Chapter 1

Introducing Red Hat Linux

LINUX IS A BETTER way to run your computers. It is reliable, secure, and flexible. It's surprisingly easy to install. It's easier to use than most people think. It's highly customizable. It's built for networking. And because you can download the latest complete Linux operating system for free, the price is right.

For many people, Red Hat Linux is Linux. That isn't quite right. Linux is based on software developed by a worldwide community of volunteers. Much of the initial work was spearheaded by the Free Software Foundation (`www.fsf.org`). Originally it was developed as a clone of the Unix operating system. Today, it is so much more. It's evolving to meet the needs of a wide variety of people, such as aerospace engineers, movie makers, theoretical physicists, and consumers. Yes, consumers. Even Wal-Mart is selling computers with a version of Linux.

Strictly speaking, Linux is just the kernel, the part of the operating system that allows your software and hardware to communicate. But oh, what a kernel! You can customize it in thousands of ways and update it for new features. Properly configured, it can optimize the effective speeds on your computer.

Red Hat Linux is a distribution, which includes the basic Linux operating system with a number of free applications. These include a fully featured office suite, as well as graphics and multimedia programs that can satisfy most users. Comparable Microsoft programs cost many hundreds of dollars—for each computer.

Linux is fast becoming the major alternative to Microsoft Windows. As a server, it includes all the tools that you might need to configure and administer a wide variety of networks. It has the backing of some major companies, which as of this writing includes Oracle, Dell, and Hewlett-Packard. IBM has invested over a billion dollars in Linux. More and more companies are adopting Linux: as a server, and as a desktop operating system.

NOTE *For those who are dedicated to the Apple Macintosh, remember that the latest Mac OS X was developed from an operating system closely related to Linux, the Berkeley Standard Distribution (BSD).*

There is no one company behind Linux, but you can get support. Red Hat offers a good support system; other companies do as well. If you participate in the give and take of the Linux community, there are thousands of developers who will bend over backwards to help you. This chapter covers the following topics:

- Introducing Red Hat Linux 9
- A short history of Unix and Linux
- Exploring the kernel
- Why choose Linux?
- The role of a Linux computer

Introducing Red Hat Linux 9

Red Hat Linux 9 is more than just an operating system: It is a complete distribution. It includes a wide variety of commands, utilities, and applications. Installing additional software in packages from the CDs is easy. With the right downloads from the Internet, you can always keep your version of Red Hat Linux up-to-date.

Other Red Hat Linux Products

Several versions of Red Hat Linux are available as of this writing. All include the same basic software that you'll find in Red Hat Linux 9, and you can download them using the directions you'll find in the introduction. Each version includes additional features, such as CDs and support, for a price. The features I cite were available at the time of this writing. They include:

Red Hat Linux 9.0 Personal Edition

As described in the introduction, Red Hat Linux 9.0 Personal Edition includes three installation CDs, three source CDs, and a documentation CD. It includes the software that you need to install Red Hat Linux in Personal Desktop, Workstation, Server, or Custom configurations. It also includes 30 days of web-based installation support and a 30-day subscription to the Red Hat network for the latest updates.

Red Hat Linux 9.0 Professional Edition

Red Hat Linux 9.0 Professional Edition includes the components in Red Hat Linux 9.0 Personal, plus an eighth CD with office and multimedia applications and a ninth CD with system administration tools. It also includes 60 days of web-based and telephone support as well as a 60-day subscription to the Red Hat network for the latest updates.

While you can install any version of Red Hat Linux as a server, the followoing versions of Red Hat Linux are explicitly designed for servers with more than one CPU. Their subscriptions include free updates during the subscription period.

Continued on next page

OTHER RED HAT LINUX PRODUCTS *(continued)*

RED HAT ENTERPRISE LINUX WS (WORKSTATION)

Red Hat Enterprise Linux Workstation includes the components in Red Hat Linux 9.0, with features customized to work with Red Hat Enterprise Linux Servers. You can get this operating system bundled with 64-bit Itanium 2-based workstations.

RED HAT ENTERPRISE LINUX ES (ENTRY-LEVEL SERVER) BASIC EDITION

This version of Red Hat Linux supports basic servers, limited to 2 CPUs and 4GB of RAM. The Basic Edition includes downloads, basic installation and configuration support for 90 days, and support through the Red Hat Enterprise network for one year.

RED HAT ENTERPRISE LINUX ES (ENTRY-LEVEL SERVER) STANDARD EDITION

This version of Red Hat Linux supports basic servers, limited to 2 CPUs and 4GB of RAM. The Standard Edition includes downloads, basic installation and configuration support as well as support through the Red Hat Enterprise network for one year.

RED HAT ENTERPRISE LINUX AS (ADVANCED SERVER) STANDARD EDITION

Red Hat Enterprise Linux AS Standard Edition includes the components and support associated with the Red Hat Enterprise Linux ES Server, plus one year of installation support, configuration support, advanced configuration support, and systems administration support.

RED HAT ENTERPRISE LINUX AS (ADVANCED SERVER) PREMIUM EDITION

Red Hat Enterprise Linux AS Premium Edition includes the components and support associated with Red Hat Enterprise Linux AS Standard Edition, plus high availability clustering support and 24x7 emergency support for Severity 1 Issues, as defined in the associated license.

OTHER RED HAT PRODUCTS

Red Hat has other specialty operating systems. These include the high-security Stronghold Enterprise Apache Server, and versions specifically designed for IBM's eServer platforms.

Basic Hardware Requirements

Table 1.1 shows the minimum hardware requirements associated with Red Hat Linux 9. These requirements are not absolute; for example, I've run Red Hat Linux 9 with just the command-line interface with as little as 16MB of RAM. Other hardware requirements are described in Chapter 2.

These minimums assume a stand-alone Linux computer with a minimum of services. Earlier versions of even Red Hat Linux can be installed on less RAM and Intel 386 CPUs. If you want to install additional software, configure a graphical user interface (GUI), or set up a server, the requirements go up accordingly.

TABLE 1.1: BASIC HARDWARE REQUIREMENTS

TYPE	MINIMUM
CPU	Pentium-class
	Recommended for text-mode: 200MHz Pentium class or better
	Recommended for graphical-mode: 400MHz Pentium II class or better
RAM	For a text-mode workstation, 64MB; for a graphical workstation, 128MB (192MB recommended)
Hard disk	475MB (not including swap space or other files); more for other types of installations, as described in Chapter 3

New Features

Red Hat is constantly incorporating new features and updating software. Most important are updates to the latest kernel and services. The following list includes some of the major improvements that Red Hat has incorporated recently:

- Linux kernel version 2.4.20, which includes proven changes to the Linux 2.5 beta series kernels, as well as a number of updated drivers.
- The Common Unix Print System (CUPS), now the default print server, replacing LPD. For more information, see Chapter 25.
- Apache 2.0.40, now the standard Red Hat Linux web server. For more information, see Chapter 30.
- `iptables`, now the default firewall tool (described in Chapter 22).
- OpenOffice, a fully featured suite of Microsoft Office–style applications. For more information, see Chapter 18.
- XFree86 Version 4.3 includes support for additional graphics adapters. It also has experimental support for RandR, the X Resize, Rotate, and Reflect extension (`www.xfree86.org/~keithp/talks/randr/protocol.txt`)

Red Hat has also configured several tools not found in other Linux distributions. You can start these tools from a command-line interface inside a GUI such as GNOME or KDE, using a `redhat-config-*` command. For example, `redhat-config-samba` lets you configure Samba, the service that allows Linux to work on a Microsoft Windows network. Samba is discussed in detail in Chapter 29.

Basic Components

Linux can be broken down into a number of modules. The modular nature of Linux allows developers to work independently and more efficiently. They can reuse and reconfigure these modules to achieve different results. At least six categories of modules are associated with Linux: kernel, network, `init`, daemons, shells and utilities, and the X Window.

Kernel

The kernel is the most important part of any operating system. It allows Linux and any software that you install to communicate with computer hardware. The kernel communicates with your hardware through dedicated device drivers. For example, when you mount a floppy drive, a specific kernel driver sends and receives messages to and from the floppy drive.

If you install new hardware and it isn't detected when you start Linux, you can add a driver module to your kernel, as described in Chapter 11. If you have to download a driver for your new hardware, you should also add that driver module to the kernel.

Other parts of the kernel manage the Linux filesystem as well as any data stored in such areas as your disk cache. The kernel is loaded into protected-mode memory when you start Linux. You can learn how to configure and compile the kernel in Chapter 12.

Network

Linux computers are most commonly organized in a client/server network. Some computers act as workstations, or clients, for users; others are servers, which control resources shared by multiple users on different workstations. In this type of network, clients ask servers for items they need, like files or applications. In a Linux network, clients can even ask for X Window information. In other words, you can set up terminals on Linux clients that access their GUI data from a Linux server.

The network modules of the Linux operating system are designed to keep client/server communication running as smoothly as possible. Ideally, the connection between client and server is seamless. If your network is fast enough, your users won't be able to tell the difference between local and network services.

Because network modules are loaded in the same area as the kernel, their failure may mean that you have to reboot Linux. We cover the basics of Linux networking in Chapters 20–22.

init

In general, the only way to start a Linux program is with another Linux program. For example, you log into the Linux terminal program, known as `mingetty`. But something has to start the terminal program. When you boot Linux on your computer, the kernel loads and starts `init`. The `init` program then mounts your drives, and starts your terminal programs. When you log in, the terminal program starts your command-line interface shell.

After Linux boots on your computer, `init` watches for anything that might shut down your computer, such as a power failure signal from an uninterruptible power supply (UPS) or a reboot command. Details of `init` and the governing `/etc/inittab` file are discussed in Chapter 11.

Daemons

Linux includes a series of services. These are programs that can run in the background and start as needed. Many Linux services are known as *daemons*. In Linux, several dozen daemons can run simultaneously, standing at the ready to start your network, serve web pages, print your files, or connect you to other Linux or Windows computers. Typical daemons include:

- Apache, the most popular web server on the Internet, also known as `httpd`. Apache is covered in Chapter 30.

- Samba (also known as `smbd`), the network service that allows Linux to talk to Microsoft Windows computers.
- A printer daemon that manages communication with your printers. The CUPS daemon is `cupsd`; it's covered in more detail in Chapter 25.

We discuss various Linux daemons in detail throughout this book.

TIP *Case matters in Linux. For example, the acronym for the Common Unix Print System is CUPS; the associated daemon is* `cupsd`.

Shells and Utilities

Any Linux program or utility that talks to the kernel is a user-mode program, which consists of shells and utilities. User-mode programs don't communicate directly with your hardware (that's a job for the kernel). In other words, these programs can crash without affecting the basic operation of the Linux operating system. There are three basic types of user-mode programs:

- *Login* programs associate a user ID with a user's shell and other personalized settings, such as with the X Window and web browsers.
- *Shell* programs act as Linux command interpreters. The most common Linux shell is known as bash, short for the Bourne Again Shell.
- *Utilities* are small-scale commands used inside a shell.

The basics of the bash shell and associated commands are covered in Chapters 6–8.

X Window

Linux builds the GUI from different program modules. GUI window managers, such as GNOME and KDE, as well as all GUI applications are built on the foundation of the X Window. The basics of the X Window and associated applications are covered in Chapters 15–19.

A Short History of Unix and Linux

Linux was developed as a clone of Unix. In other words, the developers of Linux built their system without using the programming instructions, also known as the source code, used to build Unix. Because Linux is a Unix clone, you can use most of the same command-line commands on either operating system.

Although it would have been easier to adapt Unix for the personal computer, important historical reasons lie behind the development of Linux. And the way Linux was developed drives the way Linux developers, companies, and users work today.

Unix and the Coming Internet

Computers were once quite expensive. They were the domain of universities and larger corporations. There was a lot of demand for these early computers; to support this demand, a number of computer

scientists developed the concept of *time-sharing*, where multiple users are connected to the same computer simultaneously.

Even though computers have become more powerful and less expensive, we have returned to this notion of time-sharing. Today, administrators are quite familiar with the concept of the time-sharing system: it is now known as the multiuser server. One network often includes multiple servers; your username may be the same across all of these servers. In fact, it's fair to say that we're all time-sharing users on the biggest network of all—the Internet.

Let's take a look at some of the developments that occurred along the road to Linux.

Multics

One of the early time-sharing projects was Multics (Multiplexed Information and Computing Service), a joint project between MIT, AT&T's Bell Labs (now Lucent Technologies), and General Electric. Although Bell Labs withdrew from the project in 1969, two of their developers, Ken Thompson and Dennis Ritchie, still had an itch for what would become the multiuser operating systems we know today.

Unix

Thompson and Ritchie continued development work through the early 1970s. Perhaps the key to their success was their development of the C programming language for writing the kernel and a number of basic commands, including those in the Bourne shell.

When Unix was developed in 1969, AT&T was a regulated monopoly in the United States. Various court and regulatory rulings and agreements kept AT&T out of the computer business.

In 1974, AT&T distributed Unix to the University of California for the cost of the manuals and tapes. It quickly became popular at a number of universities. Nevertheless, AT&T was not allowed to make money from it.

A Cooperative Environment

Bell Labs has a history of groundbreaking research. The company had some of the best minds in the world working on fundamental problems. Bell Labs wanted the goodwill of the academic community. Since AT&T wasn't allowed to make money from software, it kept the license for Unix and distributed the operating system with source code to universities for a nominal fee. In exchange, AT&T's lawyers insisted that the license explicitly state that Unix came with no warranty. This release technique became known as *open source*.

The timing was good. Various universities adapted the Unix source code to work with three different kinds of computers available at the time: mainframes, minicomputers, and microcomputers.

At about the same time, the U.S. Department of Defense's Advanced Research Project Agency (ARPA) wanted to set up a nationwide communications network that could survive a nuclear war. Most universities on this ARPA network used Unix. TCP/IP was built on Unix and eventually became the communication protocol for the ARPANET. The ARPANET eventually developed into the Internet that you know today. Unix and derivative clones, like Linux, are critical parts of the Internet.

The AT&T Consent Decree

AT&T retained the license to Unix through the 1980s. When the U.S. government settled the AT&T antitrust suit in 1982, one of the provisions allowed AT&T to go into the computer business. This

became known as the AT&T consent decree. At that point, AT&T was able to sell the Unix operating system and source code with all the protections associated with a copyright.

The programmers who used Unix wanted to keep the advantages of an open-source operating system. Unix programmers wanted the ability to customize the software. As academics, they wanted to share the results. The Unix users of the time had the high level of knowledge that made open-source software worthwhile.

Ironically, AT&T was never very successful at selling Unix and eventually sold the rights to the operating system. The direct successor is now owned by the SCO Group, which also owns the rival SCO (formerly Caldera) Linux distribution.

NOTE *The SCO Group has recently filed suit against IBM over Unix. This is controversial as there are many in the Linux community who see this as a threat.*

Unix Alternatives

At the time, with their limited budgets, universities did not have the money to purchase the now proprietary Unix, and they did not want to have their academic freedoms limited by copyrights. Generally, academics are most comfortable when they can share all of their data. To this end, Douglas Comer developed Xinu (Unix, spelled backwards) in 1983 to illustrate operating system structures in a classroom setting. In 1986, Andrew Tannenbaum developed Minix as a Unix clone and free alternative. Like Linux, Minix does not use Unix's source code, and therefore does not infringe on any of AT&T's Unix copyrights.

Even before the consent decree, Bill Joy of the University of California worked on Unix. He also started work on the Berkeley Standard Distribution (BSD), which, like Unix, was released under an open-source style license. A number of BSD utilities were incorporated into later versions of Unix. In 1982, Joy became a cofounder of Sun Microsystems.

Several other operating systems are closely related to Unix, as shown in Table 1.2.

TABLE 1.2: UNIX-STYLE OPERATING SYSTEMS

OPERATING SYSTEM	DESCRIPTION
AIX	The Advanced Interactive eXecutive operating system, developed by IBM; used with high-end CPUs such as Power4 and RS64 IV (64-bit PowerPC chips).
BSD	The Berkeley Standard Distribution, an open-source alternative to Linux.
HP-UX	Developed by Hewlett-Packard; version 11i is developed for 64-bit RISC and Itanium CPUs.
IRIX	Developed by Silicon Graphics for 64-bit CPUs.
Linux	The free operating system clone of Unix.
Solaris	Developed by Sun Microsystems for its UltraSPARC CPUs.
Tru64	Formerly known as Digital Unix, optimized for 64-bit CPUs.
UnixWare	The successor to AT&T's version of Unix, now owned by the SCO Group.

One telling trend is that a number of these companies are moving toward using Linux on many of their servers. While this book is based on the 32-bit Red Hat Linux kernel, a 64-bit Red Hat kernel is available.

The Free Software Foundation

Some of the work of the academic community eventually became something of a rebellion. In its early stages, it was led by Richard Stallman and his Free Software Foundation (FSF). (For more information, see the website at `www.fsf.org`.)

Stallman started work on the GNU's Not Unix (GNU) project in 1984. He summarized the focus of the FSF in his introductory Usenet message: "I consider that the golden rule requires that if I like a program I must share it with other people who like it." Stallman's purpose was to set up a group where the free sharing of software would be strongly encouraged. To realize his dream, Stallman needed an operating system, free of the code that was then copyrighted by AT&T.

The FSF developed the General Public License (GPL) to build a body of free software protected from those who would use it to create proprietary closed-source systems. This same license still protects Linux today; you can read it in Web Chapter 4, which can be found on the Sybex website at `www.sybex.com`.

By 1991, the FSF had cloned all of the major components of a Unix-style operating system, except the kernel.

The General Public License

Richard Stallman developed the GPL to bring the advantages previously available with Unix to the general software community. He wanted to develop a license that would protect software from anyone who would hide its source code. GNU software is licensed under the GPL. While you can read the GPL in Web Chapter 4, you can also read about three basic principles behind the GPL:

- **All GPL software must be distributed with a complete copy of the source code. The source code must include clear documentation.**
- **Any software added to GPL software must also be clearly documented. If the new software interacts with the GPL software, the package as a whole must be distributed as GPL software.**
- **Any GPL software comes without a warranty.**

Linus Develops a Kernel

In 1991, Linus Torvalds was a graduate student in Finland. He was not happy with the operating systems available for his new computer with a 386 CPU. So he put together a kernel to allow some operating system components to communicate with computer hardware. By 1995, several companies assembled Linus's kernel with the GNU software of the FSF to produce the first Linux distributions.

NOTE *Richard Stallman and the people of the FSF believe that the Linux operating system is more properly known as GNU/Linux because it combines a large number of GNU-licensed programs, commands, and utilities with one Linux kernel.*

Exploring the Kernel

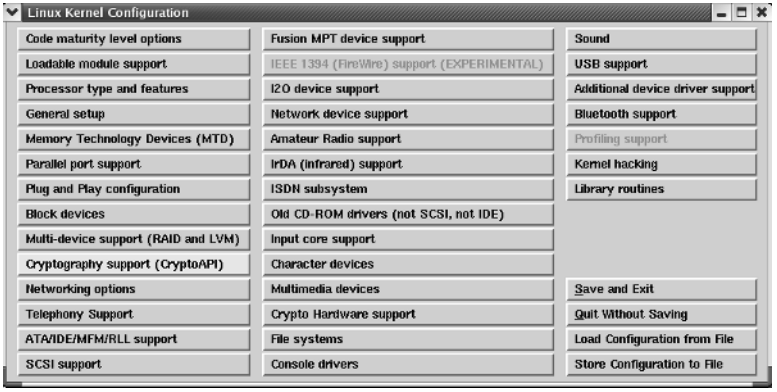
Life in any operating system begins and ends with the kernel. When properly configured, any operating system can work like a wonderful ballet where hardware is ready just when you need it. When problems crop up, the kernel can slow or stop your computer.

With the Linux kernel, you can configure hardware, filesystems, networking support, and more. Hardware drivers can be configured within the kernel or as separate modules.

Configuring the Kernel

If you ever need to reconfigure your kernel, you'll become familiar with the Linux Kernel Configuration menu shown in Figure 1.1. As you can see, there are a number of different hardware components, such as SCSI and USB devices, that you can configure through the kernel. Each of the buttons shown in the menu opens individual submenus.

FIGURE 1.1
Linux Kernel Configuration



You can also see some kernel options not directly associated with hardware, such as Networking Options and Code Maturity Level Options. For example, in the Networking Options menu, you can set up Linux to work with different network protocols. You'll find detailed information on this process in Chapter 12.

The */proc* Filesystem

The `/proc` directory is a virtual filesystem stored in your RAM. It documents the way the Linux kernel interacts with your computer. A number of these files document how the Linux kernel reads your hardware. When you read the right file, you can find hardware settings for different components. You can find more information on `/proc` in Chapter 11.

Modular or Monolithic

You can set up every hardware driver within the main part of the Linux kernel. This would be a *monolithic* kernel. But for most configurations, there are many hundreds of hardware drivers. If you put them together into one kernel file, the sheer size of the hardware drivers can overload your system.

It is usually more efficient to configure a modular kernel. Various kernel modules, normally associated with various hardware components, are loaded after Linux starts on your computer. Figure 1.2 shows an example from my desktop computer.

FIGURE 1.2
Linux modules

```
Module                  Size  Used by    Not tainted
smbfs                  44400   1  (autoclean)
sr_mod                 18168   0  (autoclean)
agpgart                47296   4  (autoclean)
parport_pc             19076   1  (autoclean)
lp                      8996   0  (autoclean)
parport                37056   1  (autoclean) [parport_pc lp]
autofs                 13268   0  (autoclean) (unused)
8139too                18088   1
mii                     3912   0  [8139too]
ipt_REJECT              3736   6  (autoclean)
iptable_filter          2412   1  (autoclean)
ip_tables              14968   2  [ipt_REJECT iptable_filter]
ide-scsi               12240   0
scsi_mod              107128   2  [sr_mod ide-scsi]
ide-cd                 35772   0
cdrom                  33696   0  [sr_mod ide-cd]
loop                   12152   0  (autoclean)
keybdev                 2976   0  (unused)
mousedev                5492   1
hid                    22148   0  (unused)
input                   5888   0  [keybdev mousedev hid]
usb-uhci               26412   0  (unused)
usbcore                78432   1  [hid usb-uhci]
ext3                   84960   7
jbd                    52020   7  [ext3]
raid5                  18888   1
xor                     9020   0  [raid5]
lvm-mod                62176   3
[root@RH9Desk root]#
```

As you can see, there are hardware modules, such as `usbcore`, to support USB hardware. There are also software modules, such as `smbfs`, to support the Samba filesystem. For more information on managing kernel modules, see Chapter 11. If you want to make sure that your kernel is modular, see Chapter 12.

Why Choose Linux?

Linux is most often compared to Microsoft Windows. Linux is also replacing other Unix-style operating systems described earlier in Table 1.2. Four factors make Linux a better choice for many users and organizations: cost, reliability, flexibility, and support.

Cost

You can download Red Hat Linux for free from the Internet. This cost difference can be significant when compared to the thousands of dollars associated with many other Unix-style operating systems. It's still a significant advantage when compared to the continuing licensing costs of Microsoft operating systems.

It isn't enough just to consider the price of the operating system. You should take into account the other costs, generally associated with the time for installation, configuration, and support.

Red Hat Linux 9 includes installation options suitable for everything from a home desktop to a network server. For more information, see Chapter 3. This is one operating system distribution that you can use to install Linux on a wide variety of computers.

NOTE *Red Hat also offers several heavy-duty server products based on what was originally Red Hat Advanced Server. It includes much of the same software that's available in Red Hat 9. One variation is Red Hat's Stronghold Enterprise Secure web server. For more information, see* `www.redhat.com`.

Red Hat Linux has one additional cost advantage: The CDs are loaded with a number of fully featured applications. For example, OpenOffice is a fully featured office suite, with all of the features that most users could ever want. Red Hat includes several other free applications that can save you hundreds of dollars.

Installation

As you install Linux over the next few chapters, you'll learn that the process is not difficult. If you're installing Red Hat Linux on a group of computers, you can use the kickstart techniques described in Chapter 5 to automate the installation process.

Since Red Hat Linux 9 can be installed on most PCs without a problem, the discussion of hardware in Chapter 2 might seem extreme. However, if you're an administrator responsible for installing Linux on several computers, mistakes can quickly get expensive.

Configuration

To make any operating system useful, you need to install and configure it. Whether you're configuring a desktop computer at home, a workstation for your users, or a server for your corporate network, the basic configuration process is the same. Linux has always had the command-line tools with the flexibility to satisfy most Linux gurus.

With the `redhat-config-*` tools described in Chapter 19, Red Hat Linux now offers the graphical tools that can help administrators of other operating systems make the transition.

Reliability

Linux is reliable. There are reports of Linux servers that run for several months at a time without reboots. Imagine never having to reboot your computer after installing new software. Imagine being able to stop a runaway program without rebooting your computer. That is the power of Linux.

Linux is not perfect. Mistakes happen. We describe troubleshooting techniques throughout this book. If you ever have a problem booting Linux, you can rescue most systems with your Red Hat Linux installation CD (without reinstalling Linux).

Flexibility

Linux is a flexible operating system. The Red Hat Package Management (RPM) system makes it easy to add more software as needed. For more information on RPM packages and the `rpm` command, see Chapter 10. The `redhat-config-packages` tool described in Chapter 19 makes this process of software management even easier.

You can optimize the Linux kernel using the techniques discussed in Chapter 12. An optimized kernel makes everything faster in Linux, from the boot process to networking. With the right techniques,

you should always have an easily accessible working kernel; in contrast, small errors when changing the Microsoft Windows Registry can be disastrous.

Linux is easily upgradeable. You can keep an older version of Linux up-to-date with the latest in kernels, applications, and other software. The `rpm` and `up2date` tools described in Chapter 10 help you with this process.

Support

Very good support is available for Linux. Unfortunately, many administrators and IT managers are intimidated by the "lack" of a single source of corporate support, like Microsoft. But remember, Microsoft support is not free.

If you purchase an official Red Hat Linux boxed set, you qualify for a limited amount of support. You can purchase additional support from Red Hat or from a third-party vendor such as Linuxcare (`www.linuxcare.com`). Some of the large companies behind Linux, such as IBM, also provide support for Red Hat Linux as installed on their systems.

There are two bonus sources of support for Linux. Because Linux is open source, administrators can often fix many problems. If you're working with a closed-source system, you can't even "look under the hood."

Since Linux is developed by a community, there are many in that community who are anxious to make their name by solving new problems. Their insights are available online. It's quite possible that the answer to your problem is already available in the Internet newsgroup database, accessible through `groups.google.com`.

The Role of a Linux Computer

You can configure Linux as a server or as a desktop computer. Linux is flexible; you can install it on many older computers that you might otherwise have to scrap.

Red Hat includes a number of additional programs and applications that enhance what Linux can do on the desktop, for small organizations, and for the enterprise.

Linux as a Server

Linux is built for networking. You can set it up as a server to manage many different kinds of resources for your network. Table 1.3 lists just a few of the Linux services that you can configure. Many of these services have their own individual daemons. Others are associated with the Extended Internet Services Daemon (`xinetd`) described in Chapter 23.

TABLE 1.3: LINUX SERVER SERVICES

SERVICE	DESCRIPTION	CHAPTER
`crond`	Runs scripts on a schedule	13
`cups`	Manages the Common Unix Print System	25
`httpd`	The Apache Web Server	30
`named`	The Domain Name Service	24

Continued on next page

TABLE 1.3: LINUX SERVER SERVICES *(continued)*

SERVICE	DESCRIPTION	CHAPTER
nfs	A Network File System server	28
sendmail	A common e-mail transport agent	26
smb	Samba, which makes Linux computers members of Microsoft Windows networks	29
sshd	Secure Shell	23
vsftpd	The Very Secure FTP Daemon	27
xinetd	The Extended Internet Services Daemon	23
ypserv	A Network Information Service server	28

It's common to install Linux on older computers. You can set up a Linux computer as a server with limited functionality. In many cases, this does not require a great deal of RAM or hard disk space. For example, you could set up a Linux computer as a modern print server or a firewall. You would not have to purchase dedicated hardware for these purposes.

Linux on the Desktop

Linux is a serious alternative on the desktop. As you'll see in Chapters 15–17, Linux provides essentially the same basic GUI applications and configuration tools that you can find in any version of Microsoft Windows.

In addition, three major office suites are available that you can use in place of Microsoft Office. Mozilla and Konqueror are fully featured web browsers; alternatively, you can still install Netscape or Opera on Linux. Evolution provides an alternative to Microsoft Outlook.

People are taking a serious look at Linux on the desktop. As of this writing, Wal-Mart is selling five different computers with Lindows (`www.lindows.com`), a version of Linux that is customized to run a number of Microsoft Windows applications. Linux is getting a serious look as a desktop alternative outside the United States.

Game manufacturers are creating ways to play on Linux. Tux Games is an online store (`www.tuxgames.com`) with a warehouse of interesting games. There's even a version of The Sims for Linux, courtesy of TransGaming Technologies (`www.transgaming.com`).

Applications available for Linux may not meet everyone's needs. In the personal finance area, GNUcash, in my opinion, does not compare well with the latest versions of Quicken. Other Linux personal finance programs are listed at `www.linuxlinks.com/Software/Financial/Personal_Finance/`.

If you need a few Microsoft Windows programs, multiple solutions are available. CrossOver Office (`www.codeweavers.com`) allows you to run Microsoft Office 97/2000, Quicken, Lotus Notes, and more. You can set up Microsoft Windows inside a virtual computer inside Linux, courtesy of VMWare (`www.vmware.com`) or Win4Lin (`www.trelos.com`).

Red Hat Linux for Desktops

Red Hat started a recent push toward the desktop market with version 8.0. According to Erik Troan, senior director of product marketing for Red Hat, the company is targeting the Red Hat Linux desktop for both the personal and corporate markets. At least for now, Red Hat's focus is on markets such as financial institutions and call centers. It is also looking toward high-end users who want heavy-duty software, such as computer-aided design (CAD) and applications on the same computer.

To this end, Red Hat is moving toward configuring both GNOME and KDE with a similar look and feel. The changes that Red Hat has made to GNOME and KDE is known as Bluecurve.

GNOME, the GNU Network Object Model Environment, is described in Chapter 16. KDE, the K Desktop Environment, is covered in Chapter 17. These are the two most popular GUI desktops in use for Linux today. They've also enhanced available GUI tools for both desktops, as described in Chapter 18.

Desktop users may be pleased with the wide array of applications that come with Red Hat Linux 9. They include:

- OpenOffice, a fully featured office software suite.
- Mozilla and Konqueror, web browsers as fully featured as Microsoft Internet Explorer.
- Internet utilities such as Instant Messenger, news clients, remote desktops, and more.
- Multimedia applications that allow you to write CDs and even DVDs at full speed.

While the Red Hat desktop graphics utilities don't yet have the CMYK (cyan, magenta, yellow, and black) graphics software such as Paint Shop Pro, a number of movie studios do create animation and special effects on Linux computers.

NOTE *CMYK is a color model more popular in high-end graphics applications than the original RGB (red-green-black) standard.*

Red Hat Linux for Small Businesses

Red Hat Linux can be a fantastic option for a small businesses or organizations. You can install it on all desktops and servers. You save the cost of the operating systems and applications that you would otherwise have to install.

Red Hat Linux is fairly easy to configure in a network, even if you have Microsoft Windows computers. You can even configure Red Hat Linux as a primary domain controller (PDC) in a Microsoft Windows–style network. Once Samba is properly configured (see Chapter 29), other Microsoft computers won't be able to tell the difference.

With the right configuration, you can easily connect your network to the Internet. You can also protect your network from many of the ravages of the Internet with appropriate settings on your firewall and other network tools.

Red Hat Linux for the Enterprise

Many corporations use enhanced versions of Red Hat Linux, such as Red Hat's Enterprise Server line. When configured with other tools, such as Oracle databases and the Stronghold web server, Red Hat Linux can be a powerful tool for the enterprise.

Amazon.com has saved millions by converting to Red Hat. Google runs its search engine databases on a cluster of over 8000 servers running Red Hat Linux. Red Hat is becoming more popular for other large organizations as well, such as BP, Kenwood, and MIT. In a Red Hat case study, Toyota actually found slightly *lower* support costs after converting their computers to Red Hat Linux.

Reporting Problems

Linux is a work in progress. Developers are constantly adding and revising features for new software and hardware. It's possible that in your journey with Linux, you'll run into a problem or two. There are four ways to look for a solution:

Newsgroups As described earlier, many users bring up problems that they have in different newsgroups. Google collected recent newsgroup messages into a searchable database through `groups.google.com`. If you want to post on a newsgroup, it's best to use a newsgroup reader such as those described in Chapters 16 and 17. Alternatively, you can post messages using Google's interface (registration is required).

Mailing lists Red Hat has a series of mailing lists on different topics and versions; you can sign up at `www.redhat.com/mailing-lists/`. The developers of a number of different applications maintain their own mailing lists, which you can find on their websites.

Red Hat support If you've paid for an official copy of Red Hat Linux, you can get some amount of support for your issue. The support may be limited by the version that you've purchased.

Bugzilla If you're certain that the problem is with Red Hat Linux, you can submit a bug report to Red Hat. Navigate to `bugzilla.redhat.com` and click Login Now. Create an account if you don't already have one. You can then search through the Bugzilla database to see if someone else has already raised the issue with Red Hat. If not, and if you've exhausted the other resources, submit a bug report through the Red Hat Bugzilla system.

Summary

Linux was developed as a clone of Unix. Much of it was engineered by the Free Software Foundation; critical was Linus Torvalds's creation of the Linux kernel. Most of it is protected through the General Public License.

As Red Hat Linux 9 is being released, businesses and governments are focused on reducing costs. Linux has at least an initial cost advantage over other operating systems such as Microsoft Windows. And Red Hat Linux, as the most popular Linux distribution, is in the forefront of this change.

Red Hat Linux 9 includes the same basic components as all other Linux distributions: the kernel, `init`, daemons, user mode shells and utilities, network, and the X Window. It incorporates the latest

changes to the Linux kernel, as well as new improvements in printing, web services, and more. The `redhat-config-*` graphical tools make it easier for administrators of other operating systems to make the transition.

If there is a key to Linux, it is in the kernel. It is highly configurable; when modular, it is also quite flexible.

When looking at Linux, you should consider four factors: cost, reliability, flexibility, and support. I believe that Linux has advantages in all four areas when compared to other operating systems.

Red Hat Linux can play many roles in computing. Traditionally, it's used as a server, and functions well even on many older computers. Red Hat is adding tools that make it suitable as a desktop operating system. Such flexibility makes Red Hat a viable alternative for small businesses. Red Hat is also being used in the enterprise, on clusters of computers to meet the heaviest demands.

In the next chapter, we'll start looking at getting your computers ready for Red Hat Linux. Installation often does proceed easily on most modern computers. However, if you're installing Red Hat Linux on two or more computers on a network, mistakes can be painful. If you're responsible for installing Linux on a network, you need to know more about the hardware in your computers.