Chapter 1

An Overview of Fedora and Red Hat Enterprise Linux

In This Chapter

- Introducing Fedora and RHEL
- What is Linux?
- Linux's roots in UNIX
- Common Linux features
- Primary advantages of Linux
- What is Fedora?
- Why choose Fedora?
- The culture of free software

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 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 includes stable, tested software (mostly the same software in Fedora Core 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 Core has, itself, 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 Core is a great way to get a head start learning the features of upcoming RHEL releases. The complete Fedora operating system (referred to as Fedora Core 5) is included on the DVD that comes with this book. The two CDs you get include a Fedora Core Live CD (which doubles as a network install CD) and a Fedora Extras CD (containing hundreds of extra software packages).

Introducing Fedora Core 5 and Red Hat Enterprise Linux 4

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

Technical people have chosen Red Hat 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 Red Hat Linux that would be beyond the resources of Red Hat, Inc. to test and maintain on its own.

Over 2200 individual software packages (compared to just over 600 in Red Hat Linux 6.2) are included in Fedora Core 5. These packages contain features that would cost you hundreds or 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 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 open source 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 software effort (GNU stands for "GNU is Not UNIX"), which is directed by the Free Software Foundation (`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 groups to help interoperability among Linux systems, including the Linux Standard Base Project (`www.linuxbase.org`).

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 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 (Disk Operating System) 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 (`www.unix.org`). Much of the direction of Linux today comes from the Open Source Development Labs (`www.osdl.org`), which includes Linus Torvalds on its staff and whose members include most of the major commercial vendors, and the Linux Standard Base (`www.linuxbase.org`), which coordinates compatibility among Linux distributions.

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*.

- **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 several desktop environments and several desktop managers to choose from. (Fedora and RHEL focus on the GNOME and KDE desktop environments, but make several other desktop environments and window managers available in Fedora Extras.)

- **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 pen 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.

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 my 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.

- **Application support** — Because of compatibility with POSIX and several different application programming interfaces (APIs), a wide range of freeware and shareware software is available for Linux. Most GNU software from the Free Software Foundation will run in Linux (although some may take a bit of tweaking).

> **NOTE:** Because of the popularity of the RPM Package Management (RPM) format for packaging software, many software packages are available on the Internet in RPM format. If the RPM version matches your Linux distribution and processor type (most have i386 and or i686 versions available), you can install the package without building and compiling the package. In fact, there are major software repositories that include software packaged specifically for the latest Fedora distribution. See Chapter 5 for information on working with RPM packages.

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.

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 later 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.)

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 software packages 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, SUSE, Slackware, Gentoo, and Mandrake. 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 Fedora Core 5 and Red Hat Enterprise Linux 4, the promises Red Hat made to the open source community and to Red Hat's commercial customers have finally begun to solidify. The Fedora Extras project has made excellent inroads in providing ready-to-run RPMs of software that didn't make it into Fedora Core. Red Hat Enterprise Linux product offering is looking like a solid, reliable system for mass deployment of Linux in large organizations.

A year or two 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://fedora.redhat.com` and `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 (called Fedora Core) that the project produces.

- **Red Hat Enterprise Linux** (`www.redhat.com/software/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 result of the Fedora Project are sets of binary and source code packages (distributed on DVD or CDs) containing the Linux distribution referred to as Fedora Core.

Before its name was changed to Fedora Core 1, that distribution was being tested simply as the next in the series of Red Hat Linux distributions (presumably, Red Hat Linux 10). The complete set of binary and source code included on the DVD that comes with this book are distributed as the official fifth release of that software: Fedora Core 5.

The name change from Red Hat Linux to Fedora Core wasn't the only difference between Fedora and Red Hat Enterprise Linux, however. Red Hat, Inc. also changed its association with Fedora Core 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.

- **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 (possibly two or three times per year, but so far only one every six to nine months). 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 Fedora Core. It is really a collection of projects that also includes the following:

- **Fedora Extras** — Provides packaging guidelines, suggestions, policies, mailing lists and other resources to help developers contribute RPM packages for a wide range of open source software to Fedora Extras repositories. At the moment, there are more than 1,600 packages in Fedora Extras (and the list is growing).

- **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 (Kadischi)** — The Fedora live CD initiative centers on a set of tools under the name Kadischi. Rather than being a live CD distribution itself, Kadischi

incorporates the Fedora anaconda installer into a procedure for producing customized live CDs of Fedora. 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 withouth disturbing anything installed on your hard disk.

- **Fedora Documentation** — Besides seeking to release Red Hat documentation under an open source licence 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 Projects Reports (`http://fedoraproject.org/wiki/Projects`). If you are interested in contributing to any of the Fedora projects, the Weekly Projects Reports page is a good place to start.

Another potential upside to Fedora is that the Fedora Project hopes to encourage community software developers to create compatible software. By including software download and installation tools (such as the yum utility) in Fedora Core, the Fedora Project hopes to encourage people to contribute to software repositories that Fedora users can rely on to download additional software packages.

In the past few months, there has been an extraordinary upsurge of software being made available to run on Fedora. Officially sanctioned software packages that don't make it into Fedora Core are being added to software repositories called Fedora Extras. Third-party repositories for Fedora Core 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.)

In the area of support, Red Hat has endorsed the `FedoraForum.org` site as the end-user forum of choice for Fedora users. That site already has more than 30,000 members and over 300,000 posts you can search for answers to your questions. As for the Fedora Project itself, it is currently transitioning from `http://fedora.redhat.com` to `Fedoraproject.org` as the official Fedora Project site.

Just as Fedora Core 4 was being released in June 2005, Red Hat announced its intention to free the Fedora Project from Red Hat's direct control. Near the end of that year, the Fedora Foundation was established as a 501(c)3 nonprofit organization. Over time, it is expected that a board made up of Red Hat and non-Red Hat people will steer the future direction of the Fedora Project.

Red Hat shifts to 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 will have 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 install types focus on three different types of computer systems, referred to as WS (for workstations), AS (for high-end systems), and ES (for small and mid-range servers). Red Hat has also recently released a new Red Hat Desktop product targeted for wide-scale desktop deployments.

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 Core and Red Hat Enterprise Linux. However, many of the newest features of Fedora Core 5 provide a way to test out much of the software that is slated to go in Red Hat Enterprise Linux 5 editions.

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. Despite its lack of formal support, however, Fedora Core 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 learn and use the latest Linux technology before it makes its way to Red Hat Enterprise Linux.

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.

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 Core 5, major features include the latest Linux 2.6 kernel, Security Enhanced Linux, and X server from X.Org. New features for managing Global File Systems (GFS) and clusters were added to Fedora to be shaken out for RHEL. You can get your hands on the latest of those and many other new Linux features before they go into commercial Linux products.

- **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 Package Updater, 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 process (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 your video card, user accounts, and even your network connection.

> **CROSS-REFERENCE:** Chapter 2 covers Fedora Core 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 use 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.

- **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 KDE Control Center for configuring the desktop.

- **Desktop look-and-feel** — With the latest Fedora release, Fedora Core is establishing a strong visual representation that includes the new Fedora logo on screensavers, backgrounds, login screens, and other desktop elements.

- **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. (Prior to Fedora Core 2, many of these GUI administration tools were launched from commands that began with `redhat-config-*`. Now, those commands have been renamed to start with `system-config-*`.)

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. The simple fact that a software package is included in Fedora Core or other Red Hat Linux distributions is an indication that Red Hat and the community that supports Fedora and RHEL believe it has achieved a certain level of quality. By opening testing of early versions of Fedora to the open source community, many more bugs have been uncovered and fixed than might otherwise have been the case.

- **Automatic updates** — The software packages that make up Fedora Core are constantly being fixed in various ways. To provide a mechanism for the automatic selection, download, and installation of updated software packages, Red Hat created several different facilities.

For officially supported Red Hat Enterprise Linux distributions, the Red Hat Network provides a focal point for software updates. Using the `up2date` command, as an RHEL user you can receive critical security fixes and patches very simply over the Internet.

With the addition of yum software repositories on the Internet that include Fedora Core packages, whole sets of RPM software packages can be updated with a single `yum update` command. In Fedora Core 5, a new Package Manager window and Package Updater (Pup) window provide the first graphical tools with Fedora to install from software repositories on the Internet (as opposed to local CD or DVD media). Pup, in particular, can be used to easily get the latest software enhancements and fixes. See Chapter 5 for descriptions of these tools.

New Features in Fedora Core 5

The major components in Fedora Core 5 include (with version numbers):

- Linux kernel: version 2.6.15 — This reflects a major upgrade over the 2.4.22 kernel included in Fedora Core 1 and a more stable kernel than the 2.6.11 kernel included with Fedora Core 4.
- GNOME (desktop environment): version 2.14
- KDE (desktop environment): version 3.5
- X Window System (X.org graphical windowing system): version 7 (X11R7.0)
- OpenOffice.org (office suite): version 2.0
- GCC (GNU C language compilation system): version 4.1
- Apache (Web server): version 2.2
- Samba (Windows SMB file/printer sharing): version 3.0.21b
- CUPS (print services): version 1.1.23
- Sendmail (mail transport agent): version 8.13.5
- vsFTPd (secure FTP server): version 2.0.4
- INN (Usenet news server): version 2.4.2
- MySQL (database server): version 5.0 (represents a major upgrade)
- BIND (Domain name system server): version 9.3.2

> **TIP:** If you want the latest features in Linux when looking at different Linux distributions, compare the version numbers shown above. Version numbers and names that Linux distributors such as Mandrake, SUSE, and Red Hat associate with their releases can be arbitrary. By comparing versions of the kernel, KDE and GNOME desktops, and GNU compiler they are using, you can tell which distribution actually has the latest features.

Fedora Extras

While not a new feature of Fedora Core itself, the tight integration of the Fedora Extras repository with Fedora Core, and greatly improved Extras packages (in number and quality), make it an excellent asset for Fedora Core. Also, as Fedora continues to consolidate its

distribution, some popular packages have been dropped from Fedora Core. Fedora Extras has become the place where many of these second-string software packages (such as extra word processors, Internet tools, and window managers) are finding new life.

Many of the packages dropped from Fedora Core have been added to the official Fedora Extras software repository. So, with yum configured as described in Chapter 5 and an Internet connection, installing abiword word processor is as easy as typing:

```
# yum install abiword
```

Finding and learning about packages in Fedora Extras has improved greatly as well. Fedora Extras software repositories enabled with the RepoView feature let you browse packages by category or alphabetically, then read descriptions of any packages you choose. An example of such a repository is available from the Fedoraproject.org:

```
http://fedoraproject.org/extras/5/i386/repodata/index.html
```

More than 1600 unique RPM packages are maintained by Fedora Extras for Fedora Core 5, with multiple versions of each package bringing the total to more than 3500 packages. Packages available from Fedora Extras for Fedora Core 5, such as WINE, audacity, freeciv, kipi-plugins, and others, are either described or noted throughout the book.

Desktop Features

The most obvious and striking new feature of the desktop for Fedora Core 5 is the new Fedora look-and-feel. The new logo, which includes an "f" (for freedom), an infinity sign (to represent unlimited potential), and a cartoon-like dialog balloon (indicating that people have a voice), is included on backgrounds, screensavers, login screens and other desktop elements.

The Fedora look-and-feel applies to both GNOME and KDE desktops. Other enhancements for Fedora Core 5 desktops apply specifically to those two environments.

GNOME Desktops

For GNOME 2.14 desktops, the GNOME Screensaver has replaced Xscreensaver as the default and the GNOME Power Manager replaces the Battery Charge Monitor. You may also notice subtle differences in the GNOME file manager (Nautilus), such as the ability to see files, and not just folders, in the tree view. Places and bookmarks can also be viewed from the Nautilus side panel.

On the GNOME panel, there is now a trash icon on the lower panel and the new System menu (which used to be called Desktop). Also, you will notice that new applications being opened will blink on the Window List in the panel, to indicate that they are ready for you to view.

Improvements to applications associated with GNOME desktops include changes to the Totem video player, Sound Juicer CD ripper, and Evolution e-mail and groupware client. Totem has a new look that includes a Playlist panel on the right side. Sound Juicer was enhanced to let you

extract audio tracks to removable USB devices and network servers (as well as hard disk). Changes to Evolution include a new menu layout and the ability to add memos to your calendars.

KDE Desktops

As with GNOME, look for subtle improvements for the KDE 3.5 desktop. For example, on the pager, you can now see icons representing tasks (on the KDE panel). You can also grab a task and drop it on any of your active desktops.

The KDE window manager (Konqueror) has added an ad-block feature and improved Web searching capability. From the new Konqueror search bar, you can click Select Search Engine and select from among nearly 100 search engines to use for Web searches.

Installing and Updating Packages

Some major enhancements have been made to software installation with improvements to the Fedora Core installer (anaconda) and Package Management window, and the addition of the Package Updater. In anaconda, partitioning has been improved, firewall configuration has moved out of anaconda to the firstboot program, and a feature was added to allow you to log installation messages to other computers using syslog.

Graphical tools for installing packages after initial installation, however, have seen the most dramatic improvements for Fedora Core 5. The Package Management window, which once only allowed you to install package from your installation CD/DVD, is now able to install from any Fedora software repositories you have configured (Core, Extras, or others). With the up2date feature no longer in Fedora Core, the Package Updater window lets you get listings of available software updates to your system, download from Fedora repositories, and install them on your system with just a few clicks.

Mono and Windows .NET Applications

Software needed to develop and run applications that were developed for Windows' .NET initiative has been created in a project called Mono (`www.mono-project.com`). In Fedora Core 5, the Fedora project has included more than a dozen mono packages needed to develop and run .NET applications in Fedora. Several nice applications that require mono are included with Fedora Core 5, such as the following:

- **F-Spot** — Import images from digital cameras, do basic manipulation (rotate, adjust color, attach tags, and so on), add them to albums, and play them in slide shows with F-Spot. (F-Spot is in the f-spot package and can be launched by selecting Applications → Graphics → F-Spot Photo Manager from the GNOME desktop.)

- **Tomboy** — Take desktop notes with Tomboy. Tomboy can relate notes together (as you would in a Wiki) and access them from a Tomboy applet on your GNOME desktop

panel. (Tomboy is in the tomboy package and can be started by adding the Tomboy Notes applet to your panel.)

- **Beagle** —Search your desktop computer for documents, images, applications or other content. (Beagle is in the beagle package and can be started by selecting Places → Search from the GNOME desktop.)

What is surprising and encouraging about including Mono support in Fedora Core is that Red Hat's legal department originally had concerns about patent issues related to including Mono in Fedora Core. With restrictions against Mono lifted, Fedora now has the potential of including a ton of .NET applications in the future.

Virtualization with Xen

Xen (`http://xensource.com/xen`) is virtualization software that provides a way of having multiple operating systems running on the same computer at the same time. Using Xen, companies that are now running Windows, Red Hat Enterprise Linux, SunOS and other operating systems on different machines (because their applications require it) could eventually run them on the same physical machine.

One of the greatest advantages Xen might ultimately offer is the ability to quickly move entire running operating systems to different machines. The promise of this feature could allow a data center to use much less hardware, by moving systems to underutilized hardware as demand dictates.

Fedora Core 5 includes software packages that let you try out Xen in Fedora. Because the software is being actively developed, rather than add descriptions of Xen that will be quickly outdated, I suggest you refer to the following link that is being maintained to describe how to use Xen in Fedora Core 5:

```
http://fedoraproject.org/wiki/FedoraXenQuickstartFC5
```

Enterprise GFS and clustering software

Software that is critical for Red Hat's enterprise strategy continues to be developed for Fedora Core 5. In particular, there is a set of Cluster Configuration System (ccs) packages and Global File System (GFS) packages. There were also many new packages to support Java software development.

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 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.

> **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 `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 Core 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 Core 5, a complete version of which is included on the DVD that comes with this book, as well as Red Hat Enterprise Linux 4. Fedora Core includes cutting-edge Linux technology that is slated for inclusion in commercial Red Hat Linux systems. Features in Fedora Core 5 include a simplified installation procedure, RPM Package Management (RPM) tools for managing the software, and easy-to-use GNOME and KDE desktop environments. You can get Fedora Core 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.