

Installation

RHCE PREPARATION TOPICS COVERED IN THIS CHAPTER:

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- Know What Information May Be Required during Installation
- Know How to Select and Prepare Installation Media

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his chapter summarizes what you need to know to be able to install and initially configure Red Hat Linux. One of the two performance-based parts of the RHCE exam requires you to install and configure Red Hat Linux to satisfy a list of requirements, so you'll find this chapter important in preparing for that part of the exam. This chapter is also a handy reference whenever you're planning or performing a Red Hat Linux installation.

Preparing for Installation

- Determine System Needs
- Know What Information May Be Required during Installation
- Know How to Select and Prepare Installation Media

Preparation is important to effective and efficient execution, no less in system administration than in other endeavors. This section describes the tasks you should perform and the decisions you should make before installing Red Hat Linux. If you follow the instructions given here, you can expect the installation of Red Hat Linux to go smoothly, with only an occasional exception.

Critical Information

The first step in installation planning is to determine the needs that the system must satisfy. For example, a worker who will use the system as a workstation for preparing graphics will have a different set of needs

than a system administrator who plans to use the system primarily as an FTP server. Once you know what the system must do, you're ready to decide what hardware is needed and how Red Hat Linux should be installed and configured.

Gathering Information

Installation will go more smoothly if you've collected information about the hardware on the target system. If you have the flexibility to choose the hardware, choose hardware listed in the Red Hat Hardware Compatibility List (HCL) over other hardware. Be wary of devices, such as CD-ROM drives, that have proprietary interfaces. Also be wary of WinModems and WinPrinters.

Before beginning the installation, have the following information handy:

- CPU: type and speed.
- Motherboard: bus type (ISA, EISA, VESA, PCI, MCA, and so on).
- Drive controllers: the type of interface and the chipset used.
- Drives: the make and model of each drive and its drive number or SCSI ID on the controller.
- System RAM: size.
- Network adapters: the make and model. For non-PCI cards, know the IRQ, DMA, and I/O ports used.
- Modems: the IRQ, DMA, and I/O ports used by an internal modem or the number of the serial port to which an external modem is connected.
- Sound cards: the IRQs, DMAs, and I/O ports used.
- Serial and parallel ports: the IRQs and I/O ports used.
- Mouse: type (serial, PS2, or bus) and number of buttons. For a serial mouse, know the number of the serial port to which it's connected.

- Video card: make, model, chipset, amount of RAM, and color depths supported.
- Monitor: make, model, horizontal sync range, and vertical sync range.

You should have similar information for any other hardware devices installed in the system.

If your system will be attached to a network, you should also have the following information available:

• Method of IP address assignment: static, DHCP, BOOTP

For statically defined hosts, you should have the following information available:

- IP address
- Network IP address or network mask
- Gateway IP address
- Fully qualified domain name (FQDN)

In some circumstances, additional information will be needed. But, generally, this information will be enough to let you complete the installation procedure. Once the installation procedure is complete, you can configure special options as needed.

In addition to information on the hardware of the target system, you should have available *The Red Hat Linux Installation Guide* and other Linux documentation, particularly the HOWTOs. If necessary, you can use another Linux system or a Microsoft Windows system to read documentation stored on the installation CD-ROM or to access Web sites and newsgroups providing pertinent information. Having this information available will help you complete the installation procedure; otherwise, you may find it necessary to terminate the installation procedure, obtain the needed information, and then restart the installation.

Selecting and Preparing Boot Media

In order to install Red Hat Linux, you must boot the target system using a special Linux kernel. You can boot the system from the installation CD-ROM or from a floppy disk you create from files on the CD-ROM. You can also boot the system from MS-DOS.

Booting from CD-ROM

Most recently manufactured PCs can boot from a CD-ROM that contains appropriate boot information, such as that contained on the Red Hat Linux installation CD-ROM. To boot from a CD-ROM, the system BIOS must specify that the system will attempt to boot from the CD-ROM before attempting to boot from a hard-disk drive or a floppy-disk drive. Generally, this BIOS setting is labeled Boot Sequence or something similar.

Booting from MS-DOS

If the system is set up to boot DOS, you may be able to boot by using the files on the CD-ROM, even if the system cannot boot from its CD-ROM. The file dosutils/autoboot.bat invokes the Linux Loadlin program, which uses DOS-system calls to boot a Linux kernel residing on a hard disk or CD-ROM drive.

To use autoboot.bat, boot the system into DOS, not Microsoft Windows. If the system runs Microsoft Windows, restart the system in MS-DOS mode by using the Shut Down dialog box. When the system enters DOS, move to the drive associated with the CD-ROM. Then, launch the boot sequence by issuing the command

dosutils/autoboot.bat

The system should load and execute the Linux kernel.

Booting from a Floppy Disk

If you can't boot the system from a CD-ROM, and the system isn't set up to boot DOS, you must prepare a boot floppy disk from which to boot the system. This is most easily done using a Linux system to copy

the image file on the CD-ROM to a floppy disk. An image file contains an exact replica of a floppy disk. By copying the image file to a disk, you create a duplicate of the disk that was used to make the image file.

Mount the Red Hat Linux installation CD-ROM by issuing the command

mount -t iso9660 /dev/cdrom /mnt/cdrom -o ro

Place a formatted floppy disk in the floppy drive and issue the command

dd if=/mnt/cdrom/images/boot.img of=/dev/fdOH1440 \$obs=18k

It may take a minute or so to write the image to the floppy disk. When activity ceases, remove the disk, which can now be used to boot the target system.

NOTE If you plan to install Linux via the network rather than from a CD-ROM, copy the image file bootnet.img, rather than boot.img.

If you need to access PCMCIA devices during installation, you'll need a second floppy disk. Use a similar command to copy the file pcmcia.img to a second floppy disk.

If you don't have handy access to a Linux system, you can make a floppy from an image file by using the DOS program Rawrite, which resides in the dosutils directory of the CD-ROM. The Rawrite program can be run from DOS or from a Microsoft Windows MS-DOS Prompt window. The program prompts for the letter of the drive containing the floppy disk (usually drive A) and for the path of the image file (usually d:\images\boot.img).

Selecting Installation Media

Most users install Red Hat Linux from an installation CD-ROM. However, if you frequently install Linux, you may prefer to set up a server that makes the installation files available via a network. You can access Red Hat Linux installation files

- via FTP
- via NFS
- via HTTP
- on a local hard drive

TIP Red Hat Linux does not currently support installation via files shared by a Samba server.

Exam Essentials

Be thoroughly familiar with, and capable of, Red Hat installation, particularly network installations This section explained installation planning, ways of booting the installation procedure, and the preparation of installation media. You should be familiar with these topics.

Understand different approaches to multiple-boot installations and be familiar with installation-related tools (such as Rawrite) sometimes used during multiple-boot installations This section explained the use of Rawrite and the dd command to prepare installation media. You should be able to prepare installation media using either method.

Key Terms and Concepts

Image file A file that can be used to create a floppy disk that's used to boot a system or as a device driver.

Loadlin A program that can be used to boot Linux from MS-DOS.

Rawrite A program that can create a floppy disk from an image file.

Sample Questions

- 1. What is the name of the MS-DOS batch file that can be used to boot Red Hat Linux?
 - A. dosutils/autoboot.bat
 - **B**. dosutils/boot.bat
 - C. dosutils/linux.bat
 - D. dosutils/loadlin.bat

Answer: A. You can boot Linux from MS-DOS by invoking the batch file dosutils/autoboot.bat on the Red Hat Linux installation CD-ROM.

- **2.** Which of the following should you know if you're installing Red Hat Linux on a PC that has a static network configuration (choose all that apply)?
 - A. Fully qualified domain name
 - B. Gateway IP address
 - C. IP address
 - D. Network IP address

Answer: A, B, C, D. All this information is needed if the host has a static network configuration. Little information is needed if the host uses DHCP or BOOTP to obtain its network configuration.

Working with Partitions

- Know How to Design a Partition Structure
- Know How to Use Fips to Split an MS-DOS Partition

When installing Red Hat Linux, if you select the workstation or Server installation class, the installation procedure partitions your hard-disk drive automatically. However, if you select the Custom installation class, you must partition the hard disk. This section summarizes what you need to know about partitions and the related procedures you should be able to perform.

Critical Information

Partitions improve system data integrity and can improve system data security. If a hard disk suffers damage, the damage is often confined to a single partition. Recovery of a single partition may be simpler and quicker than recovery of an entire drive. It's also possible to mount partitions as read-only. By organizing data that need not be changed into a partition and mounting the partition as read-only, data integrity and security can be improved. A partition that cannot be written is less vulnerable to corruption than one mounted for reading and writing. And, it's more difficult for a hacker to surreptitiously modify data on a read-only partition than on a read-write partition.

In designing a partition structure, the following directories should be kept in a single partition:

- /
- /etc
- /lib
- /bin
- /sbin
- /dev

These directories—and their subdirectories—contain programs and files essential to proper system operation. They should always be present and, therefore, should be part of the so-called root partition, mounted as /.

The non-Custom installation classes create a 16MB boot partition, mounted as /boot. Generally, your design should include such a partition. By locating a boot partition within the 1024-cylinder region addressable by the system's BIOS, you ensure that the kernel will be accessible at boot time.

Generally, you should include one or more swap partitions. As a rule of thumb, the swap partitions should have a total size 2–3 times that of the installed RAM. For example, a system having 16MB of RAM should have 32–48MB of swap space. No more than eight swap partitions can be defined; the total swap space cannot exceed 4GB.

Directories that are often used as mount points include

- /home
- /opt
- /tmp
- /usr
- /usr/local
- /var

Necessary Procedures

This section describes how to use Fips to split an MS-DOS partition.

Using Fips

Often, a target system has insufficient free disk space for installing Linux. If an MS-DOS (FAT or FAT32) partition contains unused space, you can use Fips to split the partition, creating an empty partition into which you can install Linux.

To use Fips, follow these steps:

- **1**. Use Microsoft ScanDisk to check the partition for errors.
- **2.** Use Microsoft Defrag to move the files to the low end of the partition.
- 3. Disable virtual memory using the System Control Panel applet.
- **4.** Create an MS-DOS boot floppy by using the Add/Remove Programs Control Panel applet.
- **5.** Copy the following files from the installation CD-ROM to the floppy disk:
 - \dosutils\fips20\restorrb.exe
 - \dosutils\fips20\fips.exe
 - \dosutils\fips20\errors.txt
- **6**. Rename autoxec.bat and config.sys to autoexec.fips and config.fips so that no startup programs will write to the hard disk.
- 7. Boot from the floppy, and run Fips.
- 8. Let Fips create a backup of the partition table on the floppy.
- **9.** Specify the number of the partition you want to split and the number of the cylinder on which the new partition should begin.
- **10.** Type **y** to save changes, and then exit.
- 11. Boot MS-DOS, and run ScanDisk to make sure the disk is okay.
- **12.** Re-enable virtual memory, and restore your autoexec.bat and config.sys files to their original names.

Exam Essentials

Understand different approaches to multiple-boot installations and be familiar with installation-related tools (Rawrite, Fips) sometimes used during multiple-boot installations This section explained the use of Fips to split an MS-DOS partition. Be sure you know how to use Fips.

Understand disk partitioning and know how to use Red Hat's installtime partitioning tools This section explained how to design a partition structure for Red Hat Linux. Be sure you can design a partition structure.

Key Term and Concept

Root partition The Linux partition that hosts a file system that contains all essential system files, except those required to boot the system.

Sample Questions

- **1.** How many times more swap space than RAM should a Red Hat Linux system generally have?
 - **A.** 1–2
 - **B.** 2–3
 - **C**. 3–4
 - **D.** 4–8

Answer: B. The system should generally have an amount of swap space 2–3 times its amount of RAM.

- **2.** What is the maximum amount of swap space a Red Hat Linux system can use?
 - **A.** 1GB
 - **B.** 2GB
 - **C**. 4GB
 - **D.** 8GB

Answer: C. A Red Hat Linux system can have as much as 4GB of swap space.

Performing the Installation

- Know How to Select the Installation User Interface
- Know How to Select the Installation Class and Type
- Know How to Select Components and Packages

Red Hat Linux is designed to be easy to install. But, that doesn't mean that you should approach installation naively. This section summarizes what you need to know to be able to install Red Hat Linux efficiently and effectively.

Critical Information

Red Hat Linux supports two installation types: Install and Upgrade. You should choose Install when installing Linux on a target system that doesn't currently host Linux. Choose Upgrade when the target system already hosts an earlier version of Red Hat Linux. The Upgrade procedure generally saves the existing configuration files rather than overwriting them. The existing files are renamed with the extension .rpmsave. Some updated packages may require replacement of the existing configuration files; in such cases, the existing configuration file is renamed with the extension .rpmorig.

Red Hat Linux 6.1 introduced a graphical mode installation procedure based on X. The initial screen of the installation procedure lets you choose the new graphical mode installation procedure or a text mode installation procedure.

Beginners generally find the graphical mode installation procedure easier to use. However, you may prefer the text mode installation for the following reasons:

• The graphical mode installation procedure may fail if the target system has unusual video characteristics, such as an old or uncommon video adapter.

- The text mode installation procedure can recover from some errors—such as running out of disk space—that cause the graphical mode installation procedure to fail.
- The text mode installation will run better and faster than the graphical mode installation on computers having a slow processor or a small amount of RAM.
- The graphical mode installation supports only media mounted as a file system, such as an existing hard-drive partition, a CD-ROM, or media made available via NFS.

The operation of the graphical mode user interface resembles that of familiar point-and-click interfaces in the following ways:

- You use the mouse to select a control, such as a button or text field, and to manipulate check boxes and radio buttons.
- If you prefer, you can use the Tab key to move from control to control.
- You use the keyboard to enter text.

The text mode user interface is not a command-line interface, but a mouse-less, low-resolution graphical user interface. It includes familiar controls such as text boxes, check boxes, scroll bars, and buttons. Since the text mode interface is mouse-less, you use it somewhat differently from more familiar graphical user interfaces. This interface works in the following ways:

- You use Tab and Alt+Tab to move from control to control.
- You press the spacebar to select or deselect check boxes.
- You use the Left, Right, Up, and Down keys to move the cursor.
- You press Enter or the spacebar to click a highlighted button.
- You press Enter to select an item from a list.

Installation Consoles and Message Logs

The installation program uses the Linux virtual consoles to display a variety of information. Virtual consoles let you associate the keyboard and monitor with any of several tasks, performing in text mode a function that's analogous to using Windows in graphical mode. Virtual consoles are handier than having several physical consoles, because they don't require extra desk space and it's easy to switch from one to the other. Table 1.1 summarizes the virtual consoles used during installation.

TABLE 1.1	: Virtual	I Consoles Use	d during Installation
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Console	Keystrokes	Contents
1	Ctrl+Alt+F1	Text-based installation procedure
2	Ctrl+Alt+F2	Shell prompt
3	Ctrl+Alt+F3	Messages from the installation program
4	Ctrl+Alt+F4	Kernel messages
5	Ctrl+Alt+F5	Other messages, including file system creation messages
7	Ctrl+Alt+F7	Graphical installation procedure

The indicated keystrokes let you switch to a given console. By switching to a console, you can view messages that can help you diagnose and troubleshoot installation problems. Console 2 provides a shell prompt that you can use to issue commands to resolve problems.

The Installation Process

To start the installation process, you must boot the target system using a special Red Hat Linux installation kernel. You can boot the system in any of several ways, as described earlier in this chapter. In order to boot the system, you must provide the proper boot medium (for example, a boot floppy disk).

You must also configure the target system's BIOS to boot from the boot medium. Often, the BIOS is set to boot the system from its internal hard drive and must be reconfigured to boot from a floppy or CD-ROM.

Installation Mode

When the system boots, it displays the Welcome to Red Hat Linux screen. This screen lets you select the installation mode: graphical, text, or expert. The graphical mode installation is the easiest to use. The text mode installation is more robust, but somewhat clumsier to use. The expert mode installation suppresses automatic device probes and gives you almost complete control over the installation process. Expert mode is useful primarily when automatic device probes hang a system. Otherwise, it's generally more convenient to use graphical or text mode.

Language

If you selected the graphical mode installation and the installation program detects a Red Hat Linux CD-ROM, it immediately enters graphical mode. Otherwise, the next several screens are presented in text mode even if you selected graphical mode. The Language Selection screen lets you specify the language in which the installation program displays instructions.

The selected language also becomes the default language used by the target system. Most installation options, including the language, can be changed after the installation is complete.

Keyboard

The Keyboard Configuration screen lets you select the system's keyboard type. The graphical mode screen lets you test your choice by typing characters in the text box at the bottom of the screen.

Mouse

The Mouse Configuration screen lets you specify the system's mouse type. The Port and Device options are required only for a serial mouse; do not specify them for a PS/2 or bus mouse. If the mouse has two buttons, you should generally specify the Emulate 3 Buttons option. The three-button mouse emulation lets you simultaneously press both mouse buttons of a two-button mouse to emulate the pressing of the missing middle mouse button. Use the Generic mouse type if you find no closer match.

Installation Media

If you selected an installation mode other than graphical or the installation program failed to detect a Red Hat Linux CD-ROM, the Installation Method screen appears. This screen lets you specify the installation media, which can be a CD-ROM or files on a local hard drive. You can also install Red Hat Linux via FTP, HTTP, or NFS. However, you must use a special boot floppy that supports network installation. Chapter 2, "Advanced Installation," explains network installations.

If you selected the graphical mode installation, a second welcome screen appears. This screen contains no options; it merely explains where to find documentation that explains the installation procedure and how to register Red Hat Linux.

Installation Path

Next, you're prompted to select the installation path, which defines the type—Install or Upgrade—and class—GNOME Workstation, KDE Workstation, Server, or Custom—of the installation.

WARNING If you specify Install rather than Upgrade as the installation type, the installation program will erase all Linux partitions present on the system.

WARNING If you specify Server as the installation class, the installation program will erase all partitions present on the system, including non-Linux partitions.

TIP Neither the GNOME Workstation nor KDE Workstation class will overwrite existing non-Linux partitions, unless there is insufficient free disk space available.

The Red Hat Linux installation procedure provides three default installation classes, or configurations:

- GNOME Workstation
- KDE Workstation
- Server

The workstation classes are a quick way to get a Red Hat Linux system up and running. Both workstation classes install the most commonly used packages. In addition, the GNOME Workstation class installs the GNOME desktop manager and the KDE Workstation class installs the KDE desktop manager.

The workstation classes are particularly useful for building a dualboot system, because they don't disturb non-Linux partitions as long as sufficient unallocated disk space is available. They do, however, delete all existing Linux (ext2) partitions. They establish three standard partitions:

- a 64MB swap partition
- a 16MB boot partition (/boot)
- a root partition (/) that uses the remaining free disk space

Both workstation installation classes require about 600MB of free disk space.

In contrast to the workstation classes, the Server installation class deletes all existing partitions, including DOS/Windows partitions. The Server installation class requires about 1.6GB of disk space. A Server installation also includes a different set of default packages than a workstation installation. Moreover, a Server installation creates a more elaborate partition structure, including

- a 64MB swap partition
- a 16MB boot partition (/boot)
- a 256MB root partition (/)
- a 256MB /var partition

Two further partitions split the remaining free disk space equally:

- /home
- /usr

If neither the workstation classes nor the Server installation class meets your needs, you can specify a Custom installation. The Custom installation class has no predefined characteristics. You can partition hard-disk drives and install components and packages as you choose.

Partitioning Hard Disks

If you selected the GNOME Workstation, KDE Workstation, or Server installation class, the installation procedure offers to perform automatic partitioning of the system's hard disks.

If you prefer to partition the disks manually, check the Manually Partition check box. If you do so, the installation program displays the Partitions screen, which lets you access Disk Druid, Red Hat Linux's partitioning program, or Fdisk, the standard Linux partitioning program.

The Partitions screen displays the existing partitions, if any, giving the following information:

Mount Point The directory name at which the device will be mounted. Use the Edit button to specify the mount point. Swap partitions have no mount point.

Device The name of the device on which the partition resides.

Requested The partition's original size. You cannot change the size of a partition; you must delete the partition and add a new one.

Actual The amount of space allocated to the partition.

Type The type of partition.

The Partitions screen also summarizes the status of each hard-disk drive, giving the drive's geometry, total space, free space, and allocated space.

Buttons let you add, edit, and delete partitions. Clicking the Reset button returns Disk Druid to its original state. You can use the Make RAID Device button to create a software RAID device.

Clicking the Add button opens a dialog box that lets you add a new partition. The dialog box contains the following fields:

Mount Point Lets you specify the directory at which the partition will be mounted. You shouldn't specify a mount point for a swap partition.

Size The size of the partition, in MB.

Grow to Fill Specifies that the partition size should be increased until all available free space is allocated.

Allowable Type The partition type.

Allowable Drives The drive or drives from which you're willing to let Disk Druid choose in placing the partition.

Once the partitions have been automatically or manually established, the installation program displays the Choose Partitions to Format screen, which lets you specify which partitions should be formatted.

WARNING Formatting a partition destroys all the data on the partition. Be sure not to format partitions that contain useful data or programs.

Configuring LILO

If you specified the Custom installation class, the installation program displays the LILO Configuration screen. You can use the LILO Configuration screen to specify that the installation program should skip the creation of a boot disk or the installation of LILO. You can also specify whether LILO should be installed on the master boot record (MBR) or on the first sector of the boot partition. Unless the system has a boot manager installed, such as the Windows NT loader or OS/2 boot manager, and you wish to use the boot manager to boot Linux, you should install LILO on the MBR.

The LILO Configuration screen lets you disable use of linear block addressing (LBA); to do so, uncheck the Use Linear Mode check box. The screen also lets you specify parameters to be passed to LILO or the kernel. You might use this capability, for example, if you know that one or more system devices cannot be automatically probed and, therefore, require kernel parameters.

The LILO Configuration screen lists bootable partitions and lets you associate a boot label with a partition so that you can boot the partition by using LILO. You can also specify a default partition that is booted if no partition is specified at boot time.

Network Configuration

If the installation program determines that the system has a network adapter, the installation program displays the Network Configuration screen.

If the system has multiple network adapters, the Network Configuration screen includes tabs that let you choose each adapter. The screen lets you specify the following network configuration information:

Configure Using DHCP Specifies that network configuration will be obtained from a DHCP server at system startup. If you enable this option, you don't need to specify other network configuration options or parameters.

Activate on Boot Specifies that networking is enabled on system startup.

IP Address The static IP address of the system.

Netmask The static IP network mask of the system.

Network Address The static network IP address of the system.

Broadcast Address The static broadcast IP address of the system.

Hostname The fully qualified domain name (FQDN) of the system.

Gateway The IP address of the default gateway used by the system.

Primary, Secondary, and Ternary DNS Servers The IP addresses of one or more DNS servers to be used to resolve host names to IP addresses and IP addresses to host names.

Setting the Time Zone

The Time Zone Selection screen lets you specify the time zone associated with the system's location. You can specify the time zone by using a world map or by specifying an offset from Universal Time (UTC). You can specify that the system's clock is set to UTC. However, other operating systems may not support this capability, so be careful about specifying this option if the system is to be configured for dual-booting.

Creating User Accounts

The Account Configuration screen lets you specify the password for the root user. This screen also lets you add other user accounts. For each account, you specify the user ID, password, and full name.

Specifying Authentication Options

If you specified the Custom installation class, the Authentication Configuration screen appears. Unless you plan to use network passwords, you can take the default values proposed by the installation program. Otherwise, you must enter an NIS domain. You may also enter an NIS server. You should generally enable MD5 and shadow passwords, as these options improve system security.

Selecting Packages

Red Hat Linux combines related programs, configuration files, and data files into a unit known as a *package*, which is contained in a single file. By treating a package as a unit, Red Hat Linux makes it

relatively simple to install, update, or uninstall programs. Packages contain dependency information that identifies programs or libraries needed for proper operation. In general, Red Hat Linux will not let you install a package unless the package's dependencies are satisfied. This helps ensure that installed programs operate correctly.

If you selected the Server or Custom installation class, the Package Group Selection screen appears. This screen lets you select package groups (also known as components) for installation. You can also deselect package groups that you don't want to install. To gain greater control over package selection, you can specify the Select Individual Packages option. This causes the Individual Package Selection screen to appear.

The Individual Package Selection screen lets you select packages to be installed. You can also deselect specific packages. Clicking a package icon causes the installation program to display information about the selected package. The installation program uses the Red Hat Package Manager (RPM) to determine whether the selected packages require support provided by unselected packages. If so, the installation program displays the Unresolved Dependencies screen. The Unresolved Dependencies screen lets you specify whether the installation program will automatically install the required packages, even though you did not select it.

TIP The RPM program makes it easy to install packages after installation is complete, so it's not crucial to select exactly the right components or packages during installation.

Configuring the X Window System

If you selected packages that are part of the X Window system, the installation program displays the X Configuration screen, which lets you configure X. The installation program uses Xconfigurator to probe and determine the type of video card and monitor on the system. If Xconfigurator cannot identify your card or monitor, it displays a list of hardware from which you can choose. Hundreds of cards and

monitors are listed; scroll down the list to find your card and monitor. If your hardware is not listed, you may nevertheless be able to configure X. Select Unlisted Card and specify the characteristics of your video card. Alternatively, select Custom Monitor and specify the horizontal and vertical sync ranges of your monitor.

You can test the configuration to see that it works. To do so, click Test This Configuration. You can also select a custom resolution or color depth. To do so, click Customize X Configuration. Enable the Use Graphical Login check box to cause Linux to display an X login when the system starts. If you prefer a text-based login, disable the Use Graphical Login check box.

If you cannot configure X or you prefer not to try, you can postpone configuration by selecting Skip X Configuration.

Installing Packages

Finally, the installation program presents the About to Install screen. Up to this point, the configuration changes that you've specified have been stored in RAM memory. You can reboot at this point without affecting the configuration of the target system. However, clicking Next commits the changes.

When you click Next, the installation program displays the Installing Packages screen. The Installing Packages screen lets you monitor the progress of package installation. The Next button is disabled until the package installation is complete.

Creating a Boot Disk

Unless you specified that no boot disk is needed, the installation program displays the Boot Disk Creation screen. You can skip creation of the boot floppy disk by clicking Skip Boot Disk Creation and then clicking Next. However, in most cases, you should not do this; the boot disk is useful if you find that you're unable to boot Linux from the hard drive. To create the boot disk, place a blank floppy disk in the floppy drive and click Next.

Completing the Installation

Next, the installation program displays the Congratulations screen, which signals the completion of installation. You should remove the boot disk—if you created one—from the floppy drive, and click Exit. The computer will automatically restart. However, you may need to set the system's BIOS so that the system will boot from its hard disk.

Exam Essentials

Be thoroughly familiar with, and capable of, Red Hat installation, particularly network installations This section explained the procedure for non-network installation of Red Hat Linux. Be sure you're able to install and upgrade Red Hat Linux using both the graphical and text-based installation procedures.

Understand disk partitioning and know how to use Red Hat's installtime partitioning tools This section explained the use of Red Hat's install-time partitioning tools, Fdisk and Disk Druid. Be sure you're able to use them.

Understand install-time configuration elements (LILO, authentication, networking, system initialization, packages, etc.) This section explained the install-time configuration element. Be sure you're able to configure all install-time configuration elements, including X.

Key Terms and Concepts

Component A set of related packages that can be installed as a unit.

Dependency information Information on the files that are not stored in the same package as an application, but which are needed for proper operation of the application.

Installation class Red Hat Linux provides several installation classes, including GNOME Workstation, KDE Workstation, and Server.

Installation type When installing Red Hat Linux, you can choose to either upgrade existing Red Hat Linux packages or perform a fresh install.

Package An application and its associated files, which can be stored and installed as a unit.

Sample Questions

1. What program is generally used to manage the booting of Linux?

A. Fips

B. The NT loader

C. LILO

D. Loadlin

Answer: C. LILO is the LInux LOader.

2. What is the default swap partition size associated with the Server installation class?

A. 16MB

- **B.** 32MB
- **C.** 64MB

D. 128MB

Answer: C. The Server installation class has a 64MB swap partition.

Configuring Options after Installation

The Red Hat Linux installation program presents a series of dialog boxes that make it easy to configure many devices and options. From time to time, you may need to reconfigure a device or option. You could reinstall Red Hat Linux, but that's unnecessarily difficult and time-consuming. Instead, you can use the appropriate configuration program or tool that enables you to reconfigure the device or option without otherwise disturbing the system configuration.

Critical Information

Table 1.2 describes some tools used to configure system options after installation. Each of these tools has a user interface that resembles that of the text-based installation procedure. However, you can perform many other configuration tasks by using the Linuxconf system administration tool, which Red Hat Linux installs by default.

TABLE 1.2: Tools for Configuring System Options

Program	Function
kbdconfig	Configures the keyboard
mouseconfig	Configures the mouse
timeconfig	Configures the time zone
sndconfig	Configures sound

Linuxconf

To launch Linuxconf, issue the command linuxconf. Linuxconf has several user interfaces; the appearance of the Linuxconf screen will vary depending upon whether you're running a text-mode virtual console or an X window. You can also access Linuxconf via a browser-based interface, but to enable this facility, you must configure /etc/inetd.conf.

In Linuxconf's text-mode and graphical-mode screens, the left half of the screen presents a collapsible menu tree. The right half of the screen presents a dialog box.

When you change a configuration option using Linuxconf, the change may occur immediately, or it may remain pending until the

change is activated. Although configuration files are updated immediately, most system services will not detect changes in their configuration until the services are restarted. When you instruct Linuxconf to activate pending changes, it restarts those services whose configurations you've changed.

To activate pending changes, click Act/Changes. The Status of the System screen appears. If you want to know what changes are pending, click Preview What Has to Be Done. Linuxconf displays the pending changes. To activate pending changes, click Activate the Changes. To exit the Status of the System screen without activating any pending changes, click Quit.

You should generally activate pending changes before exiting Linuxconf. If you neglect to do so, Linuxconf will prompt you to confirm that you want to exit without activating the changes you specified.

Necessary Procedures

You can configure any install-time configuration after installation. This section gives the procedures for post-installation configuration of each install-time configuration element.

Configuring Authentication

The installation program lets you configure several authentication options. You can

- Enable or disable shadow passwords
- Set a password for the root user
- Enable or disable creation of MD5 passwords

After installation, you can easily enable or disable shadow passwords, set a new password for root, or enable or disable creation of MD5 passwords.

Shadow Passwords

You can convert to and from using shadow passwords after installation is completed. Recall that when shadow passwords are enabled, encrypted passwords are stored in a file (/etc/shadow) that is readable only by root. The /etc/shadow file contains several fields in addition to the encrypted password, including the following:

- the date that the account was disabled, given as the number of elapsed days since January 1, 1970
- the date that password was last changed, given as the number of elapsed days since January 1, 1970
- the number of days after which the password must be changed
- the number of days before the password may be changed
- the number of days before password expiration that the user is warned
- the number of days after password expiration that the account is disabled

Enabling shadow passwords improves system security. However, a handful of old Unix programs may not function correctly if shadow passwords are enabled.

To enable shadow passwords, issue the command

pwconv

To disable shadow passwords, issue the command

pwunconv

Changing the root Password

You can easily change the root password using linuxconf. To do so, select Config > Users Accounts > Normal > Change root Password. The Changing Password screen appears.

You must first enter the current root password and click Accept. If you enter the correct password, the program prompts you for the new password. Type the new password and click Accept. The program confirms your choice for the new password by asking you to enter the new password again. Do so, and click Accept to set the new password.

TIP If you prefer using the command line, you can change the root password by issuing the passwd command, which will prompt you twice for the new password.

Configuring LILO

Rather than edit the /etc/lilo.conf file, you can use Linuxconf to configure LILO. To edit LILO defaults, select Config \geq Boot Mode \geq LILO \geq Configure LILO Defaults from Linuxconf's menu tree. The LILO Defaults screen appears.

The LILO Defaults screen provides access to configuration options that correspond to LILO's global options, affecting every boot image. For example, you can use this screen to specify the location to which LILO is installed, the boot delay, and the prompt time-out. The screen does not include a control that lets you specify the default boot image. Another screen, described later in this subsection, provides access to this option.

Configuring Linux Boot Images

To add, change, or delete a Linux boot image, select Config ≽ Boot Mode ≽ LILO ≽ Configure LILO Linux Configurations from Linuxconf's menu tree. The LILO Linux Configurations screen appears.

You can add a new Linux boot image by clicking Add. To edit or delete an existing Linux boot image, select the image and press Enter. The Linux Boot Configuration screen appears. To delete the boot image, click the Del button. To edit the boot image, make the desired changes and click Accept. The screen provides access to LILO boot image options and several less commonly used options. **NOTE** You can find more information about the LILO boot image options in the online chapter at www.sybex.com.

Configuring Non-Linux Boot Images

To add, change, or delete a non-Linux partition, select Config ≥ Boot Mode ≥ LILO ≥ Configure LILO Other OSs Configurations from Linuxconf's menu tree. The LILO Other OSs Configurations Screen appears.

You can add a new non-Linux boot image by clicking Add. To edit or delete an existing non-Linux boot image, select the image and press Enter. The Other Operating System Setup screen appears. To delete the boot image, click the Del button. To edit the boot image, make the desired changes and click Accept. The Other Operating Systems Setup screen provides access to the label and other options. The text field labeled Partition to Boot corresponds to the other option.

Configuring the Default Boot Image

To specify the default boot image, select Config > Boot Mode > LILO > Change Default Boot Configuration from Linuxconf's menu tree. The Default Boot Configuration screen appears.

To specify a different default boot image, click the radio button corresponding to the desired default boot image and click Accept.

Configuring Boot Options

You can use Linuxconf to configure boot options. To do so, select Config ≥ Boot Mode ≥ Mode ≥ Default Boot Mode from Linuxconf's menu tree. The Boot Mode Configuration screen appears.

You can use this screen to enable or disable LILO's boot menu and to specify the boot delay and prompt time-out. The latter two options are also available on the LILO Defaults screen. You can also use the Boot Mode Configuration screen to specify whether the system starts in text mode (runlevel 3) or graphical mode (runlevel 5).

Configuring Networking

You can use Linuxconf to configure basic and advanced networking options. This subsection explains how to configure basic options; subsequent chapters—especially Chapter 6, "System Initialization and Configuration"—explain how to configure advanced options.

Configuring the Host Name

To configure the host name, select Config > Networking > Client Tasks > Basic Host Information from Linuxconf's menu tree. The This Host Basic Configuration screen appears.

The graphical This Host Basic Configuration screen includes several tabs that let you select from among various windows. If the Host Name screen is not visible in the graphical screen, click the Host Name tab. To specify the host name, type it into the text box and click Accept.

Configuring Network Adapters

To configure a network adapter, select Config \geq Networking \geq Client Tasks \geq Basic Host Information from Linuxconf's menu tree. The This Host Basic Configuration screen appears. The graphical screen includes several tabs that let you select from among various windows. If the Adapter 1 screen is not visible in the graphical screen, click the Adapter 1 tab so that the Adapter 1 screen appears.

If you're using the text version of Linuxconf, simply scroll to view the portion of the This Host Basic Configuration screen that pertains to Adapter 1. The Linuxconf program provides access to configuration options for as many as five network adapters.

Using the Adapter 1 screen, or one of the other adapter screens, you can enable or disable the adapter, and you can specify whether its configuration is static or obtained via DHCP or BOOTP. If the configuration is static, you can specify the fully qualified domain name (FQDN) using the text box labeled Primary Name + Domain. You can also specify the IP address, netmask, and several other options, including device options. Click Accept to save your changes.

Configuring Nameservers

To configure nameservers, select Config > Networking > Client Tasks > Name Server Specification from Linuxconf's menu tree. The Resolver Configuration screen appears.

If DNS is not required for normal operation, disable DNS Is Required for Normal Operation. Otherwise, specify the default domain and the IP address (number) of the primary nameserver associated with the system. You can specify as many as two additional nameservers and as many as six additional search domains. Click Accept to save your changes.

Configuring the Default Gateway

To configure the default gateway, select Config > Networking > Client Tasks > Routing and Gateways > Set Defaults from Linuxconf's menu tree. The Defaults screen appears.

Specify the IP address of the default gateway. If you want this system to act as a router, turn on Enable Routing. For more information on configuring routing, see Chapter 13, "Routing."

Exam Essentials

Understand and be able to implement post-installation configuration of install-time options This section gave procedures for postinstallation configuration of install-time configuration elements. Be sure you're able to configure each such element.

Sample Questions

- **1.** Which of the following is the program used to configure the keyboard?
 - A. kbdconfig
 - B. kboardconfig
 - C. keyboardconfig

D. keyconfig

Answer: A. The kbdconfig program lets you configure the keyboard after system installation is complete.

- 2. Which of the following is the command to enable shadow passwords?
 - A. pwconv
 - **B.** pwenable
 - C. pwshadow
 - **D.** pwunconv

Answer: A. The pwconv program enables shadow passwords.