Red Hat Enterprise Linux ES 2.1

Red Hat Enterprise Linux ES Installation Guide

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Red Hat Enterprise Linux ES 2.1: Red Hat Enterprise Linux ES Installation Guide
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Introduction

Welcome to the *Red Hat Enterprise Linux ES Installation Guide*. This guide contains useful information to assist you during the installation of Red Hat Enterprise Linux ES. From fundamental concepts such as installation preparation to the step-by-step installation procedure, this book will be a valuable resource as you install Red Hat Enterprise Linux ES.

This manual will walk you through a typical installation using the Red Hat Enterprise Linux ES CD-ROMs. Once you have completed the installation as outlined in this manual, you will have a fully functioning Red Hat Enterprise Linux ES system.

1. Document Conventions

When you read this manual, you will see that certain words are represented in different fonts, typefaces, sizes, and weights. This highlighting is systematic; different words are represented in the same style to indicate their inclusion in a specific category. The types of words that are represented this way include the following:

`command`

> Linux commands (and other operating system commands, when used) are represented this way. This style should indicate to you that you can type the word or phrase on the command line and press [Enter] to invoke a command. Sometimes a command contains words that would be displayed in a different style on their own (such as filenames). In these cases, they are considered to be part of the command, so the entire phrase will be displayed as a command. For example:
>
> Use the `cat testfile` command to view the contents of a file, named `testfile`, in the current working directory.

`filename`

> Filenames, directory names, paths, and RPM package names are represented this way. This style should indicate that a particular file or directory exists by that name on your Red Hat Linux system. Examples:
>
> The `.bashrc` file in your home directory contains bash shell definitions and aliases for your own use.
>
> The `/etc/fstab` file contains information about different system devices and filesystems.
>
> Install the `webalizer` RPM if you want to use a Web server log file analysis program.

application

> This style should indicate to you that the program named is an end-user application (as opposed to system software). For example:
>
> Use Netscape **Navigator** to browse the Web.

[key]

> A key on the keyboard is shown in this style. For example:
>
> To use [Tab] completion, type in a character and then press the [Tab] key. Your terminal will display the list of files in the directory that start with that letter.

[key]-[combination]

> A combination of keystrokes is represented in this way. For example:
>
> The [Ctrl]-[Alt]-[Backspace] key combination will restart the X Window System.

text found on a GUI interface

A title, word, or phrase found on a GUI interface screen or window will be shown in this style. When you see text shown in this style, it is being used to identify a particular GUI screen or an element on a GUI screen (such as text associated with a checkbox or field). Example:

Select the **Require Password** checkbox if you would like your screensaver to require a password before stopping.

top level of a menu on a GUI screen or window

When you see a word in this style, it indicates that the word is the top level of a pulldown menu. If you click on the word on the GUI screen, the rest of the menu should appear. For example:

Under **Settings** on a GNOME terminal, you will see the following menu items: **Preferences**, **Reset Terminal**, **Reset and Clear**, and **Color selector**.

If you need to type in a sequence of commands from a GUI menu, they will be shown like the following example:

Click on **Programs=>Applications=>Emacs** to start the Emacs text editor.

button on a GUI screen or window

This style indicates that the text will be found on a clickable button on a GUI screen. For example:

Click on the **Back** button to return to the webpage you last viewed.

`computer output`

When you see text in this style, it indicates text displayed by the computer on the command line. You will see responses to commands you typed in, error messages, and interactive prompts for your input during scripts or programs shown this way. For example:

Use the `ls` command to display the contents of a directory:

```
$ ls
Desktop            axhome          logs          paulwesterberg.gif
Mail               backupfiles     mail          reports
```

The output returned in response to the command (in this case, the contents of the directory) is shown in this style.

`prompt`

A prompt, which is a computer's way of signifying that it is ready for you to input something, will be shown in this style. Examples:

```
$
```

```
#
```

```
[stephen@maturin stephen]$
```

```
leopard login:
```

user input

Text that the user has to type, either on the command line, or into a text box on a GUI screen, is displayed in this style. In the following example, **text** is displayed in this style:

To boot your system into the text based installation program, you will need to type in the **text** command at the `boot:` prompt.

Additionally, we use several different strategies to draw your attention to certain pieces of information. In order of how critical the information is to your system, these items will be marked as note, tip, important, caution, or a warning. For example:

Note

Remember that Linux is case sensitive. In other words, a rose is not a ROSE is not a rOsE.

Tip

The directory `/usr/share/doc` contains additional documentation for packages installed on your system.

Important

If you modify the DHCP configuration file, the changes will not take effect until you restart the DHCP daemon.

Caution

Do not perform routine tasks as root — use a regular user account unless you need to use the root account for system administration tasks.

Warning

If you choose not to partition manually, a server installation will remove all existing partitions on all installed hard drives. Do not choose this installation class unless you are sure you have no data you need to save.

2. How to Use This Manual

This manual focuses on a CD-ROM based installation, so it is ideal for users (both new and old) who want a quick and simple installation solution. It will help you prepare your system, walk you through the installation, and assist you in the configuration of Red Hat Enterprise Linux ES.

If you are an experienced user who wants to perform a Red Hat Enterprise Linux ES CD-ROM installation, and you do not need a review of the basics, you can skip ahead to Chapter 3 to begin the installation process.

Tip

Refer to the **Red Hat Frequently Asked Questions** for answers to questions and problems that may occur before, during, or after the installation. You will find the FAQ online at:

http://www.redhat.com/support/docs/faqs/rhl_general_faq/

2.1. We Need Feedback!

If you spot a typo in the *Red Hat Enterprise Linux ES Installation Guide*, or if you have thought of a way to make this manual better, we would love to hear from you! Please submit a report in Bugzilla (http://bugzilla.redhat.com/bugzilla/) against the component *rhel-ig-es-x86*.

Be sure to mention the manual's identifier:

```
rhel-ig-es-x86(EN)-2.1-HTML-RHI (2003-01-31T11:13-0400)
```

That way we will know exactly which version of the guide you have.

If you have a suggestion for improving the documentation, try to be as specific as possible when describing it. If you have found an error, please include the section number and some of the surrounding text so we can find it easily.

If you have a support question (for example, if you need help configuring X, or if you are not sure how to partition your hard drive[s]), please register your product at http://www.redhat.com/apps/activate/ and use the online support system for those type of requests.

I. Installing Red Hat Enterprise Linux ES

Table of Contents

Chapter 1.
Steps to Get You Started

Before you install Red Hat Enterprise Linux ES, you should perform the following steps:

1.1. Do You Have the Right Components?

If you have purchased an Official Red Hat Enterprise Linux ES product, you are ready to go. However, mistakes occasionally happen, so now is a good time to double-check the contents of your product.

A black, red, and white Registration Information card is included with your product. A list of the contents of your boxed set version is on the back of the card. Please read over the list and check to make sure that you have all the CDs and manuals that are included with the version of Red Hat Enterprise Linux ES that you purchased.

If you have purchased an Official Red Hat Enterprise Linux ES product from Red Hat, Inc. (or one of its distributors), and you are missing one or more of the items listed, please let us know. Contact information is also available on the Registration Information card.

How to identify our official boxed set: The bottom of our box has an ISBN number next to one of the bar codes. That ISBN number should be in this form:

```
1-58569-x-y
```

(The x and y will be unique numbers.)

Red Hat partners with companies (international and domestic) so that we can make Red Hat Enterprise Linux ES available to you in the most convenient form. Because of these partnerships, you might find that your Red Hat Enterprise Linux ES product may not have been actually produced by Red Hat.

If your product has a different ISBN number (or none at all), you will need to contact the company that produced it. Normally, third-party producers will include their logo and/or contact information on the outside of their box; an official Red Hat Enterprise Linux ES boxed set lists only our name and contact information.

1.1.1. Where to Find Other Manuals

If your particular product did not include all of the printed Red Hat Enterprise Linux ES manuals, you can find them online or on the Red Hat Enterprise Linux ES Documentation CD included with your official Red Hat Enterprise Linux ES product.

To find the manuals in both HTML and PDF formats online, go to http://www.redhat.com/docs.

1.1.2. Registering Your Product

If you have purchased an Official Red Hat Enterprise Linux ES product, you should register your product. Registration offers many useful services, such as installation support, access to Red Hat Network, and more.

To register your product, go to http://www.redhat.com/apps/activate/. You will find your *Product ID* on the Registration Information card in your Official Red Hat Enterprise Linux ES boxed set. Once registered, you will have access to all the extras that Red Hat provides to its registered users.

For more information on registering and the scope of Red Hat technical support offerings, see Appendix B.

1.2. Is Your Hardware Compatible?

Hardware compatibility is particularly important if you have an older system or a system that you built yourself. Red Hat Enterprise Linux ES 2.1 should be compatible with most hardware in systems that were factory built within the last two years. However, hardware specifications change almost daily, so it is hard to guarantee that your hardware will be 100% compatible.

The most recent list of supported hardware can be found at http://hardware.redhat.com/hcl/.

1.3. Do You Have Enough Disk Space?

Nearly every modern-day operating system (OS) uses *disk partitions*, and Red Hat Enterprise Linux ES is no exception. When you install Red Hat Enterprise Linux ES, you may have to work with disk partitions. If you have not worked with disk partitions before (or need a quick review of the basic concepts) read Appendix D before proceeding.

The disk space used by Red Hat Enterprise Linux ES must be separate from the disk space used by other OSes you might have installed on your system , such as Windows, OS/2, or even a different version of Linux. At least two partitions (`/` and `swap`) must be dedicated to Red Hat Enterprise Linux ES.

Before you start the installation process, one of the following conditions must be met:

- Your computer must have enough *unpartitioned[1]* disk space for the installation of Red Hat Enterprise Linux ES.
- You must have one or more partitions that may be deleted, thereby freeing up enough disk space to install Red Hat Enterprise Linux ES.

1.3.1. Installation Disk Space Requirements

Note

> These recommendations are based on an installation that only installs one language (such as English). If you plan to install multiple languages to use on your system, you should increase the disk space requirements.

See Section 1.5, for further information regarding disk space requirements for your specific installation needs.

Server

    For a Server installation, choosing to install GNOME[2] or KDE[3], requires at least 1.0 GB of free

---

1.   Unpartitioned disk space means that the hard drive(s) you are installing to have not been divided into sections for data. When you partition a disk, each partition will behave like a separate disk drive.

2.   Acronym for GNU Network Object Model Environment. GNOME is part of the GNU project and part of the free software, or open source, movement. GNOME is a Windows-like desktop system that works on UNIX and UNIX-like systems. The main objective of GNOME is to provide a user-friendly suite of applications and an easy-to-use desktop.

3.   Acronym for K Desktop Environment. A network-transparent, contemporary desktop environment for UNIX workstations, KDE is part of the open source movement. It is free to anyone and its source code is available to anyone to modify.

space. Choosing both GNOME and KDE requires at least 1.3 GB of free disk space.

Custom

A Custom installation requires for a minimal installation (without the Server packages) and at least 3.2 GB of free space if every package is selected.

If you are not sure that you meet these conditions, or if you want to know how to create free disk space for your Red Hat Enterprise Linux ES installation, please refer to Appendix D.

1.4. Can You Install Using the CD-ROM?

There are several methods that can be used to install Red Hat Enterprise Linux ES. This manual focuses on installing from the CD-ROM. For instructions on alternative installation methods, refer to Chapter 4.

Installing from a CD-ROM requires that you have purchased a Red Hat Enterprise Linux ES 2.1 product, or you have a Red Hat Enterprise Linux ES CD-ROM, and you have a CD-ROM drive. Most new computers will allow booting from the CD-ROM. If your system will support booting from the CD-ROM, it is an easy way to begin a local CD-ROM installation.

Your BIOS may need to be changed to allow booting from your CD-ROM drive. For more information about editing your BIOS, see Section 3.2.1.

1.4.1. Alternative Boot Methods

If you cannot boot from the CD-ROM drive, the following alternative boot method is available:

Local Boot Disk

If you need a *local boot disk*[4], you must create it. The local boot disk image file, `boot.img`, is located in the `images` directory on your Red Hat Enterprise Linux ES CD-ROM. Refer to Section 1.4.2, for more information on making a boot disk.

☞**Note**

USB Floppies — You can also boot the Red Hat Enterprise Linux ES installation program using a USB floppy as a boot disk (if your system supports booting from a USB floppy).

☞**Note**

Although it is not required to boot your installation, you may occasionally find that a driver disk is needed to continue with the installation. Appendix E explains why a driver disk may be necessary for your installation, and how to obtain one if needed.

---

4. A boot disk is a diskette you create during an installation that can later be used to boot the operating system. Normally, your computer boots from a hard disk, but if the hard disk is damaged, you can boot the computer from a bootable diskette.

1.4.2. Making Installation Diskettes

You may need to create a diskette from an *image file*; for example, you may need to use updated diskette images obtained from the Red Hat Enterprise Linux ES errata page (http://www.redhat.com/apps/support/errata) or you may need to create a boot disk.

An image file contains an exact copy (or image) of a diskette's contents. Since a diskette contains filesystem information in addition to the data contained in files, the image file is not usable until it has been written to a diskette.

To start, you will need a blank, formatted, high-density (1.44MB), 3.5-inch diskette. You will need access to a computer with a 3.5-inch diskette drive. The computer must be able to run either an MS-DOS program or the `dd` utility found on most Linux-like operating systems.

The `images` directory on your Red Hat Enterprise Linux ES CD-ROM contains the boot images. Once you have selected the proper image (such as `boot.img` for a CD-ROM-based installation or `bootnet.img` for a network installation), transfer the image file onto a diskette.

1.4.2.1. Using the `rawrite` Utility

To make a diskette using MS-DOS, use the `rawrite` utility included on the Red Hat Enterprise Linux ES CD-ROM in the `dosutils` directory. First, label a blank, formatted 3.5-inch diskette appropriately (such as "Boot Disk" or "Updates Disk"). Insert it into the diskette drive. Then, use the following commands (assuming your CD-ROM is drive `d:`):

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

First, `rawrite` asks you for the filename of a diskette image; enter the directory and name of the image you wish to write (for example, `..\images\boot.img`). Then `rawrite` asks for a diskette drive to write the image to; enter `a:`. Finally, `rawrite` asks for confirmation that a formatted diskette is in the drive you have selected. After pressing [Enter] to confirm, `rawrite` copies the image file onto the diskette. If you need to make another diskette, label that diskette, and run `rawrite` again, specifying the appropriate image file.

1.4.2.2. Using the `dd` Command

To make a diskette under Linux (or any other Linux-like operating system), you must have permission to write to the device representing a 3.5-inch diskette drive (known as `/dev/fd0` under Linux).

First, label a blank, formatted diskette appropriately (such as "Boot Disk" or "Updates Disk"). Insert it into the diskette drive (but do not issue a `mount`[5] command). After mounting the Red Hat Enterprise Linux ES CD-ROM, change to the directory containing the desired image file, and use the following command (changing the name of the image file and diskette device as appropriate):

```
# dd if=boot.img of=/dev/fd0 bs=1440k
```

To make another diskette, label that diskette, and run `dd` again, specifying the appropriate image file.

---

5.   When you mount a floppy or CD-ROM, you make that device's contents available to you. See the *Official Red Hat Linux Getting Started Guide* for more information.

1.5. Which Installation Class is Best For You?

Usually, Red Hat Enterprise Linux ES is installed on its own disk partition or set of partitions, or over another installation of Linux.

🛈 **Warning**

Installing Red Hat Enterprise Linux ES over another installation of Linux (including Red Hat Linux) does *not* preserve any information (files or data) from a prior installation. Make sure you save or back up any important files!

Red Hat Enterprise Linux ES provides two different classes, or types, of installations:

Server

The Server configuration includes, at your option, the ability to install a default X Window System environment with management.

Custom

A Custom installation allows you the greatest flexibility during your installation. You choose your boot loader, which packages you want, and more. Custom installations are most appropriate for those users more familiar with Red Hat Linux installations and for those afraid of losing complete flexibility.

These classes give you the option of simplifying the installation process (with some potential for loss of configuration flexibility), or retaining flexibility with a slightly more complex installation process. Next, take a detailed look at each class, so you can decide which one is right for you.

1.5.1. Server Installation

Below are the minimum recommended disk space requirements for a Server installation where only one language (such as English) will be installed.

☞ **Note**

The *minimum recommended disk space requirements* as listed below, are just minimum recommendations for the installation itself. You should adjust these disk space requirements as appropriate for your specific computing needs (such as disk space for personal files, additional applications you may install at a later time, and so on).

- Server (minimum, no graphical interface): 800 MB
- Server (default, choosing GNOME or KDE): 1 GB
- Server (choosing GNOME and KDE): 1.3 GB
- Server (choosing everything, GNOME and KDE): 1.5 GB

If you plan to choose all group packages, as well as select additional individual packages, you may want to allow yourself 2.0 GB or more of disk space. This will provide space where additional data may be written.

1.5.1.1. What a Server Installation Will Do

A Server installation, with automatic partitioning, will create the following partitions:

☞ **Note**

> The partitions represented below were created on a system with 9 GB of hard drive space and 512 MB of RAM. Depending on the amount of hard drive space and memory you have available, these values may differ slightly.

- A 47 MB partition (mounted as /boot) in which the Linux kernel and related files are kept.
- A partition of at least 4877 MB (mounted as /usr).
- The size of the swap partition is determined by the amount of RAM in your system and the amount of space available on your hard drive. If you have 128 MB of RAM, then the swap partition created can be 128 MB – 256 MB (twice your RAM), depending on how much disk space is available.

  For this example, a 1020 MB swap partition (mounted as <swap>) is created.
- A 2738 MB ext partition.
- A partition of at least 2094 MB (mounted as /home).
- A 384 MB partition (mounted as /).
- A 259 MB partition (mounted as /var).

This partitioning scheme offers a reasonably flexible filesystem configuration for most server tasks.

1.5.2. Custom Installations

The *Custom installation* allows you the most flexibility during your installation. During a Custom installation, you have complete control over the packages that will be installed on your system.

The recommended disk space requirements for a Custom installation are as follows:

☞ **Note**

> The *minimum recommended disk space requirements* as listed below, are just minimum recommendations for the installation itself. You should adjust these disk space requirements as appropriate for your specific computing needs (such as disk space for personal files, additional applications you may install at a later time, and so on).

- Custom (minimum, without Server packages): 350 MB
- Custom (minimum, with Server packages): 500 MB
- Custom (default): 1 GB
- Custom (choosing everything): 3.2 GB

1.5.2.1. What a Custom Installation Will Do

As you might guess from the name, a custom installation puts the emphasis on flexibility. You have complete control over which packages will be installed on your system.

If you choose automatic partitioning, a Custom installation will create the following partitions:

Note

The partitions represented below were created on a system with 9 GB of hard drive space and 512 MB of RAM. Depending on the amount of hard drive space and memory you have available, these values may differ slightly.

- The size of the swap partition is determined by the amount of RAM in your system and the amount of space available on your hard drive. If you have 128 MB of RAM, then the swap partition created can be 128 MB – 256 MB (twice your RAM), depending on how much disk space is available.

  For this example, a 1020 MB swap partition (mounted as <swap>) is created.

- A 47 MB partition (mounted as /boot) in which the Linux kernel and related files reside.

- A 2609 MB root partition (mounted as /) in which all other files are stored (the exact size of this partition is dependent on your available disk space).

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System Requirements Table

The most recent list of supported hardware can be found at http://hardware.redhat.com/hcl/.

This chapter provides you with a system requirements table, which will help you keep a record of your current system settings and requirements. Enter information about your system in the table provided as a handy reference to help make your Red Hat Enterprise Linux ES installation go more smoothly.

hard drive(s): type, label, size; ex: IDE hda=1.2 GB	
partitions: map of partitions and mount points; ex: `/dev/hda1=/home`, `/dev/hda2=/` (fill this in once you know where they will reside)	
memory: amount of RAM installed on your system; ex: 64 MB, 128 MB	
CD-ROM: interface type; ex: SCSI, IDE (ATAPI)	
SCSI adapter: if present, make and model number; ex: BusLogic SCSI Adapter, Adaptec 2940UW	
network card: if present, make and model number; ex: Tulip, 3COM 3C590	
mouse: type, protocol, and number of buttons; ex: generic 3 button PS/2 mouse, MouseMan 2 button serial mouse	
monitor: make, model, and manufacturer specifications; ex: Optiquest Q53, ViewSonic G773	
video card: make, model number and size of VRAM; ex: Creative Labs Graphics Blaster 3D, 8MB	

sound card: make, chipset and model number; ex: S3 SonicVibes, Sound Blaster 32/64 AWE	
IP, DHCP, and BOOTP addresses: four numbers, separated by dots; ex: 10.0.2.15	
netmask: four numbers, separated by dots; ex: 255.255.248.0	
gateway IP address: four numbers, separated by dots; ex: 10.0.2.245	
one or more name server IP addresses (DNS): one or more sets of dot-separated numbers; ex: 10.0.2.1	
domain name: the name given to your organization; ex: for Red Hat, this would be `redhat.com`	
hostname: the name of your computer; your personal choice of names; ex: `cookie`, `southpark`	

Table 2-1. System Requirements Table

If any of these networking requirements or terms are unfamiliar to you, contact your network administrator for assistance.

Installing Red Hat Enterprise Linux ES

This chapter explains how to install Red Hat Enterprise Linux ES from the CD-ROM using the graphical, mouse-based installation program. The following topics are discussed:

- Getting familiar with the installation program's user interface
- Starting the installation program
- Selecting an installation method
- Configuration steps during the installation (language, keyboard, mouse, etc.)
- Finishing the installation

3.1. The Installation Program User Interface

If you have used a *graphical user interface (GUI)* before, you will be familiar with this process; simply use your mouse to navigate the screens, "click" buttons, or enter text fields. You can also navigate through the installation using the [Tab] and [Enter] keys.

3.1.1. A Note about Virtual Consoles

The Red Hat Enterprise Linux ES installation program offers more than the dialog boxes of the installation process. Several different kinds of diagnostic messages are available to you, in addition to providing a way to enter commands from a shell prompt. The installation program displays these messages on five *virtual consoles*, among which you can switch using a single keystroke combination.

These virtual consoles can be helpful if you encounter a problem while installing Red Hat Enterprise Linux ES. Messages displayed on the installation or system consoles can help pinpoint a problem. Please see Table 3-1 for a listing of the virtual consoles, keystrokes used to switch to them, and their contents.

Console	Keystrokes	Contents
1	[Ctrl]-[Alt]-[F1]	installation dialog
2	[Ctrl]-[Alt]-[F2]	shell prompt
3	[Ctrl]-[Alt]-[F3]	install log (messages from installation program)
4	[Ctrl]-[Alt]-[F4]	system-related messages
5	[Ctrl]-[Alt]-[F5]	other messages
7	[Ctrl]-[Alt]-[F7]	X graphical display

Table 3-1. Console, Keystrokes, and Contents

Generally, there is no reason to leave the default console (virtual console #7) unless you are attempting to diagnose installation problems.

3.2. Starting the Installation Program

To start the installation, you must first boot the installation program. Please make sure you have all the resources you will need for the installation. If you have already read through Chapter 1, and followed the instructions, you should be ready to begin.

☞ **Note**

> Occasionally, some hardware components require a *driver disk* during the installation. A driver disk adds support for hardware that is not otherwise supported by the installation program. Refer to Appendix E for more information.

3.2.1. Booting the Installation Program

☞ **Note**

> To create a boot disk, refer to Section 1.4.2.

You can boot the Red Hat Enterprise Linux ES installation program using any one of the following media (depending upon what your system can support):

- *Bootable CD-ROM* — Your machine supports a bootable CD-ROM drive and you want to perform a local CD-ROM installation.
- *Local boot disk* — Your machine will not support a bootable CD-ROM and you want to install from a local CD-ROM or a hard drive.
- *Network boot disk* — Use a network boot disk to install via NFS, FTP, and HTTP.

Insert the boot disk into your computer's first diskette drive and reboot (or boot using the CD-ROM, if your computer supports booting from it). Your BIOS settings may need to be changed to allow you to boot from the diskette or CD-ROM.

ⓘ **Tip**

> To change your BIOS settings, watch the instructions provided on your display when your computer first begins to boot. Often you will see a line of text telling you to press the [Del] or [F1] key to enter the BIOS settings.
>
> Once you've entered your BIOS setup program, find the section where you can alter your boot sequence. The default is often C, A or A, C (depending on whether you boot from your hard drive [C] or a diskette drive [A]). Change this sequence so that the CD-ROM is first in your boot order and that C or A (whichever is your typical boot default) is second. This instructs the computer to first look at the CD-ROM drive for bootable media; if it does not find bootable media on the CD-ROM drive, it will then check your hard drive or diskette drive.
>
> Save your changes before exiting the BIOS. For more information, please refer to the documentation that came with your system.

After a short delay, a screen containing the `boot:` prompt should appear. The screen contains information on a variety of boot options. Each boot option also has one or more help screens associated with it. To access a help screen, press the appropriate function key as listed in the line at the bottom of the screen.

As you boot the installation program, be aware of two issues:

- Once you see the `boot:` prompt, the installation program will automatically begin if you take no action within the first minute. To disable this feature, press one of the help screen function keys.
- If you press a help screen function key, there will be a slight delay while the help screen is read from the boot media.

Normally, you only need to press [Enter] to boot. Watch the boot messages to see if the Linux kernel detects your hardware. If your hardware is properly detected, please continue to the next section. If it does not properly detect your hardware, you may need to restart the installation in expert mode.

3.2.1.1. Additional Boot Options

If you do not wish to perform a CD-ROM GUI installation, you can start a text mode installation using the following boot command:

```
boot: text
```

For text mode installation instructions, please refer to Chapter 4.

If you are having trouble booting into the graphical installation program, you can try to boot using the no framebuffer (`nofb`) boot option.

At the boot command, enter the following:

```
boot: nofb
```

This option allows you to use the graphical installation program without using a framebuffer.

Enter expert mode using the following boot command:

```
boot: linux expert
```

If you need to perform the installation in *serial mode*, type the following command:

```
boot: linux console=<device>
```

In the above command, $<device>$ should be the device you are using (such as ttyS0 or ttyS1). For example, `linux console=ttyS0,115200n8`.

3.2.1.2. Kernel Options

Options can also be passed to the kernel. For example, to instruct the kernel to use all the RAM in a system with 128 MB of RAM, enter:

```
boot: linux mem=128M
```

After entering any options, press [Enter] to boot using those options.

If you need to specify boot options to identify your hardware, please write them down. The boot options will be needed during the boot loader configuration portion of the installation (please see Section 3.14 for more information).

3.2.1.3. Booting Without Diskettes

The Red Hat Enterprise Linux ES CD-ROM can be booted by computers that support bootable CD-ROMs. Not all computers support this feature, so if your system cannot boot from the CD-ROM, there is one other way to start the installation without using a boot disk. The following method is specific to x86-based computers only.

If you have MS-DOS installed on your system, you can boot directly from the CD-ROM drive without using a boot disk. To do this (assuming your CD-ROM is drive d:), use the following commands:

```
C:\> d:
D:\> cd \dosutils
D:\dosutils> autoboot.bat
```

This method will not work if run in a DOS window — the autoboot.bat file must be executed with DOS as the only operating system. In other words, Windows cannot be running.

If your computer cannot boot directly from CD-ROM (and you cannot use a DOS-based autoboot), you will have to use a boot diskette to get things started.

3.3. Selecting an Installation Method

What type of installation method do you wish to use? The following installation methods are available:

CD-ROM

> If you have a CD-ROM drive and the Red Hat Enterprise Linux ES CD-ROM, you can use this method. You will need a boot disk or a bootable CD-ROM. PCMCIA boot and driver disks may also be used. Continue reading this chapter for further instructions.

Hard Drive

> If you have copied the Red Hat Enterprise Linux ES ISO images to a local hard drive, you can use this method. You will need a boot disk. PCMCIA boot and driver disks may also be used. Refer to Chapter 4, for hard drive installation instructions.

NFS Image

> If you are installing from an NFS server which is exporting the Red Hat Enterprise Linux ES CD-ROM(s) or a mirror image of *PROD;, you can use this method. You will need a network boot disk. PCMCIA boot and driver disks may also be used. Refer to Chapter 4, for network installation instructions. Please note that NFS installations may also be performed in GUI mode.

FTP

> If you are installing directly from an FTP server, use this method. You will need a network boot disk. PCMCIA boot and driver disks may also be used. Refer to Chapter 4, for FTP installation instructions.

HTTP

> If you are installing directly from an HTTP (Web) server, use this method. You will need a network boot disk. PCMCIA boot and driver disks may also be used. Refer to Chapter 4, for HTTP installation instructions.

3.4. Beginning the Installation

If you are planning to install via CD-ROM using the graphical interface, please continue reading.

If you would rather perform a text mode installation, reboot your system and at the `boot:` prompt, type `text`. Refer to Chapter 4, for more information.

3.4.1. Installing from CD-ROM

To install Red Hat Enterprise Linux ES from a CD-ROM, choose the **CD-ROM** option from the boot loader screen and select **OK**. When prompted, insert the Red Hat Enterprise Linux ES CD into your CD-ROM drive (if you did not boot from the CD-ROM). Once the CD is in the CD-ROM drive, select **OK**, and press [Enter].

The installation program will then probe your system and attempt to identify your CD-ROM drive. It will start by looking for an IDE (also known as an ATAPI) CD-ROM drive. If found, it will continue to the next stage of the installation process (see Section 3.5).

Note

> To abort the installation process at this time, reboot your machine and then eject the boot diskette or CD-ROM. You can safely cancel the installation at any point before the **About to Install** screen. See Section 3.23, for more information.

If a CD-ROM drive is not detected, you will be asked what type of CD-ROM drive you have. Choose from the following types:

SCSI

> Select this if your CD-ROM drive is attached to a supported SCSI adapter; the installation program will then ask you to choose a SCSI driver. Choose the driver that most closely resembles your adapter. You may specify options for the driver if necessary; however, most drivers will detect your SCSI adapter automatically.

Other

> If your CD-ROM drive is neither an IDE nor a SCSI, it is an "other." Sound cards with proprietary CD-ROM interfaces are good examples of CD-ROMs in the *Other* category. The installation program will display a list of drivers for supported CD-ROM drives — choose a driver and, if necessary, specify any driver options.

Tip

> A partial list of optional parameters for CD-ROM drives can be found in the *Official Red Hat Linux Reference Guide*, in the *General Parameters and Modules* appendix.

3.4.1.1. What If the IDE CD-ROM Was Not Found?

If you have an IDE (ATAPI) CD-ROM, but the installation program fails to find your it and asks you what type of CD-ROM drive you have, try the following boot command. Restart the installation, and at the `boot:` prompt enter **`linux hdX=cdrom`**. Replace the **`X`** with one of the following letters, depending on the interface the unit is connected to, and whether it is configured as master or slave:

- `a` — first IDE controller, master
- `b` — first IDE controller, slave
- `c` — second IDE controller, master
- `d` — second IDE controller, slave

If you have a third and/or fourth controller, continue assigning letters in alphabetical order, going from controller to controller, and master to slave.

3.5. Language Selection

Using your mouse, select the language you would prefer to use for the installation and as the system default (see Figure 3-1).

Selecting the appropriate language will also help target your time zone configuration later in the installation. The installation program will try to define the appropriate time zone based on what you specify on this screen.

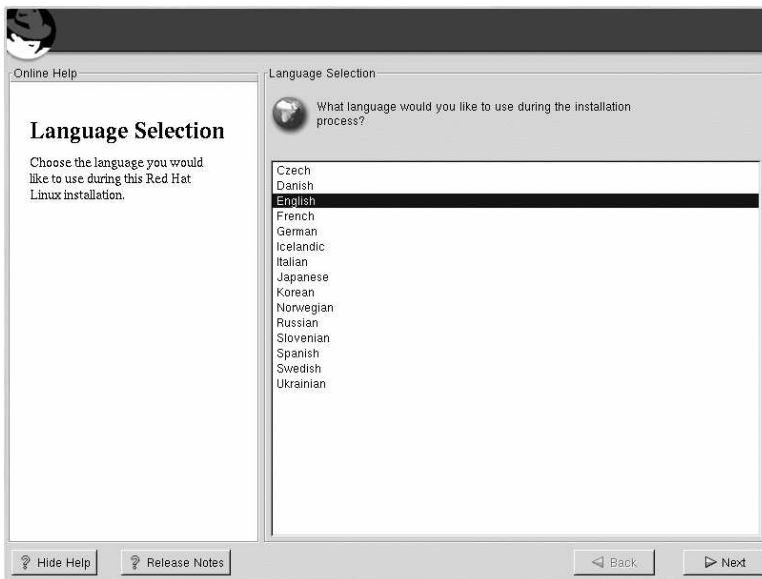Once you select the appropriate language, click **Next** to continue.

Figure 3-1. Language Selection

3.6. Keyboard Configuration

Choose the keyboard model that best fits your system (see Figure 3-2). If you cannot find an exact match, choose the best **Generic** match for your keyboard type (for example, **Generic 101-key PC**).

Next, choose the correct layout type for your keyboard (for example, U.S. English).

Creating special characters with multiple keystrokes (such as Ñ, Ô, and Ç) is done using "dead keys" (also known as compose key sequences). Dead keys are enabled by default. If you do not wish to use them, select **Disable dead keys**.

ⓘ **Tip**

> The following example will help you determine if you need dead keys enabled. An example of a dead key is the backspace (^H) key on a US English 101 Standard Keyboard. Dead keys are not exclusive to non-English keyboards.

To test your keyboard configuration, use the blank text field at the bottom of the screen to enter text.

Once you have made the appropriate selections, click **Next** to continue.

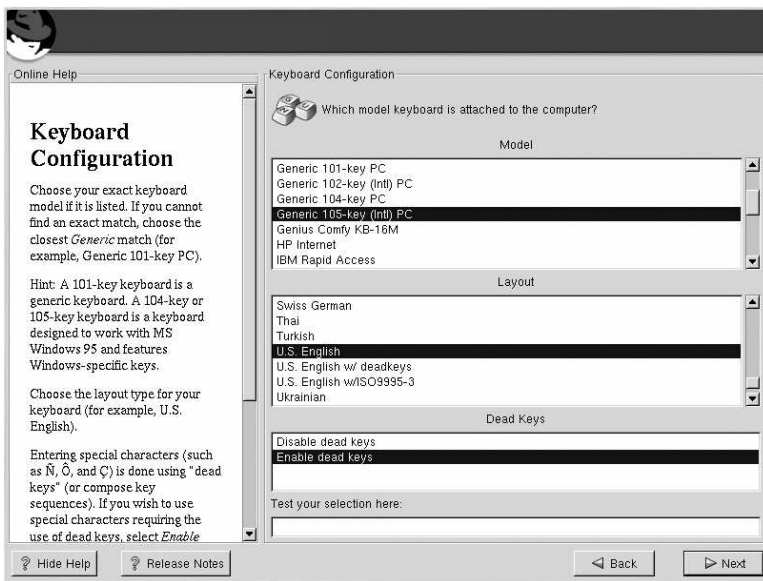**Figure 3-2. Keyboard Configuration**

ⓘ **Tip**

> To change your keyboard type after you have installed Red Hat Enterprise Linux ES, log in as root and use the `/usr/sbin/kbdconfig` command. Alternatively, you can type `setup` at the `root` prompt.

To become root, type `su -` at the shell prompt in a terminal window and then press [Enter]. Then, enter the root password.

(i) **Tip**

To re-enable dead keys (assuming you chose to disable them during the installation), you will also need to comment out the line enabling dead keys in the `XF86Config-4` file (or, it you are using XFree86 version 3, the `XF86Config` file) in `/etc/X11`.

An **InputDevice** section, that would disable dead keys on a keyboard layout that used dead keys (for example, German), would look similar to the following:

```
Section "InputDevice"
        Identifier  "Keyboard0"
        Driver      "keyboard"
        Option      "XkbRules" "xfree86"
        Option      "XkbModel" "pc101"
        Option      "XkbLayout" "de"
        Option      "XkbVariant" "nodeadkeys"
EndSection
```

By default, the keyboard layout for various languages which use dead keys should have them enabled unless the `nodeadkeys` option is present.
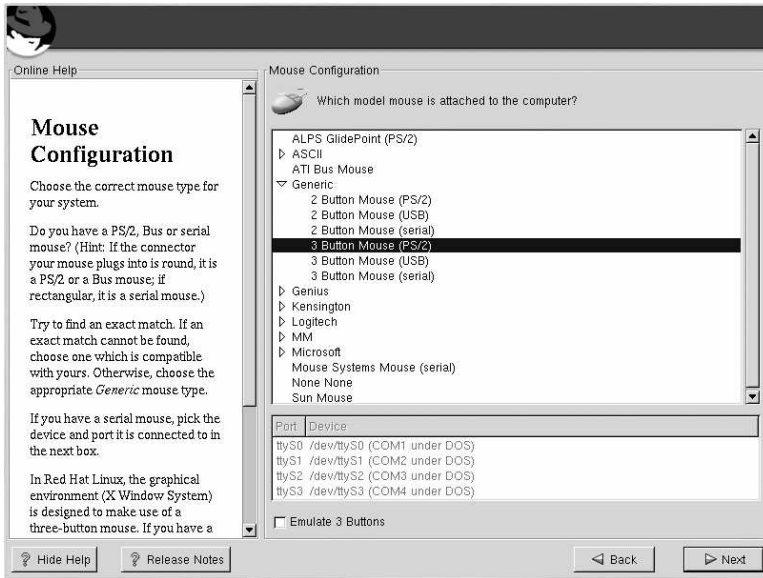
3.7. Mouse Configuration

Choose the correct mouse type for your system. If you cannot find an exact match, choose a mouse type that you are sure is compatible with your system (see Figure 3-3).

To determine your mouse's interface, follow the mouse cable back to where it plugs into your system. If the connector at the end of the mouse cable plugs into a rectangular connector, you have a serial or USB mouse; if the connector is round, you have a PS/2 mouse or mouse port.

If you are not sure if your mouse is a serial or USB mouse, check the vendor documentation.

If you cannot find a mouse that you are sure is compatible with your system, select one of the **Generic** entries, based on your mouse's number of buttons, and its interface.

Figure 3-3. Mouse Configuration

If you have a PS/2 or a bus mouse, you do not need to pick a port and device. If you have a serial mouse, you should choose the correct port and device that your serial mouse is on.

The **Emulate 3 Buttons** checkbox allows you to use a two-button mouse as if it had three buttons. In general, the X Window System is easier to use with a three-button mouse. If you select this checkbox, you can emulate a third, "middle" button by pressing both mouse buttons simultaneously.

Tip

To change your mouse configuration after you have completed the installation of Red Hat Enterprise Linux ES, become root; then use the `/usr/sbin/mouseconfig` command from a shell prompt.

To configure your mouse to work as a left-handed mouse, reset the order of the mouse buttons. To do this, after you have booted your Red Hat Enterprise Linux ES system, type `gpm -B 321` at the shell prompt.

3.8. Welcome to Red Hat Enterprise Linux ES

The **Welcome** screen does not prompt you for any input. Please read over the help text in the left panel for additional instructions and information on where to register your Official Red Hat Enterprise Linux ES product.

Please notice the **Hide Help** button at the bottom left corner of the screen. The help screen is open by default. If you do not want to view the help information, click on **Hide Help** to minimize the help portion of the screen.

Click on the **Next** button to continue.

3.9. Install Options

Choose the type of installation you would like to perform (see Figure 3-4). Red Hat Enterprise Linux ES allows you to choose the installation type that best fits your needs. Your options are **Server** and **Custom**.

☞**Note**

> The choices for **Installation Type** presented on the **Install Options** screen vary depending on which product you are installing.
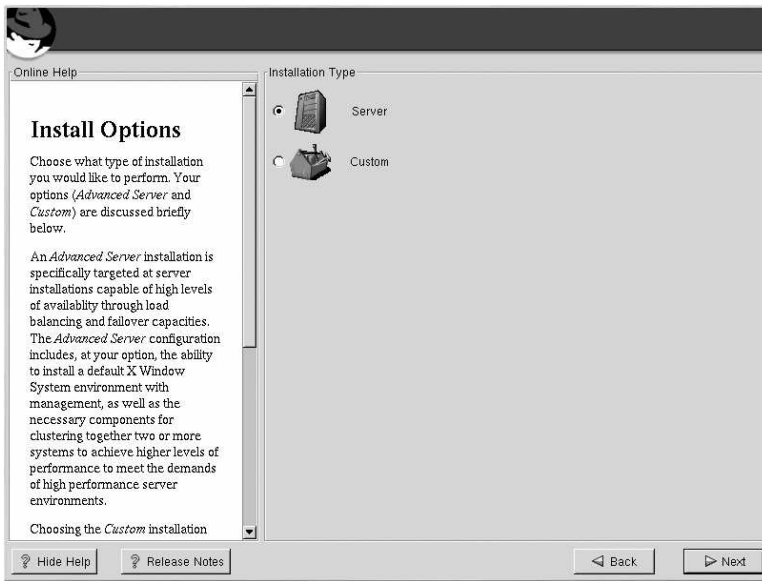

Figure 3-4. Choosing Your Installation Type

For more information about the different installation classes, please refer to Section 1.5.

3.10. Disk Partitioning Setup

Partitioning allows you to divide your hard drive into isolated sections, where each section behaves as its own hard drive. Partitioning is particularly useful if you run more than one operating system. If you are not sure how you want your system to be partitioned, read Appendix D for more information.

On this screen, you can choose to perform automatic partitioning, or manual partitioning using **Disk Druid** or **fdisk** (see Figure 3-5).

Automatic partitioning allows you to perform an installation without having to partition your drive(s) yourself. If you do not feel comfortable with partitioning your system, it is recommended that you *do not* choose to partition manually and instead let the installation program partition for you.

To partition manually, choose either the **Disk Druid** or **fdisk** (recommended for experts only) partitioning tool.
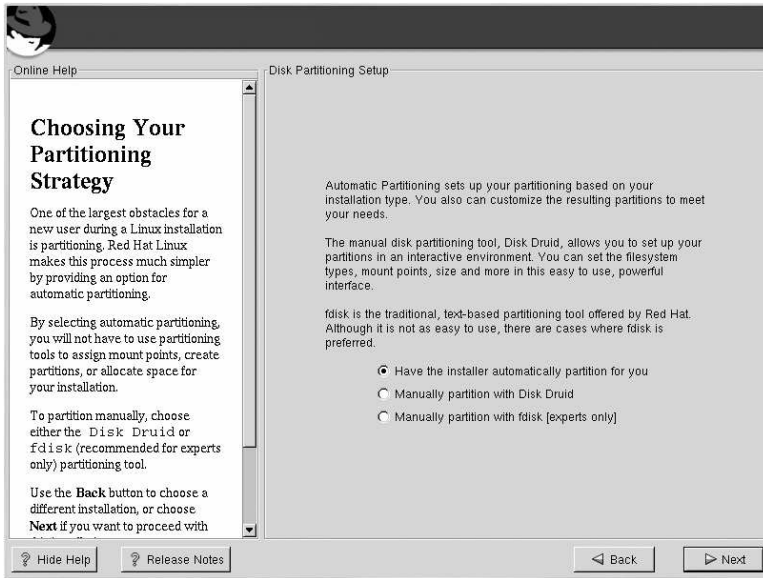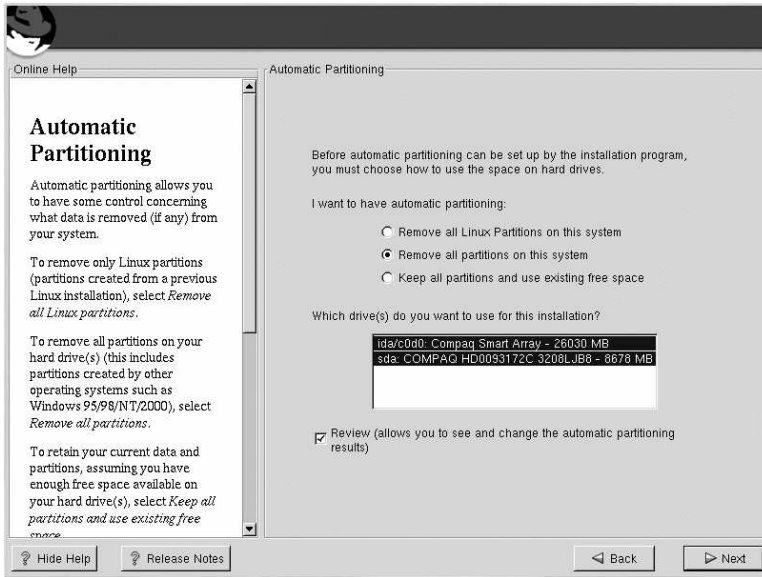

Figure 3-5. Disk Partitioning Setup

If you chose to manually partition using **Disk Druid**, refer to Section 3.12.

If you chose to manually partition using **fdisk**, refer to Section 3.13.

3.11. Automatic Partitioning

Figure 3-6. Automatic Partitioning

Automatic partitioning allows you to have some control concerning what data is removed (if any) from your system. Your options are:

- **Remove all Linux partitions on this system** — select this option to remove only Linux partitions (partitions created from a previous Linux installation). This will not remove other partitions you may have on your hard drive(s).
- **Remove all partitions on this system** — select this option to remove all partitions on your hard drive(s) (this includes partitions created by other operating systems such as Windows 95/98/NT/2000).

> ⚠ **Caution**
>
> If you select this option, all data on the selected hard drive(s) will be removed by the installation program. Do not select this option if you have information that you want to keep on the hard drive(s) where you are installing Red Hat Enterprise Linux ES.

- **Keep all partitions and use existing free space** — select this option to retain your current data and partitions, assuming you have enough free space available on your hard drive(s).

Using your mouse, choose the hard drive(s) on which you want Red Hat Enterprise Linux ES to be installed. If you have two or more hard drives, you can choose which hard drive(s) should contain this installation. Unselected hard drives, and any data on them, will not be touched.

Caution

> If you have a RAID card, be aware that some BIOSes do not support booting from the RAID card. In cases such as these, the `/boot` partition must be created on a partition outside of the RAID array, such as on a separate hard drive. An internal hard drive is necessary to use for partition creation with problematic RAID cards.
>
> If you have chosen to automatically partition your system, you should select **Review** and manually edit your `/boot` partition.

To review and make any necessary changes to the partitions created by automatic partitioning, select the **Review** option. After selecting **Review** and clicking **Next** to move forward, you will see the partitions created for you in **Disk Druid**. You will also be able to make modifications to these partitions if they do not meet your needs.

Click **Next** once you have made your selections to proceed.

3.12. Partitioning Your System

If you chose automatic partitioning and did not select **Review**, please skip ahead to Section 3.16.

If you chose automatic partitioning and selected **Review**, you can either accept the current partition settings (click **Next**), or modify the setup using Disk Druid, the manual partitioning tool.

If you chose **Manually partition with fdisk**, please skip ahead to Section 3.13.

At this point, you must tell the installation program where to install Red Hat Enterprise Linux ES. This is done by defining mount points for one or more disk partitions in which Red Hat Enterprise Linux ES will be installed. You may also need to create and/or delete partitions at this time (refer to Figure 3-7).

Note

> If you have not yet planned how you will set up your partitions, refer to Appendix D. At a bare minimum, you need an appropriately-sized root partition, and a swap partition equal to twice the amount of RAM you have on the system.
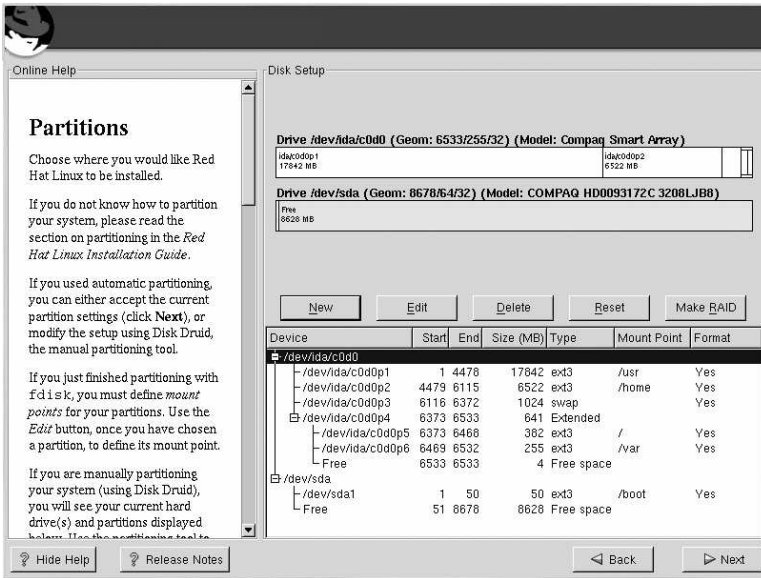
Figure 3-7. Partitioning with Disk Druid

The partitioning tool used in Red Hat Enterprise Linux ES is **Disk Druid**. With the exception of certain esoteric situations, **Disk Druid** can handle the partitioning requirements for a typical Red Hat Enterprise Linux ES installation.

3.12.1. Graphical Display of Hard Drive(s)

Disk Druid offers a graphical representation of your hard drive(s).

Using your mouse, click once to highlight a particular field in the graphical display. Double-click to edit an existing partition or to create a partition out of existing free space.

Above the display, you will see the **drive** name (such as /dev/hda), the **geom** (which shows the hard disk's geometry and consists of three numbers representing the number of cylinders, heads, and sectors as reported by the hard disk), and the **model** of the hard drive as detected by the installation program.

3.12.2. Disk Druid's Buttons

These buttons control **Disk Druid's** actions. They are used to change the attributes of a partition (for example the filesystem type and mount point) and also to create RAID devices. Buttons on this screen are also used to accept the changes you have made, or to exit **Disk Druid**. For further explanation, take a look at each button in order:

- **New**: Used to request a new partition. When selected, a dialog box appears containing fields (such as mount point and size) that must be filled in.
- **Edit**: Used to modify attributes of the partition currently selected in the **Partitions** section. Selecting **Edit** opens a dialog box. Some or all of the fields can be edited, depending on whether the partition information has already been written to disk.

You can also edit free space as represented in the graphical display to create a new partition within that space. Either highlight the free space and then select the **Edit** button, or double-click on the free space to edit it.

- **Delete**: Used to remove the partition currently highlighted in the **Current Disk Partitions** section. You will be asked to confirm the deletion of any partition.

- **Reset**: Used to restore **Disk Druid** to its original state. All changes made will be lost if you **Reset** the partitions.

- **Make RAID**: **Make RAID** can be used if you want to provide software RAID redundancy to any or all disk partitions. *It should only be used if you have experience using RAID.* To read more about RAID, please refer to *RAID (Redundant Array of Independent Disks)* in the *Official Red Hat Linux Customization Guide*.

  To make a RAID device, you must first create software RAID partitions. Once you have created two or more software RAID partitions, select **Make RAID** to join the software RAID partitions into a RAID device.

3.12.3. Partition Fields

Above the partition hierarchy are labels which present information about the partitions you are creating. The labels are defined as follows:

- **Device**: This field displays the partition's device name.

- **Start**: This field shows the sector on your hard drive where the partition begins.

- **End**: This field shows the sector on your hard drive where the partition ends.

- **Size**: This field shows the partition's size (in MB).

- **Type**: This field shows the partition's type (for example, ext2, ext3, or vfat).

- **Mount Point**: A mount point is the location within the directory hierarchy at which a volume exists; the volume is "mounted" at this location. This field indicates where the partition will be mounted. If a partition exists, but is not set, then you need to define its mount point. Double-click on the partition or click the **Edit** button.

- **Format**: This field shows if the partition being created will be formatted.

3.12.4. Recommended Partitioning Scheme

Unless you have a reason for doing otherwise, we recommend that you create the following partitions:

- A swap partition (at least 32 MB) — swap partitions are used to support virtual memory. In other words, data is written to a swap partition when there is not enough RAM to store the data your system is processing. The size of your swap partition should be equal to twice your computer's RAM, or 32 MB, whichever amount is larger, but no more than 2048 MB (or 2 GB). In **Disk Druid**, the partition field for swap should look similar to the following:
  ```
  <Swap>  hda6  64M   64M  Linux swap
  ```

  For example, if you have 1 GB of RAM or less, your swap partition should be at least equal to the amount of RAM on your system, up to two times the RAM. For more than 1 GB of RAM, 2 GB of swap is recommended. Creating a large swap space partition will be especially helpful if you plan to upgrade your RAM at a later time.

- A /boot partition (50 MB) — the partition mounted on /boot contains the operating system kernel (which allows your system to boot Red Hat Enterprise Linux ES), along with files used during the bootstrap process. Due to the limitations of most PC BIOSes, creating a small partition to hold

these files is a good idea. For most users, a 50 MB boot partition is sufficient. In **Disk Druid**, the
partition field for `/boot` should look similar to:

```
/boot  hda1  50M   50M  Linux native
```

> ⚠️ **Caution**
>
> If your hard drive is more than 1024 cylinders (and your system was manufactured more than two
> years ago), you may need to create a `/boot` partition if you want the `/` (root) partition to use all of
> the remaining space on your hard drive.

> ⚠️ **Caution**
>
> If you have a RAID card, be aware that some BIOSes do not support booting from the RAID card.
> In cases such as these, the `/boot` partition must be created on a partition outside of the RAID
> array, such as on a separate hard drive.

• A `root` partition (350 MB - 3.2 GB) — this is where "/" (the root directory) will be located. In this
setup, all files (except those stored in `/boot`) are on the root partition.

A 350 MB partition will allow you to install a minimal Custom installation (without the Server
packages), a 1.0 GB root partition will permit the equivalent of a default Server (with GNOME or
KDE) installation (with *very* little free space), while a 3.2 GB root partition will let you perform a
full Custom installation, choosing everything.

In **Disk Druid**, the partition field for `/` should look similar to:

```
/  hda5  3734M   3734M   Linux native
```

3.12.5. Adding Partitions

To add a new partition, select the **New** button. A dialog box appears (see Figure 3-8).

> ☞ **Note**
>
> You must dedicate at least one partition to Red Hat Enterprise Linux ES, and optionally more. For
> more information, see Appendix D.

Figure 3-8. Creating a New Partition

- **Mount Point**: Enter the partition's mount point. For example, if this partition should be the root partition, enter **/**; enter **/boot** for the **/boot** partition, and so on. You can also use the pulldown menu to choose the correct mount point for your partition.

- **Filesystem Type**: Using the pulldown menu, select the appropriate filesystem type for this partition. For more information on filesystem types, see Section 3.12.5.1.

- **Allowable Drives**: This field contains a list of the hard disks installed on your system. If a hard disk's box is highlighted, then a desired partition can be created on that hard disk. If the box is *not* checked, then the partition will *never* be created on that hard disk. By using different checkbox settings, you can have **Disk Druid** place partitions as you see fit, or let **Disk Druid** decide where partitions should go.

- **Size (Megs)**: Enter the size (in megabytes) of the partition. Note, this field starts with a "1" (one); unless changed, only a 1 MB partition will be created.

- **Additional Size Options**: Choose whether to keep this partition at a fixed size, to allow it to "grow" (fill up the available hard drive space) to a certain point, or to allow it to grow to fill any remaining hard drive space available.

  If you choose **Fill all space up to (MB)**, you must give size constraints in the field to the right of this option. This allows you to keep a certain amount of space free on your hard drive for future use.

- **Force to be a primary partition**: Select whether the partition you are creating should be one of the first four partitions on the hard drive. If unselected, the partition created will be a logical partition.

See Section D.1.3, for more information.

- **Check for bad blocks**: Checking for bad blocks can help prevent data loss by locating the bad blocks on a drive and making a list of them to prevent using them in the future. If you wish to check for bad blocks while formatting each filesystem, please make sure to select this option.

  Selecting **Check for bad blocks** may dramatically increase your total installation time. Since most newer hard drives are quite large in size, checking for bad blocks may take a long time; the length of time depends on the size of your hard drive. If you choose to check for bad blocks, you can monitor your progress on virtual console #6.

- **Ok**: Select **Ok** once you are satisfied with the settings and wish to create the partition.
- **Cancel**: Select **Cancel** if you do not want to create the partition.

3.12.5.1. Filesystem Types

Red Hat Enterprise Linux ES allows you to create different partition types, based on the filesystem they will use. The following is a brief description of the different filesystems available, and how they can be utilized.

- **ext2** — An ext2 filesystem supports standard Unix file types (regular files, directories, symbolic links, etc). It provides the ability to assign long file names, up to 255 characters. Versions prior to Red Hat Enterprise Linux ES 2.1 used ext2 filesystems by default.
- **ext3** — The ext3 filesystem is based on the ext2 filesystem and has one main advantage — journaling. Using a journaling filesystem reduces time spent recovering a filesystem after a crash as there is no need to **fsck**[1] the filesystem.
- **software RAID** — Creating two or more software RAID partitions allows you to create a RAID device. For more information regarding RAID, refer to the chapter *RAID (Redundant Array of Independent Disks)* in the *Official Red Hat Linux Customization Guide*.
- **swap** — Swap partitions are used to support virtual memory. In other words, data is written to a swap partition when there is not enough RAM to store the data your system is processing.
- **vfat** — The VFAT filesystem is a Linux filesystem that is compatible with Windows 95/NT long filenames on the FAT filesystem.

3.12.6. Editing Partitions

To edit a partition, select the **Edit** button or double-click on the existing partition.

Note

If the partition already exists on your hard disk, you will only be able to change the partition's mount point. If you want to make any other changes, you will need to delete the partition and recreate it.

---

1. The **fsck** application is used to check the filesystem for metadata consistency and optionally repair one or more Linux filesystems.

3.12.7. Deleting a Partition

To delete a partition, highlight it in the **Partitions** section and click the **Delete** button. You will be asked to confirm the deletion.

Skip to Section 3.14 for further installation instructions.

3.13. Partitioning with fdisk

This section applies only if you chose to use **fdisk** to partition your system.

To partition your system without using **fdisk**, please skip to Section 3.11 for automatic partitioning or Section 3.12 for partitioning with **Disk Druid**.

If you have already completed disk partitioning, skip to Section 3.14 for further installation instructions.

⚠️ **Caution**

> *Unless you have previously used **fdisk** and understand how it works, we do not recommend that you use it. It is much easier for new users to accidentally corrupt or lose data using **fdisk**.*
>
> **Disk Druid** is easier to understand than **fdisk**. To exit **fdisk**, click **Back** to return to the previous screen, deselect **fdisk**, and then click **Next**.

If you have chosen to use **fdisk**, the next screen will prompt you to select a drive to partition using **fdisk**. Once you have chosen which drive to partition, you will be presented with the **fdisk** command screen. If you do not know what command to use, type [m] at the prompt for help.

When you are finished making partitions, type [w] to save your changes and quit. You will be taken back to the original **fdisk** screen where you can partition another drive or continue the installation.

📝 **Note**

> None of the changes you make take effect until you save them and exit **fdisk** using the w command. You can quit **fdisk** at any time without saving changes using the q command.

After you have partitioned your drive(s), click **Next**. You will need to use **Disk Druid** to assign mount points to the partitions you just created with **fdisk**.

You will not be able to add new partitions using **Disk Druid**, but you can edit mount points for the partitions you have already created. For each partition created with **fdisk**, click on the **Edit** button, choose the appropriate mount point for that partition from the pulldown menu, and click on **OK**.

3.14. Boot Loader Installation

In order to boot the system without a boot disk, you usually need to install a boot loader. You can choose to install either GRUB (selected by default) or LILO.

GRUB is a software boot loader that can be used to start Red Hat Enterprise Linux ES on your computer. It can also start other operating systems, such as Windows $9x$. Here, you will be asked how (or whether) you want to configure a boot loader and which one (GRUB or LILO).

Choose which boot loader you want to install. If you would rather use LILO, make sure it is selected instead of GRUB.

> ⚠️ **Caution**
>
> If you choose not to install GRUB or LILO for any reason, you will not be able to boot your Red Hat Enterprise Linux ES system directly, and you will need to use another boot method (such as a boot diskette). Use this option only if you are sure you have another way of booting your Red Hat Enterprise Linux ES system!
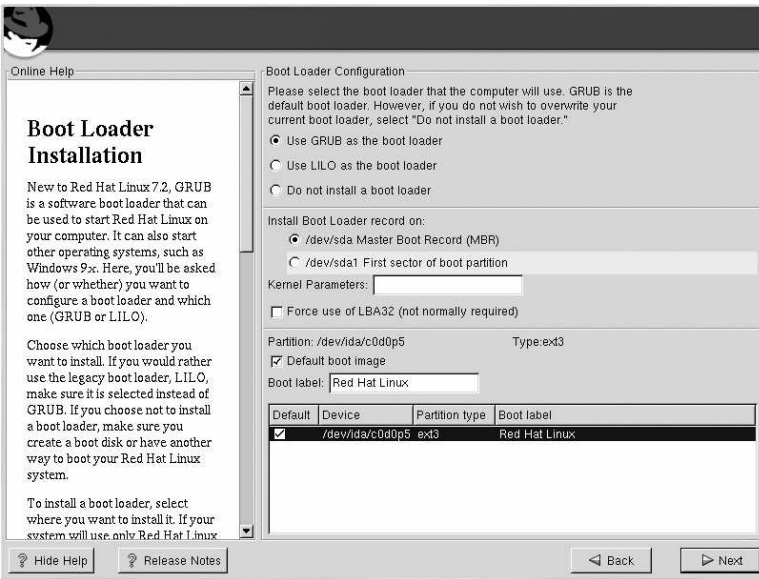
Figure 3-9. Boot Loader Installation

If you chose to install a boot loader (GRUB or LILO), you must determine where it will be installed. You may install your boot loader in one of two places:

The master boot record (MBR)

> The recommended place to install a boot loader, unless the MBR already starts another operating system loader, such as System Commander or OS/2's Boot Manager. The MBR is a special area on your hard drive that is automatically loaded by your computer's BIOS, and is the earliest point at which the boot loader can take control of the boot process. If you install it in the MBR, when your machine boots, GRUB (or LILO) will present a boot prompt. You can then boot Red Hat Enterprise Linux ES or any other operating system that you have configured the boot loader to boot.

The first sector of your root partition

> Recommended if you are already using another boot loader on your system (such as OS/2's Boot Manager). In this case, your other boot loader will take control first. You can then configure that boot loader to start GRUB (or LILO), which will then boot Red Hat Enterprise Linux ES.

⚠ Caution

> If you have a RAID card, be aware that some BIOSes do not support booting from the RAID card. In cases such as these, the boot loader *should not* be installed on the MBR of the RAID array. Rather, the boot loader should be installed on the MBR of the same drive as the /boot partition was created.

Select where you would like GRUB (or LILO) to be installed on your system. If your system will use only Red Hat Enterprise Linux ES, you should choose the MBR.

If you want to add default options to GRUB or LILO's boot command, enter them into the **Kernel parameters** field. Any options you enter will be passed to the Linux kernel every time it boots.

The **Force use of LBA32 (not normally required)** option allows you to exceed the 1024 cylinder limit for the /boot partition. If you have a system which supports the LBA32 extension for booting operating systems above the 1024 cylinder limit, you shouldplace your /boot partition above this limit. If the installation program has not already detected this extension from your BIOS, you should select the **Force use of LBA32 (not normally required)** option.

Every bootable partition is listed, including partitions used by other operating systems. The partition holding your Red Hat Enterprise Linux ES system's root filesystem will have a **Boot label** of Red Hat Enterprise Linux ES. Other partitions may also have boot labels. If you would like to add boot labels for other partitions (or change an existing boot label), click once on the partition to select it. Once selected, you can change the boot label by editing the name in the **Boot label** text field.

☞ Note

> The **Boot label** column lists what you must enter at the boot prompt in order to boot the desired operating system. However, if you forget the boot labels defined on your system, you can always press [Tab] at the prompt to display a list of defined boot labels.

3.14.1. Rescue Mode

If you need to use rescue mode, there are several options available to you.

- Using the CD-ROM to boot, type **linux rescue** at the boot: prompt.
- Using the network boot disk you have created, type **linux rescue** at the boot: prompt. You will then be prompted to retrieve the rescue image from the network.
- Using the boot disk you have created, type **linux rescue** at the boot: prompt. You then pick an installation method and choose a valid installation tree to load from.

For more information regarding rescue mode, refer to the *Official Red Hat Linux Customization Guide*.

3.14.2. Alternative Boot Loaders

If you do not wish to use GRUB or LILO to boot your Red Hat Enterprise Linux ES system, you have several alternatives:

Boot disk

> You can use the boot disk created by the installation program (if you elected to create one).

LOADLIN

> You can load Linux from MS-DOS. Unfortunately, it requires a copy of the Linux kernel (and an initial RAM disk, if you have a SCSI adapter) to be available on an MS-DOS partition. The only way to accomplish this is to boot your Red Hat Enterprise Linux ES system using some other method (for example, from LILO on a diskette) and then copy the kernel to an MS-DOS partition. LOADLIN is available from ftp://metalab.unc.edu/pub/Linux/system/boot/dualboot/ and associated mirror sites.

SYSLINUX

> SYSLINUX is an MS-DOS program very similar to LOADLIN. It is also available from ftp://metalab.unc.edu/pub/Linux/system/boot/loaders/ and associated mirror sites.

Some commercial boot loaders

> You can load Linux using commercial boot loaders. For example, System Commander and Partition Magic are able to boot Linux (but still require GRUB or LILO to be installed in your Linux root partition).

3.14.3. SMP Motherboards, GRUB, and LILO

This section is specific to SMP motherboards only. If the installation program detects an SMP motherboard on your system, it will create two `/boot/grub/grub.conf` or `/etc/lilo.conf` entries (depending on the boot loader you installed), rather than the usual single entry.

The two entries in `grub.conf` will be `Red Hat Enterprise Linux ES (`*kernel version*`)` and `Red Hat Enterprise Linux ES (`*kernel versions*`-smp)`. The `Red Hat Enterprise Linux ES (`*kernel version*`-smp)` will boot by default. However, if you have trouble with the SMP kernel, you can elect to boot the `Red Hat Enterprise Linux ES (`*kernel version*`)` entry instead. You will retain all the functionality as before, but you will only be operating with a single processor.

The two entries in `lilo.conf` will be `linux` and `linux-up`. The `linux` entry will boot by default. However, if you have trouble with the SMP kernel, you can elect to boot the `linux-up` entry instead. You will retain all the functionality as before, but you will only be operating with a single processor.

3.15. GRUB Password

If you did not select GRUB as your boot loader, or did not install a boot loader, skip to Section 3.16.

GRUB passwords provide a security mechanism in an environment where physical access to your server is available.

If you are installing GRUB as your boot loader, you should create a password to protect your system. Otherwise, users may be able to pass options to the kernel which can compromise your system security.

Figure 3-10. GRUB Password

If you choose to use a GRUB password to enhance your system security, be sure to select the checkbox labeled **Use a GRUB Password**.

Once selected, enter a password and confirm it.

3.16. Network Configuration

If you do not have a network device, you will not see this screen. Skip ahead to Section 3.17.

If you have a network device and you have not already configured your networking (such as booting from a network boot disk you created and entering in your network information as prompted), you now have the opportunity (as shown in Figure 3-11) to do so.

If you have multiple devices, you will see a tab for each device. You may switch between devices (for example, between eth0 and eth1) and the information you provide on each tab will be specific to each device.

Indicate if you would like to configure your IP address using DHCP (Dynamic Host Configuration Protocol). If you select **Activate on boot**, your network interface will be started when you boot. If you do not have DHCP client access or you are unsure what to provide here, please contact your network administrator.

Next enter, where applicable, the **IP Address**, **Netmask**, **Network**, and **Broadcast** addresses. If you are unsure about any of these, please contact your network administrator.

If you have a fully qualified domain name for the network device, enter it in the **Hostname** field.

Finally, enter the **Gateway** and **Primary DNS** (and if applicable the **Secondary DNS** and **Ternary DNS**) addresses.
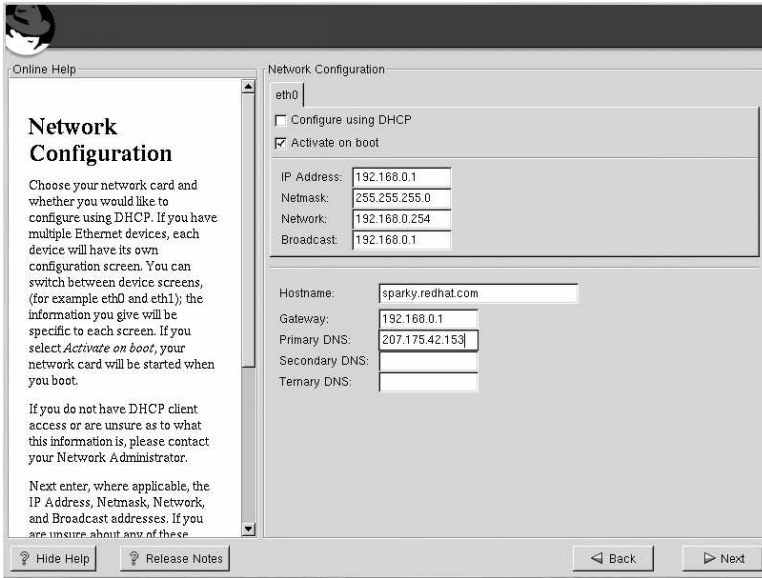

Figure 3-11. Network Configuration

☞**Note**

Do not use the numbers as seen in this sample configuration. These values will not work for your own network configuration. If you are not sure what values to enter, contact your network administrator for assistance.


ⓘ**Tip**

Even if your computer is not part of a network, you can enter a hostname for your system. If you do not take this opportunity to enter a name, your system will be known as `localhost`.

3.17. Firewall Configuration

Red Hat Enterprise Linux ES offers firewall protection for enhanced system security. A firewall exists between your computer and the network, and determines which resources on your computer remote users on the network can access. A properly configured firewall can greatly increase the security of your system.
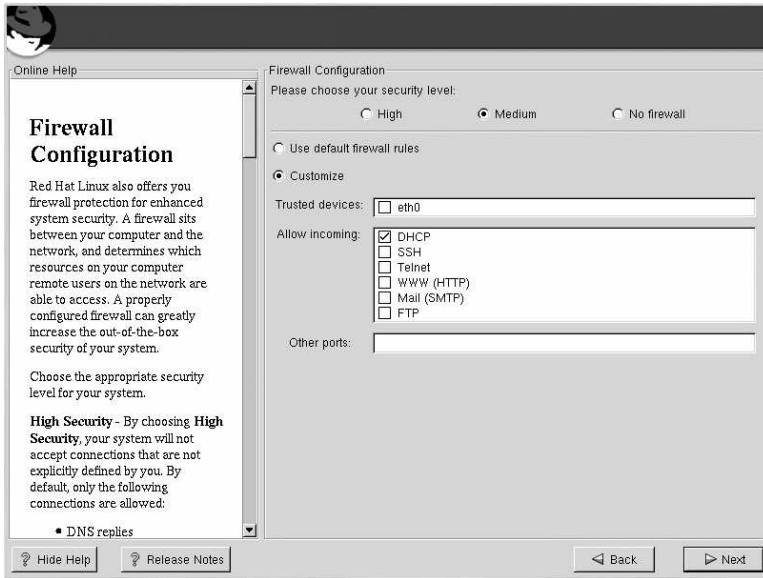
Figure 3-12. Firewall Configuration

Choose the appropriate security level for your system.

High

If you choose **High**, your system will not accept connections (other than the default settings) that are not explicitly defined by you. By default, only the following connections are allowed:

• DNS replies

• DHCP — so any network interfaces that use DHCP can be properly configured

If you choose **High**, your firewall will not allow the following:

• Active mode FTP (passive mode FTP, used by default in most clients, should still work)

• IRC DCC file transfers

• RealAudio™

• Remote X Window System clients

If you are connecting your system to the Internet, but do not plan to run a server, this is the safest choice. If additional services are needed, you can choose **Customize** to allow specific services through the firewall.

Medium

If you choose **Medium**, your firewall will not allow remote machines to have access to certain resources on your system. By default, access to the following resources are not allowed:

- Ports lower than 1023 — the standard reserved ports, used by most system services, such as **FTP**, **SSH**, **telnet**, and **HTTP**
- The NFS server port (2049)
- The local X Window System display for remote X clients
- The X Font server port (by default, **xfs** does not listen on the network; it is disabled in the font server)

If you want to allow resources such as **RealAudio™** while still blocking access to normal system services, choose **Medium**. Select **Customize** to allow specific services through the firewall.

No firewall

No firewall provides complete access to your system and does no security checking. Security checking is the disabling of access to certain services. This should only be selected if you are running on a trusted network (not the Internet) or plan to do more firewall configuration later.

Choose **Customize** to add trusted devices or to allow additional incoming services.

Trusted Devices

Selecting any of the **Trusted Devices** allows access to your system for all traffic from that device; it is excluded from the firewall rules. For example, if you are running a local network, but are connected to the Internet via a PPP dialup, you can check **eth0** and any traffic coming from your local network will be allowed. Selecting **eth0** as trusted means all traffic over the Ethernet is allowed, put the ppp0 interface is still firewalled. If you want to restrict traffic on an interface, leave it unchecked.

It is not recommended that you make any device that is connected to public networks, such as the Internet, a **Trusted Device**.

Allow Incoming

Enabling these options allow the specified services to pass through the firewall. Note, during a workstation installation, the majority of these services are *not* installed on the system.

DHCP

If you allow incoming DHCP queries and replies, you allow any network interface that uses DHCP to determine its IP address. DHCP is normally enabled. If DHCP is not enabled, your computer can no longer get an IP address.

SSH

*S*ecure *SH*ell (SSH) is a suite of tools for logging into and executing commands on a remote machine. If you plan to use SSH tools to access your machine through a firewall, enable this option. You need to have the `openssh-server` package installed in order to access your machine remotely, using SSH tools.

Telnet

Telnet is a protocol for logging into remote machines. Telnet communications are unencrypted and provide no security from network snooping. Allowing incoming Telnet access is not recommended. If you do want to allow inbound Telnet access, you will need to install the `telnet-server` package.

WWW (HTTP)

> The HTTP protocol is used by Apache (and by other Web servers) to serve webpages. If you plan on making your Web server publicly available, enable this option. This option is not required for viewing pages locally or for developing webpages. You will need to install the `apache` package if you want to serve webpages.

Mail (SMTP)

> If you want to allow incoming mail delivery through your firewall, so that remote hosts can connect directly to your machine to deliver mail, enable this option. You do not need to enable this if you collect your mail from your ISP's server using POP3 or IMAP, or if you use a tool such as **fetchmail**. Note that an improperly configured SMTP server can allow remote machines to use your server to send spam.

FTP

> The FTP protocol is used to transfer files between machines on a network. If you plan on making your FTP server publicly available, enable this option. You need to install the `wu-ftpd` (and possibly the `anonftp`) package for this option to be useful.

Other ports

> You can allow access to ports which are not listed here, by listing them in the **Other ports** field. Use the following format: **`port:protocol`**. For example, if you want to allow IMAP access through your firewall, you can specify **`imap:tcp`**. You can also explicitly specify numeric ports; to allow UDP packets on port 1234 through the firewall, enter **`1234:udp`**. To specify multiple ports, separate them with commas.

3.18. Language Support Selection

Red Hat Enterprise Linux ES can install and support multiple languages for use on your system.

You must select a language to use as the default language. The default language will be used on your Red Hat Enterprise Linux ES system once installation is complete. If you choose to install other languages, you can change your default language after the installation.

If you are only going to use one language on your system, selecting only that language will save significant disk space. The default language is the language you selected to use during the installation. However, if you select only one language, you will only be able to use that specified language after the Red Hat Enterprise Linux ES installation is complete.
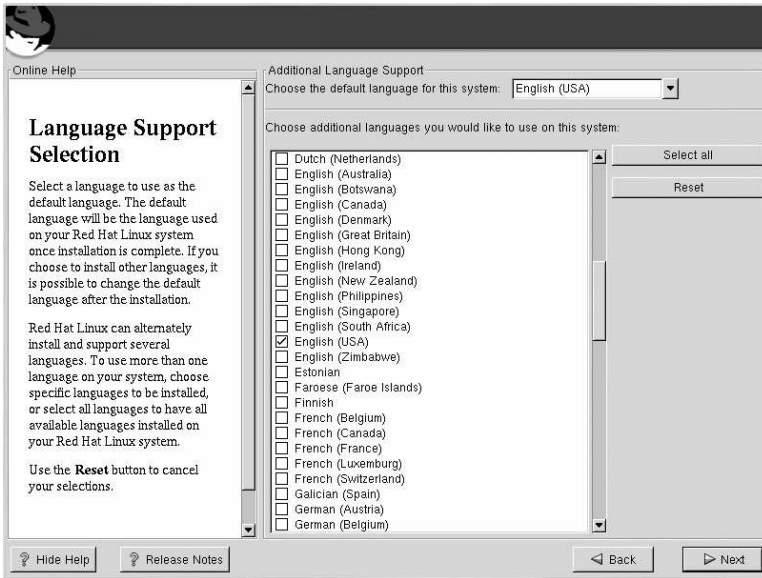
Figure 3-13. Language Support Selection

To use more than one language on your system, choose specific languages to be installed or select all languages to have all available languages installed on your Red Hat Enterprise Linux ES system.

Use the **Reset** button to cancel your selections. Resetting will revert to the default; only the language you selected for use during the installation will be installed.

3.19. Time Zone Configuration

You can set your time zone by selecting your computer's physical location or by specifying your time zone's offset from Coordinated Universal Time (UTC).

Notice the two tabs at the top of the screen (see Figure 3-14). The first tab allows you to configure your time zone by your location. You can specify different areas to view: **World**, **North America**, **South America**, **Pacific Rim**, **Europe**, **Africa**, and **Asia**.
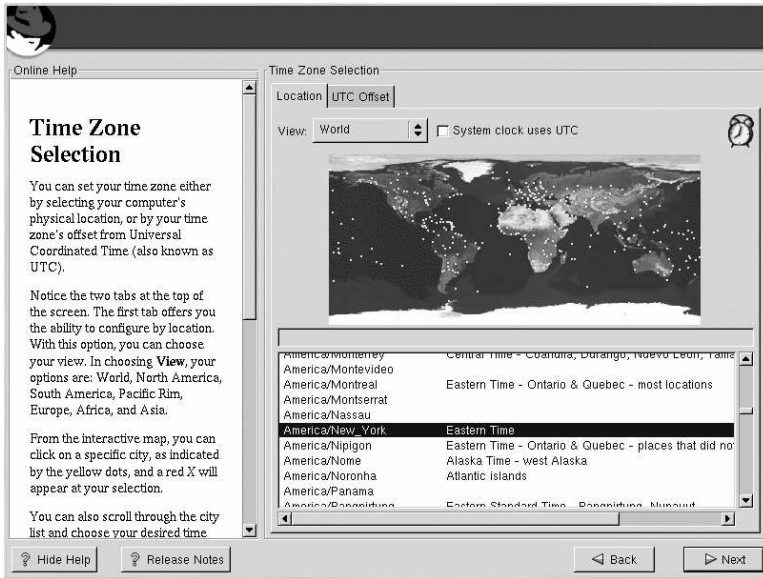
Figure 3-14. Configuring the Time Zone

On the interactive map, you can also click on a specific city, which is marked by a yellow dot; a red **X** will appear indicating your selection. You can also scroll through a list and choose a time zone.

The second tab allows you to specify a UTC offset. The tab displays a list of offsets to choose from, as well as an option to set daylight saving time.

On both tabs, you can select **System Clock uses UTC**. Please select this if you know that your system is set to UTC.

Tip

If you wish to change your time zone configuration after you have booted your Red Hat Enterprise Linux ES system, become root and use the `/usr/sbin/timeconfig` command.

3.20. Account Configuration

The **Account Configuration** screen allows you to set your root password. Additionally, you can set up user accounts for you to log in to once the installation is complete (see Figure 3-15).
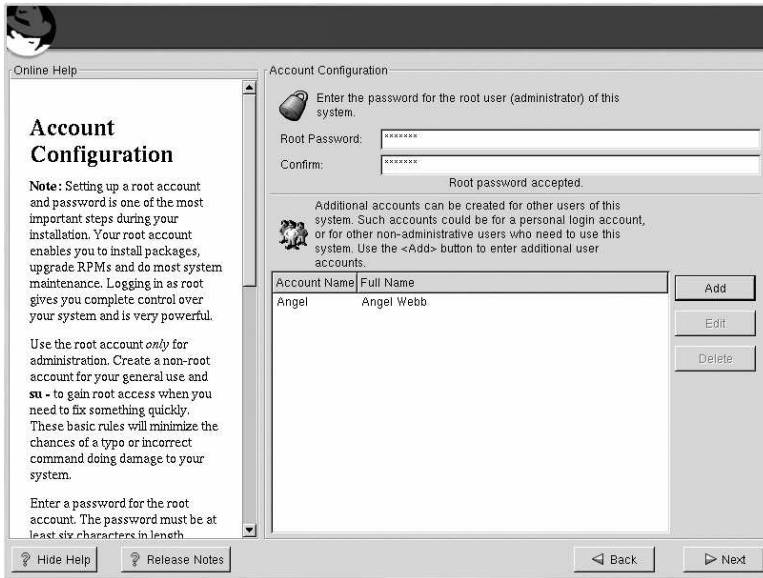
Figure 3-15. Account Creation

3.20.1. Setting the Root Password

Setting up a root account and password is one of the most important steps during your installation. Your root account is similar to the administrator account used on Windows NT machines. The root account is used to install packages, upgrade RPMs, and perform most system maintenance. Logging in as root gives you complete control over your system.

Use the root account only for system administration. Create a non-root account for your general use and `su` – to root when you need to fix something quickly. These basic rules will minimize the chances of a typo or an incorrect command doing damage to your system.

> **Tip**
>
> To become root, type `su` – at the shell prompt in a terminal window and then press [Enter]. Then, enter the root password and press [Enter].

The installation program will prompt you to set a root password[2] for your system. You must enter a root password. The installation program will not let you proceed to the next section without entering a root password.

The root password must be at least six characters long; the password you type is not echoed to the screen. You must enter the password twice; if the two passwords do not match, the installation program will ask you to enter them again.

---

2.   A root password is the administrative password for your Red Hat Enterprise Linux ES system. You should only log in as root when needed for system maintenance. The root account does not operate within the restrictions placed on normal user accounts, so changes made as root can have implications for your entire system.

You should make the root password something you can remember, but not something that is easy for someone else to guess. Your name, your phone number, *qwerty*, *password, root*, *123456*, and *anteater* are all examples of bad passwords. Good passwords mix numerals with upper and lower case letters and do not contain dictionary words: *Aard387vark* or *420BMttNT*, for example. Remember that the password is case-sensitive. If you write down your password, keep it in a secure place. However, it is recommended that you do not write down this or any password you create.

☞**Note**

Do not use one of the example passwords offered in this manual. Using one of these passwords could be considered a security risk.

☞**Note**

The root user (also known as the superuser) has complete access to the entire system; for this reason, logging in as the root user is best done *only* to perform system maintenance or administration.

3.20.2. Setting Up User Accounts

If you choose to create a user account now, you will have an account to log in to once the installation has completed. This allows you to safely and easily log into your computer without having to be root to create your user account.

Enter an account name. Then enter and confirm a password for that user account. Enter the full name of the account user and press **Add**. Your account information will be added to the account list, and the user account fields will be cleared so that you can add another user.

Figure 3-16. Creating a User Account

Choose **New** to add a new, non-root, user. Enter the user's information and use the **Add** button to add the user to the account list.

You can also **Edit** or **Delete** the user accounts you have created and no longer want.

3.21. Package Group Selection

After your partitions have been selected and configured for formatting, you are ready to select packages for installation.


👆**Note**

Unless you choose a custom installation, the installation program will automatically choose most packages for you. However, you must select either GNOME or KDE (or both) to install a graphical environment.

GNOME and KDE are both graphical desktop environments[3] that handle the overall look and feel of your system. You must choose one of these to have a default graphical setup, but you can also install both to determine for yourself which you prefer.

You can select components, which group packages together according to function (for example, **GNOME**, **KDE**, or **Software Development**), individual packages, or a combination of the two.

To select a component, click on the checkbox beside it (see Figure 3-17).
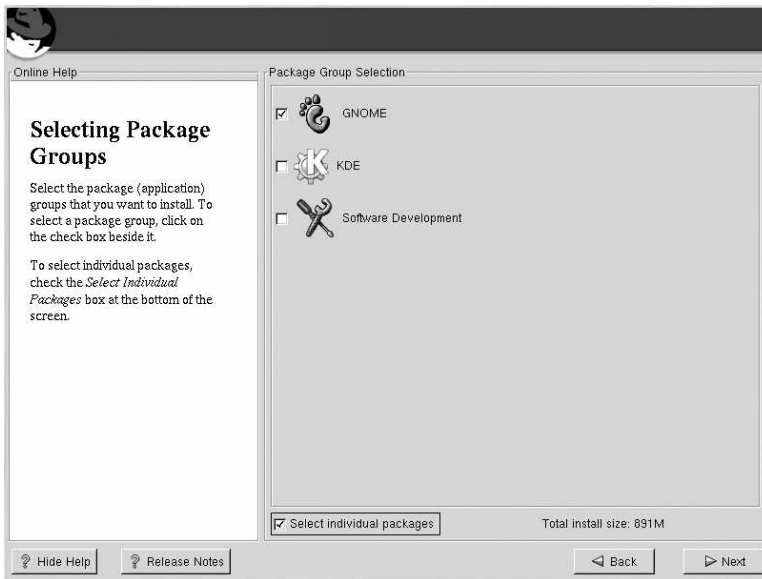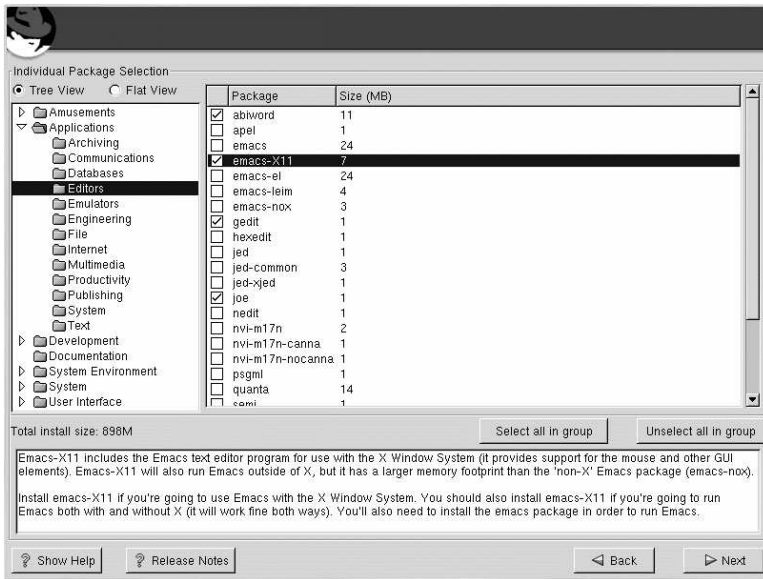

Figure 3-17. Package Group Selection

Select each component you wish to install. Selecting **Everything** (at the end of the component list) during a custom installation installs all packages included with Red Hat Enterprise Linux ES. If you select every package, you will need approximately 1.7 GB of free disk space.

---

3.   A desktop environment in Linux is similar to the environment you might see in other operating systems. However, environments differ in their look and feel and are easily customized for your individual needs.

To select packages individually, check the **Select Individual Packages** box at the bottom of the screen.

3.21.1. Selecting Individual Packages

After selecting the components you wish to install, you can select or deselect individual packages using your mouse (see Figure 3-18).

Figure 3-18. Selecting Individual Packages

You can choose to view the individual packages in **tree view** or **flat view**. **Tree view** allows you to see the packages grouped by application type. When you expand this list and pick one group, the list of packages in that group appears in the panel on the right. **Flat view** allows you to see all of the packages in an alphabetical listing on the right of the screen.

To sort alphabetically, click on the **Package** tab. To sort packages by size, click on the **Size (MB)** tab.

To select an individual package, double-click the checkbox beside the package name. A check mark in the box means that a package has been selected.

For more information about a specific package, click on the individual package name. The package information will appear at the bottom of the screen.

You can also select or deselect all packages listed within a particular group, by clicking on the **Select all in group** or **Unselect all in group** buttons.

☞ **Note**

Some packages (such as the kernel and certain libraries) are required for every Red Hat Enterprise Linux ES system and are not available to select or deselect. These base packages are selected by default.

3.21.2. Unresolved Dependencies

Many software packages, in order to work correctly, depend on other software packages that must be installed on your system. For example, many of the graphical Red Hat system administration tools require the `python` and `pythonlib` packages. To make sure your system has all the packages it needs in order to be fully functional, Red Hat Enterprise Linux ES checks these package *dependencies* each time you install or remove software packages.

If any package requires another package which you have not selected to install, the program presents a list of these unresolved dependencies and gives you the opportunity to resolve them (see Figure 3-19).

The **Unresolved Dependencies** screen appears only if you are missing packages that are needed by the packages you have selected. At the bottom of the screen, under the list of missing packages, an **Install packages to satisfy dependencies** checkbox is selected by default. If you leave this checked, the installation program will resolve dependencies automatically by adding all required packages to the list of selected packages.
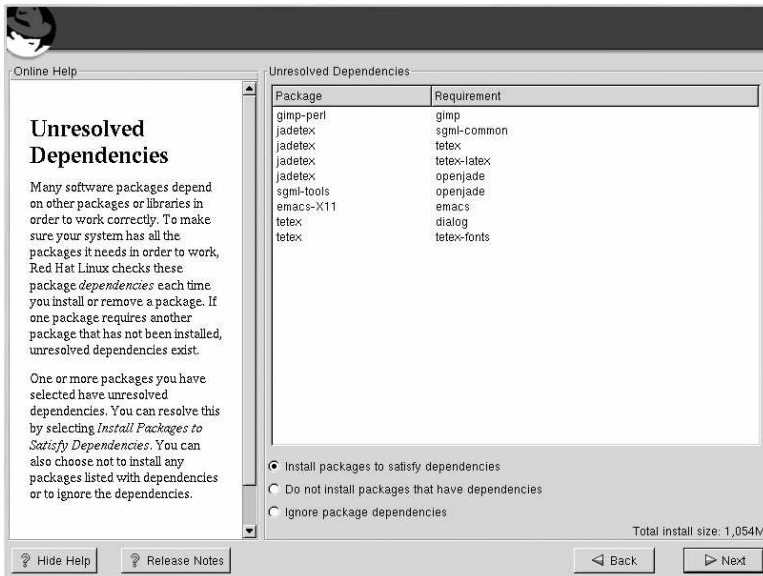

Figure 3-19. Unresolved Dependencies

3.22. X Configuration — Video Card

The first part of X configuration deals with video card configuration.

3.22.1. Video Card Configuration

Xconfigurator will now present a list of video cards for you to choose from.

If you decided to install the X Window System packages, you now have the opportunity to configure an X server for your system. If you did not choose to install the X Window System packages, skip ahead to Section 3.23.

If your video card does not appear on the list (see Figure 3-20), X may not support it. However, if you have technical knowledge about your card, you may choose **Unlisted Card** and attempt to configure it by matching your card's video chipset with one of the available X servers.
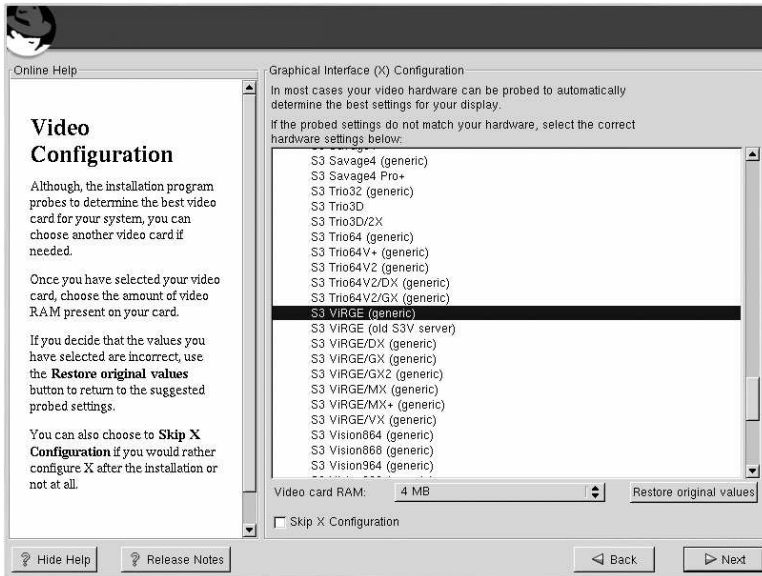
Figure 3-20. Video Card Setup

Next, enter the amount of video memory installed on your video card. If you are not sure, please consult the documentation accompanying your video card. You will not damage your video card by choosing more memory than is available, but the X server may not start correctly if you do.

If you decide that the values you have selected are incorrect, you can click the **Restore original values** button to return to the suggested settings.

You can also select **Skip X Configuration** if you would rather configure X after the installation or not at all.

3.23. Preparing to Install

You should now see a screen preparing you for the installation of Red Hat Enterprise Linux ES.

For your reference, a complete log of your installation can be found in `/tmp/install.log` once you reboot your system.

Warning

If, for some reason, you would rather not continue with the installation process, this is your last opportunity to safely cancel the process and reboot your machine. Once you press the **Next** button, partitions will be written and packages will be installed. If you wish to abort the installation, you should reboot now before any existing information on any hard drive is rewritten.

To cancel this installation process, press your computer's *Reset* button or use the [Control]-[Alt]-[Delete] key combination to restart your machine.

3.24. Installing Packages

At this point there is nothing left for you to do until all the packages have been installed (see Figure 3-21). How quickly this happens depends on the number of packages you have selected and your computer's speed.
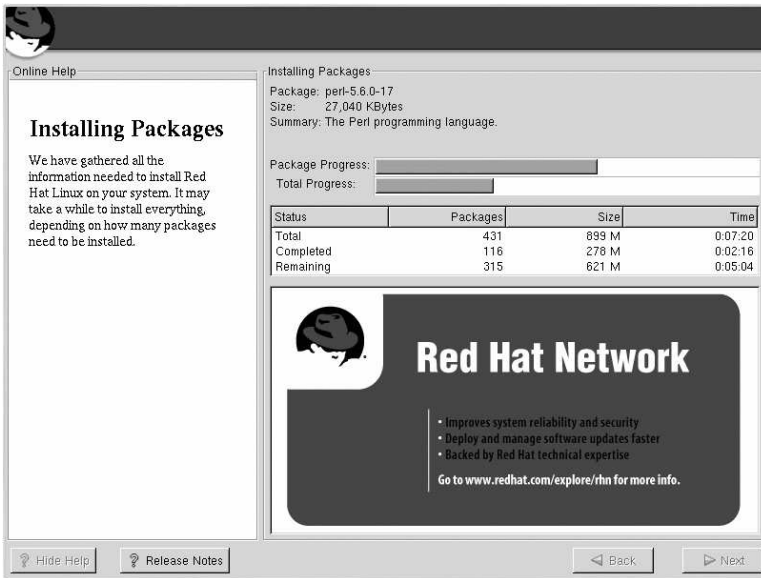
Figure 3-21. Installing Packages

3.25. Boot Disk Creation

If you chose to create a boot disk, you should now insert a blank, formatted diskette into your diskette drive (see Figure 3-22).

It is highly recommended that you create a boot disk. If your system were not able to boot properly using GRUB or LILO, a boot disk would enable you to properly boot your Red Hat Enterprise Linux ES system.

After a short delay, your boot disk will be created; remove it from your diskette drive and label it clearly. Note that if you would like to create a boot disk after the installation, you will be able to do so. For more information, please see the `mkbootdisk` man page, by typing `man mkbootdisk` at the shell prompt.

If you boot your system with the boot disk (instead of GRUB or LILO) , make sure you create a new boot disk if you make any changes to your kernel.

Figure 3-22. Creating Your Boot Disk

3.26. X Configuration — Monitor and Customization

In order to complete X configuration, you must configure your monitor and customize your X settings.

3.26.1. Configuring Your Monitor

If you chose to skip X configuration, go to Section 3.27.

Xconfigurator, the X Window System configuration tool, presents a list of monitors for you to choose from. In the list, you can either use the monitor that is autodetected for you, or choose another monitor.
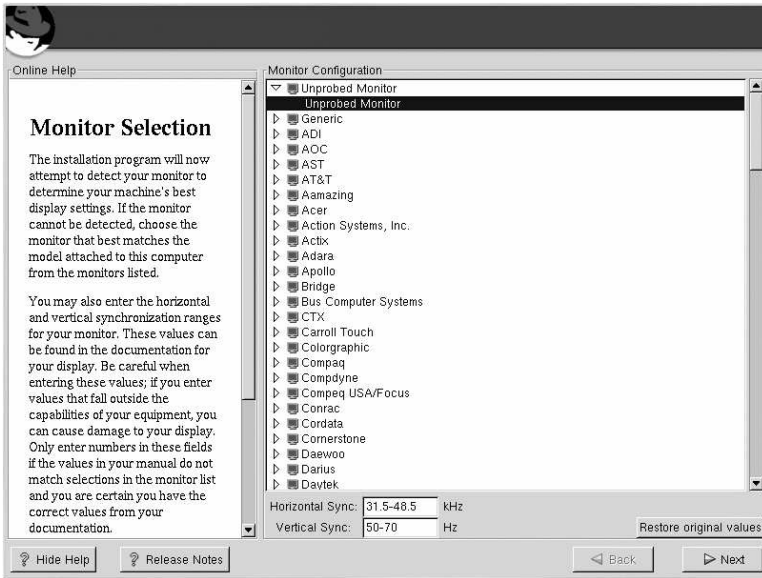
Figure 3-23. Monitor Selection

If your monitor does not appear on the list, select the most appropriate **Generic** model available. If you do select a **Generic** monitor, **Xconfigurator** will suggest horizontal and vertical sync ranges. These values are generally available in the documentation which accompanies your monitor, or from your monitor's vendor or manufacturer; please check your documentation to make sure these values are set correctly.

⚠ **Caution**

> Do not select a monitor *similar* to your monitor unless you are certain that the monitor you are selecting does not exceed the capabilities of your monitor. Doing so may overclock your monitor and damage or destroy it.

The horizontal and vertical ranges that **Xconfigurator** suggests for your monitor are also displayed on this screen.

If you decide that the values you have selected are incorrect, you can click the **Restore original values** button to return to the suggested settings.

Click **Next** when you have finished configuring your monitor.

3.26.2. Custom Configuration

Choose the correct color depth and resolution for your X configuration. Click **Test Setting** to try out this configuration. If you do not like what you see during the test, click **No** to choose another resolution.

Note

If you need to exit out of the X test, use the [Ctrl]-[Alt]-[Backspace] key combination. Also note that this will not work in some test cases.

We recommend that you test your configuration, to make sure the resolution and color settings are usable.

If you installed both GNOME and KDE, you can choose which one to use as your default desktop environment. If you installed one or the other, it will only show GNOME or KDE as the desktop default.

You can also choose whether you want to boot your system into a text or graphical environment once Red Hat Enterprise Linux ES is installed. Unless you have special needs, booting into a graphical environment (similar to a Windows environment) is recommended. If you choose to boot into a text environment, you will be presented with a command prompt (similar to a DOS environment).
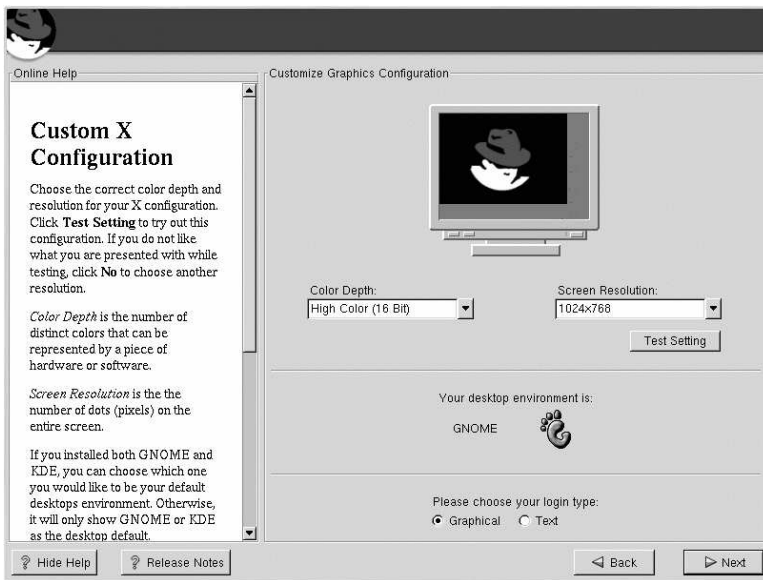
Figure 3-24. X Customization

3.27. Installation Complete

Congratulations! Your Red Hat Enterprise Linux ES 2.1 installation is now complete!

The installation program will prompt you to prepare your system for reboot. Do not forget to remove any diskette in the diskette drive or CD in the CD-ROM drive. If you did not install a boot loader, you will need to use your boot disk now.

After your computer's normal power-up sequence has completed, you should see the graphical boot loader prompt, at which you can do any of the following things:

- Press [Enter] — causes the default boot entry to be booted.
- Select a boot label, followed by [Enter] — causes the boot loader to boot the operating system corresponding to the boot label. (Press [?] at the text mode boot loader prompt for a list of valid boot labels.)
- Do nothing — after the boot loader's timeout period, (by default, five seconds) the boot loader will automatically boot the default boot entry.

Do whatever is appropriate to boot. If your system was not able to boot properly using GRUB or LILO, or a third-party boot loader, a boot disk would enable you to properly boot your Red Hat Enterprise Linux ES system. You should see one or more screens of messages scroll by. Eventually, you should see a login: prompt or a GUI login screen (if you installed the X Window System and chose to start X automatically).

> ⓘ **Tip**
>
> If you are not sure what to do next, we suggest you begin with the *Official Red Hat Linux Getting Started Guide* (available online at http://www.redhat.com/docs if not included as part of your product), which covers topics relating to the basics of your system and is an introduction to using Red Hat Enterprise Linux ES.
>
> If you are a more experienced user looking for information on administration topics, you may find the *Official Red Hat Linux Reference Guide* to be more helpful.
>
> If you are looking for information on system configuration, you may find the *Official Red Hat Linux Customization Guide* to be helpful.

Chapter 4.

Installing Red Hat Enterprise Linux ES via Text Mode

This release of Red Hat Enterprise Linux ES features a graphical, mouse-based installation program, but you can also install Red Hat Enterprise Linux ES using a text mode, keyboard-based installation program. This chapter briefly explains how to use the text mode installation program. Here are some recommendations:

- If you are new to Linux installations, read Chapter 3, first. The main focus of that chapter is the graphical installation process, but most of the concepts apply to the text mode installation as well. After reading that chapter, Section 4.1, will give you more information regarding the aspects of installing Red Hat Enterprise Linux ES that do not apply to the graphical installation process.

  Additionally, Appendix D may be helpful to you, since it discusses disk partition resizing. If you plan to install Red Hat Enterprise Linux ES on a disk where another operating system is currently installed, this knowledge will be crucial.

- If you plan to install over a network (via NFS, FTP, or HTTP), you must make a network boot disk. Chapter 1, explains how to do this.

- If you have never used the text mode installation program, or need a refresher on its user interface, read this chapter.

4.1. Things You Should Know

Before attempting to install Red Hat Enterprise Linux ES, you should collect information about your system. This information will help prevent any surprises during the installation. You can find most of this information in the documentation that came with your system, or from the system's vendor or manufacturer.

Chapter 2 provides a table for you to fill out with your specific system requirements, which helps you keep up with any information needed during your installation. Please review the hardware table at Table 2-1.

The most recent list of supported hardware can be found at http://hardware.redhat.com/hcl/. You should check your hardware against this list before proceeding.

4.1.1. Basic Hardware Configuration

You should have a basic understanding of the hardware installed in your computer, including the following:

- Hard drive(s) — specifically, the number, size, and type. If you have more than one, it is helpful to know which one is first, second, and so on. It is also good to know if your drives are IDE or SCSI. If you have IDE drives, you should check your computer's BIOS to see if you are accessing them in linear mode. Please refer to your computer's documentation for the proper key sequence to access the BIOS. Note that your computer's BIOS may refer to linear mode by other names, such as "large disk mode." Again, your computer's documentation should be consulted for clarification.

- Memory — the amount of RAM installed in your computer.

- CD-ROM — most importantly, the unit's interface type (IDE, SCSI, or other interface) and, for non-IDE, non-SCSI CD-ROMs, the make and model number. IDE CD-ROMs (also known as ATAPI) are the most common type of CD-ROM in recently manufactured, PC-compatible computers.

- SCSI adapter (if one is present) — the adapter's make and model number.
- Network card (if one is present) — the card's make and model number.
- Mouse — the mouse's type (serial, PS/2, or bus mouse), protocol (Microsoft, Logitech, MouseMan, etc.), and number of buttons; also, for serial mice, the serial port it is connected to.

On many newer systems, the installation program is able to automatically identify most hardware. However, it is a good idea to collect this information anyway, just to be sure.

4.1.2. Video Configuration

If you will be installing the X Window System, you should also be familiar with the following:

- Your video card — the card's make and model number (or the video chipset it uses) and the amount of video RAM it has. (Most PCI-based cards are auto-detected by the installation program.)
- Your monitor — the unit's make and model number, along with allowable ranges for horizontal and vertical refresh rates. (Newer models may be auto-detected by the installation program.)

4.1.3. Network-related Information

If you are connected to a network, be sure you know the following:

- IP address — usually represented as a set of four numbers separated by dots, such as `10.0.2.15`.
- Netmask — another set of four numbers separated by dots; an example netmask would be `255.255.248.0`.
- Gateway IP address — another set of four dot-separated numbers; for example, `10.0.2.254`.
- One or more name server IP addresses — one or more sets of dot-separated numbers; for example, `10.0.2.1` might be the address of a name server.
- Domain name — the name your organization uses; for example, Red Hat has a domain name of `redhat.com`.
- Hostname — the name assigned to your individual system; for example, a computer might be named `pooh`.

Note

The information provided here is as an example only! Do *not* use it when you install Red Hat Enterprise Linux ES! If you do not know the proper values for your network, ask your network administrator.

4.2. The Installation Program User Interface

The Red Hat Enterprise Linux ES text mode installation program uses a screen-based interface that includes most of the on-screen "widgets" commonly found on graphical user interfaces. Figure 4-1, and Figure 4-2, illustrate the screens you will see.
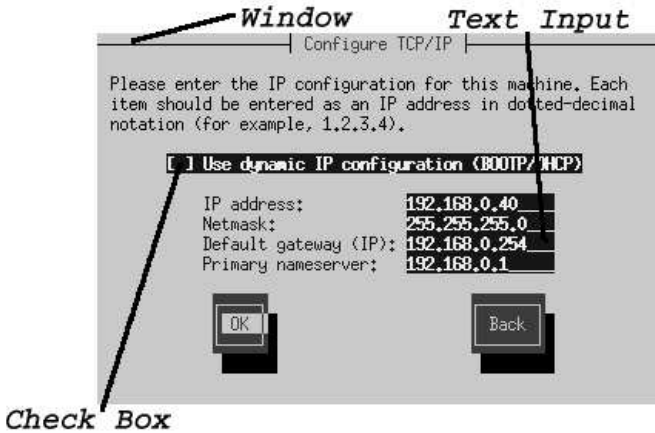
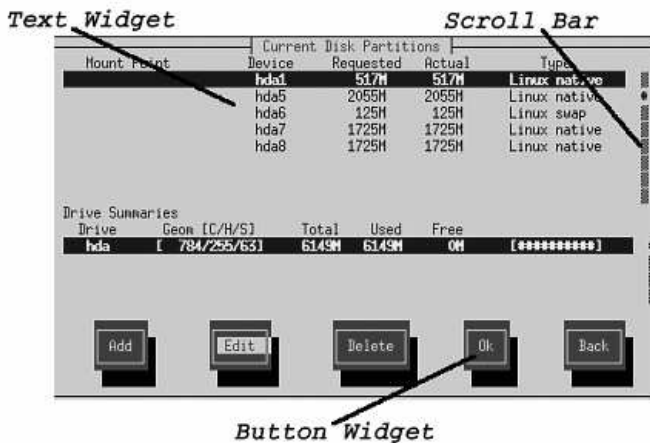Figure 4-1. Installation Program Widgets as seen in Configure TCP/IP

Figure 4-2. Installation Program Widgets as seen in Disk Druid

Here is a list of the most important widgets shown in Figure 4-1, and Figure 4-2:

• Window — windows (usually referred to as *dialogs* in this manual) will appear on your screen throughout the installation process. At times, one window may overlay another; in these cases, you can only interact with the window on top. When you are finished in that window, it will disappear, allowing you to continue working in the window underneath.

- Text Input — text input lines are regions where you can enter information required by the installation program. When the cursor rests on a text input line, you may enter and/or edit information on that line.

- Checkbox — checkboxes allow you to select or deselect a feature. The box displays either an asterisk (selected) or a space (unselected). When the cursor is within a checkbox, press [Space] to select an unselected feature or to deselect a selected feature.

- Text widget — text widgets are regions of the screen for the display of text. At times, text widgets may also contain other widgets, such as checkboxes. If a text widget contains more information than can be displayed in the space reserved for it, a scroll bar appears; if you position the cursor within the text widget, you can then use the [Up] and [Down] arrow keys to scroll through all the information available. Your current position is shown on the scroll bar by a **#** character, which moves up and down the scroll bar as you scroll.

- Button widget — button widgets are the primary method of interacting with the installation program. You progress through the windows of the installation program by navigating these buttons, using the [Tab] and [Enter] keys. Buttons can be selected when they are highlighted.

- Cursor — although not a widget, the cursor is used to select (and interact) with a particular widget. As the cursor is moved from widget to widget, it may cause the widget to change color, or you may only see the cursor itself positioned in or next to the widget. In Figure 4-1, the cursor is positioned on the **OK** button. Figure 4-2, shows the cursor on the **Edit** button.

4.2.1. Using the Keyboard to Navigate

Navigation through the installation dialogs is performed through a simple set of keystrokes. To move the cursor, use [Left], [Right], [Up], and [Down] arrow keys. Use [Tab], and [Alt]-[Tab] to cycle forward or backward through each widget on the screen. Along the bottom, most screens display a summary of available cursor positioning keys.

To "press" a button, position the cursor over the button (using [Tab], for example) and press [Space] or [Enter]. To select an item from a list of items, move the cursor to the item you wish to select and press [Enter]. To select an item with a checkbox, move the cursor to the checkbox and press [Space] to select an item. To deselect, press [Space] a second time.

Pressing [F12] accepts the current values and proceeds to the next dialog; it is equivalent to pressing the **OK** button.

Caution

Unless a dialog box is waiting for your input, do not press any keys during the installation process (doing so may result in unpredictable behavior).

4.3. Starting the Installation Program

The following methods can be used to start the installation:

- Insert a boot diskette that you have created into the primary diskette drive and reboot your computer.

- Insert the Red Hat Enterprise Linux ES CD 1 into the drive and reboot, if your computer can boot from the CD-ROM drive.

While the installation program loads, messages will scroll on your screen. When the installation program has loaded, this prompt appears:

```
boot:
```

4.3.1. Text Mode Boot Options

If you press [Enter] at the `boot:` prompt, or if you take no action within the first minute after the `boot:` prompt appears, the graphical installation program will start. Pressing one of the help screen function keys as described in Section 4.3.2 disables this autostart feature.

To start the text mode installation program, before pressing [Enter], type:

```
boot: text
```

If the installation program does not properly detect your hardware, you may need to restart the installation in "expert" mode. To start an expert mode installation, type:

```
boot: text expert
```

Expert mode disables most hardware probing, and gives you the option of entering options for the drivers loaded during the installation.

☞ **Note**

> The initial boot messages will not contain any references to SCSI or network cards. This is normal; these devices are supported by modules that are loaded during the installation process.

Note that the command to start a serial installation has changed. If you must perform the installation in serial mode, use the following command:

```
boot: linux text console=<device>
```

In this command, *<device>* should be the device you are using (such as ttyS0 or ttyS1).

You can also pass options to the kernel as you are booting the installation program. For example, to instruct the kernel to use all the RAM in a 128 MB system, enter:

```
boot: linux text mem=128M
```

4.3.2. Displaying Online Help

Once the installation program is loaded into memory, you can obtain information about the installation process and options by pressing [F1] through [F6]. For example, press [F2] to see general information about the online help screens.

4.4. Installation Cross-Reference Table

☞ **Note**

> This installation cross-reference table only documents the screens seen when performing a Server installation.

Most text mode installation screens can be cross-referenced with the corresponding GUI screen. Table 4-1 lists the screens, in order, and gives section references for more information.

For those screens which do not have adequate GUI counterparts, installation-related instructions and screenshots will be provided in this chapter.

Text Mode Screen	Text Mode Reference Point
Language Screen	Section 3.5
Installing from a Hard Disk	Section 4.5
Installing over a Network	Section 4.6
Mouse Selection	Section 3.7
Welcome Screen	Section 3.8
Installation Type	Section 3.9
Disk Partitioning Setup	Section 3.10
Automatic Partitioning	Section 3.11
fdisk	Section 3.13
Hostname Configuration	Section 3.16
Firewall Configuration	Section 3.17
Network Configuration	Section 3.16
Language Support and Default Language	Section 3.18
Time Zone Selection	Section 3.19
Root Password	Section 3.20
Add User/User Account Setup	Section 3.20
Package Installation (Group, Individual, Dependencies)	Section 3.21
Video Card Configuration	Section 3.26
Package Installation	Section 3.23 and Section 3.24
Boot Disk Creation	Section 3.25
Monitor Configuration	Section 3.26.1
Custom X Configuration	Section 3.26.2
Installation Complete	Section 3.27

Table 4-1. Installation Cross-reference Table

4.5. Installing from a Hard Drive

☞ **Note**

> Hard drive installations only work from ext2, ext3, or FAT filesystems. If you have a filesystem other than those listed here, such as reiserfs, you will not be able to perform a hard drive installation.

Hard drive installations require the use of the ISO (or CD-ROM) images rather than copying an entire installation tree. After placing the required ISO images (the binary Red Hat Enterprise Linux ES CD-ROMs) in a directory, choose to install from the hard drive. You will then point the installation program at that directory to perform the installation.

Verifying that the ISO images are intact before you attempt an installation will help to avoid problems that are often encountered during a hard drive installation. To verify the ISO images are intact prior to performing an installation, use an **md5sum** program (many **md5sum** programs are available for various operating systems). An **md5sum** program should be available on the same server as the ISO images.

The **Select Partition** screen (Figure 4-3) applies only if you are installing from a disk partition (that is, if you selected **Hard Drive** in the **Installation Method** dialog). This dialog allows you to name the disk partition and directory from which you are installing Red Hat Enterprise Linux ES.

Enter the device name of the partition containing the Red Hat ISO images. There is also a field labeled **Directory holding images**. If the ISO images are not in the root directory of that partition, enter the path to the ISO images (for example, if the ISO images are in /test/new/RedHat, you would enter /test/new).

After you have identified the disk partition, you will next see the **Welcome** dialog. See Table 4-1, for more information.

Figure 4-3. Selecting Partition Dialog for Hard Drive Installation

4.6. Installing over a Network

If you are performing a network installation, the **Configure TCP/IP** dialog appears; for an explanation of this dialog, go to Section 3.16, and then return here.

4.6.1. Setting Up the Server

If you are not sure how to do this, refer to the *Official Red Hat Linux Customization Guide* and the *Official Red Hat Linux Reference Guide* for more information.

4.6.2. NFS Setup

The NFS dialog (Figure 4-4) applies only if you are installing from an NFS server (if you booted from a network or PCMCIA boot disks and selected **NFS Image** in the **Installation Method** dialog).

Figure 4-4. NFS Setup Dialog

Enter the fully-qualified domain name or IP address of your NFS server. For example, if you are installing from a host named `eastcoast` in the domain `redhat.com`, enter `eastcoast.redhat.com` in the **NFS Server** field.

Next, enter the name of the exported directory. If you followed the setup described in Section 4.6, you would enter the directory `/location/of/disk/space/` which contains the `RedHat` directory.

If the NFS server is exporting a mirror of the Red Hat Enterprise Linux ES installation tree, enter the directory which contains the `RedHat` directory. (If you do not know this directory path, ask your system administrator.) For example, if your NFS server contains the directory `/mirrors/redhat/i386/RedHat`, enter `/mirrors/redhat/i386`.

Next you will see the **Welcome** dialog. See Table 4-1, for more information.

4.6.3. FTP Setup

The FTP dialog (Figure 4-5) applies only if you are installing from an FTP server (if you selected **FTP** in the **Installation Method** dialog). This dialog allows you to identify the FTP server from which you are installing Red Hat Enterprise Linux ES.

Figure 4-5. FTP Setup Dialog

Enter the name or IP address of the FTP site you are installing from, and the name of the directory containing the `RedHat` installation files for your architecture. For example, if the FTP site contains the directory `/mirrors/redhat/i386/RedHat`, enter `/mirrors/redhat/i386`.

If everything has been specified properly, a message box appears indicating that `base/hdlist` is being retrieved.

Next you will see the **Welcome** dialog. See Table 4-1, for more information.

4.6.4. HTTP Setup

The HTTP dialog (Figure 4-6) applies only if you are installing from an HTTP server (if you selected **HTTP** in the **Installation Method** dialog). This dialog prompts you for information about the HTTP server from which you are installing Red Hat Enterprise Linux ES.

Figure 4-6. HTTP Setup Dialog

Enter the name or IP address of the HTTP site you are installing from, and the name of the directory there containing the `RedHat` installation files for your architecture. For example, if the HTTP site contains the directory `/mirrors/redhat/i386/RedHat`, enter `/mirrors/redhat/i386.>`

If everything has been specified properly, a message box appears indicating that `base/hdlist` is being retrieved.

Next you will see the **Welcome** dialog. See Table 4-1, for more information.

II. Appendixes

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Removing Red Hat Enterprise Linux ES

To uninstall Red Hat Enterprise Linux ES from your system, you will need to remove the GRUB or LILO information from your master boot record (MBR).

In DOS, NT, and Windows 95 you can use **fdisk** to create a new MBR with the "undocumented" flag /mbr. This will ONLY rewrite the MBR to boot the primary DOS partition. The command should look like the following:

```
fdisk /mbr
```

If you need to remove Linux from a hard drive, and have attempted to do this with the default DOS **fdisk**, you will experience the "Partitions exist but they do not exist" problem. The best way to remove non-DOS partitions is with a tool that understands partitions other than DOS.

You can do this with the installation media by typing **linux expert** at the boot: prompt:

```
boot: linux expert
```

Select install (versus upgrade) and at the point when you should partition the drive, choose **fdisk**. In **fdisk**, type [p] to print out the partition numbers, and remove the Linux partitions with the [d] command. When you are satisfied with the changes you have made, you can quit with a [w] and the changes will be saved to disk. If you deleted too much, type [q] and no changes will be made.

Once you have removed the Linux partitions, you can reboot your computer using [Control]-[Alt]-[Delete] instead of continuing with the install.

Appendix B.
Getting Technical Support

B.1. Remember to Sign Up

If you have an official edition of Red Hat Enterprise Linux ES 2.1 and/or an official Red Hat OEM partner kit, please remember to sign up for the benefits you are entitled to as a Red Hat customer.

You will be entitled to any or all of the following benefits, depending upon the Official Red Hat Enterprise Linux ES product you purchased:

• Official Red Hat support — Get help with your installation questions from the Red Hat support team.

• Red Hat Network — Easily update your packages and receive security notices that are customized for your system. Go to http://rhn.redhat.com for details.

• Under the Brim: The Official Red Hat E-Newsletter — Every month, get the latest news and product information directly from Red Hat.

To sign up, go to http://www.redhat.com/apps/activate/. You will find your *Product ID* on the Registration Information Card in your Official Red Hat Enterprise Linux ES boxed set.

B.2. An Overview of Red Hat Support

Note

Refer to the service level agreement at http://www.redhat.com/support/sla/ for more information on how the Red Hat technical support staff can assist you.

Red Hat provides installation assistance for Official Red Hat Enterprise Linux ES products and covers installation on a single computer. This assistance is intended to help customers successfully install Red Hat Enterprise Linux ES. Assistance with installation is offered via telephone and the Web. Note, telephone support is only available with certain Red Hat Enterprise Linux ES products. Please check your to see what types of support are available to you.

Red Hat Support will attempt to answer any questions you may have before the installation process is initiated. Depending on the product purchased, it can include the following:

• Hardware compatibility questions

• Basic hard drive partitioning strategies

Red Hat Support can provide the following assistance during the installation process:

• Getting supported hardware recognized by the Red Hat Enterprise Linux ES operating system

• Assistance with drive partitioning

We can also help you with basic post-installation tasks, such as:

- Successfully configuring the X Window System using **Xconfigurator**
- Configuring a local parallel port printer to print text
- Configuring a mouse

Our installation assistance service is designed to get Red Hat Enterprise Linux ES running on your system as quickly and as easily as possible. However, there are many other things that you may want to do with your Red Hat Enterprise Linux ES system, from compiling a custom kernel to setting up a Web server, which are not covered.

For assistance with these tasks, there is a wealth of online information available in the form of HOWTO documents, Linux-related websites, and commercial publications. The various Linux HOWTO documents are included with Red Hat Enterprise Linux ES on the Documentation CD in the /HOWTOS directory. These HOWTOS are provided in text files that can easily be read from within Red Hat Enterprise Linux ES and other operating systems.

A large number of Linux-related websites are available. The best starting point for finding information on Red Hat Enterprise Linux ES is the Red Hat, Inc. website:

```
http://www.redhat.com/
```

Many Linux-related books are available. If you are new to Linux, a book that covers Linux basics will be invaluable. We can recommend several titles: The *Official Red Hat Linux Getting Started Guide*; *Using Linux*, by Bill Ball; *Linux Clearly Explained*, by Bryan Pfaffenberger; *Linux for Dummies*, by Jon "maddog" Hall; and *Learning Red Hat Linux*, by Bill McCarty.

Certain Red Hat Enterprise Linux ES products include additional support programs covering advanced configurations. Please see the Red Hat Support website for more information. The Red Hat technical support website is located at the following URL:

```
http://www.redhat.com/support/
```

B.3. Scope of Red Hat Support

Red Hat, Inc. can only provide installation assistance to customers who have purchased an Official Red Hat Enterprise Linux ES boxed set and/or an Official Red Hat OEM partner kit. If you have obtained Linux from any other company, you must contact that company for support. Other companies include:

- Macmillan
- Sams/Que
- Linux Systems Labs (LSL)
- Mandrake
- CheapBytes

Additionally, Red Hat Enterprise Linux ES obtained via any of the following methods does not qualify for support from Red Hat:

- Red Hat Enterprise Linux ES PowerTools Archive
- Downloaded via FTP on the Internet
- Included in a package such as Motif or Applixware
- Copied or installed from another user's CD
- A CD-ROM (or CD-ROM set) included in a Linux book or other publication.

B.4. How to Get Technical Support

In order to receive technical support for your Official Red Hat product, you must register your product on the Red Hat website.

Every Official Red Hat product comes with a Product Identification code: a 16-character alphanumeric string. The Product ID for Red Hat Enterprise Linux ES 2.1 is located on the Registration Information Card that can be found inside the box. Your Product ID is included in your boxed set, and you should keep it in a safe place. You need this code, so do not lose the card!

☞**Note**

> Do not throw away the card with your Product ID. You need the Product ID to get technical support. If you lose the certificate, you may not be able to receive support.

The Product ID is the code that will enable your technical support and any other benefits or services that you purchased from Red Hat, depending upon which Red Hat product you purchased.

B.4.1. Signing up for Technical Support

To sign up for technical support, you will need to:

1. Create a customer profile at http://www.redhat.com/apps/activate/. You may have already completed this step; if you have, continue to the next step.

2. Using the login name and password you created during the customer profile, please log in at the Red Hat Support website at http://www.redhat.com/support.

   If you created a new customer profile, once you activate your product you will see a webpage that shows your registered products. There is also a button, **Access Web Support**, on this page that will take you to the support website.

3. Update your contact information if necessary.

   ☞**Note**

   > If your email address is not correct, communications regarding your technical support requests CANNOT be delivered to you, and you will not be able to retrieve your login and password by email. Be sure that you give us your correct email address.

   If you are worried about your privacy, please see the Red Hat privacy statement at http://www.redhat.com/legal/privacy_statement.html.

4. Add a product to your profile. Please enter the following information:

   • The Product ID for your boxed set product

   • The Support Certificate Number or Entitlement Number if the product is a contract

5. Set your customer preferences.

6. Answer the optional customer questionnaire.

7. Submit the form.

If the previous steps were completed successfully, you can now login at http://www.redhat.com/support and open a new technical service request. However, you must still use your Product ID in order to obtain technical support via telephone (if the product you purchased

came with phone support). You will also be asked for your login name when contacting the technical support team via telephone.

B.5. Questions for Technical Support

Technical support is both a science and a mystical art form. In most cases, support technicians must rely on customer observations and communications with the customer in order to diagnose and solve the problem. Therefore, it is extremely important that you are as detailed and clear as possible when you state your questions and report your problems. Examples of what you should include are:

- Symptoms of the problem (for example: "Linux is not able to access my CD-ROM drive. When it tries, I get timeout errors.")
- When the problem began (for example: "My system was working fine until yesterday, when a lightning storm hit my area.")
- Any changes you made to your system (for example: "I added a new hard drive and used **Partition Wizzo** to add Linux partitions.")
- Other information that may be relevant to your situation, such as the installation method (CD-ROM, NFS, HTTP)
- Specific hardware devices that may be relevant to your problem (for example: If you cannot setup networking, what kind of network card do you have?)

Note

Refer to the service level agreement at http://www.redhat.com/support/sla/ for more information on how the Red Hat technical support staff can assist you.

B.5.1. How to Send Support Questions

Please login at http://www.redhat.com/support and open a new service request, or call the phone number for support. If your product came with phone support, or you have purchased a phone support contract, the phone number you will need to call will be provided to you during the sign up process.

For more information on using the Red Hat online support system go to http://www.redhat.com/support/services/access.html.

Troubleshooting Your Installation of Red Hat Enterprise Linux ES

This appendix discusses some common installation problems and their solutions.

C.1. You are Unable to Boot Red Hat Enterprise Linux ES

C.1.1. Is Your System Displaying Signal 11 Errors?

If you receive a fatal signal 11 during your installation, it is probably due to a hardware error in memory on your system's bus. A hardware error in memory can be caused by problems in executables or with the system's hardware. Like other operating systems, Red Hat Enterprise Linux ES places its own demands on your system's hardware. Some of this hardware may not be able to meet those demands, even if they work properly under another OS.

Check to see if you have the latest installation and supplemental boot diskettes from Red Hat. Review the online errata to see if newer versions are available. If the latest images still fail, it may be due to a problem with your hardware. Commonly, these errors are in your memory or CPU-cache. A possible solution for this error is turning off the CPU-cache in the BIOS. You could also try to swap your memory around in the motherboard slots to see if the problem is either slot or memory related.

For more information concerning signal 11 errors, refer to http://www.bitwizard.nl/sig11/.

C.1.2. Are You Unable to Boot from a Network Boot Disk?

If you are experiencing difficulties in getting the network boot disk you made to boot your system correctly, you may need an updated boot disk.

Check the online errata for updated diskette images (if available) and follow the instructions provided to make an updated boot disk for your system.

C.1.3. Are You Unable to Boot With Your RAID Card?

If you have performed an installation and cannot boot your system properly, you may need to reinstall and create your partitions differently.

Some BIOSes do not support booting from RAID cards. At the end of an installation, a text-based screen showing the boot loader prompt (for example, GRUB:) and a flashing cursor may be all that appears. If this is the case, you will need to repartition your system.

Whether you choose automatic or manual partitioning, you will need to install your /boot partition outside of the RAID array, such as on a separate hard drive. An internal hard drive is necessary to use for partition creation with problematic RAID cards.

You must also install your preferred boot loader (GRUB or LILO) outside of the RAID array — not on the MBR. The boot loader should be installed on the MBR of the same drive as the /boot partition was created.

Once these changes have been made, you should be able to finish your installation and boot the system properly.

C.2. Trouble Beginning the Installation

C.2.1. Is Your Mouse Not Detected?

If the **Mouse Not Detected** screen (see Figure C-1) appears, then the installation program was not able to identify your mouse correctly.

You can choose to continue with the GUI installation or use the text mode installation, which does not require using a mouse. If you choose to continue with the GUI installation, you will need to provide the installation program with your mouse configuration information (see Figure 3-3).

Figure C-1. Mouse Not Detected

For an overview of text mode installation instructions, please refer to Chapter 4.

C.2.2. Problems with Booting into the Graphical Installation

The Red Hat Enterprise Linux ES installation program uses frame buffers by default. However, there are some video cards that will not work with this setting. The end result will be a problem booting into the graphical installation program.

The installation program will first try to run in frame buffer mode. If that fails, it will try to run in a lower resolution mode. If that still fails, the installation program will run in text mode.

Users who have video cards that will not run at 800 x 600 resolution should type **lowres** at the `boot:` prompt to run the installation program in 640 x 480 resolution.

If this still does not work, you can run the installation program without frame buffers by typing **nofb** at the `boot:` prompt.

C.3. Trouble During the Installation

C.3.1. Partition Creation Problems

If you are having trouble creating a partition (for example, a root (/) partition), make sure you are setting its partition type to Linux Native.

Unless your BIOS supports otherwise, make sure /boot does not exceed the 1023 cylinder head. If you do not, the installation program will not allow you to create a /boot or / partition. Some new systems allow you to exceed the 1023 limit (with GRUB and the newer LILO versions that are available), but most machines with older BIOS will not.

C.3.2. Using Remaining Space

You have a swap and a / (root) partition created, and you have selected the root partition to use the remaining space, but it does not fill the hard drive.

If your hard drive is more than 1024 cylinders, you must create a /boot partition if you want the / (root) partition to use all of the remaining space on your hard drive.

C.3.3. Other Partitioning Problems

If you are using **Disk Druid** to create partitions, but cannot move to the next screen, you probably have not created all the partitions necessary for **Disk Druid**'s dependencies to be satisfied.

You must have the following partitions as a bare minimum:

- A /boot partition of type Linux native
- A / (root) partition of type Linux native
- A <swap> partition of type Linux swap

(i)**Tip**

> When defining a partition's type as Linux swap, you do not have to assign it a mount point. **Disk Druid** automatically assigns the mount point for you.

C.3.4. Are You Seeing Python Errors?

During some installations of Red Hat Enterprise Linux ES, the installation program (also known as **Anaconda**) may fail with a Python or traceback error. This error may occur after the selection of individual packages or while trying to save the upgrade log in /tmp. The error may look similar to:

```
Traceback (innermost last):
   File "/var/tmp/anaconda-7.1//usr/lib/anaconda/iw/progress_gui.py",
line 20, in run
     rc = self.todo.doInstall ()
   File "/var/tmp/anaconda-7.1//usr/lib/anaconda/todo.py", line 1468, in
doInstall
     self.fstab.savePartitions ()
   File "fstab.py", line 221, in savePartitions
     sys.exit(0)
 SystemExit: 0
```

```
Local variables in innermost frame:
self: <fstab.GuiFstab instance at 8446fe0>
sys: <module 'sys' (built-in)>

ToDo object:
(itodo
ToDo
p1
(dp2
S'method'
p3
(iimage
CdromInstallMethod
p4
(dp5
S'progressWindow'
p6

<failed>
```

This error occurs in some systems where links to /tmp are symbolic to other locations or have been changed since creation. These symbolic or changed links are invalid during the installation process, so the installation program cannot write information and fails.

If you experience such an error, first try to download any available errata for **Anaconda**. Errata can be found at http://www.redhat.com/support/errata.

You can also search for bug reports related to this problem. To search the Red Hat bug tracking system, go to http://bugzilla.redhat.com/bugzilla.

Finally, if you are still facing problems related to this error, register your product and contact our support team. To register your product, go to http://www.redhat.com/apps/activate.

C.4. Problems After Installation

C.4.1. Trouble With the Graphical GRUB Screen?

If, for some reason, you need to disable the graphical boot screen, you can do so, as root, by editing the /boot/grub/grub.conf file and then rebooting your system.

To do this, comment out the line which begins with splashimage in the grub.conf file. To comment out a line, insert the ; character at the beginning of the line.

Once you reboot, the grub.conf file will be reread and your changes will take place.

You may re-enable the graphical boot screen by uncommenting (or adding) the above line back into the grub.conf file and rebooting.

C.4.2. Trouble With the Graphical LILO Screen?

If, for some reason, you need to disable the graphical boot screen, you can do so, as root, by editing the /etc/lilo.conf file and then rerunning LILO.

First, as root, comment out (or delete) the line which reads message=/boot/message in the /etc/lilo.conf file. To comment out a line, insert the ; character at the beginning of the line. Next, rerun LILO by typing /sbin/lilo -v. The next time you boot, you will see the text LILO: prompt, as used in previous Red Hat Enterprise Linux ES releases.

You may re-enable the graphical boot screen by adding the above line back into the `lilo.conf` file and rerunning LILO.

C.4.3. Problems with Server Installations and X

If you performed a server installation and you are having trouble getting X to start, you may not have installed the X Window System during your installation.

If you want the X Window System, you can perform an upgrade to install X. During the upgrade, select the X Window System packages, and choose GNOME, KDE, or both.

Alternatively, you can install the XFree86 RPMs. For more information, refer to http://www.redhat.com/support/docs/howto/XFree86-upgrade/XFree86-upgrade.html.

C.4.4. Problems When You Try to Log In

If you did not create a user account during the installation you will need to log in as root and use the password you assigned to root.

If you cannot remember your root password, you will need to boot your system as `linux single` at the LILO `boot:` or GRUB prompt. Then at the `#` prompt, you will need to type `passwd root`, which will allow you to enter a new password for root. At this point you can type `shutdown -r now` and the system will reboot with your new password.

If you cannot remember your user account password, you must become root. To become root, type `su –` and enter your root password when prompted. Then, type `passwd <username>`. This allows you to enter a new password for the specified user account.

If you selected either the Custom or Server installation and do not see the graphical login screen, check your hardware for compatibility issues. The *Hardware Compatibility List* can be found at http://hardware.redhat.com/hcl/.

C.4.5. Does Netscape Navigator Crash on JavaScript Pages?

If Netscape **Navigator** continuously crashes on pages that contain JavaScripts, you may need to edit your `~/.mailcap` file.

Edit the file using **pico** by typing `pico ~/.mailcap` at the prompt in a terminal window. (You may use any text editor.)

Remove the following lines from the file:

```
application/x-javascript;;\
x-mozilla-flags=save
```

You can also turn off JavaScript within Netscape **Navigator** itself. Click on **Edit=>Preferences=>Advanced** and make sure the **Enable JavaScript** checkbox is not selected.

If these do not help, you can also try to use a newer version of Netscape **Navigator** if available. Check the Red Hat Enterprise Linux ES errata website under security advisories for more information.

C.4.6. Your Printer Will Not Work Under X

If you are not sure how to set up your printer or are having trouble getting it to work properly, try using the graphical **printconf** program. Log in as root, open a terminal window, and type `printconf-gui`.

C.4.7. Is Your RAM Not Being Recognized?

Sometimes, the kernel does not recognize all of your memory (RAM). You can check this with the following command:

```
cat /proc/meminfo
```

Find out if the displayed quantity is the same as the known amount of RAM in your system. If they are not equal, add the following line to the `/boot/grub/grub.conf` or `/etc/lilo.conf` file, depending on the boot loader you installed:

append="mem=*xx*M"

Replace *xx* with the amount of RAM you have in megabytes. Remember that per-image append lines completely overwrite the global append line. It might be worth adding this to the per-image descriptions, as shown in this example:

append="mem=128M"

In `/boot/grub/grub.conf`, the above example would look similar to the following:

```
#NOTICE: You have a /boot partition. This means that
#        all kernel paths are relative to /boot/
default=0
timeout=30
splashimage=(hd0,0)/grub/splash.xpm.gz
title Red Hat Linux (2.4.6-2)
        root (hd0,0)
        kernel /vmlinuz-2.2.6-2 ro root=/dev/hda3
        append="mem=128M"
```

Once you reboot, the changes made to `grub.conf` will be reflected on your system.

In `/etc/lilo.conf`, the above example would look similar to the following:

```
boot=/dev/sda
     map=/boot/map
     install=/boot/boot.b
     prompt
     timeout=50

     image=/boot/vmlinuz-2.2.12-20
             label=linux
             root=/dev/sda1
             initrd=/boot/initrd-2.2.12-20.img
             read-only
             append="mem=128M"
```

Remember to run `/sbin/lilo -v` after changing `/etc/lilo.conf`.

Note that you can also produce the same effect by actually passing this option when you are specifying the label/image to use in GRUB or LILO. For example if you had a label named *linux*, at the boot loader menu you could type:

linux mem=*xx*M

Remember to replace *xx* with the amount of RAM in your system.

C.4.8. Problems with Sound Configuration

If you do not have sound after your installation, you may need to run the sound configuration utility. As root, type `sndconfig` in a terminal window.

Note

> `sndconfig` must be run in runlevel 3. More information about runlevels can be found in the *Official Red Hat Linux Reference Guide*, in chapter *Boot Process, Init, and Shutdown*.

If the **sndconfig** application does not help, you may need to select the `Enable sound server startup` option under the **Multimedia=>Sound** in the **GNOME Control Center**.

To do this, click on **Panel=>Programs=>Settings=>GNOME Control Center** to launch the **GNOME Control Center**. In the **GNOME Control Center**, select the **Sound** submenu of the **Multimedia** menu. On the right, a **General** sound menu will appear. Select `Enable sound server startup` and then click **OK**.

An Introduction to Disk Partitions

Disk partitions are a standard part of the personal computer landscape and have been for quite some time. However, with many people purchasing computers featuring preinstalled operating systems, relatively few people understand how partitions work. This chapter attempts to explain the reasons for and use of disk partitions so the Red Hat Enterprise Linux ES installation will be as simple and painless as possible.

If you are reasonably comfortable with disk partitions, you could skip ahead to Section D.1.4, for more information on the process of freeing up disk space to prepare for a Red Hat Enterprise Linux ES installation. This section also discusses the partition naming scheme used by Linux systems, sharing disk space with other operating systems, and related topics.

D.1. Hard Disk Basic Concepts

Hard disks perform a very simple function — they store data and reliably retrieve it on command.

When discussing issues such as disk partitioning, it is important to know a bit about the underlying hardware. Unfortunately, it is easy to become bogged down in details. Therefore, we will use a simplified diagram of a disk drive to help explain what is really happening when a disk drive is partitioned. Figure D-1, shows a brand-new, unused disk drive.

Figure D-1. An Unused Disk Drive

Not much to look at, is it? But if we are talking about disk drives on a basic level, it will do. Say that we would like to store some data on this drive. As things stand now, it will not work. There is something we need to do first...

D.1.1. It is Not What You Write, it is How You Write It

Experienced computer users probably got this one on the first try. We need to *format* the drive. Formatting (usually known as "making a *filesystem*") writes information to the drive, creating order out of the empty space in an unformatted drive.
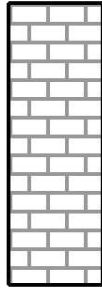
Figure D-2. Disk Drive with a Filesystem

As Figure D-2, implies, the order imposed by a filesystem involves some trade-offs:

- A small percentage of the drive's available space is used to store filesystem-related data and can be considered as overhead.
- A filesystem splits the remaining space into small, consistently-sized segments. For Linux, these segments are known as *blocks*. [1]

Given that filesystems make things like directories and files possible, these tradeoffs are usually seen as a small price to pay.

It is also worth noting that there is no single, universal filesystem. As Figure D-3, shows, a disk drive may have one of many different filesystems written on it. As you might guess, different filesystems tend to be incompatible; that is, an operating system that supports one filesystem (or a handful of related filesystem types) may not support another. This last statement is not a hard-and-fast rule, however. For example, Red Hat Enterprise Linux ES supports a wide variety of filesystems (including many commonly used by other operating systems), making data interchange between different filesystems easy.

---

1. Blocks really *are* consistently sized, unlike our illustrations. Keep in mind, also, that an average disk drive contains thousands of blocks. But for the purposes of this discussion, please ignore these minor discrepancies.

Figure D-3. Disk Drive with a Different Filesystem

Of course, writing a filesystem to disk is only the beginning. The goal of this process is to actually *store* and *retrieve* data. Let us take a look at our drive after some files have been written to it.
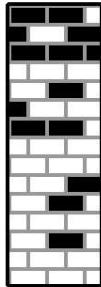
Figure D-4. Disk Drive with Data Written to It

As Figure D-4 shows, 14 of the previously-empty blocks are now holding data. However, by simply looking at this picture, we cannot determine exactly how many files reside on this drive. There may be as few as one or as many as 14 files, as all files use at least one block and some files use multiple blocks. Another important point to note is that the used blocks do not have to form a contiguous region; used and unused blocks may be interspersed. This is known as *fragmentation*. Fragmentation can play a part when attempting to resize an existing partition.

As with most computer-related technologies, disk drives changed over time after their introduction. In particular, they got bigger. Not larger in physical size, but bigger in their capacity to store information. And, this additional capacity drove a fundamental change in the way disk drives were used.

D.1.2. Partitions: Turning One Drive Into Many

As disk drive capacities soared, some people began to wonder if having all of that formatted space in one big chunk was such a great idea. This line of thinking was driven by several issues, some philosophical, some technical. On the philosophical side, above a certain size, it seemed that the additional space provided by a larger drive created more clutter. On the technical side, some filesystems were never designed to support anything above a certain capacity. Or the filesystems *could* support larger drives with a greater capacity, but the overhead imposed by the filesystem to track files became excessive.

The solution to this problem was to divide disks into *partitions*. Each partition can be accessed as if it was a separate disk. This is done through the addition of a *partition table*.

Note

> While the diagrams in this chapter show the partition table as being separate from the actual disk drive, this is not entirely accurate. In reality, the partition table is stored at the very start of the disk, before any filesystem or user data. But for clarity, we will keep it separate in our diagrams.
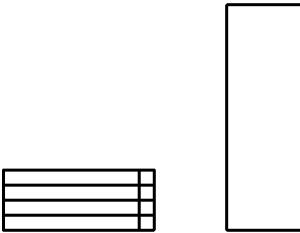
Figure D-5. Disk Drive with Partition Table

As Figure D-5 shows, the partition table is divided into four sections. Each section can hold the information necessary to define a single partition, meaning that the partition table can define no more than four partitions.

Each partition table entry contains several important characteristics of the partition:

- The points on the disk where the partition starts and ends
- Whether the partition is "active"
- The partition's type

Let us take a closer look at each of these characteristics. The starting and ending points actually define the partition's size and location on the disk. The "active" flag is used by some operating systems' boot loaders. In other words, the operating system in the partition that is marked "active" will be booted.

The partition's type can be a bit confusing. The type is a number that identifies the partition's anticipated usage. If that statement sounds a bit vague, that is because the meaning of the partition type is a bit vague. Some operating systems use the partition type to denote a specific filesystem type, to flag the partition as being associated with a particular operating system, to indicate that the partition contains a bootable operating system, or some combination of the three.

Table D-1, contains a listing of some popular (and obscure) partition types, along with their numeric values.

Partition Type	Value	Partition Type	Value
Empty	00	Novell Netware 386	65
DOS 12-bit FAT	01	PIC/IX	75
XENIX root	02	Old MINIX	80
XENIX usr	03	Linux/MINUX	81
DOS 16-bit $<=32M$	04	Linux swap	82
Extended	05	Linux native	83
DOS 16-bit $>=32$	06	Linux extended	85
OS/2 HPFS	07	Amoeba	93
AIX	08	Amoeba BBT	94
AIX bootable	09	BSD/386	a5
OS/2 Boot Manager	0a	OpenBSD	a6
Win95 FAT32	0b	NEXTSTEP	a7
Win95 FAT32 (LBA)	0c	BSDI fs	b7
Win95 FAT16 (LBA)	0e	BSDI swap	b8
Win95 Extended (LBA)	0f	Syrinx	c7
Venix 80286	40	CP/M	db
Novell	51	DOS access	e1
Microport	52	DOS R/O	e3
GNU HURD	63	DOS secondary	f2
Novell Netware 286	64	BBT	ff

Table D-1. Partition Types

By this point, you might be wondering how all this additional complexity is normally used. See Figure D-6, for an example.
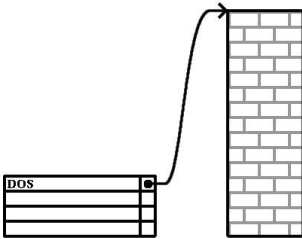
Figure D-6. Disk Drive With Single Partition

In many cases, there is only a single partition spanning the entire disk, essentially duplicating the method used before partitions. The partition table has only one entry used, and it points to the start of the partition.

We have labeled this partition as being of the "DOS" type. Although it is only one of several possible partition types listed in Table D-1, it is adequate for the purposes of this discussion. This is a typical partition layout for most newly purchased computers with a consumer version of Microsoft Windows™ preinstalled.

D.1.3. Partitions within Partitions — An Overview of Extended Partitions

Of course, over time it became obvious that four partitions would not be enough. As disk drives continued to grow, it became more and more likely that a person could configure four reasonably-sized partitions and still have disk space left over. There needed to be some way of creating more partitions.

Enter the extended partition. As you may have noticed in Table D-1, there is an "Extended" partition type. It is this partition type that is at the heart of extended partitions.

When a partition is created and its type is set to "Extended," an extended partition table is created. In essence, the extended partition is like a disk drive in its own right — it has a partition table that points to one or more partitions (now called *logical partitions*, as opposed to the four *primary partitions*) contained entirely within the extended partition itself. Figure D-7, shows a disk drive with one primary partition and one extended partition containing two logical partitions (along with some unpartitioned free space).
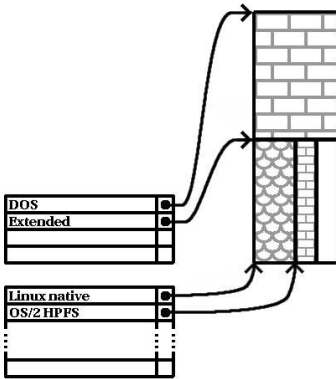
Figure D-7. Disk Drive With Extended Partition

As this figure implies, there is a difference between primary and logical partitions — there can only be four primary partitions, but there is no fixed limit to the number of logical partitions that can exist. (However, in reality, it is probably not a good idea to try to define and use more than 12 logical partitions on a single disk drive.)

Now that we have discussed partitions in general, let us see how to use this knowledge to install Red Hat Enterprise Linux ES.

D.1.4. Making Room For Red Hat Enterprise Linux ES

There are three possible scenarios you may face when attempting to repartition your hard disk:

• Unpartitioned free space is available

• An unused partition is available

• Free space in an actively used partition is available

Let us look at each scenario in order.

☞ **Note**

Please keep in mind that the following illustrations are simplified in the interest of clarity and do not reflect the exact partition layout that you will encounter when actually installing Red Hat Enterprise Linux ES.

D.1.4.1. Using Unpartitioned Free Space

In this situation, the partitions already defined do not span the entire hard disk, leaving unallocated space that is not part of any defined partition. Figure D-8 shows what this might look like.
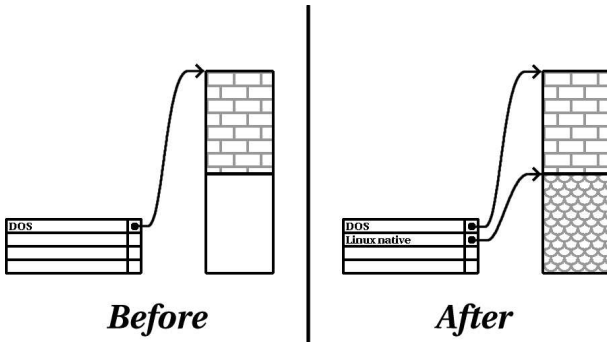
Figure D-8. Disk Drive with Unpartitioned Free Space

When you think about it, an unused hard disk also falls into this category. The only difference is that *all* the space is not part of any defined partition.

In any case, you can simply create the necessary partitions from the unused space. Unfortunately, this scenario, although very simple, is not very likely (unless you have just purchased a new disk just for Red Hat Enterprise Linux ES). Most pre-installed operating systems are configured to take up all available space on a disk drive (see Section D.1.4.3).

Next, we will discuss a slightly more common situation.

D.1.4.2. Using Space from an Unused Partition

In this case, maybe you have one or more partitions that you do not use any longer. Perhaps you have dabbled with another operating system in the past, and the partition(s) you dedicated to it never seem to be used anymore. Figure D-9, illustrates such a situation.
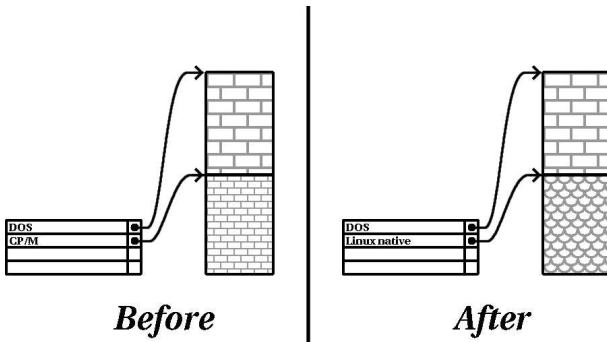
Figure D-9. Disk Drive With an Unused Partition

If you find yourself in this situation, you can use the space allocated to the unused partition. You will first need to delete the partition, and then create the appropriate Linux partition(s) in its place. You can either delete the partition using the DOS `fdisk` command, or you will be given the opportunity to do so during a custom installation.

D.1.4.3. Using Free Space from an Active Partition

This is the most common situation. It is also, unfortunately, the hardest to handle. The main problem is that, even if you have enough free space, it is presently allocated to a partition that is already in use. If you purchased a computer with pre-installed software, the hard disk most likely has one massive partition holding the operating system and data.

Aside from adding a new hard drive to your system, you have two choices:

Destructive Repartitioning

Basically, you delete the single large partition and create several smaller ones. As you might imagine, any data you had in the original partition is destroyed. This means that making a complete backup is necessary. For your own sake, make two backups, use verification (if available in your backup software), and try to read data from your backup *before* you delete the partition.

> ⚠️ **Caution**
>
> If there was an operating system of some type installed on that partition, it will need to be reinstalled as well. Be aware that some computers sold with pre-installed operating systems may not include the CD-ROM media to reinstall the original operating system. The best time to notice if this applies to your system is *before* you destroy your original partition and its operating system installation.

After creating a smaller partition for your existing software, you can reinstall any software, restore your data, and continue your Red Hat Enterprise Linux ES installation. Figure D-10 shows this being done.

Before **After**
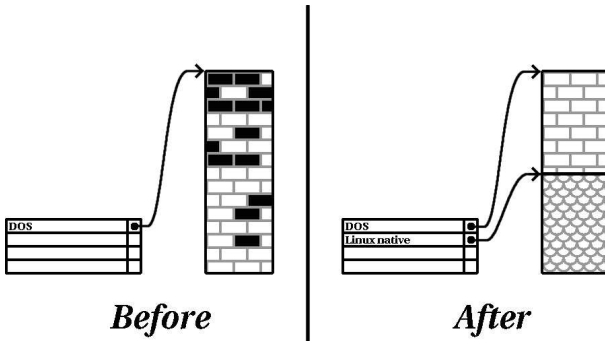
Figure D-10. Disk Drive Being Destructively Repartitioned

> ⚠️ **Caution**
>
> As Figure D-10 shows, any data present in the original partition will be lost without proper backup!

Non-Destructive Repartitioning

Here, you run a program that does the seemingly impossible: it makes a big partition smaller without losing any of the files stored in that partition. Many people have found this method to be reliable and trouble-free. What software should you use to perform this feat? There are several disk management software products on the market. You will have to do some research to find the one that is best for your situation.

While the process of non-destructive repartitioning is rather straightforward, there are a number of steps involved:

- Compress existing data
- Resize the existing partition
- Create new partition(s)

Next we will look at each step in a bit more detail.

D.1.4.3.1. Compress existing data

As Figure D-11 shows, the first step is to compress the data in your existing partition. The reason for doing this is to rearrange the data such that it maximizes the available free space at the "end" of the partition.
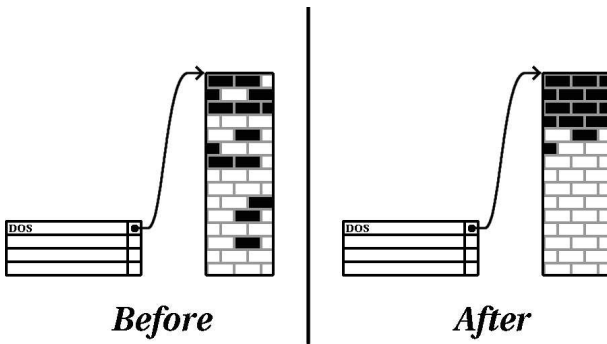
Figure D-11. Disk Drive Being Compressed

This step is crucial. Without it, the location of your data could prevent the partition from being resized to the extent desired. Note also that, for one reason or another, some data cannot be moved. If this is the case (and it severely restricts the size of your new partition(s)), you may be forced to destructively repartition your disk.

D.1.4.3.2. Resize the existing partition

Figure D-12 shows the actual resizing process. While the actual result of the resizing operation varies depending on the software used, in most cases the newly freed space is used to create an unformatted partition of the same type as the original partition.
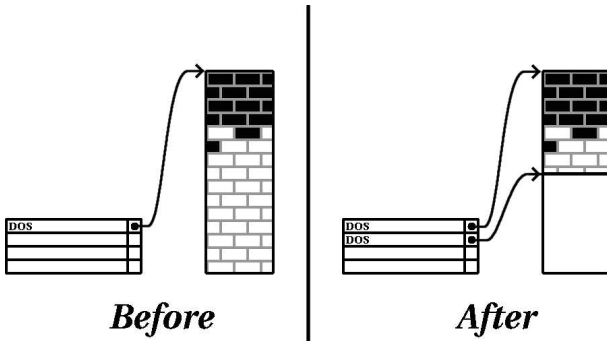
Figure D-12. Disk Drive with Partition Resized

It is important to understand what the resizing software you use does with the newly freed space, so that you can take the appropriate steps. In the case we have illustrated, it would be best to simply delete the new DOS partition and create the appropriate Linux partition(s).

D.1.4.3.3. Create new partition(s)

As the previous step implied, it may or may not be necessary to create new partitions. However, unless your resizing software is Linux-aware, it is likely you will need to delete the partition that was created during the resizing process. Figure D-13 shows this being done.
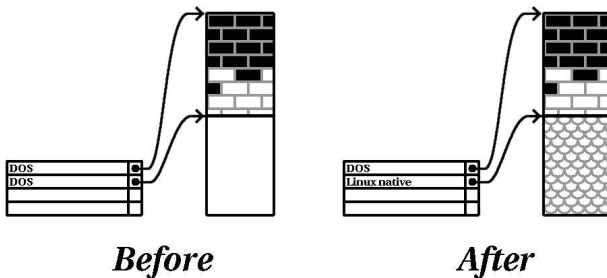
Figure D-13. Disk Drive with Final Partition Configuration

Note

The following information is specific to Intel-based computers only.

As a convenience to Red Hat Enterprise Linux ES users, the DOS `fips` utility is included on the Red Hat Linux/x86 CD 1 in the `dosutils` directory. This is a freely available program that can resize FAT (File Allocation Table) partitions.

Warning

Many people have successfully used `fips` to resize their hard drive partitions. However, because of the nature of the operations carried out by `fips` and the wide variety of hardware and software configurations under which it must run, Red Hat cannot guarantee that `fips` will work properly on your system. Therefore, no installation support is available for `fips`. *Use it at your own risk*.

That said, if you decide to repartition your hard drive with `fips`, it is *vital* that you do two things:

- *Perform a backup* — Make two copies of all the important data on your computer. These copies should be to removable media (such as tape or diskettes), and you should make sure they are readable before proceeding.

- *Read the documentation* — Completely read the `fips` documentation, located in the `dosutils/fipsdocs` subdirectory on Red Hat Linux/x86 CD 1.

Should you decide to use `fips`, be aware that after `fips` runs you will be left with *two* partitions: the one you resized, and the one `fips` created out of the newly freed space. If your goal is to use that space to install Red Hat Enterprise Linux ES, you should delete the newly created partition, either by using `fdisk` under your current operating system or while setting up partitions during a custom installation.

D.1.5. Partition Naming Scheme

Linux refers to disk partitions using a combination of letters and numbers which may be confusing, particularly if you are used to the "C drive" way of referring to hard disks and their partitions. In the DOS/Windows world, partitions are named using the following method:

- Each partition's type is checked to determine if it can be read by DOS/Windows.

- If the partition's type is compatible, it is assigned a "drive letter." The drive letters start with a "C" and move on to the following letters, depending on the number of partitions to be labeled.

- The drive letter can then be used to refer to that partition as well as the filesystem contained on that partition.

Red Hat Enterprise Linux ES uses a naming scheme that is more flexible and conveys more information than the approach used by other operating systems. The naming scheme is file-based, with filenames in the form:

`/dev/xxyN`

Here is how to decipher the partition naming scheme:

`/dev/`

This string is the name of the directory in which all device files reside. Since partitions reside on hard disks, and hard disks are devices, the files representing all possible partitions reside in `/dev/`.

`xx`

The first two letters of the partition name indicate the type of device on which the partition resides. You will normally see either `hd` (for IDE disks) or `sd` (for SCSI disks).

y

This letter indicates which device the partition is on. For example, `/dev/hda` (the first IDE hard disk) or `/dev/sdb` (the second SCSI disk).

N

The final number denotes the partition. The first four (primary or extended) partitions are numbered `1` through `4`. Logical partitions start at `5`. So, for example, `/dev/hda3` is the third primary or extended partition on the first IDE hard disk, and `/dev/sdb6` is the second logical partition on the second SCSI hard disk.

Note

There is no part of this naming convention that is based on partition type; unlike DOS/Windows, *all* partitions can be identified under Red Hat Enterprise Linux ES. Of course, this does not mean that Red Hat Enterprise Linux ES can access data on every type of partition, but in many cases it is possible to access data on a partition dedicated to another operating system.

Keep this information in mind; it will make things easier to understand when you are setting up the partitions Red Hat Enterprise Linux ES requires.

D.1.6. Disk Partitions and Other Operating Systems

If your Red Hat Enterprise Linux ES partitions will be sharing a hard disk with partitions used by other operating systems, most of the time you will have no problems. However, there are certain combinations of Linux and other operating systems that require extra care. Information on creating disk partitions compatible with other operating systems is available in several HOWTOs and Mini-HOWTOs, available on the Red Hat Enterprise Linux ES Documentation CD in the `HOWTO` and `HOWTO/mini` directories. In particular, the Mini-HOWTOs whose names start with `Linux+` are quite helpful.

D.1.7. Disk Partitions and Mount Points

One area that many people new to Linux find confusing is the matter of how partitions are used and accessed by the Linux operating system. In DOS/Windows, it is relatively simple: Each partition gets a "drive letter." You then use the correct drive letter to refer to files and directories on its corresponding partition.

This is entirely different from how Linux deals with partitions and, for that matter, with disk storage in general. The main difference is that each partition is used to form part of the storage necessary to support a single set of files and directories. This is done by associating a partition with a directory through a process known as *mounting*. Mounting a partition makes its storage available starting at the specified directory (known as a *mount point*).

For example, if partition `/dev/hda5` were mounted on `/usr`, that would mean that all files and directories under `/usr` would physically reside on `/dev/hda5`. So the file `/usr/share/doc/FAQ/txt/Linux-FAQ` would be stored on `/dev/hda5`, while the file `/etc/X11/gdm/Sessions/Gnome` would not.

Continuing our example, it is also possible that one or more directories below `/usr` would be mount points for other partitions. For instance, a partition (say, `/dev/hda7`) could be mounted on `/usr/local`, meaning that `/usr/local/man/whatis` would then reside on `/dev/hda7` rather than `/dev/hda5`.

D.1.8. How Many Partitions?

At this point in the process of preparing to install Red Hat Enterprise Linux ES, you will need to give some consideration to the number and size of the partitions to be used by your new operating system. The question of "how many partitions" continues to spark debate within the Linux community and, without any end to the debate in sight, it is safe to say that there are probably as many partition layouts as there are people debating the issue.

Keeping this in mind, we recommend that, unless you have a reason for doing otherwise, you should at least create the following partitions:

• *A swap partition* — Swap partitions are used to support virtual memory. In other words, data is written to swap when there is not RAM to hold the data your system is processing. You *must* create a swap partition to correctly use Red Hat Enterprise Linux ES. The minimum size of your swap partition should be equal to twice the amount of your computer's RAM or 32 MB, whichever is larger.

• *A /boot partition* — The partition mounted on /boot contains the operating system kernel (which allows your system to boot Red Hat Enterprise Linux ES), along with a few other files used during the bootstrap process.

> ⚠ **Caution**
>
> Make sure you read Section D.1.9 — the information there applies to the /boot partition!

Due to the limitations of most PC BIOSes, creating a small partition to hold these files is a good idea. For most users, a 32 MB boot partition is sufficient.

• *A root partition (/)* — The root partition is where / (the root directory) resides. In this partitioning layout, all files (except those stored in /boot) reside on the root partition. Because of this, it is in your best interest to maximize the size of your root partition. A 1.0 GB root partition will permit the equivalent of a Server installation (with *very* little free space), while a 3.2 GB root partition will let you install every package. Obviously, the more space you can give the root partition, the better.

Specific recommendations concerning the proper size for various Red Hat Enterprise Linux ES partitions can be found in Section 1.5.

D.1.9. One Last Wrinkle: Using GRUB or LILO

GRUB and LILO are the most commonly used methods to boot Red Hat Enterprise Linux ES on Intel-based systems. As operating system loaders, they operate "outside" of any operating system, using only the Basic I/O System (or BIOS) built into the computer hardware itself. This section describes GRUB and LILO's interactions with PC BIOSes and is specific to Intel-compatible computers.

D.1.9.1. BIOS-Related Limitations Impacting GRUB and LILO

GRUB and LILO are subject to some limitations imposed by the BIOS in most Intel-based computers. Specifically, most BIOSes cannot access more than two hard drives, and they cannot access any data stored beyond cylinder 1023 of any drive. Note that some recent BIOSes do not have these limitations, but this is by no means universal.

All the data GRUB and LILO need to access at boot time (including the Linux kernel) is located in the /boot directory. If you follow the partition layout recommended above or are performing a Red Hat Enterprise Linux ES install, the /boot directory will be in a small, separate partition. Otherwise, it may reside in the root partition (/). In either case, the partition in which /boot resides must conform to the following guidelines if you are going to use GRUB or LILO to boot your Red Hat Enterprise Linux ES system:

On First Two IDE Drives

If you have 2 IDE (or EIDE) drives, /boot must be located on one of them. Note that this two-drive limit also includes any IDE CD-ROM drives on your primary IDE controller. So, if you have one IDE hard drive, and one IDE CD-ROM on your primary controller, /boot must be located on the first hard drive *only*, even if you have other hard drives on your secondary IDE controller.

On First IDE or First SCSI Drive

If you have one IDE (or EIDE) drive and one or more SCSI drives, /boot must be located either on the IDE drive or the SCSI drive at ID 0. No other SCSI IDs will work.

On First Two SCSI Drives

If you have only SCSI hard drives, /boot must be located on a drive at ID 0 or ID 1. No other SCSI IDs will work.

Partition *Completely* Below Cylinder 1023

No matter which of the above configurations apply, the partition that holds /boot must be located entirely below cylinder 1023. If the partition holding /boot straddles cylinder 1023, you may face a situation where GRUB and LILO will work initially (because all the necessary information is below cylinder 1023) but will fail if a new kernel is to be loaded and that kernel resides above cylinder 1023.

As mentioned earlier, it is possible that some of the newer BIOSes may permit GRUB and LILO to work with configurations that do not meet these guidelines. Likewise, some of GRUB and LILO's more esoteric features may be used to get a Linux system started, even if the configuration does not meet our guidelines. However, due to the number of variables involved, Red Hat cannot support such efforts.

Note

Disk Druid, as well as the Server installation, takes these BIOS-related limitations into account.

Driver Disks

E.1. Why Do I Need a Driver Disk?

While the Red Hat Enterprise Linux ES installation program is loading, you may see a screen that asks you for a driver disk. The driver disk screen is most often seen in three scenarios:

- If you run the installation program in `expert mode`
- If you run the installation program by entering **linux dd** at the `boot:` prompt
- If you run the installation program on a computer which does not have any PCI devices

E.1.1. So What Is a Driver Disk Anyway?

A driver disk adds support for hardware that is not otherwise supported by the installation program. The driver disk could be produced by Red Hat, it could be a disk you make yourself from drivers found on the Internet, or it could be a disk that a hardware vendor includes with a piece of hardware.

There is no need to use a driver disk unless you need a particular device in order to install Red Hat Enterprise Linux ES. Driver disks are most often used for non-standard or very new CD-ROM drives, SCSI adapters, or NICs. These are the only devices used during the installation that might require drivers not included on the Red Hat Enterprise Linux ES CD-ROMs (or boot disk, if you created an installation boot disk to begin the install process).

Note

If an unsupported device is not needed to install Red Hat Enterprise Linux ES on your system, continue with the installation and add support for the new piece of hardware once the installation is complete.

E.1.2. How Do I Obtain a Driver Disk?

The Red Hat Enterprise Linux ES CD-ROM 1 includes driver disk images (`images/drvnet.img` — network card drivers and `images/drvblock.img` — drivers for SCSI controllers) containing many rarely used drivers. If you suspect that your system may require one of these drivers, you should create the driver disk before beginning your Red Hat Enterprise Linux ES installation.

Another option for finding specialized driver disk information is on Red Hat's website at http://www.redhat.com/support/errata under the section called **Bug Fixes**. Occasionally, popular hardware may be made available after a release of Red Hat Enterprise Linux ES that will not work with drivers already in the installation program or included on the driver disk images on the Red Hat Enterprise Linux ES CD-ROM 1. In such cases, the Red Hat website may contain a link to a driver disk image.

E.1.2.1. Creating a Driver Disk from an Image File

If you have a driver disk image that you need to write to a floppy disk, this can be done from within DOS or Red Hat Enterprise Linux ES.

To create a driver disk from a driver disk image using Red Hat Enterprise Linux ES:

1. Insert a blank, formatted floppy disk into the first drive.
2. From the same directory containing the driver disk image, such as *dd.img*, type `dd if=`*dd.img* `of=/dev/fd0` as root.

To create a driver disk from a driver disk image using DOS:

1. Insert a blank, formatted floppy disk into the a: drive.
2. From the same directory containing the driver disk image, such as *dd.img*, type `rawrite` *dd.img* `a:` at the command line.

E.1.3. Using a Driver Disk During Installation

Having a driver disk is not enough; you must specifically tell the Red Hat Enterprise Linux ES installation program to load that driver disk and use it during the installation process.

Note

A driver disk is different than a boot disk. If you require a boot disk to begin the Red Hat Enterprise Linux ES installation, you will still need to create that floppy and boot from it before using the driver disk.

If you do not already have an installation boot disk and your system does not support booting from the CD-ROM, you should create an installation boot disk. For instructions on how make a boot disk, see Section 1.4.2.

Once you have created your driver disk, begin the installation process by booting from the Red Hat Enterprise Linux ES CD-ROM 1 (or the installation boot disk). At the `boot:` prompt, enter either **linux expert** or **linux dd**. Refer to Section 3.2.1 for details on booting the installation program.

The Red Hat Enterprise Linux ES installation program will ask you to insert the driver disk. Once the driver disk is read by the installer, it can apply those drivers to hardware discovered on your system later in the installation process.

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