

# System Software



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## Competencies

### After you have read this chapter, you should be able to:

- 1 Describe the differences between system software and application software.
- 2 Discuss the four types of system software programs.
- 3 Discuss the basic functions, features, and categories of operating systems.
- 4 Discuss mobile operating systems, including BlackBerry OS, iOS, Android, Windows Phone, and WebOS.
- 5 Describe desktop operating systems, including Windows, Mac OS, UNIX, Linux, and virtualization.
- 6 Describe the purpose of utilities and utility suites.
- 7 Identify the four most essential utilities.
- 8 Discuss Windows utility programs.
- 9 Describe device drivers, including Windows' Add a Device Wizard and Update.

## Why should I read this chapter?

Many years ago, microcomputers were very limited in what they could do. A major limitation was their operating systems, which often required computer specialists to keep them running. That was then and this is now. Now, the possibilities seem limitless with the powerful operating systems of today. These programs make it easy and safe for any of us to use computers, the Internet, and the web.

This chapter discusses a variety of operating systems for

desktop computers including Windows 7 and 8 and Mac OS X. Additionally, you'll learn about mobile operating systems including Apple's iOS, Android, and Windows Phone. You also will learn about how to use programs that recognize and correct computer problems and use programs that guard your computer against viruses. To be competent and to be competitive in today's professional workplace, you need to know and to understand these things.



## chapter 4





## Introduction



Hi, I'm Ann, and I'm a computer support specialist. I'd like to talk with you about system software, programs that do a lot of the work behind the scenes so that you can run applications and surf the web. I'd also like to talk about the mobile operating systems that control smartphones and other small portable computers.

When most people think about computers, they think about surfing the web, creating reports, analyzing data, storing information, making presentations, and any number of other valuable applications. We typically think about applications and application software. Computers and computer applications have become a part of the fabric of our everyday lives. Most of us agree that they are great . . . as long as they are working.

We usually do not think about the more mundane and behind-the-scenes computer activities: loading and running programs, coordinating networks that share resources, organizing files, protecting our computers from viruses, performing periodic maintenance to avoid problems, and controlling hardware devices so that they can communicate with one another. Typically, these activities go on behind the scenes without our help.

That is the way it should be, and the way it is, as long as everything is working perfectly. But what if new application programs are not compatible and will not run on our current computer system? What if we get a computer virus? What if our hard disk fails? What if we buy a new digital video camera and can't store and edit the images on our computer system? What if our computer starts to run slower and slower?

These issues may seem mundane, but they are critical. This chapter covers the vital activities that go on behind the scenes. A little knowledge about these activities can go a long way to making your computing life easier. To effectively use computers, competent end users need to understand the functionality of system software, including operating systems, utility programs, and device drivers.

## System Software

End users use application software to accomplish specific tasks. For example, we use word processing programs to create letters, documents, and reports. However, end users also use system software. **System software** works with end users, application software, and computer hardware to handle the majority of technical details. For example, system software controls where a word processing program is stored in memory, how commands are converted so that the system unit can process them, and where a completed document or file is saved. See Figure 4-1.

System software is not a single program. Rather it is a collection or a system of programs that handle hundreds of technical details with little or no user intervention. System software consists of four types of programs:

- **Operating systems** coordinate computer resources, provide an interface between users and the computer, and run applications.
- **Utilities** perform specific tasks related to managing computer resources.
- **Device drivers** are specialized programs that allow particular input or output devices to communicate with the rest of the computer system.
- **Language translators** convert the programming instructions written by programmers into a language that computers understand and process.

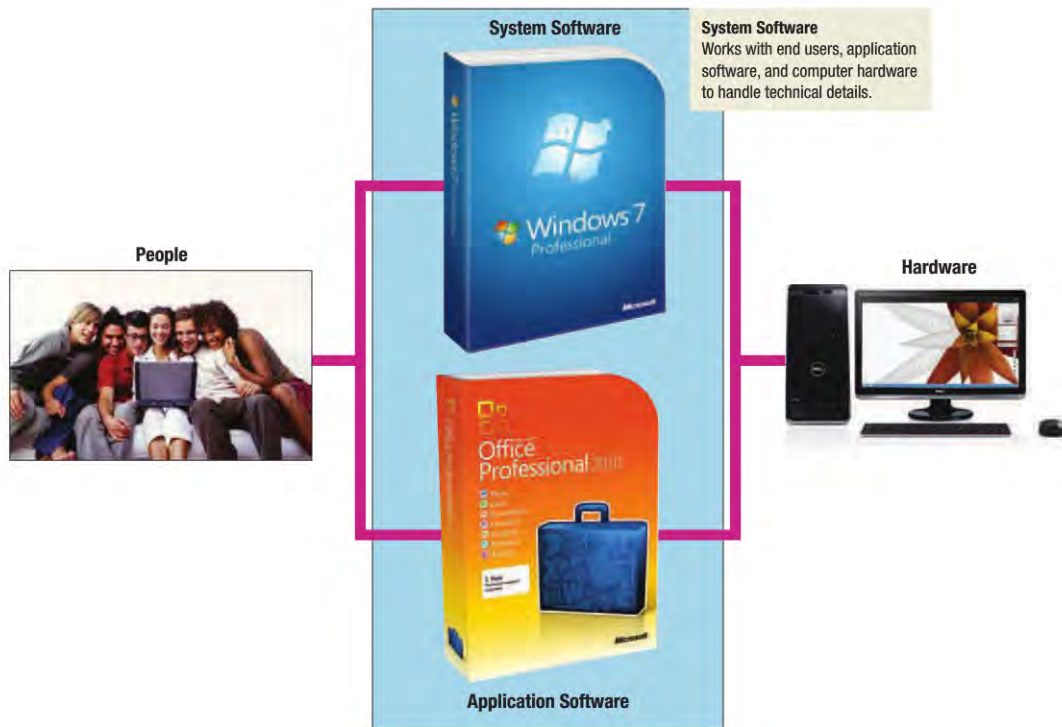


Figure 4-1 System software handles technical details

## Operating Systems

An **operating system** is a collection of programs that handle many of the technical details related to using a computer. In many ways, an operating system is the most important type of computer program. Without a functioning operating system, your computer would be useless.

### Functions

Every computer has an operating system and every operating system performs a variety of functions. These functions can be classified into three groups:

- **Managing resources:** Operating systems coordinate all the computer's resources including memory, processing, storage, and devices such as printers and monitors. They also monitor system performance, schedule tasks, provide security, and start up the computer.
- **Providing user interface:** Operating systems allow users to interact with application programs and computer hardware through a **user interface**. Many older operating systems used a character-based interface in which users communicated with the operating system through written commands such as "Copy A: assign.doc C:". Almost all newer operating systems use a **graphical user interface (GUI)**. As we discussed in Chapter 3, a graphical user interface uses graphical elements such as icons and windows.



## environment

Did you know that some operating systems help protect the environment? Recent versions of Microsoft's Windows operating system have various power management features that reduce energy consumption. For example, Windows will dim your screen and put your computer in sleep mode after a certain amount of time. The Energy Star program from the Environmental Protection Agency estimates that these features can save you up to \$50 in electricity costs per year, which in turn helps reduce carbon emissions that affect the environment. To see more environmental facts, visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword [environment](#).

- **Running applications:** Operating systems load and run applications such as word processors and spreadsheets. Most operating systems support **multitasking**, or the ability to switch between different applications stored in memory. With multitasking, you could have Word and Excel running at the same time and switch easily between the two applications. The program that you are currently working on is described as running in the **foreground**. The other program or programs are running in the **background**.

### Features

Starting or restarting a computer is called **booting** the system. There are two ways to boot a computer: a warm boot and a cold boot. A **warm boot** occurs when the computer is already on and you restart it without turning off the power. A warm boot can be accomplished in several ways. For many computer systems, they can be restarted by simply pressing a sequence of keys. Starting a computer that has been turned off is called a **cold boot**. To learn more about booting your computer system and POST (power on self-test), visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword [boot](#).

You typically interact with the operating system through the graphical user interface. Most provide a place, called the **desktop**, that provides access to computer resources. (See Figure 4-2.) Operating systems have several features in common with application programs, including

- **Icons**—graphic representations for a program, type of file, or function.
- **Pointer**—controlled by a mouse, trackpad, or touch screen, the pointer changes shape depending on its current function. For example, when shaped like an arrow, the pointer can be used to select items such as an icon.

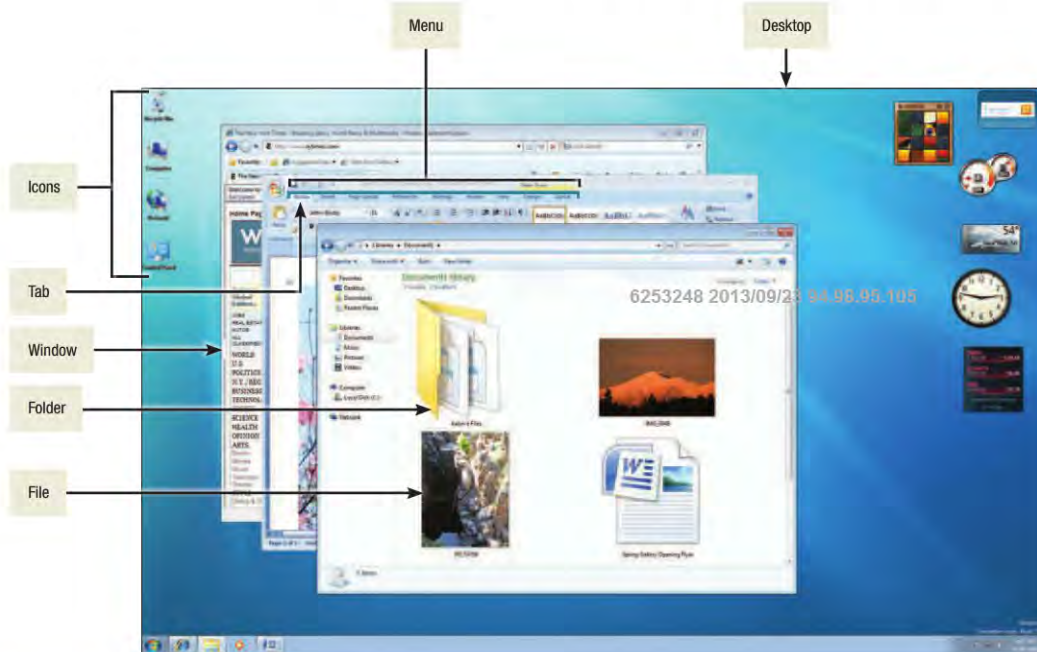


Figure 4-2 Desktop

- **Windows**—rectangular areas for displaying information and running programs.
- **Menus**—provide a list of options or commands.
- **Tabs**—divide menus into major activity areas.
- **Dialog boxes**—provide information or request input.
- **Help**—provides online assistance for operating system functions and procedures.
- **Gesture control**—ability to control operations with finger movements, such as swiping, sliding, and pinching.

Most operating systems store data and programs in a system of files and folders. **Files** are used to store data and programs. Related files are stored within a **folder**, and, for organizational purposes, a folder can contain other folders. For example, you might organize your electronic files in the *Documents* folder on your hard disk. This folder could contain other folders, each named to indicate its contents. One might be “Computer Class” and could contain all the files you have created (or will create) for this course.

### Categories

While there are hundreds of different operating systems, there are only three basic categories: embedded, network, or stand-alone.

- **Embedded operating systems** are used for handheld devices such as smartphones, cable and satellite television tuner boxes, video game systems, and other small electronics. (See Figure 4-3.) The entire operating system is stored within or embedded in the device.
- **Network operating systems (NOS)** are used to control and coordinate computers that are networked or linked together. Many networks are small and connect only a limited number of microcomputers. Other networks, like those at colleges and universities, are very large and complex. These networks may include other smaller networks and typically connect a variety of different types of computers.

Network operating systems are typically located on one of the connected computers’ hard disks. Called the **network server**, this computer coordinates all communication between the other computers. Popular network operating systems include Linux, Windows Server, and UNIX.

- **Stand-alone operating systems**, also called **desktop operating systems**, control a single desktop or notebook computer. (See Figure 4-4.) These operating systems are located on the computer’s hard disk. Often desktop computers and notebooks are part of a network. In these cases, the desktop operating system works with the network’s NOS to share and coordinate resources. In these situations, the desktop operating system is referred to as the *client operating system*.

The operating system is often referred to as the **software environment** or **software platform**. Almost all application programs are designed to run with a specific platform. For example, Apple’s iMovie software is



**Figure 4-3** Handheld devices have embedded operating systems



**Figure 4-4** Stand-alone operating system



designed to run with the Mac OS environment. Many applications, however, have different versions, each designed to operate with a particular platform. For example, one version of Microsoft Office is designed to operate with Windows. Another version is designed to operate with Mac OS.



### concept check



- What is system software? What are the four kinds of system software programs?
- What is an operating system? Discuss operating system functions and features.
- Describe each of the three categories of operating systems.

## Mobile Operating Systems

**Mobile operating systems**, also known as **mobile OS**, are a type of embedded operating system. Just like other computer systems, mobile computers including smartphones and tablets require an operating system. These mobile operating systems are less complicated and more specialized for wireless communication.

While there are numerous mobile operating systems, some of the best known are Android, BlackBerry OS, iOS, WebOS, and Windows Phone.



Figure 4-5 Apple iPhone

- **Android** was introduced in 2007. It was originally developed by Android Inc. and later purchased by Google. Android is widely used in many of today's smartphones.
- **BlackBerry OS**, also known as **RIM OS**, was first introduced in 1999 by a small Canadian firm called Research In Motion. Originally designed as the platform for the BlackBerry handheld computer, it has evolved into a powerful mobile operating system.
- **iOS**, formerly known as **iPhone OS**, was originally developed in 2007 by Apple. It is based on Mac OS and is used as the platform for Apple's iPhone, iPod Touch, and iPad. See Figure 4-5.
- **WebOS** was originally developed in 2009 by Palm, Inc. and later purchased by the Hewlett-Packard Company. Originally developed for Palm's handheld computers, it has evolved to support Hewlett-Packard's smartphones and tablet computers.
- **Windows Phone 8** was introduced in 2012 by Microsoft to support a variety of mobile devices, including smartphones. It has the ability to run many powerful programs designed for desktop and laptop computers.

In the last chapter, we discussed that not all mobile applications will run on all smartphones. That is because an app is designed to run on a particular software platform or operating system. Before downloading an app, be sure that it is designed to run with the mobile operating system on your mobile device.



## concept check



- What is a mobile operating system?
- List the five most widely used mobile operating systems.
- Which mobile operating system works with the iPhone? Which mobile operating system was developed by Microsoft?

## Desktop Operating Systems

Every microcomputer has an operating system controlling its operations. The most widely used desktop operating systems are Windows, Mac OS, Unix, and Linux.

### Windows

Microsoft's **Windows** is the most widely used microcomputer operating system. Because its market share is so large, more application programs are developed to run under Windows than any other operating system. Windows comes in a variety of different versions and is designed to run with a variety of different microprocessors.

There are many versions of Windows. The two recent versions are Windows 7 and Windows 8.

- **Windows 7** was released in 2009 and has a traditional user interface similar to previous versions of Windows. (See Figure 4-6.) It provided enhanced features, including improved handwriting recognition and advanced searching capabilities for finding files and other content on a computer.
- **Windows 8** was released in 2012 and was created to better integrate Microsoft's desktop operating systems with its mobile operating systems. (See Figure 4-7.) It provided support for gestures, cloud integration, and apps. Windows 8 also introduced a new interface. This interface is very similar to the interface for Microsoft's mobile operating system, Windows Phone, and is a dramatic shift from the traditional Windows interface. Windows 8 offers a **start screen** consisting of tiles. Each **tile** displays active content linked to an application. A desktop similar to the traditional Windows desktop can be accessed various ways. **Windows RT** is a version of Windows 8 designed to run with tablets using a particular microprocessor from ARM.

## ethics

When a new operating system is first introduced, many believe that they need to quickly replace their older operating system, and some conclude that they need to purchase a new more powerful computer. Unfortunately, they often find that some of their existing application programs do not work as well with the new operating system. It has been suggested that the introduction of new operating systems is a technique used by software and hardware manufacturers to render existing programs and computers obsolete. What do you think?

To see more ethical issues, visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword **ethics**.



Figure 4-6 Windows 7



Figure 4-7 Windows 8



## tips

Does Windows periodically ask you to restart your computer in order to install updates? Does this message sometimes interrupt or annoy you? Although you should install these updates immediately (for the health and security of your system), you can control the update settings if necessary. For Windows 7:

- 1 Click **Start**, point to **All Programs**, and then click **Windows Update**.
- 2 In the left pane, click **Change settings**.
- 3 Look under the **Important updates** heading for various download and installation options. The second option, **Download updates**, will allow Windows to download the updates, but it will not install those updates until you request them.

Although you can configure many settings in this window, it is strongly recommended that you leave the default *automatic settings* to ensure that your computer is always up to date.

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## Mac OS

Apple has been the leader in the development of powerful and easy-to-use microcomputer operating systems since its introduction of the Macintosh microcomputer in 1984. Designed to run only with Apple computers, **Mac OS** is not as widely used as the Windows operating system. As a result, fewer application programs have been written for it. With dramatically increasing sales of Apple computers, however, the use of Mac OS has been rapidly increasing and is widely recognized as one of the most innovative operating systems.

**Mac OS X** is the most widely used Mac OS. Its two most recent versions are:

- **OS X Lion** was released in 2011 and introduced several powerful features, including **Launchpad** to display and provide direct access to applications, **Mission Control** to display all running applications, and gestures.
- **OS X Mountain Lion** was released in 2012 and designed for desktops and laptops. (See Figure 4-8.) Its user interface is very similar to the interface used with its tablets

and smartphones. The functionality of Mountain Lion is similar to Windows 8 although it is generally regarded as easier to use.

## UNIX and Linux

The **UNIX** operating system was originally designed to run on minicomputers in network environments. Now, it is widely used by servers on the web, main-frame computers, and very powerful microcomputers. There are a large number of different versions of UNIX.

**Linux** is an operating system that extended one of the UNIX versions. It was originally developed by a graduate student at the University of Helsinki, Linus Torvalds, in 1991. He allowed free distribution of the operating system code and encouraged others to modify and further develop the code. Programs released in this way are



## Explorations

There are many distributions, or varieties, of Linux that are available for use on servers and desktop computers.

To learn more about Linux, visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword **linux**.



Figure 4-8 Mac OS X Mountain Lion

called **open source**. Linux is a popular and powerful alternative to the Windows operating system. (See Figure 4-9.)

Linux has been the basis of several other operating systems. For example, Google's **Chrome OS** is based on Linux. This operating system is designed for netbook computers and other mobile devices. Chrome OS focuses on Internet connectivity and cloud computing.

### Virtualization

As we have discussed, application programs are designed to run with particular operating systems. What if you wanted to run two or more applications each requiring a different operating system? One solution would be to install each of the operating systems on a different computer. There is, however, a way in which a single physical computer can support multiple operating systems that operate independently. This approach is called **virtualization**.

When a single physical computer runs a special program known as **virtualization software**, it operates as though it were two or more separate and independent computers, known as **virtual machines**. Each virtual machine appears to the user as a separate independent computer with its own operating system. The operating system of the physical machine is known as the **host operating system**. The operating system for each virtual machine is known as the **guest operating system**. Users can readily switch between virtual computers and programs running on them. There are several programs that create and run virtual machines. One such program, Microsoft's **Hyper-V**, is included with the Windows 8 Professional version. (See Figure 4-10.)

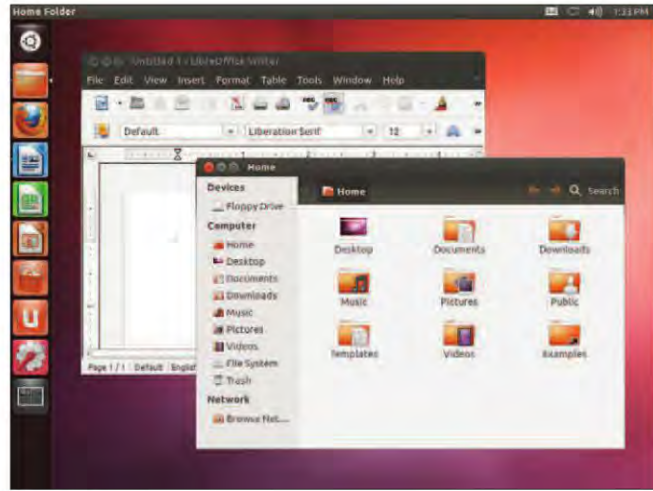


Figure 4-9 Linux



Figure 4-10 Ubuntu Linux running in a Windows 8 Hyper-V virtual machine



### concept check



- What is Windows? What are the two most recent versions?
- What is Mac OS? What are Lion and Mountain Lion?
- What is UNIX? What is Linux? What is Chrome OS?
- What are virtualization and virtualization software? What are host and guest operating systems?



## Utilities

Ideally, microcomputers would continuously run without problems. However, that simply is not the case. All kinds of things can happen—internal hard disks can crash, computers can freeze up, operations can slow down, and so on. These events can make computing very frustrating. That's where utilities come in. **Utilities** are specialized programs designed to make computing easier. There are hundreds of different utility programs. The most essential are

- **Troubleshooting or diagnostic programs** that recognize and correct problems, ideally before they become serious. To learn more about using a troubleshooting program, see *Making IT Work for You: Windows Task Manager* on pages 105 and 106.
- **Antivirus programs** that guard your computer system against viruses or other damaging programs that can invade your computer system.
- **Backup programs** that make copies of files to be used in case the originals are lost or damaged.
- **File compression programs** that reduce the size of files so they require less storage space and can be sent more efficiently over the Internet.

Most operating systems provide some utility programs. Even more powerful utility programs can be purchased separately or in utility suites.

### tips

Have you ever experienced problems after installing a new program or changing system settings? If so, the **System Restore** utility can help by reversing the changes and bringing your computer to a previous point in time. For Windows 7:

- 1 Click **Start**, and then type *System Restore* in the search box.
- 2 Follow the prompts, and choose a restore point.
- 3 Click the *Finish* button to start the process.

To see additional tips, visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword **tips**.

### Windows Utilities

The Windows operating systems are accompanied by several utility programs, including Backup and Restore, Disk Cleanup, and Disk Defragmenter.

**Backup and Restore** is a utility program included with the many versions of Windows that makes a copy of all files or selected files that have been saved onto a disk. It helps protect you from the effects of a disk failure. For example, you can select *Backup and Restore* from the Windows 7 Maintenance menu to create a backup for your hard disk as shown in Figure 4-11.

- 1 Click **Start**, and then select **Maintenance** from the *All Programs* menu.
- Select **Backup and Restore**, and then click **Set up backup**.
- Choose the destination for the backup.
- Choose the files you want to back up.
- Set up Backup Wizard to back up the selected files.

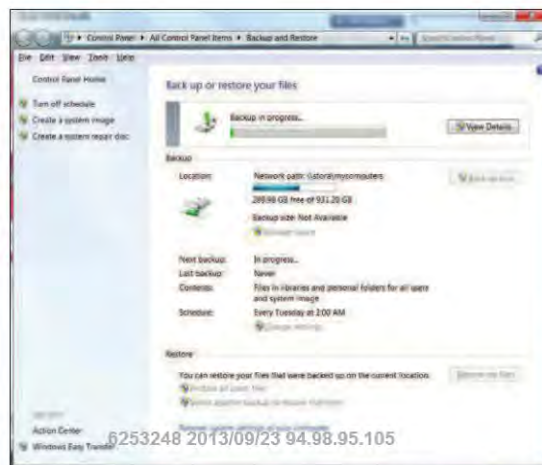


Figure 4-11 Backup and Restore utility

## Making IT work for you

### WINDOWS TASK MANAGER

Have you ever been working with a program when it simply stopped working and would not respond to you? Does your computer seem to be getting slower and slower? Windows Task Manager, which gives you a live view of every program that is currently in RAM, is designed to help with these and many other operational problems.

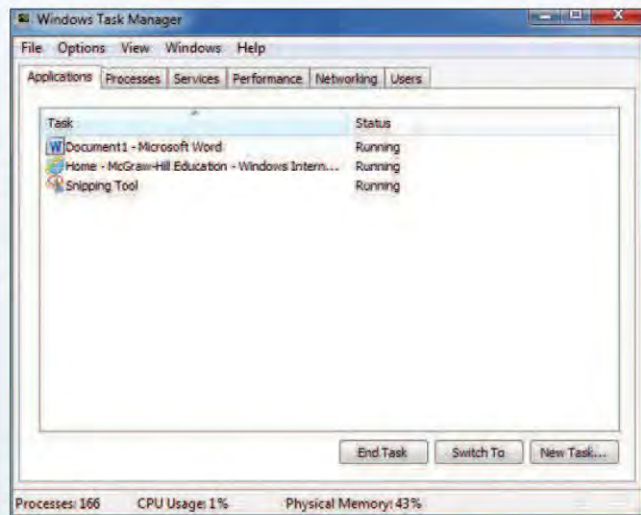
**Starting Task Manager** You can open Task Manager from anywhere by following these steps:

- 1 Press and momentarily hold the **Ctrl + Alt + Del** keys.
- 2 Select the **Start Task Manager** option.

As you can see, the Task Manager window provides a menu and several tabs. Please note that it may look slightly different in your version of Windows.

**Closing an Application** Use Task Manager when a program you are using becomes stuck and stops responding.

- 1 Go to the **Applications** tab of Task Manager.
- 2 Find the program that is stuck. Its status should read, **"Not Responding."**
- 3 Select it and click the **End Task** button.



The program that was not responding has been closed, and you can now continue using Windows normally.

**Viewing Processes** This is the most powerful area of Task Manager. Here, you will see a list of every process (running program) that is currently residing in your computer's RAM.

- 1 Go to the **Processes** tab of Task Manager.
- 2 Click the **Memory** heading. All the processes will be sorted from highest (occupying the most RAM) to the lowest.
- 3 Click the **CPU** heading. This will show any processes that the CPU is currently working on.

It is normal for the numbers to fluctuate for running programs, especially those for the CPU. Also note that a very high number on "System Idle Process" is normal.

**Ending a Process** Some problematic processes could be spyware, while others represent background services you don't need. Other processes are crucial for your system and should never be ended. **Warning:** Before ending a process, you must truly understand the risks (or benefits) of doing so. Using a search engine, type the name of the process, and the results will list several websites that explain what it does. If you want to end a process:

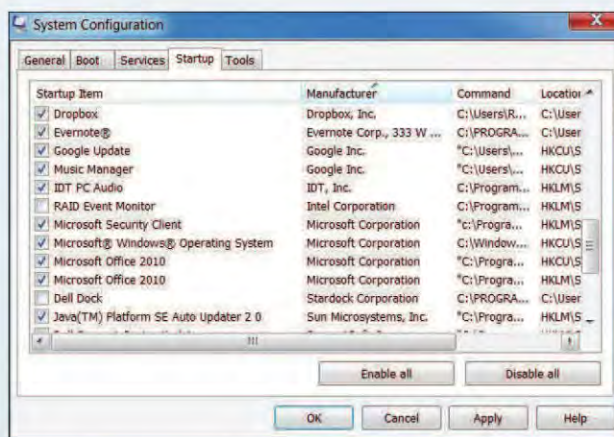
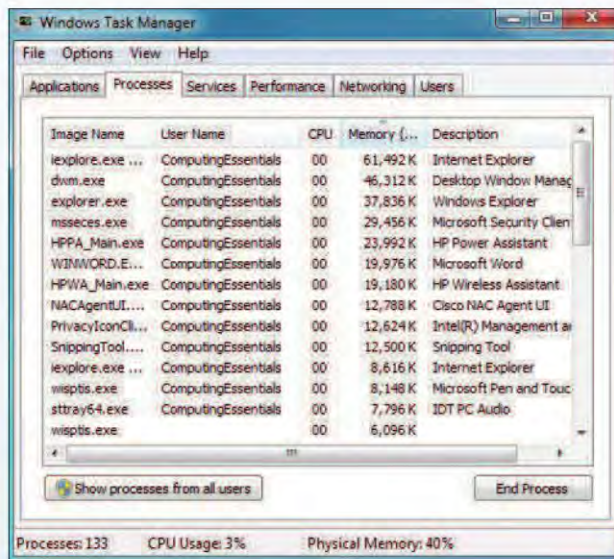


- 1 • While in the *Processes* tab, click the *Image Name* heading (to avoid the fluctuating positions of each process).
- 2 • Click the process you want to end.
- 3 • Select the *End Process* button.
- 4 • Click *End Process* again to confirm.

That particular program file will be removed from the list and from your computer's memory. Keep in mind that if this program is configured to load automatically, you will see it again when you restart your computer.

**Managing Startup Programs** If you are wondering why you have so many processes running in your computer's memory, it is likely because many of your software titles have small programs or services that begin running each time you start Windows. Some services are crucial, while others are not always needed and do little except slow down your computer. To manage these services:

- 1 • Click the *Start* button on your Windows Taskbar.
- 2 • Type "msconfig" in the *Search* box, and press *Enter*.
- 3 • Click the *Startup* tab.
- 4 • Review the list of startup processes, perform research online, and uncheck any programs that you do not want to load automatically each time you start Windows.
- 5 • Click the *OK* button when finished. This will usually require a system restart.



Before making any changes to startup programs or active processes, be sure that you have carefully researched the program and/or consulted with a professional.

To learn about other ways to make information technology work for you, visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword [miw](#).

When you surf the web, a variety of programs and files are saved on your hard disk. Many of these and other files are not essential. **Disk Cleanup** is a troubleshooting utility that identifies and eliminates nonessential files. This frees up valuable disk space and improves system performance.

For example, by selecting Disk Cleanup from the Windows 7 System Tools menu, you can eliminate unneeded files on your hard disk as shown in Figure 4-12.

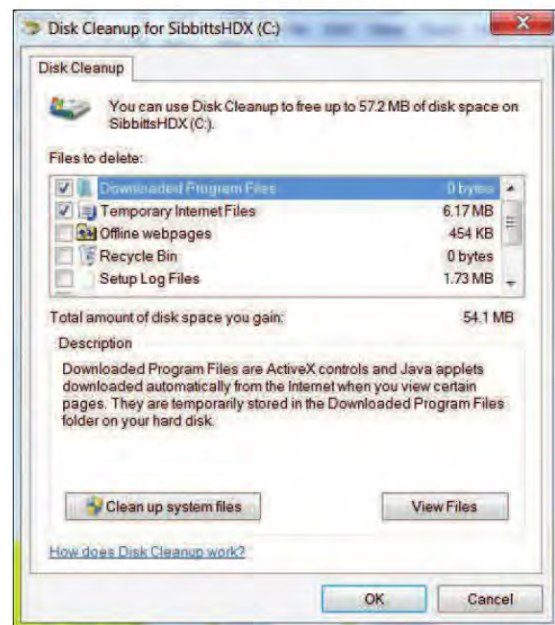
## Explorations



There are many other types of utility software for both consumers and businesses.

To learn more about utility software and a company that makes a variety of them, visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword **utility**.

- 1 Click **Start**, and then select **Accessories** from the **All Programs** menu.
- Select **Disk Cleanup** from the **System Tools** menu.
- Review the files suggested for cleanup, and then click **OK**.



- 2 The utility cleans the selected files.

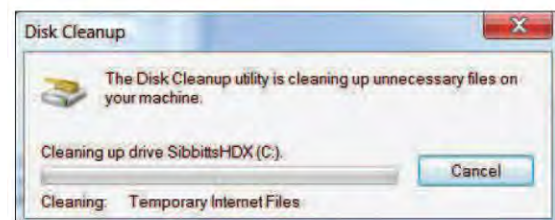


Figure 4-12 Disk Cleanup utility



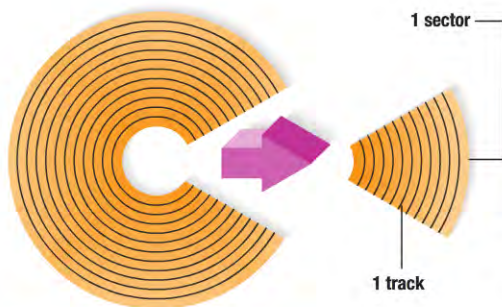


Figure 4-13 Tracks and sectors

As we will discuss in detail in Chapter 7, files are stored and organized on a disk according to tracks and sectors. A **track** is a concentric ring. Each track is divided into wedge-shaped sections called **sectors**. (See Figure 4-13.) The operating system tries to save a file on a single track across contiguous sectors. Often, however, this is not possible, and the file has to be broken up, or **fragmented**, into small parts that are stored wherever space is available. Whenever a file is retrieved, it is reconstructed from the fragments. After a period of time, a hard disk becomes highly fragmented, slowing operations.

**Disk Defragmenter** is a utility program that locates and eliminates unnecessary fragments and rearranges files and unused disk space to optimize operations. For example, by selecting Disk Defragmenter from the Windows 7 System Tools menu, you can defrag your hard disk as shown in Figure 4-14.

- 1 Click **Start**.
- Select **Accessories** from the **All Programs** menu.
- Select **Disk Defragmenter** from the **System Tools** menu. If necessary, click **Continue**.
- 2 Click the **Defragment disk** button to begin defragging.
- If necessary, choose the drive you want to defragment.
- When defragmentation is complete for the selected drive, view the report or close the window.

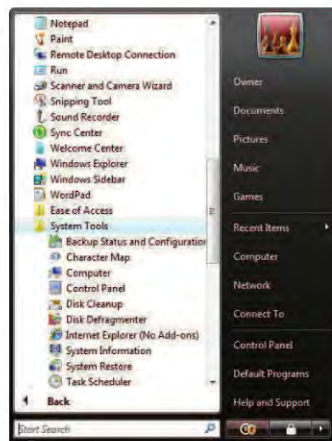


Figure 4-14 Disk Defragmenter utility



Figure 4-15 Norton Utilities

### Utility Suites

Like application software suites, **utility suites** combine several programs into one package. Buying the package is less expensive than buying the programs separately. Some of the best-known utility suites are BitDefender, Norton Utilities, and ZoneAlarm. (See Figure 4-15.) These suites provide a variety of utilities, including programs that will protect your system from dangerous programs called computer **viruses**. You can “catch” a computer virus many ways, including by opening attachments to e-mail messages and downloading software from the Internet. (We will discuss computer viruses in detail in Chapter 9.)



### concept check



- Discuss four essential utilities.
- Describe Windows Backup and Restore, Disk Cleanup, and Disk Defragmenter.
- What is the difference between a utility and a utility suite?

## Device Drivers

Every device, such as a mouse or printer, that is connected to a computer system has a special program associated with it. This program, called a **device driver** or simply a **driver**, works with the operating system to allow communication between the device and the rest of the computer system. Each time the computer system is started, the operating system loads all of the device drivers into memory.

Whenever a new device is added to a computer system, a new device driver must be installed before the device can be used. Windows supplies hundreds of different device drivers with its system software. For many devices, the appropriate drivers are automatically selected and installed when the device is first

## ethics

Everyone should worry about getting a computer virus that will corrupt or destroy files. Some suggest that software developers may be taking advantage of this fear by sending out misleading or fake virus alerts. One reported scam encourages users to download a free virus detection program. This free download begins by actually installing a virus onto the user's computer. It then performs a bogus scan, locating the virus and then offering to remove the virus for a fee. Obviously, this is unethical, not to mention illegal. How can you and legitimate antivirus manufacturers protect themselves against viruses and unethical software developers?

To see more ethical issues, visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword **ethics**.

## environment

Did you know that there are utility suites that help the environment by lowering your computer's energy consumption? These utility programs help you find the hardware components and programs that could be shut off in order to reduce the amount of battery power or electricity being used. By enhancing the power management features of the operating system, these utilities can reduce your energy consumption by as much as 30 percent. To see more environmental facts, visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword **environment**.

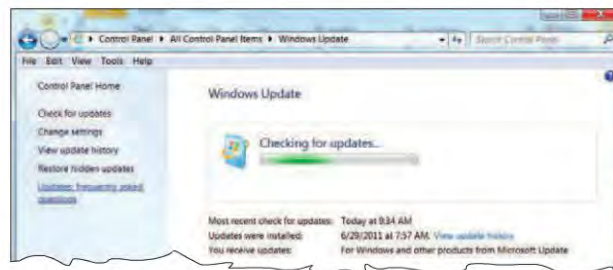


connected to the computer system. For others, the device driver must be manually installed. Fortunately, Windows provides wizards to assist in this process. For example, Windows' **Add a Device Wizard** provides step-by-step guidance for selecting the appropriate hardware driver and installing that driver. If a particular device driver is not included with the Windows system software, the product's manufacturer will supply one. Many times these drivers are available directly from the manufacturer's website.

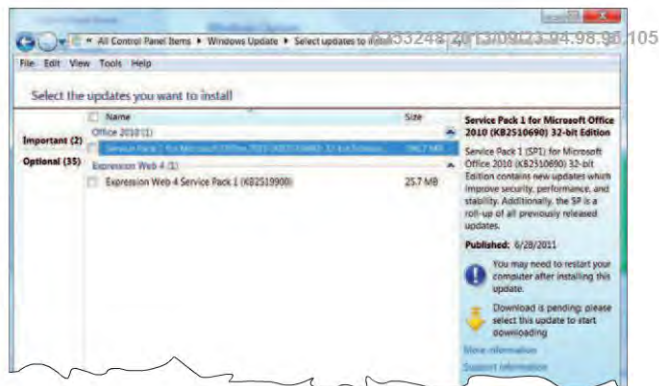
You probably never think about the device drivers in your computer. However, when your computer behaves unpredictably, you may find reinstalling or updating your device drivers solves your problems. Windows 7 makes it easy to update the drivers on your computer using **Windows Update**, as shown in Figure 4-16.

**1** Access **Windows Update** from the **All Programs** list of the **Start** menu.

Click **Check for updates**.



**2** Review the list of recommended updates.



**3** Click **Install updates** to download updates to your computer.



Figure 4-16 Windows Update



## concept check



What are device drivers, and what do they do?



What is Windows' Add a Device Wizard, and what does it do?



What is Windows Update? What does it do?

## Careers in IT

**Computer support specialists** provide technical support to customers and other users. They also may be called technical support specialists or help-desk technicians. Computer support specialists manage the everyday technical problems faced by computer users. They resolve common networking problems and may use troubleshooting programs to diagnose problems. Most computer support specialists are hired to work within a company and provide technical support for other employees and divisions. However, it is increasingly common for companies to provide technical support as an outsourced service.

Employers generally look for individuals with either an advanced associate's degree or a bachelor's degree to fill computer support specialist positions. Degrees in computer science or information systems may be preferred. However, because demand for qualified applicants is so high, those with practical experience and certification from a training program increasingly fill these positions. Employers seek individuals with good analytical and communication skills. Those with good people skills and customer service experience have an advantage in this field.

Computer support specialists can expect to earn an annual salary of \$31,000 to \$58,000. Opportunities for advancement are very good and may involve design and implementation of new systems. To learn about other careers in information systems, visit us at [www.computing2014.com](http://www.computing2014.com) and enter the keyword **careers**.



Now that you know about system software, I'd like to tell you about my career as a computer support specialist.



## A LOOK TO THE FUTURE

### Self-Healing Computers Could Mean an End to Computer Crashes and Performance Problems

Wouldn't it be nice if computers could fix themselves? What if your computer could continually fine-tune its operations to maintain peak performance? And wouldn't it be a relief if you never had to help your computer recover after a virus or other intrusion? For many people, this sounds too good to be true. Maintenance and troubleshooting tasks like these can be time-consuming and frustrating.

Now imagine you run a business, and unless these tasks are performed, you will lose time and money. It is not a pleasant daydream, and it quickly becomes a nightmare without properly trained systems administrators to keep servers running smoothly. Yet many experts predict that supercomputers and business systems are not far from becoming too complex for humans to manage and secure. Recent news from IBM makes the dream of a self-repairing, self-updating, and self-protecting server seem closer.

IBM has announced plans to concentrate research efforts on developing just such a server. The project, called the Autonomic Computing Initiative (ACI), hopes to free businesses from time-consuming computer maintenance. IBM hopes the new system will be self-regulating and virtually invisible. It believes autonomic computing has the potential to revolutionize the way businesses run.

Autonomic computing is a system that allows machines to run with little human intervention. Such computers would not

have self-awareness but would be self-correcting. Autonomic processes in machines are modeled after autonomic processes in the human body. For example, you are not consciously breathing. Instead, your body monitors and maintains your respiration without your input. Scientists hope autonomic computing will behave in a similar manner and maintain systems without intervention.

Autonomic machines would be able to identify security flaws and repair them. They would be able to sense slow com-

puter operations and take corrective action. They would be able to detect new equipment, format it, and test it. Computer usage will become less complex so that you can focus on getting work done instead of worrying about the machine's operation. These goals are impressive, and the autonomic computer is still in development.

It is important to note that autonomic computing is not artificial intelligence because

autonomic machines do not have human cognitive abilities or intelligence. Instead, these machines have knowledge of their own systems and the capability to learn from experience to correct errors.

Given the potential for a self-maintaining server, the possibility of a similar system designed for a microcomputer seems less like a dream and more like a reality. What do you think? Will microcomputers ever care for themselves? Do you think it is possible to have a computer managing its own security? Will hackers find a way to outsmart these "intelligent" systems?



## VISUAL SUMMARY

### System Software

#### SYSTEM SOFTWARE



System software works with end users, application programs, and computer hardware to handle many details relating to computer operations.

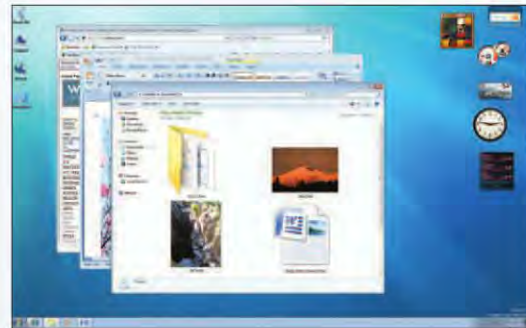
Not a single program but a collection or system of programs, these programs handle hundreds of technical details with little or no user intervention.

Four kinds of systems programs are operating systems, utilities, device drivers, and language translators.

- Operating systems coordinate resources, provide an interface between users and the computer, and run programs.
- Utilities perform specific tasks related to managing computer resources.
- Device drivers allow particular input or output devices to communicate with the rest of the computer system.
- Language translators convert programming instructions written by programmers into a language that computers can understand and process.



#### OPERATING SYSTEMS



Operating systems (software environments, software platforms) handle technical details.

##### Functions

Functions include managing resources, providing a user interface (most operating systems use a graphical user interface, or GUI), and running applications. Multitasking allows switching between different applications stored in memory; current programs run in foreground; other programs run in background.

##### Features

Booting starts (cold) or restarts (warm) a computer system. The desktop provides access to computer resources. Common features include icons, pointers, windows, menus, tabs, dialog boxes, Help, and gesture control. Data and programs are stored in a system of files and folders.

##### Categories

Three categories of operating systems are

- **Embedded**—used with handheld computers; operating system stored within device.
- **Network (NOS)**—controls and coordinates networked computers; located on the network server.
- **Stand-alone (desktop)**—controls a single computer; located on the hard disk.

Operating systems are often called software environments or software platforms.



To effectively use computers, competent end users need to understand the functionality of system software, including operating systems, utility programs, and device drivers.

## MOBILE OPERATING SYSTEMS



Mobile operating systems (mobile OS) are embedded in every smartphone and tablet. These systems are less complicated and more specialized for wireless communication than desktop operating systems.

Some of the best known are BlackBerry, iOS (iPhone OS), Android, Windows Phone, and WebOS.

- **Android** was originally developed by Android Inc. and later purchased by Google. It is a widely used mobile OS.
- **BlackBerry OS (RIM OS)** originated in Canada. It was designed as the platform for BlackBerry handheld computers.
- **iOS (iPhone OS)** was developed by Apple to support iPhone, iPod Touch, and iPad.
- **WebOS** was developed by Palm, Inc., and later purchased by HP. It has evolved into the operating system for many of HP's mobile devices.
- **Windows Phone 8** was introduced in 2012 by Microsoft to support a variety of mobile devices, including smartphones. It can run many powerful programs designed for laptop and desktop computers.

## DESKTOP OPERATING SYSTEMS



### Windows

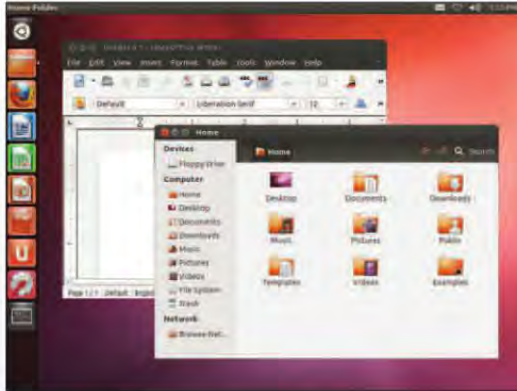
**Windows**, the most widely used operating system, is designed to run with many different microprocessors. The two recent versions are **Windows 7** and **Windows 8**. Windows 8 offers an interface very similar to the Windows Phone interface; supports desktops, notebooks, and tablets; uses a **start screen** and **tiles**; and provides support for gestures, cloud integration, and apps. **Windows RT**, a version of Windows 8, is designed to run with ARM tablets.

### Mac OS

**Mac OS**, an innovative, powerful, easy-to-use operating system, runs on Macintosh computers. The two most recent versions are **Lion** and **Mountain Lion**. Mountain Lion's interface is very similar to the interfaces on Apple's smartphone and tablets. It is designed for Apple's desktops and laptops. Lion's functionality is similar to Windows 8 but generally considered easier to use.



## DESKTOP OPERATING SYSTEMS



### UNIX and Linux

UNIX was originally designed to run on minicomputers in network environments. Now, it is widely used by servers on the web, mainframe computers, and very powerful microcomputers. There are many different versions of UNIX. One version, Linux, a popular and powerful alternative to the Windows operating system, is open source software. Google's Chrome OS is based on Linux and designed for netbooks and other mobile devices. Chrome OS focuses on Internet connectivity and cloud computing.

### Virtualization

Virtualization allows a single physical computer to support multiple operating systems. Using a special program (virtualization software) allows the single physical computer to operate as two or more separate and independent computers known as virtual machines. Host operating systems run on the physical machine. Guest operating systems operate on virtual machines. Microsoft's Hyper-V creates and runs virtual machines.



## UTILITIES



Utilities make computing easier. The most essential are troubleshooting (diagnostic), antivirus, backup, and file compression.

### Windows Utilities

Windows operating systems are accompanied by several utility programs, including Backup and Restore, Disk Cleanup, and Disk Defragmenter (eliminates unnecessary fragments; tracks are concentric rings; sectors are wedge-shaped).

### Utility Suites

Utility suites combine several programs into one package. Computer viruses are dangerous programs.

## DEVICE DRIVERS

Device drivers (drivers) allow communication between hardware devices. Add a Device Wizard gives step-by-step guidance to install printer drivers. Windows Update automates the process of updating device drivers.

## CAREERS IN IT

Computer support specialists provide technical support to customers and other users. Degrees in computer science or information systems are preferred plus good analytical and communication skills. Salary range is \$31,000 to \$58,000.



## KEY TERMS

Add a Device Wizard (110)  
 Android (100)  
 antivirus program (104)  
 background (98)  
 Backup and Restore (104)  
 backup program (104)  
 BlackBerry OS (100)  
 booting (98)  
 Chrome OS (103)  
 cold boot (98)  
 computer support specialist (111)  
 desktop (98)  
 desktop operating system (99)  
 device driver (96, 109)  
 diagnostic program (104)  
 dialog box (99)  
 Disk Cleanup (107)  
 Disk Defragmenter (108)  
 driver (109)  
 embedded operating system (99)  
 file (99)  
 file compression program (104)  
 folder (99)  
 foreground (98)  
 fragmented (108)  
 gesture control (99)  
 graphical user interface (GUI) (97)  
 guest operating system (103)  
 Help (99)  
 host operating system (103)  
 Hyper-V (103)  
 icon (98)  
 iOS (100)  
 iPhone OS (100)  
 language translator (96)  
 Launchpad (102)  
 Linux (102)  
 Mac OS (102)  
 Mac OS X (102)  
 menu (99)  
 Mission Control (102)  
 mobile operating system (100)  
 mobile OS (100)  
 multitasking (98)  
 network operating system (NOS) (99)  
 network server (99)  
 open source (103)  
 operating system (96, 97)  
 OS X Lion (102)  
 OS X Mountain Lion (102)  
 pointer (98)  
 RIM OS (100)  
 sector (108)  
 software environment (99)  
 software platform (99)  
 stand-alone operating system (99)  
 start screen (101)  
 system software (96)  
 tab (99)  
 tile (101)  
 track (108)  
 troubleshooting program (104)  
 UNIX (102)  
 user interface (97)  
 utilities (96, 104)  
 utility suite (109)  
 virtual machine (103)  
 virtualization (103)  
 virtualization software (103)  
 virus (109)  
 warm boot (98)  
 WebOS (100)  
 window (99)  
 Windows (101)  
 Windows 7 (101)  
 Windows 8 (101)  
 Windows Phone 8 (100)  
 Windows RT (101)  
 Windows Update (110)

To test your knowledge of these key terms with animated flash cards, visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword [terms4](#). Or use the free *Computing Essentials 2014* app.





## MATCHING

Match each numbered item with the most closely related lettered item. Write your answers in the spaces provided.

- |                   |  |
|-------------------|--|
| a. Android        | ___ 1. Programs that perform specific tasks related to managing computer resources.  |
| b. antivirus      | ___ 2. Restarting a running computer without turning off the power.  |
| c. driver         | ___ 3. Type of operating system that controls and coordinates networked computers.   |
| d. fragmented     | ___ 4. An operating system is often referred to as the software environment or software ___.   |
| e. Launchpad      | ___ 5. OS X Lion feature to display and provide direct access to applications.   |
| f. NOS            | ___ 6. A type of software that allows a single physical computer to operate as though it were two or more separate and independent computers.          |
| g. platform       | ___ 7. Mobile operating system that is owned by Google and is widely used in many smartphones.   |
| h. utilities      | ___ 8. Type of program that guards computer systems from viruses and other damaging programs.  |
| i. virtualization | ___ 9. If a file cannot be saved on a single track, it has to be ___.  |
| j. warm boot      | ___ 10. Program that works with the operating system to allow communication between a device and the rest of a computer system is called a device ___. |

For an interactive matching practice test, visit our website at [www.computing2014.com](http://www.computing2014.com) and enter the keyword [matching4](#). Or use the free *Computing Essentials 2014* app.

## OPEN-ENDED

On a separate sheet of paper, respond to each question or statement.

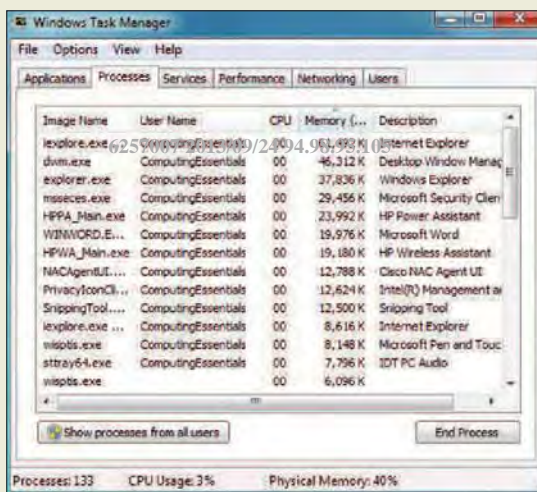
1. Describe system software. Discuss each of the four types of system programs.
2. Define operating systems. Describe the basic features and the three categories of operating systems.
3. What are mobile operating systems? Describe the leading mobile operating systems.
4. What are desktop operating systems? Compare Windows, Mac OS, Linux, and Chrome OS. Discuss virtualization.
5. Discuss utilities. What are the most essential utilities? What is a utility suite?
6. Explain the role of device drivers. Discuss Add a Device Wizard and Windows Update.

## DISCUSSION

Respond to each of the following questions.

### 1 Making IT Work for You: WINDOWS TASK MANAGER

Have you ever been working with a program when it simply stopped working and would not respond to you? Review the Making IT Work for You: Windows Task Manager on pages 105 and 106 and open Task Manager using a Windows-based computer. Then respond to the following: (a) List the top three processes in terms of memory usage. (b) List three processes that are using your CPU, even if it is only for a second or two as you look at that dialog box. (c) Find one process that you do not recognize. Using your favorite search engine, determine what the process does. Write down the name of the process, its description or purpose, and the URL of the website you used to research it.



### 2 Explorations: LINUX

Did you know that there are over a hundred different distributions, or varieties, of Linux? Review the Explorations box on page 102 and then respond to the following: (a) Discuss at least three benefits offered by many Linux distributions. (b) What are some drawbacks of using Linux? (c) Discuss two ways in which you could try Linux without removing your current operating system. (d) What are two of the most popular Linux distributions for home users? In a few sentences, describe some of the key features that make these distributions unique.

### 3 Explorations: UTILITY SOFTWARE

Did you know that there are many types of utility software for both consumers and businesses? Review the Explorations box on page 107 and then respond to the following: (a) Explore Norton Mobile Security. What does this type of utility do? Would you purchase it for your mobile device? Why or why not? (b) Explore Symantec's Web Gateway product. What does this web-filtering software do? What kind of control does it give to managers? (c) Explore Symantec's Ghost Solution Suite. What are some of the benefits of using imaging and deployment software such as this? (d) What are the advantages of using Symantec.cloud for an enterprise? If you were a manager, would you rely on the cloud for your utility software needs? Why or why not?



#### 4 Ethics: NEW OPERATING SYSTEMS

Software companies periodically release new versions of their operating systems, and many purchase these programs as soon as they are available. Review the Ethics box on page 101 and respond to the following questions: (a) When a new operating system is introduced, should you purchase it immediately? Why or why not? (b) Do you think the introduction of a new operating system is typically designed to render existing hardware and software obsolete? Defend your position. (c) Is this an ethical issue? If so, develop some ethical guidelines for software manufacturers to consider before they introduce either a new version for their operating systems or application programs. (d) Open source operating systems, such as Linux, often release new versions for free. Do you feel this is a better model for the development of operating systems? Why or why not.



#### 5 Ethics: VIRUS PROTECTION SCAMS

Everyone should be concerned about viruses infecting computer systems. Some report that this fear is being used to manipulate users into purchasing new or upgraded antivirus programs. Some even report specific antivirus scams. Review the Ethics box on page 109 and then respond to the following: (a) Have you ever been offered a free virus alert program? If so, describe the offer and whether you accepted the offer. (b) Almost all legitimate antivirus software manufacturers issue new virus alerts. Do you think these alerts are motivated by greed or by good consumer service? Why or why not? (c) Is this an ethical issue for antivirus software manufacturers? If so, create some ethical guidelines for antivirus software manufacturers to follow when issuing virus alerts. (d) What can users do to protect themselves against antivirus scams and against unethical manufacturers of antivirus programs? Be specific and defend your suggestions.



## 6 Environment: OS POWER MANAGEMENT

Did you know that some operating systems help protect the environment? Review the Environment box on page 98 and then respond to the following: (a) In what ways do operating systems help the environment? (b) Do you leave your desktop or notebook computer on all day? Do you use sleep or hibernate modes? Explain the reasons behind your decision. (c) Find the power management options for your operating system. List a few options that you would consider adjusting in order to reduce your computer's energy consumption.



## 7 Environment: GREEN UTILITY SUITES

Did you know that there are utility suites that help the environment? Review the Environment box on page 109 and then respond to the following: (a) Using a search engine, find one utility suite that claims to lower your computer's energy consumption. List the product name and URL of the website. (b) Describe at least three ways in which this utility suite lowers energy consumption. (c) Would you purchase this utility suite? Why or why not?