Basic Installation

ITINERARY

- **Objective 1.01** Determine Customer Needs
- **Objective 1.02** Identify Required Hardware
- **Objective 1.03** Understand That Linux Is Just the Kernel
- **Objective 1.04** Determine the Appropriate Installation Method
- **Objective 1.05** Define Multimedia Options
- **Objective 1.06** Identify Machine Requirements

NEWBIE	SOME EXPERIENCE	VETERAN
4+ hours	2 hours	1 hour

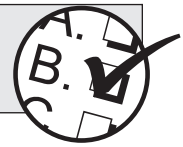
The Linux distributions listed in the CompTIA Linux+ objectives Installation domain (Domain 1.0) are all RPM-based distributions. In other words, the exam is focused more on the Red Hat Package Manager (RPM) than on the distributions associated with DEB packages, such as Debian, Linspire, and Ubuntu.

Even within these limits, the installation routines are as diverse as the number of distributions. That's why the Linux+ objectives state in Domain 1.0 that "The candidate is not expected to know how to install a specific distribution…." As you read through the chapter, focus on the information required to make decisions on what to install on a system—and where.

Remember, these objectives were released in 2005, so some of these tools may no longer be available in the latest distributions. But in my experience, CompTIA does an excellent job introducing new questions, keeping the exam as current as possible.

Exam Tip

By the end of this book, you'll recognize general prerequisites for installing Linux in regard to hardware, partitions, services, and packages.



Determine Customer Needs

Linux is freely available. Linux is reliable. Linux is customizable. Linux is supported by a world of developers. No other operating system has all of these advantages, which is why CIOs and CTOs around the world are making the move to Linux.

Linux also has a number of disadvantages, however. Some of these disadvantages are real; others are a matter of perception. As a Linux administrator, you may at some point recommend Linux to your managers and customers. When you do so, you need to be able to explain four things: the history of Linux, what applications Linux can include for clients, what you can install on Linux servers, and how to select a distribution. The following sections provide some pointers for your explanation.

The History of Linux

Linux was developed as a clone of the Unix operating system. To understand the strengths associated with Linux (and to be able to explain them to your customers), you need to understand a bit of the history of Unix.

Unix was developed in 1969 by Bell Labs, which was then the research arm of the American Telephone and Telegraph Company (AT&T). Bell Labs worked closely with a number of universities. AT&T, as a regulated monopoly, was prohibited from selling software. AT&T chose to keep the license for Unix and gain the goodwill of universities by distributing Unix for a nominal fee, without a warranty, with the source code. This release technique has evolved into what is now known as *open source*.

When the U.S. government settled its antitrust suit against AT&T in 1982, one condition allowed AT&T to get into the computer business. AT&T was soon selling Unix for profit, without the source code, with all of the standard protections associated with a copyright.

In 1985, Richard Stallman started the nonprofit Free Software Foundation (FSF) to develop an alternative operating system with all of the functionality of Unix. To get around AT&T's copyrights, the FSF needed to develop commands and programs that did not use Unix's source code. This type of development creates software known as a *clone*.

Stallman dubbed this Unix clone GNU, short for "GNU's Not Unix." By 1991, the FSF had cloned all the major components of Unix except the kernel.

Local Lingo

GNU, FSF, RPM…at this point, some of you may feel as if you have actually used a real passport, and ended up somewhere where acronyms are the official language. Actually, that isn't far off. If you are already familiar with GNU, FSF, RPM, and the many other acronyms you'll encounter in this book, that's great. If not, these technologies will be spelled out, and explained, over the course of the book. Look for this Local Lingo icon for explanations of important terms. Some of the acronyms may appear strange; GNU really does stand for "GNU's Not Unix." Recursive acronyms like GNU are sort of Linux's jab at the normal way of doing things.

In 1991, Linus Torvalds wanted a free operating system that would work with his 386 CPU-based personal computer. He developed what became known as the Linux kernel and incorporated much of the work of the FSF to create a relatively complete operating system that is now known as Linux. Because it's a combined work, the FSF believes that the Linux operating system is more properly known as GNU/Linux.

What Applications Linux Can Include for Clients

Linux is a serious option for regular PCs and workstations. It provides a variety of desktop environments such as GNOME and KDE. Most distributions are pack-

aged with a substantial number of client applications. As you review your favorite distribution, examine the package groups associated with clients. For a bit more detail, see the "Identify Machine Requirements" section later in this chapter.

Local Lingo

GNOME stands for the GNU Network Object Model Environment, but it's really just one of the major Linux GUI desktops. The other most prominent Linux GUI desktop is known as KDE, short for the KDE Desktop Environment (or K Desktop Environment).

Linux developers have gone to great lengths to make applications compatible with their Microsoft counterparts, and for the most part have succeeded. For example, while the editors of this book are using Microsoft Word, I'm writing it using OpenOffice.org Writer and saving files in Microsoft Word format.

What Server Services Can Be Installed

To understand much of what Linux can do on the server requires another history lesson. In the 1970s, the U.S. Department of Defense (DoD) developed a communications network that could survive a nuclear war. This required a network with multiple routes and a set of network protocols that can automatically bypass broken or congested routes. This redundant network evolved into the Internet.

Much of this work was done at the same universities where Unix was popular. The network protocols they developed with the DoD became known as the TCP/IP protocol suite. TCP/IP was developed on Unix, so Linux, as a Unix clone, carries its advantages as an operating system for the Internet.

To support Internet communication, Linux servers can include a wide variety of services, as detailed in the "Identify Machine Requirements" section later in this chapter.

Selecting a Distribution

As noted in Domain 1.0 of the Linux+ objectives, "The scope of the exam is limited to software and settings common to Linux software from Red Hat, SUSE, Mandrake, and Turbolinux." This list is slightly out of date, as MandrakeSoft of France, the company behind Mandrake Linux, merged its distribution with Conectiva of Brazil in 2005 and changed its corporate name to Mandriva to reflect the merged distribution, now known as Mandriva Linux. Furthermore, SUSE has been acquired by Novell, which now offers a supported SUSE Linux Enterprise

distribution as well as a community openSUSE distribution. Red Hat now releases two major distributions; Fedora Linux is the test bed for Red Hat Enterprise Linux (RHEL). There are probably a few hundred other Linux distributions available, including the popular distributions Ubuntu and Debian Linux.

Travel Advisory

When I cite the "selected Linux distributions" throughout the book, I'm referring to the distributions specified in the Linux+ objectives, Red Hat, SUSE, Mandriva (successor to Mandrake), and Turbolinux.

Providing the details of each distribution is beyond the scope of the Linux+ objectives. Fortunately, you only need to know one of these distributions to prepare for the Linux+ exam. In general, when selecting a distribution, consider the following factors:

- **Software** While every Linux distribution includes the kernel and basic packages, not all distributions include applications such as the Apache Web server or the OpenOffice.org suite.
- **Support** Some Linux distributions, such as Red Hat Enterprise and SUSE Linux Enterprise, offer some level of corporate support with a subscription; others, such as Fedora and openSUSE, are supported by a community of users and developers.

Of course, as discussed throughout the book, you need to consider a substantial number of other factors, including hardware, package management, documentation, suitability as a client or server, and more.

Identify Required Hardware

Three elements are associated with this objective. They include identifying whether the basic hardware is compatible with your selected Linux distribution, whether you have enough space, and whether the overall system is scalable.

As the amount of RAM and hard drive space varies by distribution and release, there's no need to memorize minimum requirements. As quoted in the previous section, per Domain 1.0 of the Linux+ objectives, the scope of the exam is limited to software and settings common to the selected distributions.

Basic Hardware

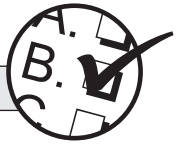
The vast majority of PC hardware is compatible with Linux. A few problem areas remain. Not all manufacturers include Linux drivers when releasing new hardware. Fortunately, Linux developers are often able to create drivers for such hardware just a few weeks after release.

If you have any doubts about your own hardware, review applicable Hardware Compatibility Lists (HCLs). They should be available on the websites associated with your preferred distribution. There's also the general Linux HCL, available online at http://tldp.org/HOWTO/Hardware-HOWTO/.

As suggested in the objectives, the basic system hardware is the CPU, RAM, and hard drive. Linux distributions are built for different types of CPUs; for example, I downloaded different CPU-specific repositories for installing Fedora 7 on my 64-bit desktop and 32-bit laptop systems. Every distribution requires some minimum amount of RAM, and it varies based on distribution, release date, and other requirements. For example, less RAM is required for a dedicated server that does not require graphics support.

Exam Tip

Know where to find appropriate Hardware Compatibility Lists.



Required Space

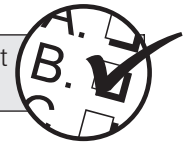
If someone asks how much space is required for a Linux system, there's no single answer. It varies widely. There are even Linux distributions that can be loaded from 1.44MB floppy disks.

Based on the selected distributions, several hundred megabytes of hard drive space are required. Depending on what's installed, several gigabytes of space can be used.

But that's just the space required for the operating system and applications. It does not include the space required by logs, shared files, and users in their home directories. It does not include the space required for applications that may be installed at a later date. It does not include the space required for temporary files, such as those required to start an X Window. And it does not include required swap space, which is normally configured in Linux as a dedicated partition. The most common standard for a swap partition is twice the amount of RAM. For example, if there's 1GB of RAM on a local system, the standard is to configure a swap partition with 2GB of space.

Exam Tip

It's most common to configure swap partitions with twice the amount of installed RAM.



Travel Advisory

There is no hard and fast rule for the size of a swap partition. Systems with more RAM can often work with a swap partition of a size equal to the amount of RAM. For example, my laptop with 2GB of RAM is configured with a 2GB swap partition.

Scalability

Scalability is the ability of a system to handle greater amounts of work. In part, scalability is based on the capacity of the hardware, namely the hard drives. With logical volume management (LVM), it is now easier to add needed hard drive space to partitions and more.

Objective 1.03 Understand That Linux Is Just the Kernel

Stallman's FSF developed most of what we know as the Linux operating system. Torvalds developed the kernel. So strictly speaking, Linux is just the kernel. But what is a kernel?

A *kernel* is the part of an operating system that translates commands from programs or utilities to hardware instructions. The Linux kernel communicates with hardware through dedicated device drivers. For example, when a computer communicates with a CD/DVD drive, a specific kernel driver transmits messages to and from that drive.

Numbering Schemes

The Linux kernel on your system is based on a label such as 2.6.22.1. This is a version number in a specific three- or four-digit format, A.B.C.D:

- The first number (A) is the kernel version, and was last changed in 1996.
- The second number (B) specifies the major revision of the kernel. Until kernel version 2.6, second numbers that were even were associated with stable kernel releases, and odd numbers, through 2.5, were developmental releases. This is changing. Kernel version 2.7 will also be a stable release.

- The third number (C) is associated with minor revisions. Until kernel version 2.6.11, it was changed for new features, drivers, bug fixes, and security patches. Starting with 2.6.11.1, changes to the third number are made only for new features and drivers.
- The fourth number (D) is changed with bug fixes and security patches.

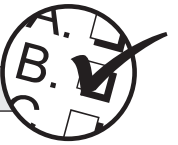
Some distributions may not follow this policy with respect to the third and fourth numbers. For example, the current kernel version on my RHEL 5 system is 2.6.18-8.el5, where -8 refers to the eighth Red Hat build of kernel version 2.6.18.

Local Lingo

A driver is a part of the kernel that allows Linux to communicate with hardware and more. Some drivers are integrated directly into the kernel; others are loaded as modules after the main kernel is loaded.

Exam Tip

Learn the numbering system associated with the Linux kernel.



Upgrades

Sometimes, you just need to upgrade (or update) or recompile a kernel. You do not need to know the actual process for the exam. You may want to upgrade a kernel for any of the following reasons:

- A new driver, such as for new hardware or an additional file system.
- A "bug fix" for a flaw in the kernel.
- A security issue; distributions often provide updated kernels that address security issues.

For a bit more information on recompiling a kernel, see Chapter 6. For detailed information on rebuilding a kernel, see Chapter 8 of this author's *RHCE Red Hat Certified Engineer Linux Study Guide*, Fifth Edition (McGraw-Hill, 2007).

Custom Kernels

Custom kernels come in two forms: a recompiled kernel and settings in the /proc directory. You do not need to know how to recompile a kernel for the exam; kernel settings are available and listed in the config-*versionnum* file in the /boot directory, where *versionnum* is the version number of the kernel, similar to what's shown in Figure 1.1.

```
[michael@enterprise5fc6d ~]$ \ls /boot
config-2.6.20-2925.9.fc7xen      System.map-2.6.20-2925.9.fc7xen
config-2.6.21-1.3194.fc7         System.map-2.6.21-1.3194.fc7
grub                             vmlinuz-2.6.20-2925.9.fc7xen
initrd-2.6.20-2925.9.fc7xen.img  vmlinuz-2.6.21-1.3194.fc7
initrd-2.6.21-1.3194.fc7.img     xen.gz-2.6.20-2925.9.fc7
lost+found                       xen-syms-2.6.20-2925.9.fc7
[michael@enterprise5fc6d ~]$
```

FIGURE 1.1 Kernel-related files in /boot

Kernel settings can be modified in the /proc directory, using the /etc/sysctl.conf configuration file. For an example of how this works, see the discussion on IP forwarding in Chapter 6.

Objective 1.04 Determine the Appropriate Installation Method

Home users often install Linux from a local source, namely from a CD or DVD, inserted in a local drive. Business users often have to install Linux on numerous computers, and administrators frequently find it more convenient to install Linux from a network source, which eliminates the need to go from system to system with one or more CDs or DVDs. But all installations require some sort of boot method.

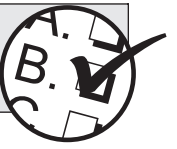
Boot Method

The methods available to boot into a Linux installation program are as diverse as those for booting a computer. If your system can boot from a CD, the major Linux distributions support booting their installation programs from such media. Some distributions also support booting from a 1.44MB floppy disc, a USB key, or even the Preboot eXecution Environment (PXE) associated with a network boot card. To review the boot methods available on your system, navigate to the BIOS or boot menu, available on most systems just after the Power-On Self-Test (POST). One example is shown in Figure 1.2.

FIGURE 1.2 Example of a boot menu

Exam Tip

Remember, the Linux+ exam objectives were developed in 2004; one common method for creating boot disks uses the DOS-based **rawwrite.exe** utility.



Once a system is booted, it can point to local or network sources for installation. The four distributions associated with the Linux+ exam can all be installed in an automated fashion using appropriate scripts. To create those scripts, SUSE uses the AutoYaST system. In contrast, Red Hat, Mandriva, and Turbolinux all use Kickstart to create automated installation scripts. Kickstart and AutoYaST installations can both specify local and network sources.

Local Source

When installing locally, there are two basic options: CD/DVD media, or installation files on a local hard drive partition. Installation from CD/DVD media is pretty basic; in most cases, you can boot directly from CD/DVD installation media downloaded for the preferred distribution, and the installation program starts automatically. Installation from a local hard drive partition requires copying the installation files (or the associated ISO files) to a partition, as well as an installation program that allows you to specify the right partition.

The Mandriva installation program allows you to copy from the CD/DVD to the local hard drive during the installation process. Red Hat supports installation from the ISO files, which represent downloaded CD/DVDs.

Local Lingo

ISO file When downloading the data for a Linux installation CD/DVD, it's most commonly done through an ISO file, with an .iso extension. (What ISO stands for is not relevant.) ISO files are a standard format for CD/DVDs that can be used to "burn" CD/DVD media using common Linux and Microsoft tools.

Network Source

When administering a network, having a central repository for the installation files can be valuable. When installing Linux on a new system, all you need is an appropriate boot disk or installation CD/DVD, which can then connect to that repository to install Linux on that system. You can use the same repository to install Linux on as many systems as you need, without having to change CDs.

There are four network installation services listed in the Linux+ objectives: HTTP, FTP, NFS, and SMB. Installations from SMB shares, also known as Samba, are obsolete in current versions of the selected Linux distributions. The other three network servers are briefly described in Table 1.1.

Network installation servers, by their nature, are configured on different computers (local or remote). If you have only one system, you could create a network installation server on the local system, and install the Linux distribution of your choice on a virtual machine such as VMware Server, Xen, or Kernel-based Virtual Machine (KVM).

To create a network installation server, copy the installation files from the CD/DVDs or Internet repository to a dedicated directory. Share the directory using the appropriate network server protocol. Make sure the applicable TCP/IP port is not blocked by a firewall, or by another layer of security such as Red Hat's Security-Enhanced Linux (SELinux) or SUSE's AppArmor.

TABLE 1.1 Servers That Can Be Used for Network Installations

Network Server	Description
NFS (Network File System)	The standard file sharing system for Linux and Unix operating systems
FTP (File Transfer Protocol)	An older fast file sharing system
HTTP (Hypertext Transfer Protocol)	The same file sharing system used for the World Wide Web

You can then install the selected Linux distribution over a network, using the IP address and shared directory of the network server.

Define Multimedia Options

There are multimedia options associated with installation, as listed in the Linux+ objectives: video, sound, and codecs. Naturally, some multimedia requires installation of some software from all three categories. For example, the MPEG (Motion Picture Experts Group) standards provide audio and video compression for network multimedia communication.

These options require Linux to detect available video and sound hardware. When installing Linux, the selected distributions allow installation of video and audio applications that incorporate appropriate codecs. There are many books (including other Linux+ exam prep books) that include an extended discussion of video and audio hardware. I believe that is beyond the scope of the Linux+ objectives.

Travel Advisory

DreamWorks and Disney have demonstrated their confidence in Linux multimedia—both create special effects for their movies on Linux workstations.

Video

Linux does an excellent job with most video cards. It supports installation on most video cards at least in text mode. But support is less than perfect. For example, I was not able to install RHEL 5 on my widescreen laptop system in graphical mode. I had to configure the video card from a remote system before the GUI would work.

While most Linux distributions have converted from the XFree86 video server to that released by X.Org, the principles remain the same. Configuration files are still stored in the /etc/X11 directory. The major configuration directives are the same. And it's still possible to create a configuration file from the command line. When the XFree86 server is installed, the following command creates an X Window configuration file from installed hardware:

```
# XFree86 -configure
```

If the X.Org server is installed, the command is similar:

```
# Xorg -configure
```

For more information on configuring the X Window Server, see Chapter 6.

The resolution available on a video card depends on the available RAM. Remember, RAM is specified in bytes. There are 8 bits in a byte. So let's calculate how much RAM is needed to support 24-bit color for a 1280×800 system:

1. Calculate the number of pixels on the screen: 1280×800 = 1,024,000.
2. For 24 bits of color in each pixel, multiply the result by 24: 1,024,000×24 = 24,576,000 bits.
3. To convert this number to bytes, divide by 8: 24,576,000 ÷ 8 = 3,072,000 bytes. This requires a video card with 4MB of RAM, a trivial amount by current standards.

Any leftover video memory may be used to store information on different GUI desktops. Try this out with the maximum resolution available for your monitor.

Sound

When the Linux+ objectives were released, sound cards often had to be selected manually, using configuration tools such as **sndconfig** or YaST. The latest Linux distributions configure sound cards automatically, and you only need to tune them, using tools such as **alsactl** and **alsamixer**. The **alsamixer** tool, shown in Figure 1.3, can be run from the command line.

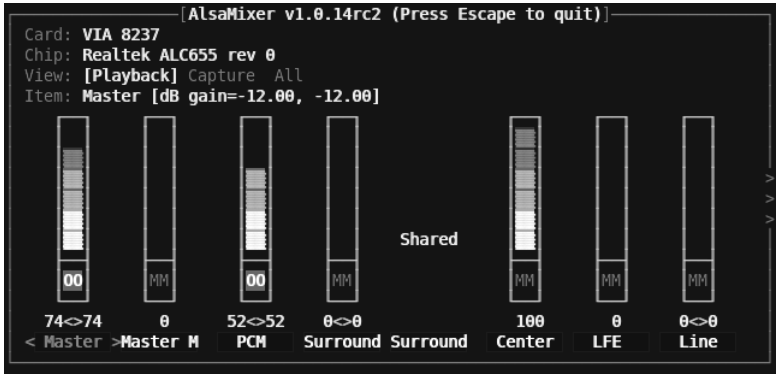


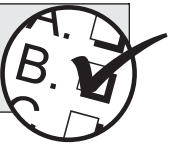
FIGURE 1.3 The **alsamixer** tool

Codecs

Codecs (short for coder/decoder) translate multimedia into (usually) compressed audio and video signals. They are associated with many formats, including the open source Vorbis, various MPEGs, RealAudio/RealVideo, and more. Codecs are incorporated into various sound and video applications. While I could cite the formats associated with typical Linux multimedia applications such as MPlayer, Kaffeine, and Totem, most Linux multimedia players can handle most popular nonproprietary formats.

Exam Tip

One popular MPEG option is MPEG-2, which is a standard for the coding of moving pictures and associated audio information. In other words, it requires video and sound hardware.



Objective 1.06

Identify Machine Requirements

The Linux+ objectives suggest that you need to identify the purpose of a Linux system "based on predetermined customer requirements." Dedicated systems are sometimes known as appliances. Linux systems, of course, can be configured as functional servers or desktop/workstations. If a customer gives you a list of requirements, you need to know what you're going to install—before you start the installation process.

Travel Advisory

Capitalization matters in Linux. Commands are case sensitive; for example, while **mount** can connect to network directories, there is no Mount command in Linux. Package names are often in lowercase; the Red Hat DHCP server package is dhcp. The open source sendmail server is different from the commercial Sendmail server.

Packages and Package Groups

While Linux+ Certification candidates are expected to have a minimum of six months of experience, the exam does not require a thorough understanding of server configuration. However, you need to know the names of more important

services, and what they can do. I've listed the packages associated with major Linux network services in Table 1.2. In some cases, package names vary, and may not be included in the table. More information on these packages is available primarily in Chapters 5 and 7.

TABLE 1.2 Services, Packages, and Functionality

Service	Package	Functionality
CUPS	cups	Print server; successor to LPD.
DNS	bind	Name server.
DHCP	dhcp, dhcp-server	Dynamic Host Configuration Protocol server.
FTP	vsftpd, proftpd	FTP *File* server (there are commonalities between the vsFTP and ProFTP servers).
HTTP	httpd, apache, apache2	The Apache Web server is the most popular Web server on the Internet.
IMAP/POP	dovecot, imap	Incoming e-mail server; the dovecot package is new (the imap package was in common use when the Linux+ objectives were released).
LPD	lpd, lprng	The Line Printer Daemon was still in common use when the current Linux+ objectives were released.
NFS	nfs-utils, many others	NFS *File* server; many NFS files come from standard Linux packages.
NTP	ntp, xntp	Network Time Protocol server.
Proxy	squid	The Squid Web Proxy caches web content and logs where users navigate online.
SMB/CIFS	samba	The Samba server shares configured directories on Microsoft SMB and successor CIFS networks; a File server.
SMTP	postfix, sendmail	The Postfix and sendmail servers process outgoing e-mail.
SQL	mysql, postgresql	The MySQL and PostgreSQL servers can help manage databases using their own structured query languages.
SSH	openssh, openssh-server	The Secure Shell (SSH) encrypts network connections at the command line.
Telnet	telnet-server	Telnet is an older but still popular and insecure method for remote connections to the command line.

Exam Tip

If you've been using Linux for 6 to 12 months (as suggested by the Linux+ objectives), you should have no problem recognizing the more popular applications included with most Linux distributions. For example, you need to know that MySQL and PostgreSQL packages are associated with a database server; Samba and NFS are associated with a File server; and so on.

Appliance

There are two categories of computer appliances. The standard computer appliance, such as a cell phone, router, or GPS, isn't even a PC. When Linux is configured as a single-function system, such as a DNS server on a PC, it's known as a software appliance. Software appliances have the following characteristics:

- Other network services are not installed (except possibly the Secure Shell to allow remote administration).
- A firewall or other security tools prevent access to all ports other than that required for the dedicated appliance (or administration).

With the popularity of virtual machine systems such as VMware, Xen, and KVM (available on systems with Linux kernel 2.6.19 and above), more Linux systems are being configured as appliances.

Any system configured with just one of the services described in Table 1.2 can be defined as an appliance.

Functional Server

Some Linux systems with more than one service have a single function. For example, a system configured with Samba, NFS, and FTP is a File server. A system configured with CUPS and LPD is a print server. Table 1.3 correlates the functionality of a server with appropriate packages.

TABLE 1.3 Server Functionality and Services

Server Functionality	Packages
Print server	cups, lpd, lprng
DNS name server	bind
File server	nfs-utils, samba, vsftpd, proftpd
Database server	mysql, postgresql
Mail server	sendmail, postfix, dovecot, imap

TABLE 1.4 Desktop Functionality and Applications

Desktop Functionality	Typical Applications
Office suites	OpenOffice.org, KOffice, GNOME Office
Graphics	The GIMP, digiKam, ImageMagick, SANE
Graphical Internet	Firefox, Evolution, Thunderbird
Multimedia	Kaffeine, Totem, MPlayer, RealPlayer

Most Linux systems have multiple functions. The default RHEL 5 installation includes NFS and CUPS for file and print sharing. My multifunctional Fedora 7 system is also configured as an e-mail, NTP, Samba, and DNS server.

Desktop

Linux developers have worked hard to create fully functional desktop environments. Although not all popular applications work on Linux, I believe that the Linux desktop is more fully functional than any Microsoft operating system. Desktop applications are available in a number of categories, including those described in Table 1.4. This table includes only some of the more popular packages; many more packages are available.

This just scratches the surface of available applications, as there is a variety of educational, gaming, authoring, finance, and other applications available for the Linux desktop.

✔ **Objective 1.01: Determine Customer Needs** Even a junior Linux administrator needs to know something about selling Linux. Client applications are diverse, and are usually compatible with files created by Microsoft applications. Linux services work well on networks such as the Internet. The distribution that you should select depends on the software and support needs of your customer.

✔ **Objective 1.02: Identify Required Hardware** All but the latest hardware works with Linux, and is often documented in HCLs. The installation space required can vary from several hundred megabytes to several gigabytes—and that doesn't include space required for logs and home directories.

✔ **Objective 1.03: Understand That Linux Is Just the Kernel** Linux kernels used a three-number format when the current Linux+ objectives were released. They now have a four-number format, with variations by distribution.

✔**Objective 1.04: Determine the Appropriate Installation Method** While many home users install Linux from a local CD/DVD, network administrators need a central repository from which to install Linux on multiple systems. Some distributions use the **rawwrite** utility to create a boot disk in DOS.

✔**Objective 1.05: Define Multimedia Options** Linux works well with most video cards, and may even be configured from the command line. Sound configuration tools such as **sndconfig** or YaST used to be required. Codecs are available as part of many Linux multimedia applications.

✔**Objective 1.06: Identify Machine Requirements** Before installing Linux, know your needs. Linux configured with a single service is an appliance. Linux can also be configured with multiple functions such as file, print, and database services. With packages such as the OpenOffice.org suite, Linux also makes an excellent desktop.

REVIEW QUESTIONS

Before leaving for the next chapter, take a few minutes to go through these questions. While doing so, take in both the content and the question format. Understanding what to expect on the exam can increase your chances for success.

1. If the MySQL and Secure Shell software is installed on a local system, what kind of server is it?
   - **A.** File server
   - **B.** Database server
   - **C.** Print server
   - **D.** Secure Shell server
2. Which of the following service packages would you install on a File server?
   - **A.** httpd
   - **B.** ssh
   - **C.** filed
   - **D.** samba
3. If you need more information on hardware compatibility with your selected Linux distribution, which of the following sources would *not* help?
   - **A.** The Hardware Compatibility List at http://tldp.org
   - **B.** The Linux.org website
   - **C.** The website associated with the selected Linux distribution
   - **D.** Information from hardware manufacturers' websites

4. If you're installing a Linux desktop and don't want it used as a server (possibly except for sharing files and directories), which of the following packages or applications are not appropriate?
   - **A.** cups
   - **B.** openoffice.org
   - **C.** Multimedia applications
   - **D.** FTP clients
5. Which of the following do you *not* need to know prior to installation?
   - **A.** Packages to install
   - **B.** Hardware information
   - **C.** Usernames in remote databases
   - **D.** Partition configuration
6. You're working with a system with Linux kernel version number 2.7.1.2. Which of the following statements is true about the kernel?
   - **A.** It's a production kernel.
   - **B.** It's a developmental kernel.
   - **C.** It's only supposed to have three numbers.
   - **D.** It wasn't installed on Red Hat Enterprise Linux.
7. To install Linux over a network connection, which of the following network services won't work to host the installation files?
   - **A.** HTTP
   - **B.** FTP
   - **C.** Telnet
   - **D.** NFS
8. Which of the following hardware components do you *not* need to know before acquiring Linux distribution files?
   - **A.** Hard disk capacity
   - **B.** Mouse hardware
   - **C.** CPU
   - **D.** RAM
9. If your customer tells you that she wants a secure DNS server, which of the following best describes the type of Linux machine you should create?
   - **A.** Web server
   - **B.** File server
   - **C.** Appliance
   - **D.** Database

10. Which of the following commands can be used to create a boot disk in DOS to install some distributions?
    - **A.** **rawwrite.exe**
    - **B.** **boot.iso**
    - **C.** **diskboot.img**
    - **D.** **dd**

REVIEW ANSWERS

1. **B** MySQL is a database service. Secure Shell is just one method to connect to a server.
2. **D** Samba is the only file sharing service on the list. The httpd package is associated with the Apache Web server. The ssh package is associated with the Secure Shell. There is no filed package, at least in the distributions associated with the Linux+ exam.
3. **B** While the Linux.org website does have some valuable information on hardware, it is not one of the standard sources for hardware compatibility information.
4. **A** The cups package is associated with the CUPS print server.
5. **C** Even if you're configuring a database server for usernames, you don't need to know those usernames, certainly not prior to installation.
6. **A** Prior to kernel version 2.6, Linux kernels with an odd second number were developmental kernels. Starting with version 2.7, that's no longer true. Standard kernels only had three numbers through version 2.6.11.
7. **C** It's possible to create a Linux installation server on an HTTP, FTP, or NFS server. No current Linux installation server can be created on a Telnet server.
8. **B** While a mouse can be a terrific convenience, it's not required for Linux, especially if you're not installing a GUI.
9. **C** A single-function Linux system defines a computer appliance. While a DNS server does define a database, it's not a standard database service, such as that associated with MySQL or PostgreSQL.
10. **A** The **rawwrite.exe** command can be used from the DOS command line to create boot disks. While installation boot disks can be created from boot.iso and diskboot.img files, they are not commands, and while the **dd** command can be used to create boot disks, it's not a DOS command.