Chapter 1

Getting Ready to Install Red Hat Linux 7.1

In this chapter, you'll learn how to install Red Hat Linux 7.1. Most of this chapter is concerned with decisions that affect the installation process, rather than with the actual installation process itself, but this decision-making is an essential step to ensure that your Linux installation goes smoothly and that you end up with a well-configured system.

This chapter starts with a brief discussion of the minimum Linux system. What hardware is necessary to run a useful Linux system? It is possible to boot Linux from a single floppy disk, but the resulting system will be so limited that it will be useless for most purposes. This chapter describes what equipment you need in order to make Linux a useful tool in your computing arsenal.

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From there, this chapter discusses a crucial issue: hardware compatibility. Even in the Windows world where vendors quickly provide drivers for almost every conceivable piece of hardware, things go wrong, and hardware incompatibility can be the cause of long, sleepless nights trying to get the Windows operating system to work. In Linux, there is equal potential for problems, especially if you try to use hardware for which there is currently limited or no support.

What You Need

Before you can install Linux, it is important to step back and consider exactly what type of computer you need. Linux can be installed on a wide range of hardware, including the following:

- ARM processors
- Motorola 68000 series processors
- Alpha processors
- SPARC processors
- MIPS systems
- PowerPC-based systems
- S/390-based servers
- Acorn computers
- Power Macintoshes
- Intel and Intel-compatible PCs

By far, though, Intel-compatible PC hardware is the most common Linux platform. It generally provides the lowest cost/performance ratio for Linux and is the primary development platform for most Linux tools. Intel Linux offers the best selection of device drivers for peripheral hardware, the largest body of available applications (both commercial and free), and the strongest user community on the Internet to turn to for support and assistance.

The Minimum PC for Linux

As an operating system, Linux has amazingly modest requirements for computer resources. It is possible to get Linux up and running on a 386-based computer with only 4MB of RAM. Of course, such a machine is limited in the following ways:

- It can't run X Windows (so, no GUI).
- The number of programs it can run simultaneously is limited by the amount of physical RAM.
- Its performance is slow enough to prevent its use in most mission-critical applications (for instance, as a mail server or web server).

Given these limitations, a system like this can still play a role in an organization as:

- A terminal to another Linux or Unix server where applications are running
- A low-end server for services such as Domain Name System (DNS), which helps computers translate hostnames such as `www.yahoo.com` into actual numeric Internet Protocol (IP) addresses or as an authentication server for a small network

In fact, Linux can provide a better way to use this type of old hardware than DOS can. DOS has limited networking capabilities and cannot handle the server duties described.

If you want to try to run this type of minimalist Linux system, turn to the Small Memory Mini-HOWTO at `http://www.linuxdoc.org/HOWTO/mini/Small-Memory` for some basic tips to help you get Linux up and running in a system with limited memory.

A Good PC for Linux

Needless to say, just as you wouldn't want to run Windows on the type of machine described in the previous section, you need a more robust PC to fully enjoy the features and benefits of Linux.

Linux actually requires far fewer resources to perform far more functions than the average Windows 98 or Windows NT/2000 system. For instance, a functional workstation can be put together with a

486-100MHz processor and 16MB of RAM. This system will be able to run X Windows (for a graphical interface), access the Internet, run a graphical web browser, and all the while perform as a low-end server on a network.

Still, the average user will want a somewhat more powerful Linux system. A respectable Linux workstation needs the following specifications:

A Pentium-class CPU Even a Pentium 133 will do just fine for most users. It is wise to avoid certain clone chips, such as the Cyrix 686 line, because of some reported difficulties people have had running these chips. Generally, though, most Pentium-class systems work well. Of course, if you are buying a new PC today, you won't be able to find a standard Pentium, so choose a Pentium IV, Celeron, Athlon, Duron, or Itanium-class system.

32MB of RAM Linux is exceptionally good at taking advantage of any extra memory you throw at it. 32MB is enough for the average workstation, but you will notice the difference if you add 64MB or more of RAM.

A 3GB hard disk You can get away with a 1GB (or even smaller) hard disk, but a roomier disk is preferable. Larger disks tend to perform better than the older, smaller ones. In a number of cases, you won't be able to install all of the features associated with Red Hat Linux 7.1 unless you have at least 3GB of hard disk space.

A supported video card See the section "Checking Your Hardware for Compatibility," later in this chapter.

With a system like this, you will have more than sufficient resources to run Linux as a desktop operating system. You don't need to go out and buy the latest 1.7GHz Pentium IV system with all the bells and whistles to get Linux up and running at a respectable speed. In fact, you may want to avoid the latest hardware, especially if it was just released in the past few weeks.

Added Bonuses

Of course, in today's computing environment, you will probably want to extend your PC's capabilities into areas such as multimedia and the

Internet. There are a few add-ons that greatly enhance any Linux system, and you should consider them as a way to round out your workstation:

A CD-ROM drive If you are going to install one, consider an IDE/ATAPI CD-ROM drive or, if you can afford it, a SCSI CD-ROM drive. Generally, it is best to avoid proprietary CD-ROM drives that work with their own interface cards or connect directly to special interfaces on sound cards. These CD-ROM drives are usually poor performers and difficult to configure in Linux.

A sound card Most Sound Blaster®–compatible cards are supported in Linux; check the hardware compatibility section of this chapter.

A modem In terms of speed, the same rules apply here as with Windows: It is generally best to get the fastest modem you can that will be able to connect at its top speed to your Internet service provider (ISP).

Two caveats, though: First, it is generally wise to opt for external modems in Linux. This is especially true for ISDN modems, because there is limited support in Linux for internal ISDN modems. The advantages of external modems (ISDN or analog) are that they are easier to configure and they offer external indicators so you can more easily debug configuration problems.

Second, it is generally wise to avoid "winmodems," which are modems that use Microsoft Windows driver library files. Linux supports only a few winmodems without difficulty.

Although a CD-ROM, a sound card, and a modem are fairly standard equipment on newer PCs, if you plan to use Linux as a small server on your intranet, you should consider the following add-ons:

A SCSI card SCSI offers much better performance for hard drives than the IDE interface and has better support for multiple devices. If you plan to run any type of multiuser system (for instance, file server, web server, or applications server), you really need to use a SCSI card. Be sure to consult the hardware compatibility section before selecting a SCSI card and, if possible, choose a card with Ultra-Wide SCSI support.

SCSI hard drive(s) One function of the SCSI card is to be able to use the faster SCSI hard drives. If possible, use Ultra-Wide SCSI drives for the best performance. You may want to consider multiple disk drives. For instance, if you estimate that you need 8GB of space for your users' data as well as the operating system and all installed applications, you may want to consider two 4GB drives (one for the user data and the other for the system and software). By splitting the software and the data, you will probably find that performance improves because the same disk is not being accessed for both.

A tape drive If you plan to run a server, you will want to do backups to ensure that your data is safe from system failure and other disasters. While it is possible to use some tape drives that connect through the floppy disk bus, you will find that life is a lot easier if you opt for a SCSI tape drive, if you can afford one. They are faster and better supported by Linux.

Checking Your Hardware for Compatibility

As with a Windows (especially Windows NT/2000) system, it is important to check that hardware you intend to buy will work with your Linux operating system and with the rest of the hardware in your computer before buying. Hardware incompatibility with the operating system and other hardware can be the cause of endless difficulty and time spent trying to debug and reconfigure a computer.

This issue is especially important in the Linux community. Although support for Linux is growing among hardware vendors, many vendors still do not provide Linux drivers for their hardware, and their support staff may be unable or unwilling to work with users to debug hardware conflicts and problems in a Linux environment. This means that the hardware needs to be supported by drivers included in the user's Linux distribution or by add-on software that provides drivers for the hardware in question. In addition, users must rely on the Linux community for help when problems arise.

Although a vast majority of hardware is supported in some way by Linux, it is wise to do some research before installing Linux or before purchasing new hardware for a Linux-based system. Here's what you can do:

- Try consulting the Red Hat Hardware Compatibility List at `hardware.redhat.com`. This contains a searchable database of compatible hardware for the most current Red Hat distributions.
- Consult the Linux Hardware Compatibility HOWTO. This document, authored by Patrick Reijnen, contains extensive lists of hardware known to work with Linux, hardware known not to work with Linux, and issues related to both types of hardware. If you purchase hardware that has the stamp of approval from this HOWTO guide, your life will be easier. You can find the latest version of this guide at `http://www.linuxdoc.org/HOWTO/Hardware-HOWTO.html`.
- Consult the `comp.os.linux.hardware` newsgroup. This is a good source of information about hardware issues as they relate to Linux. If you are unsure whether your intended hardware purchase is wise, post a question to the group asking if anyone has had any experience with the hardware in question. You will usually find that others have tried what you are considering, and their collective wisdom is an invaluable resource in making informed purchase decisions. Alternatively, search through newsgroup archives at `http://groups.google.com`.
- Try to evaluate the hardware before purchasing it. If you are considering making a corporate purchase of hardware from a vendor you use regularly, it may be possible to borrow the hardware to test it with Linux before actually purchasing it. Of course, this is the only way to be certain that the hardware will work the way you want it to.

Recording Your Hardware Information

Once you have put together your target Linux PC, you need to collect the hardware-related information necessary to get your hardware working. This section briefly looks at the information you should be aware of in order to get your hardware working quickly with Linux.

Video Cards

If you install Linux without X Windows (the graphical user interface for Unix systems), you will probably have no difficulties with any video card. However, with X Windows, you need to take care and pay attention to detail to get your card working. Record the following information about your video card before installing Linux:

- Vendor and model of the card.
- Video chipset used on the card. (Sometimes X Windows might not provide explicit support for a particular card but will offer general support for the chipset used in the card.)
- Amount of video memory on the card.
- Type of clock chip on the card. (If there is one; many common cards do not have clock chips.)

All of this information should be available in the documentation that came with your card or in Linux-related archives, HOWTOs, or the card manufacturer's website if you no longer have the documentation.

Sound Cards

Sound cards require that you supply very specific information in order to get them working. The following information is critical to configuring most sound cards:

- Vendor and model of the card
- IRQ(s) of the card
- I/O address(es) of the card
- DMA address(es) of the card

You may have to set the IRQ, I/O address, and DMA address manually, using jumpers or DIP switches. Depending on your card, not all of this information may be required. Refer to the card's documentation for instructions.

Monitors

As with your video card, it is important to record the technical specifications of your monitor in order to get it working optimally with X Windows. If you don't have this information or use the wrong information,

there is a risk that your monitor will be damaged. Record the following specifications after consulting your monitor's documentation:

- Vendor and model of the monitor
- Top resolution of the monitor
- Top refresh rate of the monitor when running at its top resolution
- Horizontal sync range of your monitor
- Vertical sync range of your monitor

Mice

In order to get your mouse working, both in Linux's character-based console mode and in X Windows, you need to note the following information:

- Vendor and model of the mouse.
- Number of mouse buttons.
- Protocol of the mouse. (Consult the mouse's documentation for this; common protocols include the Microsoft protocol, USB, the Mouse Systems protocol, and the PS/2 protocol.)
- Port where your mouse is connected to your computer. (In DOS terms, this is generally COM1:, COM2:, or the PS/2 mouse port.)

Hard Drives

If you plan to use Linux to repartition your hard drive during installation (see the section about arranging your hard disk's partitions, "Arranging Your Hard Disk," later in this chapter), you may need the following information:

- Total storage capacity of the hard disk
- Number of cylinders
- Number of heads
- Number of sectors per track

Generally, you will not need to provide this information because Linux will successfully auto-detect it when the system is booted.

Modems

If you have a modem, you should record the following information:

- Vendor and model of the modem
- Speed of the modem
- Port that your external modem is connected to or that you have configured your internal modem to use (in DOS terms, this is generally COM1: or COM2:) or with internal modems, the IRQ, I/O address, as well as the port

Network Cards

If you have a network card, you should record the following information:

- Vendor and model of the network card
- IRQ(s) of the card
- I/O address(es) of the card
- Specialized drivers, if available
- Compatibility with Novell 1000 or 2000 network card drivers

Some network cards include driver disks with Linux drivers. Alternatively, if your card is compatible with Novell 1000 or 2000 network card drivers, you may be able to use these drivers to install your network card on Linux. Consult your network card's documentation for more information.

USB

Several Linux distributions include partial USB support, primarily for keyboards and mice. These distributions include SuSE 6.4, Red Hat 7.0, Mandrake 7.1, and Corel Linux Second Edition (and above). As of this writing, Linux support for USB hardware within the 2.2.*x* kernel is limited to static configuration.

However, Red Hat 7.1 is based on the 2.4.*x* kernel, which allows nearly the full available range of USB support. As shown in the Linux-USB device database at `http://www.qbik.ch/usb/devices`, Linux USB support is available at some level for just about every type of USB device, from modems to web cameras.

If you're interested in "hotplugging," installing a USB device while your computer is in operation, refer to the Linux Hotplugging website at `http://linux-hotplug.sourceforge.net`. This site includes downloadable scripts in `.rpm` format that are designed to work with Red Hat Linux.

Considerable work on USB for Linux is in progress. If you can't install your USB hardware on your distribution, you can review the Linux USB project at `http://www.linux-usb.org` for additional drivers and utilities.

Other Peripherals

Many other peripherals have specific requirements for configuration. The number and types of possible peripherals are too varied to list here. Generally, additional hardware such as specialized serial cards, specialized PCMCIA or PC cards, and tape drives is not configured and installed at the time Linux is installed but rather after you have a running Linux system.

Choosing an Installation Method

Generally, Linux is distributed on CD-ROMs because of its size. Although Linux can be downloaded from the Internet, it is too large for most people to download unless they have access to a high-speed, dedicated Internet connection.

A CD-ROM, then, is usually at the core of installing Linux, as it is in the case of the Red Hat Linux 7.1 distribution. While it is theoretically possible to install Linux directly off the Internet, this method is too time-consuming or too expensive to be practical for most Linux users.

This section will consider different approaches to installing Linux from CD-ROM. The procedures will be similar to most other Linux distributions that are available on CD-ROM; consult the documentation for those distributions to determine the differences.

From CD-ROM

If you have an IDE/ATAPI CD-ROM drive and a computer with a fairly recent BIOS, it is possible to boot your computer from the Linux CD-ROM to start the installation process.

To check this, consult your computer's or main board's manual, or enter the BIOS setup of your computer while it is booting and see if you can switch the default boot device to your CD-ROM drive. If you can boot from the CD-ROM drive, insert the Red Hat Linux 7.1 Installation CD-ROM and attempt to boot your system. You should see an Installation menu and a boot prompt that says `boot:`.

NOTE

Even though an installation CD may be designed to boot from the CD-ROM, it still may not boot in all PCs that support bootable CD-ROMs. If you experience difficulty booting Linux, try installing from a floppy disk and CD-ROM as described in the "From Floppy Disk and CD-ROM" section of this chapter.

From Floppy Disk and CD-ROM

If you have a CD-ROM drive but can't boot from it, the next best thing is to install Linux from a combination of floppy disk and CD-ROM. In this scenario, you boot from one or more floppy disks to start the installation process and then install the actual Linux software from the CD-ROM.

Some preparation is necessary to do this. For most distributions of Linux, you need to prepare a boot floppy disk and maybe one or more supplementary disks. Everything you need to do this should be included on the CD-ROM containing your Linux distribution.

If you need a boot disk and any supplementary disks, you can build them off most Linux installation CD-ROMs from DOS or the Windows DOS prompt.

On the Red Hat 7.1 CD-ROM, the `Images` subdirectory contains two files, `boot.img` and `bootnet.img`, that are disk images of the floppy disks used for installing Red Hat Linux 7.1 from files on the local computer or through a network. It also includes various driver disks for PCMCIA cards (`pcmcia.img` and `pcmciadd.img`), drivers for older CD-ROMs (`oldcdrom.img`), and other drivers (`drivers.img`). Each of these images requires a blank, formatted, high-density 1.44MB floppy and the `rawrite.exe` utility.

For instance, assuming that your CD-ROM drive is drive D, you use `rawrite.exe` as follows to create the Red Hat boot install disk:

```
C:\>d:\dosutils\rawrite.exe
Enter disk image source file name: d:\images\boot.img
Enter target diskette drive: a
Please insert a formatted diskette into drive A:
and press -ENTER- :
```

Similarly, you enter **`d:\images\bootnet.img`** as the source filename to create the network boot installation disk.

When this is done, you can boot from the boot install disk to start the installation process.

From Hard Disk

If you have plenty of disk space, you may want to copy the entire contents of the CD-ROM to your hard disk and install from the hard disk. Starting with Red Hat Linux 7.1, hard disk–based installation requires the use of ISO images, which is a single file that contains all of the files in a Red Hat Installation CD-ROM.

There are two basic ways to get the right ISO images. First, you can download them directly over the Internet from a source such as `ftp.redhat.com`. The ISO file for each Red Hat Linux 7.1 CD-ROM is as large as the CD-ROM itself—in other words, about 650MB. Alternatively, you can create an ISO image from a Red Hat Linux 7.1 Installation CD-ROM, using the `mkisofs` command. More information on this process is available in Chapter 3, "Special Installations."

Of course, if you have access to a CD-ROM drive to create an ISO image, then you don't need to install from a hard disk. The only time this should really become necessary is if the Linux installation software won't recognize your CD-ROM drive. With the drivers available on the previously mentioned `oldcdrom.img` file, this should rarely be necessary.

Arranging Your Hard Disk

When it comes time to install Linux, you are going to have to make some fundamental decisions regarding where to place the operating system on

your hard disk(s). If you are extremely lucky, then one of the following two situations applies to you:

- You have a blank hard disk, or one you can reformat, available on which to install Linux.
- You have a blank partition, or one you can reformat, available on which to install Linux.

Unfortunately, most users who are looking at installing Linux for the first time want Linux to coexist with their current Windows and DOS installations and do not want to reformat an existing partition or hard disk to do this.

Partitioning Concepts

In order to install Linux into an existing system with no free partitions or hard disks, you need to find sufficient disk space and then carefully adjust your system's partitioning to free up a partition to work with during the Linux installation. Generally, if you want to install a fairly complete Linux system, you should free up at least 2GB of disk space. The space you free up should be on a single partition. (In Windows, each partition appears as a separate drive letter such as C, D, or E, so you need to find a drive with 2GB or more of free space.)

A Simple Partition Scheme for a Windows 98 System

Let's look at a simple example. You have a computer with a single 12GB hard disk divided into two 6GB partitions as drives C and D under DOS. You are able to free up 3GB of disk space on drive D, and you want to use this to install Linux.

There are two steps to be taken before you are ready to install Linux:

1. Defragment the drive to ensure that you have a large, continuous area of free space at the end of the partition.
2. Repartition the drive to make the space available for the Linux installation.

Defragmenting a Drive

Defragmenting a drive under Windows 98 is fairly simple. Just follow these steps:

1. Back up the data on your drive.
2. In My Computer or Windows Explorer, right-click the Drives icon.
3. Select Properties from the drop-down menu.
4. Choose the Tools tab at the top of the Properties window.
5. Click the Defragment Now button. Wait until defragmentation is complete and then proceed to the next section.

Partitioning Your Disk

Once you have defragmented a drive with sufficient space to install Linux, you need to create a new partition out of the free space. Most Linux distributions, including Red Hat Linux 7.1, come with a free DOS tool called `fips.exe`, which is in the `dosutils` subdirectory or in a subdirectory of that directory.

WARNING

Red Hat does not support FIPS. It is covered under the General Public License, which means that the people behind FIPS have no liability even if you use it correctly and it destroys your data. While I've used FIPS a number of times and have never had a problem, be warned: Use it at your own risk. There are alternative commercial partition-splitting programs, including System Commander (`www.v-com.com`) and Partition Magic (`www.powerquest.com`).

This tool enables you to adjust the size of an existing partition, making it smaller by removing empty space at the end of the partition. This empty space is then converted into another partition.

To use `fips.exe`, you first need to be in MS-DOS mode. To do this, select Shut Down from the Start menu and choose Restart In MS-DOS Mode. Windows 98 should shut down and switch to a full-screen DOS environment.

WARNING

This is a critical step. You shouldn't use a program like FIPS inside a DOS window or full-screen DOS environment while Windows 98 is running. Unlike DOS, Windows 95 and above allow multiple programs to run simultaneously, so it is possible for other programs to try to access the partition being worked with by FIPS. If this happens, your data may be corrupted and irretrievable.

Once in DOS mode, run `fips.exe` from your CD-ROM. If your CD-ROM drive is drive E, use the command

```
C:\>e:\dosutils\fips20\fips.exe
```

The program first presents your partition table. In the previous example of a two-partition drive, this will look something like the following:

```
Partition table:

     |        |     Start      |      |     End        | Start   |Number of |
Part.|Bootable|Head Cyl. Sector|System|Head Cyl. Sector| Sector  |Sectors   |  MB
-----+--------+----------------+------+----------------+---------+----------+----
1    |   yes  |   1    0    1  | 06h  | 254  222  63   |       63|  3582432 |1749
2    |   no   |   0  223    1  | 05h  | 254  286  63   |  3582495|  1028160 | 502
```

On most systems, identifying your partitions is easy because drive C is partition 1, drive D is partition 2, and so on. If you have trouble, use the size of the partition in megabytes in the last column to help.

You are then prompted to choose a partition. In this case, choose 2, since you want drive D to be adjusted. Once you choose, the partition will be scanned, and summary information about the partition, similar to the following, will be presented:

```
Bytes per sector: 512
Sectors per cluster: 8
Reserved sectors: 1
Number of FATs: 2
Number of rootdirectory entries: 512
Number of sectors (short): 0
Media descriptor byte: f8h
Sectors per FAT: 145
Sectors per track: 63
Drive heads: 16
```

```
Hidden sectors: 63
Number of sectors (long): 141057
Physical drive number: 80h
Signature: 29h
```

Assuming you have free space at the end of the partition you have chosen, you are asked which disk cylinder to use as the line where the partition is cut and split. You can use your arrow keys to change the selected cylinder. As you do this, the size of the partitions in megabytes is shown so that you can make sure that the new partition is large enough. The FIPS program handles the job of making sure that you can't choose a cylinder to split that would leave some of the data from your current partition on the new partition.

Finally, a revised partition table appears, and you are asked to confirm that everything looks okay. In this example, you should now have three partitions, with the third being your new partition and the second being smaller in size than it was originally.

TIP

To protect against mistakes, copy `fips.exe`, `restorrb.exe`, and `errors.txt` from your Linux Installation CD-ROM to a bootable floppy disk. These files are usually located in a subdirectory such as `dosutils`. When asked if you want to write backup copies of your boot and root sectors to a floppy disk, answer Yes. Then, if you need to recover from a mistake, you can boot from the floppy and run `restorrb.exe` to restore your original boot and root sectors.

What's Next?

In this chapter, you conducted the basic preparation needed to install Linux. Now you are ready for the actual installation.

In Chapter 2, "Installing Red Hat Linux 7.1," you will run through a basic installation of Linux, examining each screen of the installation program and learning how to decide what choices to make.

In Chapter 3, "Special Installations," you will look at special cases, such as how to install Linux on multiple hard drives and how to install Linux onto an existing DOS partition.