CHAPTER 3

Installing Fedora

In this chapter, you learn how to do a basic installation of Fedora Core. You'll see how to boot and then install Fedora using the CD-ROMs included with this book. The chapter first shows how to prepare and research your install, choose a strategy on how Fedora will use your computer's hard drive, decide how to boot Fedora, and then how to complete the Fedora Core installation. You'll get a step-by-step walk through of a sample installation, and then you learn how to log in to Fedora and shut down or reboot the system.

Before You Begin the Installation

Part of the process of installing Fedora Core (or any operating system for that matter) is to first research how well the new operating system will fit into an existing hardware environment, or if new hardware will be required to host the operating system. The following sections provide some basic points to consider when installing Fedora and augment the checklists and ideas presented in Chapter 2, "Preparing to Install Fedora."

You start by researching and documenting your hardware. This information can prove helpful later on during the installation.

Research Your Hardware Specifications

You should first have a basic understanding of your system's hardware, such as the type of mouse, keyboard, or monitor, the amount of installed system memory, and the size of the hard drive. You need to know the storage capacity of your hard drive in order to choose a partitioning scheme, for example. Knowing the difference between a PS/2 and USB mouse will ensure proper pointer configuration. Such information will help make the installation fast, efficient, and as trouble-free as possible.

IN THIS CHAPTER

Use the checklist shown in Table 2.2 in Chapter 2 to inventory or at least record some basic features of your system. Some items you'll need to know include the amount of installed memory, size of your hard drive, type of mouse, capabilities of the display monitor (such as maximum resolution), and number of installed network interfaces (if any).

Choose an Installation Type

You should also know what type of installation you plan to do beforehand (such as a workstation, server, firewall, gateway, router, development system, and so on). The type of install, or rather, the purpose of your intended install will dictate the type and amount of software installed (and also influence hard drive storage requirements).

For convenience, the Fedora installer offers a personal desktop, workstation, and server installation. Each type will install a set of preselected software libraries and applications. Use the custom installation option to select individual software packages and fine-tune your software selection. See Chapter 2 for details and hardware requirements for these installs.

NOTE

Although you can support nearly any operation (such as a development workstation or server) by installing all the software included with this book's CD-ROMs, this approach generally isn't a good idea unless you're testing new hardware or learning how to use Linux at home. The reason for this is that installing extraneous software not relevant to support specific operations, especially in a business or production environment, can introduce security risks. For example, it would be unwise to have compilers and software development tools installed on an e-commerce Web server because successful intruders can simply upload and build malicious software with relative ease.

Choose Software Installation Options

Most new users with standalone Linux workstations will install all the software included with Fedora and depend on Red Hat's RPM technology (using `up2date`) or Fedora's support of `yum` to sort out and handle software dependencies (see Chapter 8, "Managing Software and System Resources" for more details about using these programs). Although Fedora is very stable and robust (read, doesn't crash), crafting an efficient, stable, and working system can sometimes require consideration about the type of software to use given your existing hardware. For example, don't expect to run a fully loaded multimedia workstation if you plan to use Fedora Core on an early Pentium-based PC. However, that same PC can easily support email, print, or FTP server operations and even perform light duty as an intranet documentation Web server.

Planning Partition Strategies

Part of planning a custom system involves implementing a partitioning strategy based on how you plan to use Fedora and, as previously mentioned, the capabilities of your existing

hardware. For example, if you plan to host thousands of graphic images or audio files, how much storage will you need? If you plan to back up this collection, will you use a tape drive, burn copies of directories onto optical media, transfer files across a network, or will you simply copy the files to another hard drive?

If you are planning an installation for a corporate or enterprise-level environment, you must also consider future expansion or evolution of the system. You will want to craft a flexible system that can evolve with your business and its system needs.

Knowing how software is allocated on your hard drive for Linux involves knowing how Fedora organizes its *file system*, or layout of directories on storage media. This knowledge will help you make the most out of hard drive space; and in some instances, such as planning to have user directories mounted via NFS or other means, can help head off data loss, increase security, and accommodate future needs. Create a great system, and you'll be the hero of information services.

To plan the best partitioning scheme, research and know the answers to these questions:

- How much disk space does your system require?
- Do you expect your disk space needs to grow significantly in the future?
- Will the system boot just Fedora, or do you need a dual-boot system?
- How much data will require backup, and what backup system will work best? (See Chapter 11, "Backing Up, Restoring, and Recovery," for more information on backing up your system.)

CD-ROM INSTALLATION JUMPSTART

To install Fedora Core from the CDs included with this book, you must have at least a Pentium-class CPU, 700MB hard drive, and 64MB RAM. You'll need at least 128MB to install using Fedora's graphical installer. A 10GB hard drive can easily host the entire distribution, leaving about 4GB free for other data.

To begin the installation, set your PC's BIOS to boot from CD-ROM. Next, insert the first CD-ROM and boot your computer. Press Enter at the first screen and follow through the subsequent dialogs to install.

Remember or write down your system's root password. Also, even if you thoroughly test configuration of a graphical desktop during installation, you can choose to have Fedora boot to a text-based login (see the section "Step-by-Step Installation" later on). You can then start a graphical session after you finish the install, reboot, and log in. You can always set Fedora to boot to a graphical login later (see Chapter 6, "The X Window System," to see how).

If you have a floppy drive, create a boot disk during the install (see the "Step-by-Step Installation" section in this chapter). Finally, finish the install, remove the CD-ROM from your computer, and reboot. Then log in and enjoy Fedora!

The Boot Loader

You will need to decide how to boot your system. For example, you can boot Fedora from a hard drive or floppy disk using the default boot loader, the Grand Unified Boot Loader (known as GRUB), use a commercial boot loader (as discussed in Chapter 2), or choose to not use a boot loader at all. Not using a boot loader can make booting Fedora difficult, but not impossible. For example, you can use another operating system such as DOS to jump-start to a Fedora session.

A boot loader is most often installed in the Master Boot Record (MBR) of an IDE hard drive, but can also be installed in the root Linux partition, or on a floppy disk. The boot loader can be used to pass essential kernel arguments to the Linux kernel for use during the boot process. Some arguments might include special disk geometry settings or specifying additional network interfaces. Fedora's boot loader, GRUB, supports special operations, such as booting from read-only memory (ROM) or flashed memory chips containing boot-loading code. Using a bootloader from floppy disk will work with many PCs, but you should be aware that not all PC hardware BIOS supports booting via Universal Serial Bus (USB) removable media or from a floppy disk. In fact, many PCs no longer include a floppy disk drive!

The GRUB loader works with all BSD UNIX variants and many proprietary operating systems. This utility also supports menuing, command lines, installed RAM detection, and diskless and remote network booting. GRUB also offers password protection.

NOTE

Red Hat's `mkbootdisk` command can be used to create floppy and CD-ROM boot media while using Linux. To do so, use the Linux kernel release number (returned by using the `uname -r` command) and a specified device. For example, to create a boot floppy, use the command like this:

```
# mkbootdisk --device /dev/fd0 `uname -r`
```

To create a CD-ROM boot image (which must then be burned onto a CDR or CDRW blank), use the command with its `-iso` option like this:

```
# mkbootdisk --iso --device boot_cd.img `uname -r`
```

Fedora can also be booted from a DOS session using the `LOADLIN` program, a DOS PATH to the Linux kernel, and the location of Linux kernel, such as

```
LOADLIN c:\KERNEL\VMLINUZ root=/dev/hda2 ro
```

In this example, the kernel named `VMLINUZ` is loaded, and the second primary partition of the first IDE hard drive is specified at the root (`/`) partition of a Linux system.

NOTE

If you find that `LOADLIN` fails to boot Linux and complains about a large kernel size, you can either try using `make bzimage` to build a smaller kernel or rebuild a kernel that relies less on built-in features and more on loadable modules. See Chapter 24, "Kernel and Module Management," for more information.

When choosing a commercial boot loader, weigh its capabilities and options. A good boot loader will support multiple operating systems, the ability to boot different Linux kernels (in order to change the characteristics of a system or easily accommodate new hardware), password protection, custom boot displays, and sane defaults, such as requiring verification before over writing existing configurations and accommodating other recognized filesystems or previously installed boot code.

If you run into trouble after installing Fedora Core, make sure to read the documentation for your boot loader to acquire any diagnostic information. Most boot loaders will report on any problems, and the solution might be commonly fixed. Your best (and least expensive) bet is to use GRUB because it is the default boot loader for Fedora Core.

Choosing How to Install Fedora

Fedora can be installed in a variety of ways using different techniques and hardware.

Most users will install Fedora by booting to the installation directly from a CD-ROM. Other options include

- Booting to an installation using a floppy diskette.
- Booting to an installation using Fedora's mini CD-ROM.
- Using a hard drive partition to hold the installation software.
- Booting from a DOS command line.
- Booting via a virtual network session. (See the file Release Notes included on the first Fedora Core CD-ROM for details.)
- Booting to an installation and installing software over a network using FTP or HTTP protocols.
- Booting to an installation and installing software from an NFS-mounted hard drive.

How you choose to install (and use) Fedora depends on your system's hardware, networking capabilities, corporate information service policy, or personal preference. The following sections describe the issues surrounding each of these types of installation.

Installing from CD-ROM

Most PCs' BIOS support booting directly from a CD-ROM drive, and offer the capability to set a specific order of devices (such as floppy, hard drive, CD-ROM, or USB) to search for bootable software. Turn on your PC, set your PC's BIOS if required (usually accessed by pressing an F or Del key after powering on); then insert Fedora Core's first CD-ROM, and boot to install Fedora.

To use this installation method, your computer must support booting from CD-ROM, and the CD-ROM drive must be recognizable by the Linux kernel. You can verify this by checking your BIOS and then booting your PC.

Older PCs with some CD-ROM drives might prove problematic when you desire to boot to an install using optical media. The good news is that this should no longer be a problem with most post-1995 personal computers. However, you can consult Table 3.1, which lists a driver disk image that can be used to support older drives.

The file `boot.iso` listed in Table 3.1 is a 4.7MB CD-ROM image found under the `images` directory on the first Fedora Core CD-ROM. The image can be burned onto a CDR, mini CDR, or business-card sized CDR and supports booting to a network install. This is a convenient way to boot to a network install on a PC with a bootable CD-ROM drive, but no installed floppy drive, or when you don't want to use multiple floppies during an install requiring driver diskettes.

You burn the image onto optical media using the `cdrecord` command. For example, copy the file to your hard drive, insert a blank CDR into your CDRW drive, and then use a command line like so:

```
# cdrecord -v speed=4 dev=0,0,0 -data -eject boot.iso
```

This example will create a bootable CD-ROM, and then eject the new CD-ROM after writing the image. The speed (4 in this example) depends on the capabilities of your CD writing device. The device numbers are those returned by running `cdrecord` with its `scanbus` option, like so:

```
# cdrecord -scanbus
```

Booting to an Install from DOS

As previously mentioned, you can use a DOS utility such as `LOADLIN` (or `BOOTLIN`) to either directly boot to an install from the CD-ROM or to load the install kernel.

See the `dosutils` directory on the first Fedora Core CD-ROM included with this book, and read the README file under the `dosutils` directory for an overview of the DOS utilities. The directory contains a one-line DOS batch file (`.bat` file) that can help boot to an install:

```
loadlin autoboot\vmlinuz initrd=autoboot\initrd.img
```

In this example, the `LOADLIN` command will boot the install kernel residing under the `dosutils/autoboot` directory, and then load the installation software to launch an install.

> **NOTE**
>
> A half-dozen DOS and Windows-based utilities will be found under the `dosutils` directory. The software also includes programs such as the `fips.exe` FAT partition editor, and a Windows equivalent command of `RAWRITE` (to create boot diskettes) named `RAWRITEWIN`. Documentation is also included to help you get started.

Making an Installation Boot Diskette

Your installation can also be started using a boot floppy. A boot floppy can be used to support booting the Install CD-ROM on older CD-ROM drives. A boot floppy can also be used to start an install over a network when the PC does not have a CD-ROM drive but has a network interface card (NIC). Boot floppies are created from floppy images (`.img` files). These images are contained in the `images` directory on the first Fedora Core CD-ROM.

Fedora Core provides a number of images, as listed in Table 3.1.

TABLE 3.1 Fedora Boot and Driver Disk Images

Name	Description
`boot.iso`	CD-ROM boot image supporting single-media network installs
`bootdisk.img`	Enables booting to an install using all install methods
`drvblock.img`	Utility image containing various hardware drivers, such as SCSI
`drvnet.img`	Auxiliary network interface card drivers to support network installs
`pcmciadd.img`	PCMCIA driver disk with support for SCSI, network, and other adapters
`images/pxeboot`	Directory containing a PXE-enabled Linux boot kernel and RAM-disk image use to support booting various installs

Most of the images listed in Table 3.1 support booting to an install. The `pxeboot` directory contains a kernel that supports a remote booting protocol named PXE that enables installation, or upgrades of Fedora Core for network-only PCs. Use of this software requires a properly configured DHCP server and a supported BIOS. Although it might be possible to use a floppy boot disk, this method is not supported by Fedora. Browse to `http://www.compaq.com/products/servers/linux/redhat-whitepapers.html` and read the Compaq white paper titled "Configuring a Preboot eXecution Environment (PXE) using Red Hat Linux 7.1 on Compaq ProLiant Servers" to see one way of booting to an install using PXE. Browse to `http://www.europe.redhat.com/documentation/mini-HOWTO/Remote-Boot.php3` to read how to set up remote boot environments using older versions of Red Hat.

TIP

If your PC's BIOS supports booting from a USB device, you can use a USB floppy drive to boot to an install. It is also possible to boot from an IEEE-1394 (FireWire) CD-ROM if supported by your PC's BIOS.

You can create the boot floppies using the DOS `RAWRITE` command or the Linux `dd` command. You'll need one or more blank floppies. Use the `RAWRITE` command after starting DOS like this:

```
D:\dosutils\rawrite
```

Follow the prompts to create the images, entering a source filename and a target drive (such as `A` or `B`). To get a copy of the latest version of `RAWRITE`, browse to `http://www.tux.org/pub/dos/rawrite/`.

To create a boot diskette while running Linux, use the `dd` command. The first step is to insert the first Fedora Core CD-ROM and to make sure that it is mounted:

```
$ df
Filesystem      1k-blocks     Used Available Use% Mounted on
/dev/hda2        18714368 10410280   7353444  59% /
/dev/hda1           46636    13247     30981  30% /boot
none               120016        0    120016   0% /dev/shm
/dev/cdrom         655808   655808         0 100% /mnt/cdrom
```

This example uses the disk filesystem or the `df` command to show free hard drive space and currently mounted devices and partitions. As you can see, the contents of the first Fedora Core CD-ROM is found under the `/mnt/cdrom` directory. If the CD-ROM is not mounted, use the `mount` command to manually mount the CD-ROM. You will need to be the *superuser* or Linux root operator to do this (see Chapter 5, "First Steps with Fedora," for details about how to become root):

```
# mount -t iso9660 /dev/cdrom /mnt/cdrom
```

You can then use the convert and copy (`dd`) command like so:

```
# dd if=/mnt/cdrom/images/nameofimage.img of=/dev/fd0
```

This will take the contents of the specified image file (from Table 3.1) and create a diskette in the DOS drive A (represented by `/dev/fd0`). Use `/dev/fd1` if you want to use an installed secondary floppy drive.

TIP

PC notebook users installing via a network or external CD-ROM drive using a PCMCIA adapter should also create the `pcmciadd.img` diskette.

Hard Drive Partition Installation

Another way to install Fedora Core is to use a Linux or DOS hard partition to either boot to the install or hold the software required for an install. The partition must be large enough to hold `.iso` images (binary images of a CD-ROM). Copy the images of the first and second Fedora Core CD-ROMs into a directory on the local hard drive. If you use this type of install and don't need the required hard drive space later on, keep the images installed on the hard drive because Fedora can then be quickly reinstalled from the partition.

The `.iso` images can be downloaded from the Fedora Project or a mirror FTP site (see `http://fedora.redhat.com` for links). To perform this installation, you will need to know the hard drive's device name (such as `/dev/hdb`), along with the partition number and the name of directory containing the images (such as `/dev/hdb1` and `/redhat/images`; if you simply copy the images to the formatted DOS or Linux partition, you don't need the directory information). See Chapter 10, "Managing the Filesystem," for more information about using hard drive partitions.

Installing Using a Network

Fedora can be installed using a local network (or even over the Internet if you have broadband access). You will need access to a Web, FTP, or NFS server hosting the installation packages. To boot to a network install, use a network boot floppy, a bootable CD-ROM created using the `boot.iso` boot image, or the first Fedora Core CD-ROM included with this book. Boot your PC with the boot floppy or, if you use CD-ROM, type **`linux askmethod`** at the boot prompt. Follow the prompts, and you'll then be asked to choose the type of network installation.

TIP

Just press Enter at the boot prompt if you boot to a network install using a CDR created with the `boot.iso` image. You'll boot a graphical network install.

To install using FTP, select the network IP address assignment for your target PC, such as DHCP, or manually enter an IP address along with optional gateway IP address and nameserver addresses. You'll then be asked for the FTP site name. You can enter the name or IP address of a remote FTP server hosting the Fedora Core release. The name of the remote directory will depend on where the Fedora install files are located on the remote server.

Installing Fedora using the File Transfer Protocol (FTP) will require access to an FTP server (see Chapter 18, "Secure File Transfer Protocol (FTP) Service," to see how to set up a server and use FTP). You'll need to know the hostname or IP address of the server, along with the path (directory) holding the Fedora Core software. One way to prepare a server to host installs is to

1. Create a directory named `Fedora` under the FTP server's `pub` directory. The directory will usually be `/var/ftp/pub` on a Linux server.

2. Create a directory named `base` and a directory named `RPMS` underneath the `Fedora` directory.
3. Copy or download all RPM packages included with Fedora Core into the `pub/Fedora/RPMS` directory.
4. Copy all original base files (`comps.rpm`, `comps.xml`, `hdlist`, `hdlist2`, `hdstg2.img`, `netstg2.img`, `stage2.img`, `TRANS.TBL`) from the first CD-ROM's `base` directory into the `pub/Fedora/base` directory.

Using this approach, enter **`pub`** when asked for the name of the remote directory holding the Fedora Core install software.

Installing Fedora Core using a remotely mounted Network File System (NFS) is similar to a hard drive installation, but requires access to an NFS server. You'll need access permission, a permitted IP address or hostname for your computer, the hostname or IP address of the NFS server, and the path to the Fedora Core software. See Chapter 13, "Network Connectivity," for more information about NFS and network addressing.

To install Fedora using HTTP, you will need the hostname or IP address of the remote Web server, along with the directory containing Fedora's software. See Chapter 16, "Apache Web Server Management," to see how to set up a Web server.

NOTE

See Chapter 18 for details on how to configure the `vsftpd` FTP server. Chapter 16 provides information on how to set up and configure Apache for Web service. See Chapter 13 for Samba settings. Note that you can have your server perform all three duties.

Step-by-Step Installation

This section provides a basic step-by-step installation of Fedora Core from CD-ROM. There are many different ways to proceed with an install, and the installer can provide a graphical or text-based interface in a variety of modes.

This example installation prepares a computer for general duties as a server, perhaps to host a File Transfer Protocol (FTP) site, a Web server using Apache, or Session Message Block (SMB) services using Samba.

Before you begin, you should ensure that your computer is not connected to the Internet. Although you can use the installer to set up network protection during the install, it is best to check your system settings after any install and before opening up any public services (see the section "Firewall and Security Configuration" later in this chapter).

TIP

If you're installing to a system that has an older display monitor, it's a good idea to have your monitor's manual handy during the installation. If the install doesn't detect your monitor settings, you might need to specify the monitor's vertical and horizontal frequencies. This doesn't happen often, but if it does, you'll be prepared.

NOTE

Fedora Core's graphical installation dialogs are convenient and easy to use. However, you can use a text-based installation, which works with any PC. Simply specify **`linux text`** at the install boot prompt. Use the graphical install outlined here as a starting point for learning more about installing Fedora.

Starting the Install

To get started, insert the first Fedora Core CD-ROM and reboot your computer. You'll first see a boot screen that offers a variety of options for booting (see Figure 3.1). Options may be passed to the Linux install kernel by typing special keywords at the boot prompt. Note that the install kernel is different from the kernel that will be installed on your system during installation!

The basic options most often used are

- `<ENTER>`—Starts the install using a graphical interface. The graphical interface supports a mouse and offers check boxes and text fields for choosing software, configuring options, and entering information.
- `linux text`—Starts the install using a graphical text interface.

To install using a text-based interface (used for our example), type `linux text` and press Enter; otherwise, just press Enter to start the install.

Several function keys can be used at this first boot screen to cycle through four help screens providing additional install information. Use these function keys at the boot prompt to jump to different screens describing alternative installation options and modes:

- Pressing F1 returns to the initial boot screen.
- Pressing F2 details some boot options.
- Pressing F3 gives general installation information (described next in this chapter).
- Pressing F4 describes how to pass kernel video arguments, useful for configuring video hardware to support a graphical install at a specific resolution (such as 800-by-600 pixels).
- Pressing F5 describes Fedora Core's rescue mode.

FIGURE 3.1 Select an installation option in this first Fedora Core boot screen.

Some of the options you can use at the boot prompt include

- `linux noprobe`—Disables probing of the system's hardware.
- `linux mediacheck`—Verifies the integrity of one or more install CD-ROMs.
- `linux rescue`—Boots to single-user mode with a root operator prompt, disabling X, multitasking, and networking; this option can be used if you need to reconfigure your boot loader or to rescue data from your system.
- `linux dd`—Uses a driver disk (a floppy image) and possibly one or more kernel arguments (such as `linux mem=512M expert`) to enable certain types of hardware, such as networking cards.
- `linux askmethod`—Prompts for the type of install to perform, such as over a network.
- `linux updates`—Starts an installation update.
- `memtest86`—Starts a cyclical, intensive series of memory tests of your PC's RAM.
- `linux nofb`—Starts a graphical installation, but does not use a framebuffer (helpful with problematic or unsupported video).
- `linux resolution=`*`width x height`*—Installs using a graphical display of *width*-by-*height* pixels (such as `resolution=800x600`), which can help match older or less capable display monitors and video cards.

The F4 screen lists options that can be used at the boot prompt to set a specific resolution for the installation. For example, this is done by typing `linux resolution=` at the boot

prompt, along with an option such as `"800x600"`. Other options, such as optional arguments for kernel modules (in order to properly configure or initialize hardware) may be passed to the install kernel if you use the `noprobe` option.

TIP

The installer will start automatically in 60 seconds. Press the spacebar, reboot, or turn off your PC if you need to halt the install.

After you press Enter, the installer's kernel loads, and you're asked (in a text-based screen) if you would like to perform a media check of your CD-ROM, as shown in Figure 3.2.

This check can take quite some time (depending on the speed of your CD drive), but can ensure the integrity of the CD-ROM's contents, as an `md5sum` value is embedded on each CD-ROM. This check can help foil installation of malicious software from CD-ROMs with tampered contents. The check can also be helpful to make sure that the CD-ROM you are using will work on your PC and in your CD drive. To perform the check, choose OK; otherwise, use the Tab key to navigate to the Skip button and press Enter to choose it.

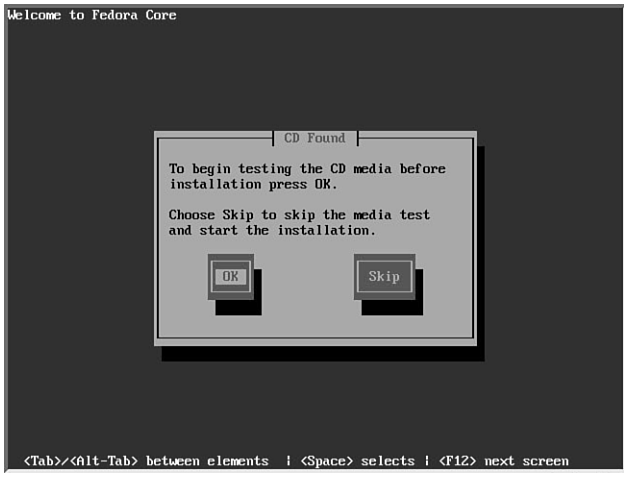

FIGURE 3.2 You can check your CD-ROM media before installing Fedora.

After checking your CD-ROM or skipping the check, the display will clear. The Fedora installer, Anaconda, will load, and you are presented with a graphical welcome screen as show in Figure 3.3. The installer should recognize your PC's graphics hardware and mouse. You can then click on the Release Notes button to get detailed information about Fedora Core, along with tips on hardware requirements and how to perform various installs.

If your pointing device (mouse) is not recognized, you can press Alt+R to "press" the Release Notes button. Similarly, you can click Alt+H to hide text shown on the left side of the screen, but you should take a minute to read frame's contents.

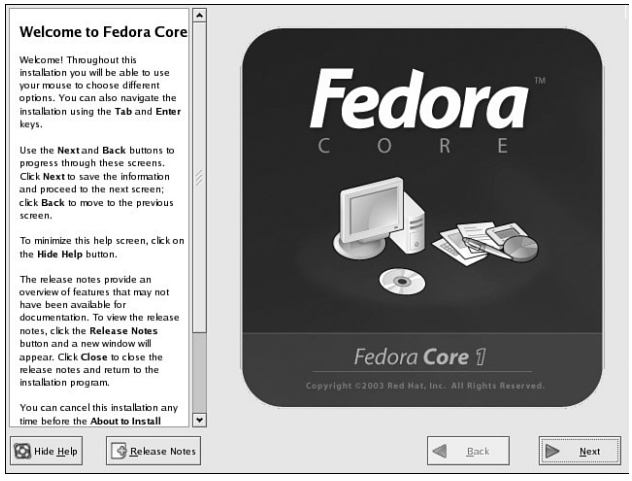

FIGURE 3.3 Read Help or Release Notes before installing Fedora.

Click Next (or press Alt+N) to continue, and the installer asks you to select one of 21 different languages for the installation, as shown in Figure 3.4.

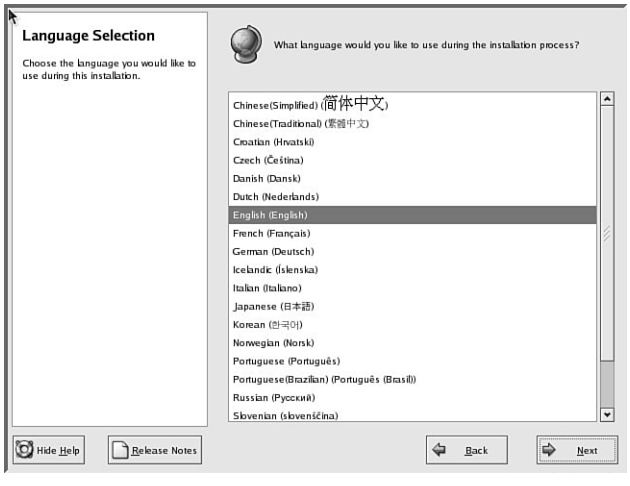

FIGURE 3.4 Select a language to use when installing Fedora.

You can navigate the installer's dialogs (during a text-based or graphical install) using the Tab key. You can scroll through lists using your cursor keys. Note that you can now "step backward" through the install by using a Back button. Select a language and click the Next button.

You'll then be asked to select a keyboard for the install, as shown in Figure 3.5.

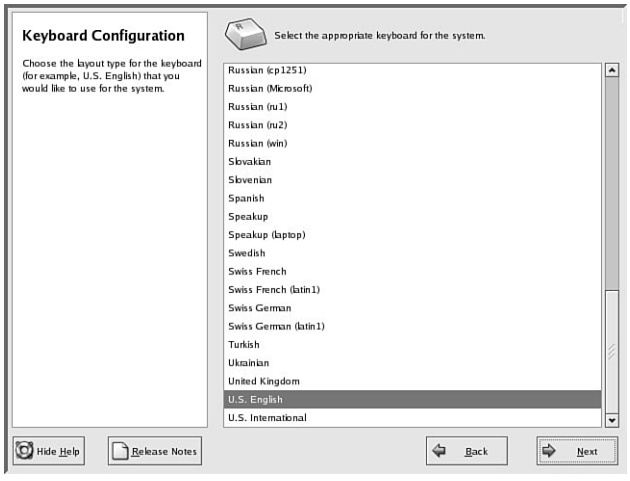

FIGURE 3.5 Select a default keyboard to use when installing and using Fedora.

Scroll to the appropriate keyboard option. You use this option to configure the install to support one of 54 different language keyboards. Click Next after making your selection. You're next asked to select a pointing device (your mouse), as shown in Figure 3.6.

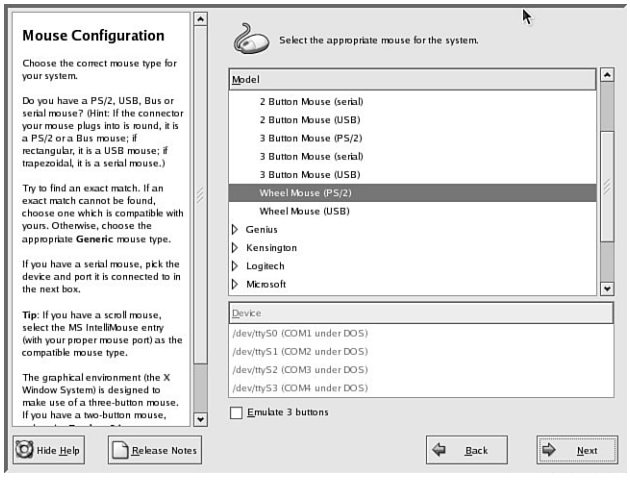

FIGURE 3.6 Select a pointing device to use when installing and using Fedora.

Select one of the 41 different mouse types to match the pointing device you plan to use for your console or desktop sessions. Note that Linux supports USB devices, including USB mice.

TIP

If you select a two-button mouse from the list during installation, notice that three-button emulation is automatically selected. This emulation enables a middle-mouse button to be simulated when both the left and right mouse buttons are pressed simultaneously. Use of the middle (or 2) button is important for certain actions, such as pasting text. You can also press Alt+E to mark the check box for three-button emulation.

Click Next to continue. If your PC's monitor was not detected, you might be asked to select your model from 132 different manufacturers. In rare instances, you might have to specify your monitor's exact horizontal and vertical frequencies. This can happen with older displays.

If an existing Linux install is detected, you'll be asked if you want to upgrade and reinstall; otherwise, you're then asked to select a type of installation, as shown in Figure 3.7.

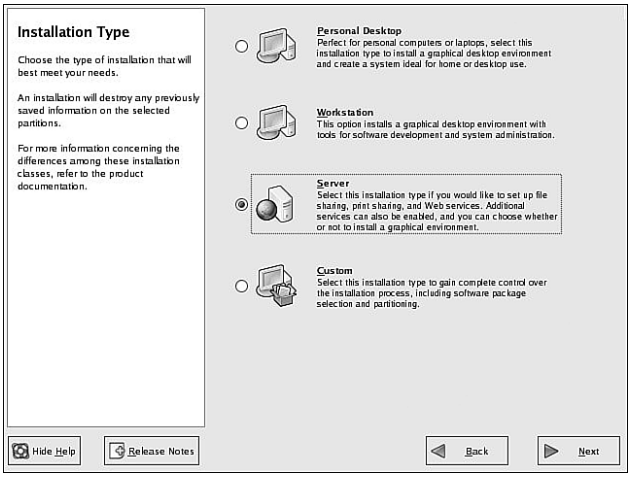

FIGURE 3.7 Select a type of installation.

Select a type of installation suitable for your intended use—we'll use a Server install for our example. As we mentioned earlier, you can use the Custom install instead to tailor the amount, type, and specific packages to be installed. This can be helpful in order to prune unnecessary software from your system and might save some time later on. After you select the installation type, click Next to continue. You'll then see a screen that offers a choice of partitioning schemes and tools.

NOTE

Fedora's installer also supports the ability to monitor background and install processes running during an installation. You can watch the progress of an install and hardware information reported by the Linux install kernel by navigating to a different console display or *virtual* console by simultaneously pressing the Ctrl, Alt, and appropriate F*n* key (such as F1 through F5).

Use this approach to watch for kernel messages, monitor hardware detection, gain access to a single-user shell, and view the progress of the installer script.

When using a graphical installer, press Ctrl+Alt+F4 (then Alt+F2 or Alt+F3) to navigate to the various screens. Press Alt+F7 to jump back to the installer. When performing a text-based installation, use Alt+F2 (then Alt+F3 or Alt+F4). Use Alt+F1 to jump back to a text-based install.

Partitioning Your Drive

You learned how to choose and plan a partitioning scheme in "Planning Partition Strategies," earlier in this chapter, based on the more specific partitioning information offered in Chapter 2. The Disk Partitioning Setup screen, shown in Figure 3.8, offers two options for disk partitioning. Here is what the options do:

- Using the Automatically Partition button conveniently partitions your hard drive according to the type of installation you selected and configures the partitions for use with Linux.
- Choosing the Manually Partition with Disk Druid button launches a graphical partition editor that enables the creation of custom partition schemes.

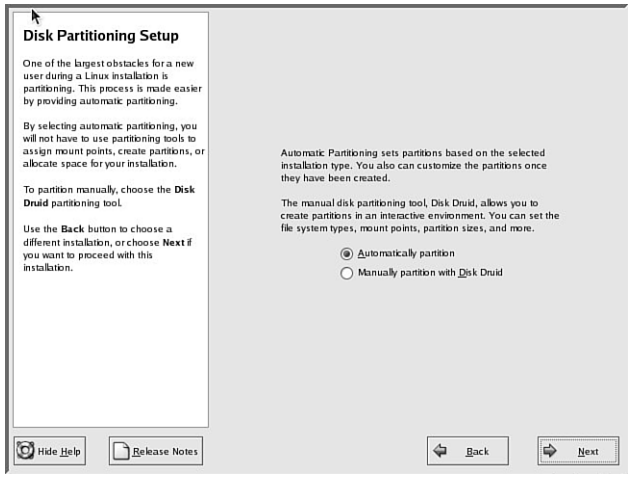

FIGURE 3.8 Select a partitioning scheme or tool.

NOTE

See the section "Partitioning Before and During Installation" in Chapter 2. Chapter 10 contains information on using another partitioning utility, the text-based Linux `fdisk` command.

For this example, select Manually Partition with Disk Druid button and click Next. If you are using a new hard drive that hasn't previously been partitioned, you'll be asked if you would like to create new partitions on the drive. Click the Yes button to initialize the drive. If you are using a hard drive that has been previously partitioned or formatted and the partitions are recognized, Disk Druid will present the partitions in its partition dialog. Figure 3.9 shows the graphical interface presented for a 6GB hard drive that hasn't been partitioned.

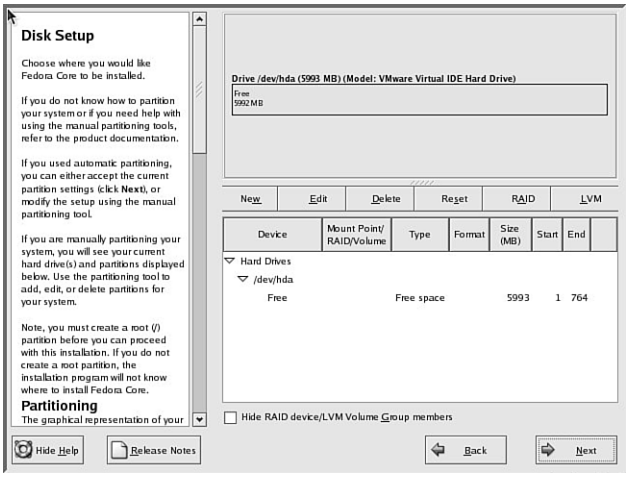

FIGURE 3.9 You can use Disk Druid to partition your drive before installing Fedora.

To use Disk Druid, select any listed free space, and then click the New button (or press Alt+W) to create a new partition. Alternatively,

- To get help, see the help frame on the left.
- To create free space, scroll to an existing partition and use the Delete button to delete the partition.

After you choose the New button, you see a screen as shown in Figure 3.10.

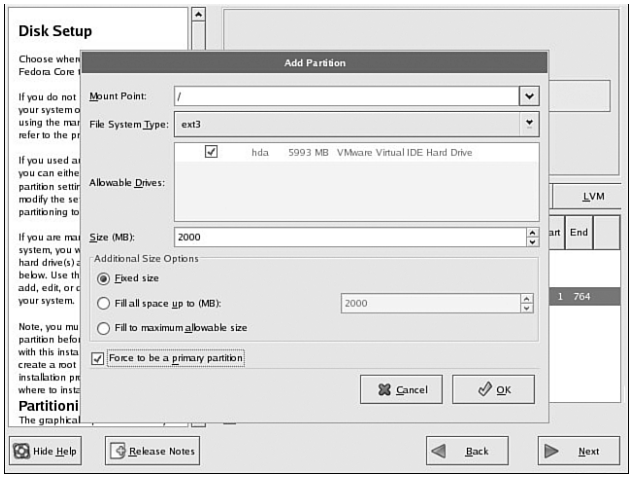

FIGURE 3.10 Set partition information about a selected or new partition on a hard drive.

You use the Add Partition dialog to assign a mount point (such as `/boot` or `/`), assign a filesystem (such as `ext2`, `ext3`, RAID, swap, or vfat) by using the drop-down menu set at `ext3` by default, and assign the size of the partition. Remember that, at a minimum, your system should have a root (`/`) and swap partition. The `ext3` filesystem is the best choice for your Linux partitions because it is the default and specifically supported by Fedora, but you can also use `ext2` (and convert to `ext3` later on—see Chapter 10). The size of the partition can be fixed by entering a number (in megabytes), or if you select the Fill All Available Space field, will use all remaining free space (but not yet, as you need to create a partition for swap). Click OK to save the new partition information.

TIP

You can perform diagnostic checks on your storage media after installing Fedora by using various Linux software tools, as shown in Chapter 10.

Remember: Linux requires at least a root (`/`) and swap partition. The swap partition should be at least twice as large as the amount of installed memory (or more) in order to assure system performance if you run a lot of programs or host many users. After you create an initial partition for the root filesystem, repeat the steps to create a new partition, but select swap as the filesystem type using the drop-down menu. Figure 3.11 shows a simple, completed partitioning scheme with a separate `/home` partition on a server using a 6GB hard drive.

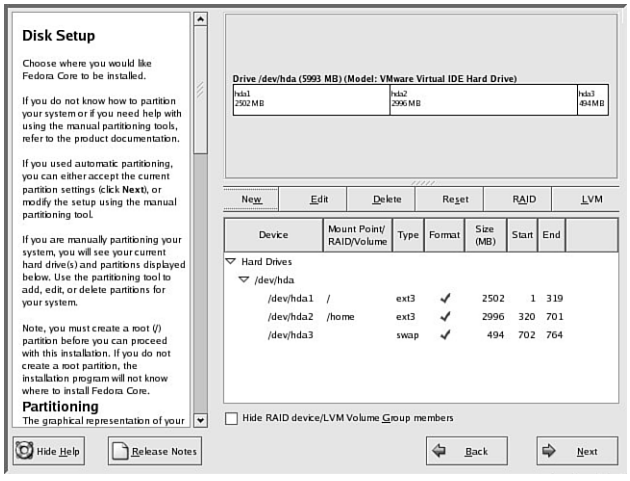

FIGURE 3.11 Review your partitioning scheme for your hard drive.

Take a moment to review your partitioning scheme. If you are not satisfied with the partitioning, you can make changes by selecting a partition and then using the Edit button to change the partition's information (such as mount point or type of filesystem). Use the Delete button to delete the partition entry and to free up partition space. You can then use the New button again to create partitions in the space that is now free. When satisfied, click Next to continue the install.

Choosing, Configuring, and Installing the Boot Loader

After you accept the partitioning scheme, a screen appears asking you to select a boot loader for booting Fedora (see Figure 3.12). This screen also enables you to choose not to use a boot loader (when booting from floppy, a commercial boot utility, a DOS partition, or over a network), and the ability to boot other operating systems if you have configured a dual-boot system. Review "Choosing a Boot Loader," shown previously in this chapter, for more information on making this choice.

TIP

Fedora will work well with other operating systems, but the reverse is not always true. If you need specialized help with configuring a dual-boot system, check various HOWTOs at `http://www.tldp.org` for hints and tips.

Select the GRUB boot loader. GRUB is typically installed in the MBR of the first IDE hard drive in a PC. However, the boot loader can also be installed in the first sector of the Linux boot partition, or even not installed on the hard drive. (In which case, you'll need to create a boot floppy during the install; see "Create a Boot Disk," later in this chapter.) Note that you can also backtrack through the install process to change any settings.

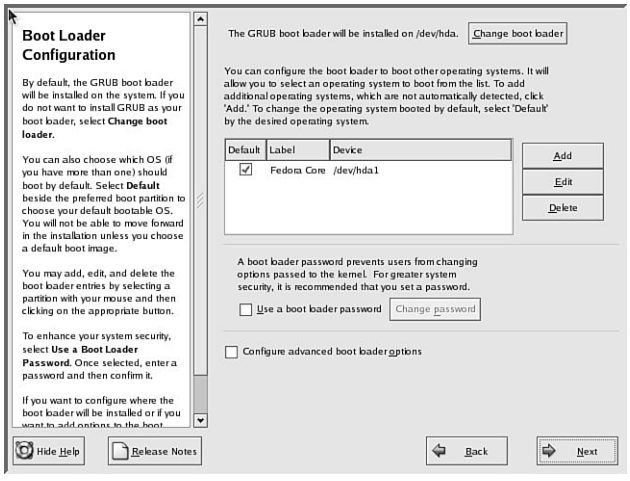

FIGURE 3.12 Select whether you want to use a boot loader and configure other boot options.

Note that you can assign a password for the boot loader. If you choose to use this option, you will need to enter a password at the GRUB boot screen (see the section "Login and Shutdown" at the end of this chapter for information on graphical logins). Carefully note the password! It does not have to be the same password used to log in, but if you password protect booting through your computer's BIOS and use a boot loader password here, you will subsequently need to enter three passwords (BIOS, boot loader, and login) in order to access Linux. Type in a password of at least eight characters twice (once on each line); then click OK or Cancel to exit the dialog.

If you click the Configure Advanced Boot Loader Options button, you're asked for arguments to pass to the Linux kernel before booting. Kernel arguments are used to enable or disable various features of Linux at boot time. If you install the source to the Linux kernel, you'll find documentation about the more than 200 different kernel arguments in the file `kernel-parameters.txt` under the `/usr/src/linux/Documentation` directory.

Click Next to set your boot loader configuration. You'll then proceed to network interface configuration, as shown in Figure 3.13.

Network Configuration

If you have an installed network adapter, you are asked for network configuration details, as shown in Figure 3.13. Fedora can be set to automatically configure networking upon booting. Note that you can also configure networking following installation using Red Hat's `redhat-config-network` graphical network administration tool (see Chapter 13 for details about using these tools).

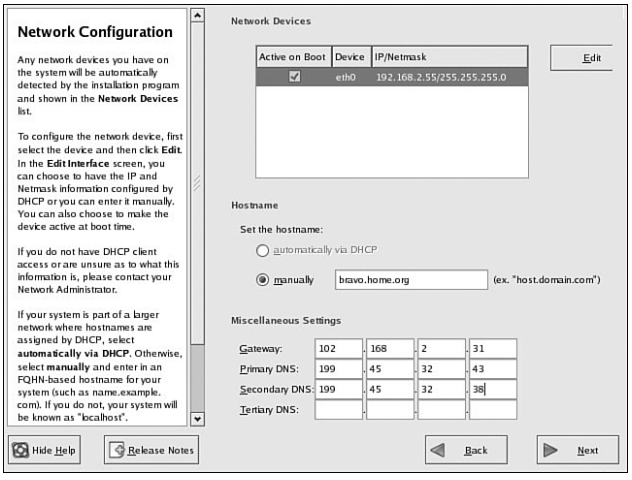

FIGURE 3.13 Select or enter networking configuration information.

NOTE

If the Linux kernel finds more than one network interface installed on your computer, you might be asked to configure a second Ethernet device. This might be the case, for example, if you are installing Fedora Core on a computer that will serve as a gateway or firewall. If you configure more than one Ethernet device, the device named `eth0` will be the first active interface when you start Fedora.

You can choose to have your interface information automatically set using DHCP. Otherwise, especially if you are configuring a DHCP server, manually enter an IP address, hostname, or gateway address (such as for a router), along with DNS information if you click the Edit button listed by the interface (such as `eth0` in the example).

After making your selection, click Next to continue. You'll be asked to select a firewall configuration.

Firewall and Security Configuration

Figure 3.14 shows the Fedora Core installer Firewall Configuration dialog, which offers an opportunity to set default security policies for the new server. Protecting your system using a firewall is especially important if your server is connected to a network (although it is best to first install Linux, set security policies, and then connect to a network). These settings in this installation screen determine how remote computers or users will be able to access your server. You can change these policies after finishing the install and logging in.

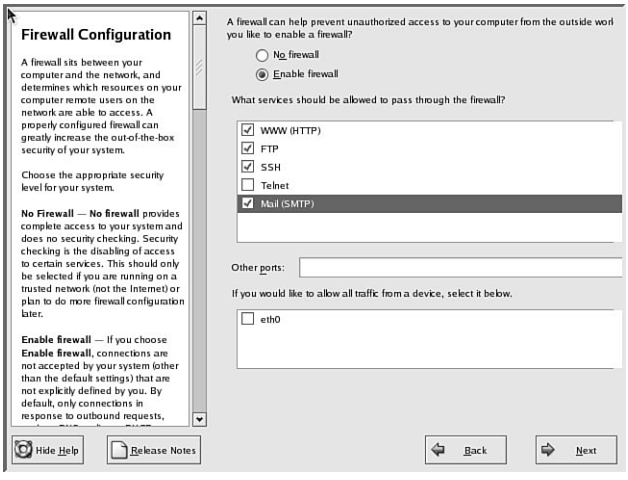

FIGURE 3.14 Select a desired security level and allowed services.

If you have a general idea of how you want to protect your computer, use the dialog shown in Figure 3.14 to turn on firewalling.

Choosing the No Firewall setting isn't recommended; use this setting only if Fedora will be used as a non-networked workstation.

> **NOTE**
>
> Note that you can also manually configure security settings after installation using the text-based `lokkit` command, `redhat-config-securitylevel` client, or graphical `gnome-lokkit` client. See Chapter 13 for details on how to protect your system using these clients and various security level settings.

Click any allowable services, as shown in Figure 3.14. For some servers, HTTP, FTP, and Simple Mail Transport Protocol (SMTP) requests are acceptable and reasonable. *Do not select or use the Telnet service, which is used to allow remote network logins.* For security reasons, the Secure SHell (SSH) service is a much better choice (see Chapter 5 on how to use the `ssh` client).

Click Next to install the firewall security settings. You'll then be asked to select additional language support on your server. Again click Next when finished.

Setting the Time Zone

You're next shown a Time Zone Selection dialog (see Figure 3.15). There are two "clocks," or times, when using a PC: the hardware clock, maintained by hardware in the computer and a backup battery; and the system time, set upon booting and used by the Linux kernel. It is important to keep the two times accurate and in synchronization because automated system administration might need to take place at critical times. Many

computer installations use computers with hardware clocks set to GMT, which stands for Greenwich Mean Time. (The more modern designation is *UTC* or *Coordinated Universal Time*.) The Linux system time is then set relative to this time and the default time zone, such as Eastern Standard Time, which is –5 hours of UTC.

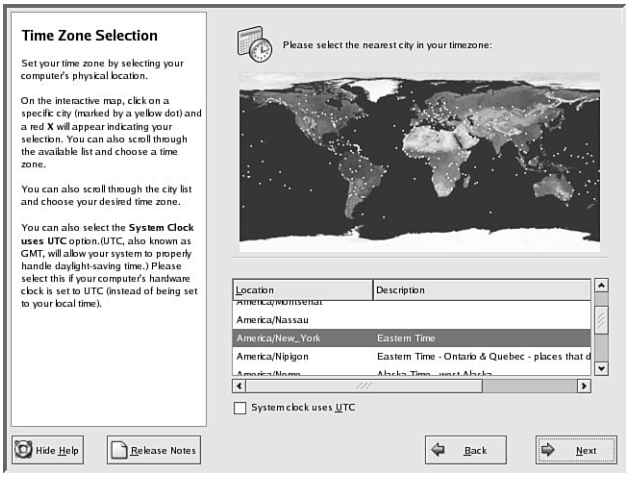

FIGURE 3.15 Select your time zone.

Setting the computer's hardware clock to UTC (GMT) has the advantage of allowing the Linux system time to be easily set relative to the geographic position of the computer and resident time zone (such as a Linux laptop user who would like to create files or send electronic mail with correct time stamps, and who has traveled from New York to Tokyo). See Chapter 4, "Post-Installation Issues," for details on setting the date and time for Linux.

TIP

Read the manual page for the `hwclock` command to learn how to keep a running Linux system synchronized with a PC's hardware clock. See Chapter 4 for more details on using the `hwclock` command and Linux time-related software.

Choose your time configuration, and then click Next.

Creating a Root Password and User Accounts

You're next asked to enter a root operator password, as shown in Figure 3.16. Type in a password, press Tab or Enter, and then type it again to make sure that it is verified. The password, which is case sensitive, should be at least eight characters (or more) and consist of letters and numbers. Note that the password isn't echoed back to the display. Your root password is important because you will need it to perform any system administration or user management with Fedora.

FIGURE 3.16 Type in, and don't forget, your root password.

CAUTION

Don't forget your system's BIOS, boot loader, or root passwords! Some equipment, such as notebook computers, might require factory replacement of motherboard components if the owner forgets the BIOS password. The BIOS settings on most desktop PCs can usually be reset via a jumper or removal and insertion of the motherboard battery. If you forget your boot loader password, use a bootdisk (perhaps created during installation as shown later on in this chapter) or boot to a rescue mode using your first Fedora Core CD-ROM and reset the root password using the `passwd` command.

When finished, click Next to continue on to software package selection for your new server.

NOTE

You can only create a root account during a Fedora Core install. You will have to create user accounts later on after booting, using command-line programs (such as `adduser`) or the graphical `redhat-config-users` client. Create an account for yourself and any additional users. Usernames traditionally consist of the first letter of a person's first name and the last name. For example, Cathy Taulbee would have a username of *ctaulbee.* Don't forget to enter a password for any new user! If you create a user without a creating a password, the new user will not be able to log in.

You should create at least one user for your server besides the root operator. This is for security purposes and to avoid logging in as root, either through the keyboard at the server or remotely over the network. The default shell and home directory settings should remain set at the defaults, which are the Bourne Again SHell (`bash`) and the `/home` directory.

NOTE

See Chapter 5 for how to become the root user or run root commands as a regular user. See Chapter 9, "Managing Users," for details on managing users.

Software Selection and Installation

The Package Group Selection dialog shown in Figure 3.17 displays the installer's suggested software for your class of installation (a server in our example).

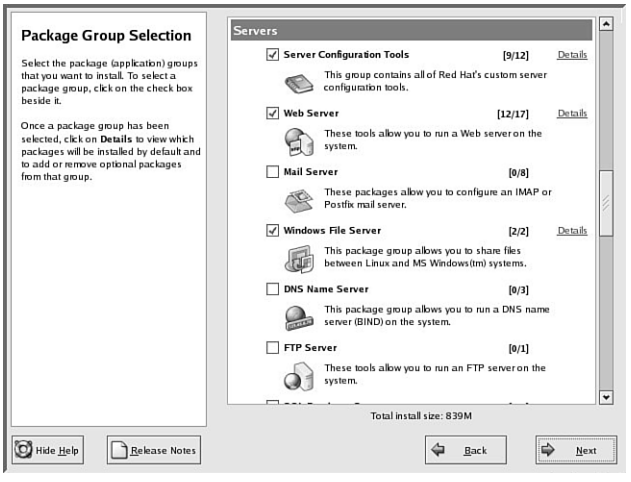

FIGURE 3.17 Select software package groups for installation.

If you choose to install a personal desktop, workstation, or other installation type, the software packages appropriate for that installation will be automatically selected for you. Each package (actually a Group) provides many different individual software packages (refer to "Choosing Software Installation Options," earlier in the chapter).

Scroll through the list of package groups, and then click a software package check box to select or deselect software to be installed. Note that the entire size (drive space requirements) of the installed software will be dynamically reflected by your choices.

Click the Next button when finished to start installing Linux and the Fedora Core software.

The installer will then perform a quick dependency check and present a dialog informing you that a log of the install will be saved under the `/root` directory in the file named `install.log`. Press the Enter key to begin the installation of the software on your system. Be certain that you're ready when you confirm the process, as you cannot step back from this point on!

The installer will then format and prepare your new Linux partitions.

Next, the installer will prepare for the install by gathering a list of the RPM files and will start placing the software on the newly formatted partitions. This process can take anywhere from several minutes to two or more hours, depending on your PC and the amount of software you have chosen to be installed. The installer reports on the name of the current package being installed and the remaining time, as shown in Figure 3.18.

FIGURE 3.18 The Fedora installer formats your drive, and then installs selected software package groups.

If you are installing over a network, go take a break because the install will proceed unattended through the software installation. If you are using this book's CD-ROMs, you might be prompted to remove the first CD-ROM and insert another. You might also be asked to repeat this operation using the third CD-ROM at some point.

Create a Bootdisk

When the software installation finishes, the installer will perform some temporary file cleanup, install the boot loader, and then ask if you'd like to create a boot diskette for possible use later on, as shown in Figure 3.19.

You can create this boot disk now, or, as mentioned earlier, you can use Red Hat's `mkbootdisk` command later on while using Fedora. Select Yes or No. Having a boot disk can be handy, especially if an error was made during the install and the boot loader fails to boot Linux.

If you choose to create a boot disk, you'll need to have a blank disk on hand. Select Yes, insert a blank disk when prompted, create the boot disk, and continue the install.

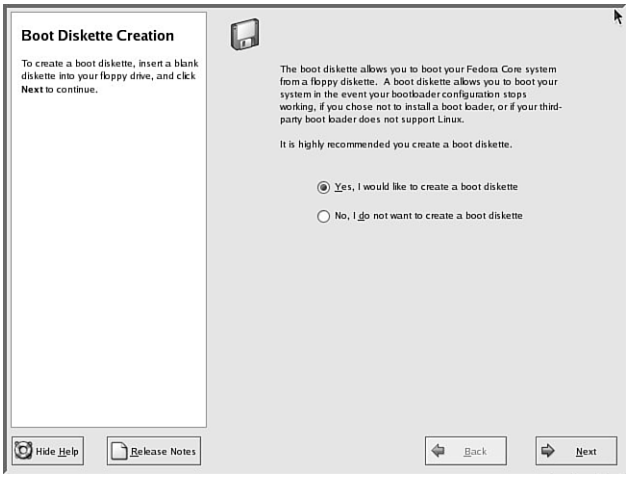

FIGURE 3.19 Create a boot disk for use with Fedora.

TIP

If you chose the X Window System, you can skip X configuration during the install and configure X after installation. This might be a better approach if the install fails to accurately probe your hardware or cannot configure X during the install, but you still desire to have X software installed. See Chapter 6 for details on configuring X to work with your PC's graphics card.

Finishing the Install

You're done! Press the Exit button, and the installer will eject any inserted CD-ROM and reboot. The GRUB boot loader will present a boot prompt as shown in Figure 3.20.

If you have set a GRUB password, press the p key, type your password, and press Enter. If you do nothing for 10 seconds or press Enter, either boot loader will boot Linux.

NOTE

After installation, you can edit the file `/boot/grub/grub.conf` and change the `timeout=` setting to change the boot time to a value other than 10 seconds.

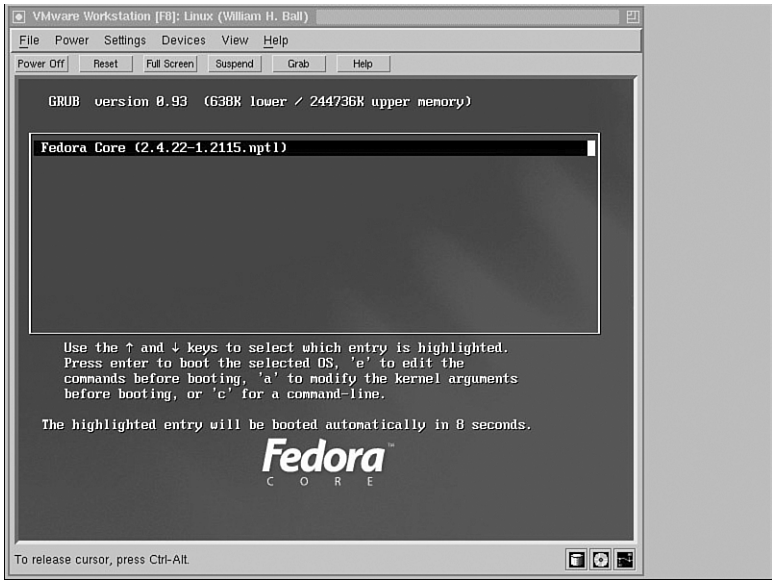

FIGURE 3.20 Boot Fedora with GRUB by pressing the Enter key or waiting 10 seconds.

Login and Shutdown

After rebooting your PC, you'll be able to log in to a Linux session. If you didn't choose to use X11 software during the installation, you'll log in at a text-based login prompt. If you configured X and enabled a graphical login, the screen will clear after your system boots, and you'll be presented with a graphical login screen, as shown previously in Figure 3.20.

To log in at the text-based prompt, type your username and press Enter. You'll then be prompted for your password. After you press Enter, you'll be at the Linux command line. If you use a graphical login, you can use the shutdown or reboot menus in the screen's dialog to shut down or reboot your system. To immediately shut down your system from the command line of a text-based session, use the `su` command and its `-c` option to run the `shutdown` command. In addition, use the `-h` or halt option and the keyword `now`, or the numeral `0`, like this:

```
$ su - c "/sbin/shutdown -h now"
```

You can also use

```
$ su -c "/sbin/shutdown -h 0"
```

You can also use the `shutdown` command to immediately reboot your computer like this:

```
$ su -c "/sbin/shutdown -r now"
```

Or, you can use

```
$ su -c "/sbin/shutdown -r 0"
```

For new users, installing Fedora is just the beginning of a new and highly rewarding journey on the path to learning Linux. See Chapter 5 for additional information about using Linux commands. For Fedora system administrators, the task ahead is to fine-tune the installation and to customize the server or user environment.

RELATED FEDORA AND LINUX COMMANDS

You might use the following commands while installing Fedora:

- `dd`—Convert and copy data
- `fdisk`—The Linux disk partitioning utility
- `grub`—The GNU boot loader for Linux and other operating systems
- `LOADLIN`—A Linux boot loader for DOS
- `mkbootdisk`—Red Hat's Linux boot disk creation utility
- `RAWRITE`—A disk image utility for DOS

Reference

`http://fedora.redhat.com` —The place to start when looking for news, information, and documentation about installing, configuring, and using Fedora.

`http://www.powerquest.com/partitionmagic/`—Powerquest's PartitionMagic utility includes BootMagic, which can be used to support booting of Linux or, regrettably, other less-capable operating systems, such as Windows XP.

`http://www.v-com.com/product/sc7_ind.html`—V Communications, Inc.'s System Commander, a commercial 4.2MB download that can be used to support booting of any operating system capable of running on today's PCs. An intelligent partitioning utility, Partition Commander, is included.

`http://www.nwc.com/columnists/1101colron.html`—How to use Intel's Pre-execution Environment (PXE) protocol to remote boot workstations.

`http://www.gnu.org/software/grub/`—Home page for the GRUB boot loader.

`http://elserv.ffm.fgan.de/~lermen/HOME.html`—Home of the `LOADLIN` Linux loader.

`http://www.linuxdoc.org/HOWTO/BootPrompt-HOWTO.html`—Link for obtaining BootPrompt-HOWTO, a guide to using the boot prompt for passing kernel arguments.

`http://www.tldp.org/HOWTO/Installation-HOWTO/index.html`—Link for obtaining Linux Installation-HOWTO, a guide to installing Linux by Eric S. Raymond.