktop GUI ready to go by configuring user accounts, keyboard, mouse and even your network connection. With Fedora 10, you can install directly from a running live CD, or choose from several different install-only media.

CROSS-REFERENCE: Chapter 2 covers Fedora installation.

- **UNIX System V–style run-level scripts** — To have your system services (daemon processes) start up and shut down in an organized way, Fedora and RHEL support the UNIX System V mechanism for starting and stopping services. Shell scripts (that are easy to read and change) are contained in subdirectories of `/etc`. When the run level changes, such as when the system boots up or you change to single-user mode, messages tell you whether each service started correctly or failed to execute properly. Chapter 12 describes how to use runlevel scripts and how these services are evolving away from System V scripts
- **Desktop environments (GNOME and KDE)** — To make it easier to use Linux, Fedora and RHEL come packaged with the GNOME and KDE desktop environments. GNOME is installed by default and offers some nice features that include drag-and-drop protocols and tools for configuring the desktop look and feel. KDE is another popular desktop manager that includes a wide range of tools tailored for the KDE environment, such as the Konqueror Web browser. You can try out separate Fedora live CDs for GNOME and KDE, and then install software from those CDs directly to your hard disk. (This book includes the KDE live CD.)
- **GUI Administration tools** — There are some helpful configuration tools for setting up some of the trickier tasks in Linux. Several different GUI tools provide a graphical, form-driven interface for configuring networking, users, file systems, security and initialization services. Instead of creating obtuse command lines or having to create tricky configuration files, these graphical tools can set up those files automatically.

NOTE: There are advantages and disadvantages of using a GUI-based program to manipulate text-based configuration files. GUI-based configuration tools can lead you through a setup procedure and error-check the information you enter. However, some features can't be accessed through the GUI, and if something goes wrong, it can be trickier to debug. With Linux, you have the command-line options available as well as the GUI administration tools.

- **Testing** — The exact configuration that you get on the Fedora or RHEL distribution has been thoroughly tested by experts around the world. Because Fedora is now represented by a single huge software repository, the most intensely tested software will be that which is offered in official CD and DVD versions of Fedora.
- **Automatic updates** — The software packages that make up Fedora are constantly being fixed in various ways. To provide a mechanism for the automatic selection, download, and installation of updated software packages, Fedora and RHEL rely primarily on the yum facility.

With the addition of yum software repositories on the Internet that include Fedora packages, whole sets of RPM software packages can be updated with a single `yum update` command. The PackageKit facility provides graphical tools with Fedora to install from multiple software repositories on the Internet (as opposed to local CD or DVD media A desktop applet automatically alerts you when updated packages are available to download and install. See Chapter 5 for descriptions of these tools.

New Features in Fedora 10

When it comes to versions of different software projects that come with Fedora, the major components in Fedora 10 include (with version numbers):

- Linux kernel: version 2.6.27
- GNOME (desktop environment): version 2.24
- KDE (desktop environment): version 4.1.2
- X Window System (X.org graphical windowing system): version 11, Release 1.5
- OpenOffice.org (office suite): version 3
- GIMP (image manipulation application): version 2.6.1
- GCC (GNU C language compilation system): version 4.3.2
- Apache (Web server): version 2.2.9
- Samba (Windows SMB file/printer sharing): version 3.2.4
- CUPS (print services): version 1.3.9
- Sendmail (mail transport agent): version 8.14.3
- vsFTPd (secure FTP server): version 2.0.7
- INN (Usenet news server): version 2.4.5
- MySQL (database server): version 5.0.67
- BIND (Domain name system server): version 9.5.1

TIP: These features are constantly being updated. Fedora ships with tools to help keep your system up to date with the latest versions of software.

The following sections describe major new features of Fedora 10 (besides the latest versions of those basic components just named).

Better Printing

In a major revamp aimed at making life easier, the system-config-printer user interface got a dramatic overhaul. The goal is to make it easier to set up and manage your printers. In

addition, you no longer need to be the root user to modify printers. Printing has long been an area where Linux was difficult to use. The revamped system configuration will help.

FirstAidKit

This project consolidates a number of system recovery tools into one framework and application. The goal is that if your system shows problems, you can just run the FirstAidKit and it will do what is necessary to fix your system. FirstAidKit does this by supporting plug-ins. Each plug-in diagnoses and fixes a different part of your system. In Fedora 10, the FirstAidKit ships with three plug-ins. Many more are under development.

OpenOffice.org 3

OpenOffice.org 3.0 provides a major upgrade to the previous 2.4 versions of this office suite. OpenOffice.org was designed as a drop-in replacement for Microsoft Office. Major improvements in OpenOffice.org 3.0 include support for Microsoft Office 2007 file formats, a numeric solver, and support for 1024 columns per sheet (up from 256) in the spreadsheet package, called Calc. See Chapter 6 for more detail on OpenOffice.org.

Faster Boot Times

No one likes to wait for their computer to boot up. And, even though Linux systems tend to boot faster than Windows boxes, the time can certainly be improved. A Fedora project called 30-second boot aims at providing just that: a maximum of 30 seconds for booting your computer, from power up to the login screen. Another effort in Fedora 10 provides a better-looking boot screen and improves the overall system boot experience.

K Desktop Environment (KDE) 4

KDE 4 marks a major revision of the popular desktop environment. The new Plasma desktop shell provides a framework for KDE 4 enhancements. With Plasma, you get a new look-and-feel, new ways of finding applications, files and URLs, and new "widget" technology that lets you run the same mini-applications on the desktop or on panels.

The Dolphin File Manager was added to provide a more streamlined tool for managing files and folders for daily use. Desktop configuration features are now available on a new System Settings window. For details on using the new KDE 4 desktop, refer to Chapter 3.

To let you immediately try out KDE 4, we have included the Fedora 10 KDE desktop live CD. You can boot that live CD directly to a KDE 4 desktop system, then, if you choose, you can install that desktop system directly to your hard disk if you choose.

PackageKit Software Management

Starting in Fedora 9, PackageKit became the default GUI package for managing software updates and adding software packages. It is a community-developed software management

system that has replaced the Red Hat-developed Package Updater (`pup`) and Package Manager (`pirut`) applications.

With PackageKit, an icon in the top panel alerts you when software updates are available. Or you can use the PackageKit Package Manager for GNOME to search for and install additional packages. PackageKit is described in Chapter 5.

Firefox 3 Web browser

This new major release of Firefox Web browser offers improvements in security, ease-of-use, personalization and performance. There is one-click access to a site's security information (via a favicon in the location bar) when a site uses Extended Validation (EV) SSL certificates. With EV SSL certificates, certificate authorities validate that the site you are visiting is the one it claims to be. Password information bars replace the previous password dialog.

For personalization, bookmarks have improved by letting you add tags to them so they can be sorted by topic. You can use smart bookmarks to immediately access bookmarks that were recently tagged or created. In the location bar, auto-completion is improved to display frequent and recently visited locations as you type a URL.

Preupgrade

A new preupgrade feature lets you install and run a preupgrade application that prepares a Fedora 9 system to be upgraded to Fedora 10. This feature lets you do much of the time-consuming package download and dependency checking that takes place during upgrades while you are still using the existing system. Preupgrade is described in Chapter 2. While you can run preupgrade starting with Fedora 8.1, I recommend upgrading fully to Fedora 9 before trying to use preupgrade.

Ext4 file systems

Support was added so that Fedora can handle the new ext4 file system type. The ext4 file system was designed to provide better performance and scalability than ext3 systems. While there should be no differences in how people use ext4 file systems, a set of tools for creating, checking and maintaining ext4 file systems is included with Fedora 10.

Encrypted file systems

Using the cryptsetup and LUKS features in Fedora 10, you can encrypt file systems other than your root (`/`) or `/boot` partitions. Encrypted file systems can be particularly important to secure your data on laptop systems.

Identity management with freeIPA

The freeIPA framework for managing identity, policy, and audit features across an enterprise has been added to Fedora Linux. The long-term goal of freeIPA is to provide an open source mechanism for centrally maintaining these critical security and monitoring features. Chapter 14 contains a description of freeIPA.

NetworkManager

To simplify the process of setting up connections to wired and wireless networks, NetworkManager is providing continued improvements. In Fedora 10, it is the default method of connecting to and managing wired and wireless networks interfaces.

Getting custom Fedora spins

Fedora used to be released as a set of CDs or a DVD containing all the Fedora packages that could be installed from those media. The results of new tools first added in Fedora 7 for creating custom software repositories (Pungi) and custom live CDs (livecd-creator) have continued to improve in the form of a growing set of *custom spins*.

A custom spin of Fedora is a CD, DVD, or USB flash drive image that can be run as a live CD and/or Fedora installer. Official Fedora spins include:

- **Fedora DVD** — Contains almost 4GB with a cross-section of desktop, server, and software development software packages that you can install to hard disk. The contents of this disk are similar to what used to be in Fedora Core.
- **Fedora CD Set** — This six-CD set contains everything from the Fedora install DVD. This is for those who don't have a DVD drive on their computer.
- **Fedora Desktop Live CD (GNOME)** — From this single, 700MB live CD you can run a GNOME desktop Fedora 10 system. An install icon on the desktop then lets you install that desktop system to your hard disk.
- **Fedora Desktop Live CD (KDE)** — Fedora is showing KDE some love by offering a KDE desktop live/install CD of Fedora 10. As with the GNOME desktop, you can select the install icon to install the KDE desktop system to your hard disk. (This CD is included with this book.)
- **Everything DVD Set** — An "Everything" 2-DVD set containing the entire Fedora 10 repository (about 11GB) is expected to be produced shortly after Fedora 10 is released. This set is for people who want every installable software package with Fedora 10. (The DVD that comes with this book contains most of the contents of the two Everything DVDs, respun onto a high-capacity DVD-9.)

The KDE desktop CD and Nearly-Everything DVD included with this book are for standard 32-bit PCs (i386). If you need media to install Fedora on PowerPC (PPC) or 64-bit PC (X86_64) computer architectures, you can download ISO images for those media either using either Bittorrent (`http://spins.fedoraproject.org`) or an official Fedora public mirror site (`http://mirrors.fedoraproject.org`). Refer to Chapter 2 for information on using and installing Fedora from these different media.

Unofficial custom spins are also available from the Custom Spins page (`http://fedoraproject.org/wiki/CustomSpins`). So far there are already Fedora Live Developer, Games, Art, Xfce Desktop, and Electronic Lab spins. (The term *spin* means a

compilation of software from the Fedora software repository, combined into the form of one or more bootable images (typically to fit on a CD or DVD), that lets you either run live or install that set of software.)

Creating your own spins

The same tools that the Fedora Project uses to build packages and create live CDs and installation CDs are themselves distributed with Fedora. That means that anyone can use those tools to create their own installation package sets, and then turn those package sets into their own repositories. Using those repositories, you could then create your own CD or DVD images to later install or run live.

Pungi (`http://hosted.fedoraproject.org/projects/pungi`) is the project created for Fedora to build the Fedora system itself. The pungi package contains the `pungi` command and related configuration files. You can use the `pungi` command to fashion your own installation trees that result in installable ISO images.

The Fedora Live CD project (`http://fedoraproject.org/wiki/FedoraLiveCD`) has produced tools for building your own live CDs from Fedora software repositories. The primary tool for creating those live CDs is called livecd-creator. Refer to the Live CD HOWTO (`http://fedoraproject.org/wiki/FedoraLiveCD/LiveCDHowTo`) for information on using livecd-creator.

A nice recent addition to livecd-creator for Fedora is that you can create kickstart files (described in Chapter 2) to direct the creation of live CDs. This means that the same format you use to automate installs with anaconda can be used to save the package list and other settings you use to create your live CDs.

Firewall Configuration

The Firewall Configuration window was enhanced to provide several features that previously needed to be added manually to your iptables firewall. In particular, you can identify selected ports to do port forwarding (for example, if you wanted to have a Web server on a private address behind your firewall). You can also indicate which ICMP types you support, such as the commonly used echo request (`ping`) and echo reply (`pong`).

The Culture of Free Software

I would be remiss to not say something about the culture of free software development from which Linux has thrived and will continue to thrive. The copyright for Fedora and Red Hat Enterprise Linux systems is covered primarily under the GNU public license. That license, which most free software falls under, provides the following:

- **Author rights** — The original author retains the rights to his or her software.
- **Free distribution** — People can use the GNU software in their own software, changing and redistributing it as they please. They do, however, have to include the source code with their distribution (or make it easily available).
- **Copyright maintained** — Even if you were to repackage and resell the software, the original GNU agreement must be maintained with the software. This means that all

future recipients of the software must have the opportunity to change the source code, just as you did.

It is important to remember that there is no warranty on GNU software. If something goes wrong, the original developer of the software has no obligation to fix the problem. However, the Linux culture has provided resources for that event. Experts on the Internet can help you iron out your problems, or you can access one of the many Linux newsgroups or forums to read how others have dealt with their problems and to post your own questions about how to fix yours. Chances are that someone will know what to do — maybe even going so far as to provide the software or configuration file you need.

If you need reliable support for your Linux system, commercial Linux support is available from a variety of companies. Also, many of the software projects that go into Linux offer their own support features, which let you get help directly from those who are building the code.

NOTE: The GNU project uses the term *free software* to describe the software that is covered by the GNU license. Many Linux proponents tend to use the term *open source software* to describe software. Although source code availability is part of the GNU license, the GNU project claims that software defined as open source is not the same as free software because it can encompass semi-free programs and even some proprietary programs. See `http://www.opensource.org` for a description of open-source software.

Summary

Linux is a free computer operating system that was created by Linus Torvalds in 1991 and has grown from contributions from software developers all over the world. Fedora and Red Hat Enterprise versions of Red Hat Linux are distributions of Linux that package together the software needed to run Linux and make it easier to install and use.

This book specifically describes Fedora 10, a complete version of which is included on the DVD that comes with this book, as well as Red Hat Enterprise Linux 5. Fedora includes cutting-edge Linux technology that is slated for inclusion in commercial Red Hat Linux systems. Features in Fedora 10 include the recent Online Desktop feature, PulseAudio sound server, and an enhanced Firewall Configuration window. You can get different “spins” of Fedora (both live and install CDs) from the Internet or from distributions that come with books such as this one.

Linux is based on a culture of free exchange of software. Linux’s roots are based in the UNIX operating system. UNIX provided most of the framework that was used to create Linux. That framework came from the POSIX standard, the System V Interface Definition, and the Berkeley Software Distribution, pieces of which have all found their way into Linux. Now the Linux Standard Base creates the standards to provide consistency among Linux distributions.