ONLINE DISCOVERY

Visit the E-cycling Central Web site at *www.ecyclingcentral.com*. Find the list of questions to ask recyclers, and then answer the following:

1. How should recyclers remove personal data from computer disks?
2. How much of the material that recyclers collect should be recycled rather than disposed or incinerated?
3. How do you know whether a recycler has the proper facilities, training, and equipment to recycle computer equipment?
4. How can you find out whether the recycler exports electronic wastes to other countries?

IC³ 1-1.2.9

JOB SKILLS

Most companies are looking for employees who can solve their problems and help them achieve their goals. Because of this, interviewers often want to know about your problem-solving skills. To answer such a question, avoid generalizations such as "I'm a good problem-solver. I solve problems nearly every day in my current occupation." Instead, tell a story about a specific situation. Complete the following:

1. Identify a time at school or work when you were confronted with a difficult problem. A difficult problem is one that could cause severe consequences if it continues.
2. Describe the problem in a one-page document.
3. Describe specifically what you did to solve the problem.

Estimated Time: 1 hour

LESSON 6

Software and Hardware Interaction

OBJECTIVES

Upon completion of this lesson, you should be able to:

- Understand how hardware and software interact.
- Explain how a software program works.
- Track software development.
- Compare application software and system software.
- Identify options for software distribution.

DATA FILES

You do not need data files to complete this lesson.

WORDS TO KNOW

algorithm
application software
beta testing
bundleware
flowchart
inputting
network license
operating system
patch
service pack
single-user license
software
Software as a Service (SaaS)
software development
software license
software piracy
system software
update
upgrade
Web application

Over the last 50 years or so, computer technology has changed the world. Not long ago, the typical worker did not use computers on the job. Customers did not order products online or scan ID cards to receive benefits for frequent shopping. Accounting was done using ledgers. When you think about the recent history of computers, you probably think of innovations in hardware—computers have become smaller and faster. Computer usage has changed just as dramatically. Early computers were used as little more than high-speed calculators. Because computers developed the capacity to do many tasks very quickly, they now have a major influence on the culture and economy. Computers have had such an impact due to the vision and desire of software developers, who created thousands of ways to use computers. They created programs that affect every aspect of your life.

IC3 1-2.1.1

Understanding How Hardware and Software Interact

Although software and hardware are clearly distinct parts of a computer system, they often play similar roles and perform similar tasks. Recall that hardware refers to anything you can touch, including objects such as the keyboard, mouse, monitor, printer, chips, disk drives, and CD/DVD recorders. ***Inputting*** is the process of using an input device to enter data. In Lesson 2, you reviewed input devices. Popular input devices include the keyboard (used for inputting text and numbers), the mouse (used for selecting items on the screen), scanner (used to input images and documents), microphone (used to input sound), and video camera (used to input video).

VOCABULARY
inputting

Using input devices, you interact with software by typing commands such as entering a name for a word-processing document as shown in **Figure 6–1**, selecting an option from a menu, or clicking a button, such as the Save button used in most software programs.

ABOVE AND BEYOND

An early computer called the Univac I was a sensation in 1952 when it correctly predicted that Dwight D. Eisenhower would win the presidential election in a landslide victory. The election results were remarkably close to the computer's prediction, but the computer didn't perform a miracle. The programmers who used statistical vote samples (the data) and shrewd analysis techniques (the program commands) deserve the credit for the accurate prediction.

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FIGURE 6–1 Interacting with software

The Role of Software

You cannot touch software because it has no substance. ***Software*** (or a program) is programming code written to provide instructions to the hardware so it can perform tasks, such as printing, displaying a Web page or dialog box, or saving a document on the hard disk. Hardware and software interact as a computer processes data. You use input devices—hardware—to enter data. Then specific programmed instructions tell the computer how to process that data—this is the software component that tells the hardware what to do. Finally, other software instructions format the data correctly so you can understand it when you see it on a monitor, print it on a page, or hear it through the speakers.

For instance, a computer programmer might write a program that lets you use the keyboard to access a Web site and then use the mouse to select a music file and download it from the Internet. The software makes it possible to download or retrieve the music file from a server somewhere on the Internet, and other software on your computer allows you to play the music. The CPU, sound card, and speakers in your computer system are hardware devices that function as output devices. Other examples of how data is processed and then sent to an output device are as follows:

- You use a scanner to scan a document and then print a copy (see **Figure 6–2**).
- You create video with your digital video camera and then transfer it from your camera to your computer.
- You use a microphone to create an audio file to accompany a message to your grandmother.

VOCABULARY
software

© Pelham James Mitchinson / Shutterstock.com

FIGURE 6–2 Scanning a document

The software provides the instructions on how to accomplish these tasks and where to save the files.

When people have a problem with how their computer is working, they might say, "It's a software problem." This means there is a problem with the program or data, and not with the computer or hardware itself.

A good analogy is a book. The book, including the pages and the ink, is the hardware. The words and ideas on the pages are the software. One has little value without the other. The same is true of computer software and hardware: how the two interact allows us to use the computer to complete tasks.

How a Software Program Works

VOCABULARY
algorithm

A computer processes data by applying rules called algorithms. An ***algorithm*** is a set of clearly defined, logical steps that solve a problem. For example, if you want to explain to someone who has never done laundry how to do it properly, you would explain the process step by step, as shown in **Figure 6–3**.

HOW TO DO LAUNDRY
Collect the clothes that need to be washed.
Separate the clothes into light and dark piles.
Take the light pile to the washing machine and put clothes in the machine.
Add laundry detergent to the washing machine.
Set the dial on the washing machine for the correct size load.
Set the dial on the washing machine for warm wash and warm rinse water.
Turn on the washing machine.
When the cycle has finished, take wash out and put clothes in dryer.
Add a dryer fabric softener sheet to the dryer.
Set dryer cycle to Permanent Press.
Set dryer timer to 40 minutes.
Turn on dryer.
When the cycle has finished, take clothes out.
Fold clothes.
Put away clothes.
Repeat all previous steps with dark clothes.

FIGURE 6–3 An algorithm lists steps required to perform a task

If these steps seem like they offer very detailed instructions for performing a simple task, remember that the person you are instructing has no idea how to do laundry. You cannot assume he or she knows anything about it. In the same way, when a programmer writes software instructions for a computer, every step must give explicit instructions. A computer cannot do anything without being instructed how to do it through programmed software commands.

The following is a very simple example of how a programmer would begin to write a software program. After writing an algorithm for solving the problem in plain English (or French, Chinese, or Portuguese, depending on the spoken language of the programmer), the next step would be to rewrite the instructions in a formal programming language. Even then the computer will not understand the instructions; a specialized computer program translates the programming language to machine language that the computer can understand.

To instruct a computer how to perform a simple task such as outputting the average of three numbers, the program must break this down into many steps. For example:

1. Let A equal 50.
2. Let B equal 144.
3. Let C equal 68.
4. Add $A + B + C$.
5. Let the sum of $A + B + C$ equal X.
6. Divide X by 3.
7. Let the quotient equal Y.
8. Print the text "The average is " followed by Y.

Tracking Software Development

VOCABULARY
software development
flowchart

Software development is a multistep process that usually begins when someone recognizes a need to perform a task more effectively using a computer. As you have seen, the programmer must first break down the task into an algorithm, or series of steps, that will cover all the actions needed to perform the task. Often the programmer works out the logic for the steps in the algorithm by using a ***flowchart*** that shows different paths the program will take depending on what data is inputted (see **Figure 6–4**).

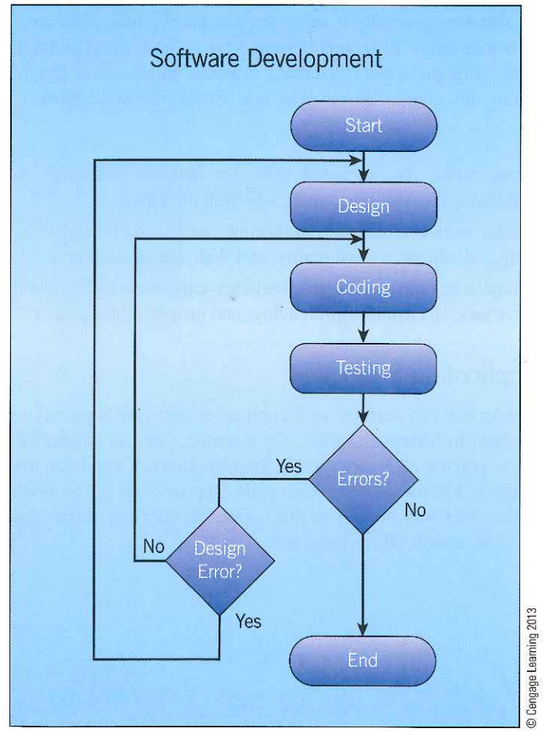


FIGURE 6–4 Flowchart

Next, the programmer writes the steps in a computer programming language, or code, that uses a formal set of terms and syntax, or rules for how the words are used together. The computer takes that code, translates it into language it can understand, and uses the translated commands to execute the program.

This, however, is not the end of the process. Computer programs are written by people, and people can make mistakes. Someone might enter a line of code with a small error in syntax or spelling, producing very different results from what the programmers were expecting. So software development also requires a quality control process that involves running systematic tests, debugging (finding and correcting errors in the code), and ***beta testing***, a process that releases commercial software in development to a cross-section of typical users who evaluate the program and report any problems, or "bugs," in the software before it is released to the public.

VOCABULARY
beta testing
application software
system software

IC3 1-2.1.2

Comparing Application Software and System Software

There are two basic types of computer software: ***application software*** and ***system software***. Application software helps you perform a specific task. System software refers to the operating system and all utility programs that manage computer resources. Figuratively speaking, application software sits on top of system software. Without the operating system and system utilities, the computer cannot run any applications.

Application Software

Application software generally is referred to as productivity software. This type of software is composed of programs designed for an end user. Common application programs are word processors, database systems, presentation programs, spreadsheet programs, and graphic design programs. Some other application categories are as follows:

- *Education, home, and personal software*: Includes reference, entertainment, personal finance, calendars, e-mail, and Web browsers
- *Multimedia software*: Includes authoring, animation, music, video and sound capturing and editing, virtual reality, and Web site development
- *Workgroup computing software*: Includes calendars and scheduling, e-mail, Web browsers, electronic conferencing, and project management

Using Application Software

One of the tasks you can perform with application software is modifying and applying rules to data. In Microsoft Office, for instance, you can customize options that determine how you use each program. In Step-by-Step 6.1, you learn how to customize one feature in Microsoft Word. Complete Step-by-Step 6.1 to modify the Quick Access Toolbar, which is the toolbar that appears to the right of the program icon on the title bar in Microsoft Office programs.

Step-by-Step 6.1

1. Click the **Start** button on the taskbar, point to *All Programs*, and then click **Microsoft Office**.
2. Click **Microsoft Word 2010** to open the program and display a new, blank document.
3. Click the **File** tab and then point to the **Options** button (see **Figure 6–5**).

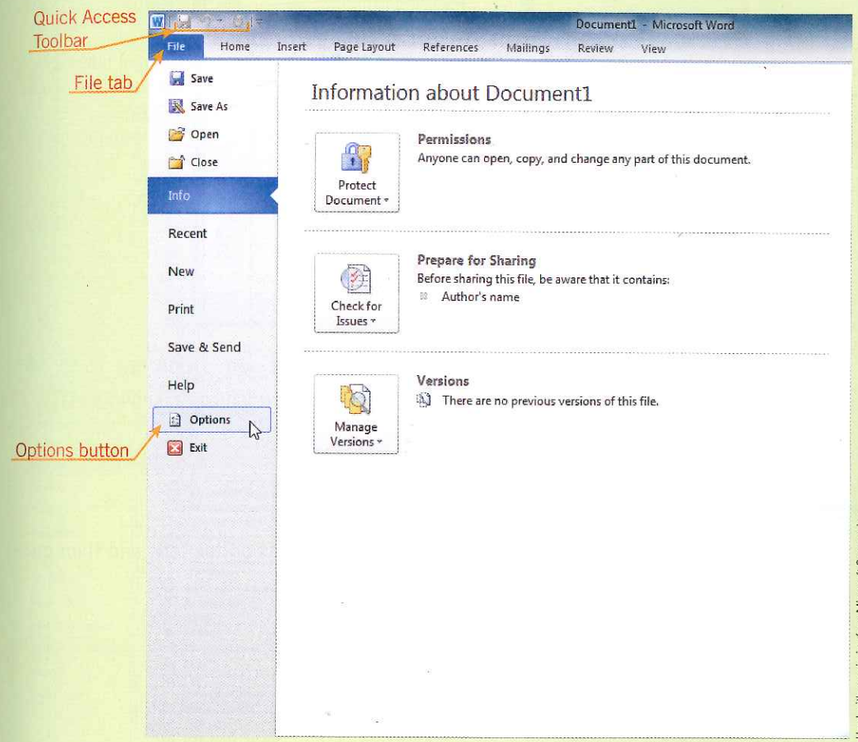


FIGURE 6–5
Word File tab

4. Click the **Options** button to display the Word Options dialog box. Click **Quick Access Toolbar** in the left pane (see **Figure 6–6**). You use the Quick Access Toolbar category of options to add and remove buttons on the Quick Access Toolbar. When you add a command to the list on the right, Word adds a corresponding button to the toolbar.

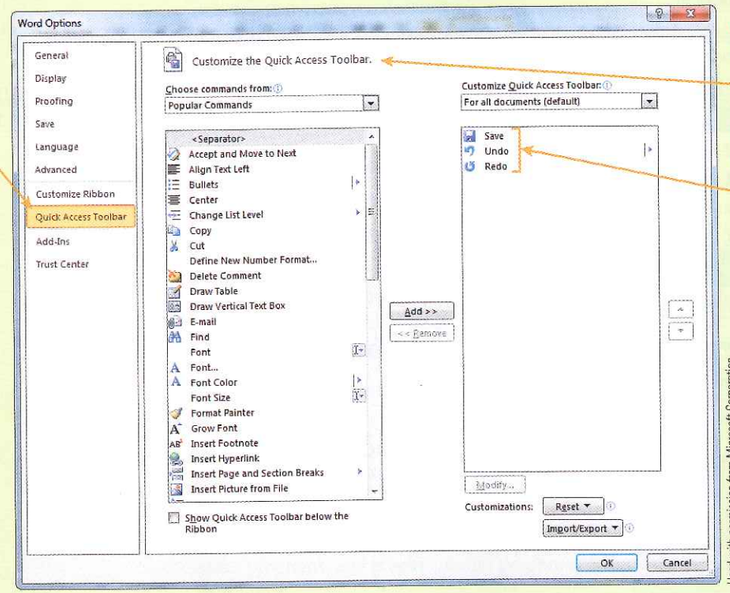


FIGURE 6–6
Word Options dialog box

5. Review the options in the list of commands on the left, and then click **E-mail** (see **Figure 6–7**).

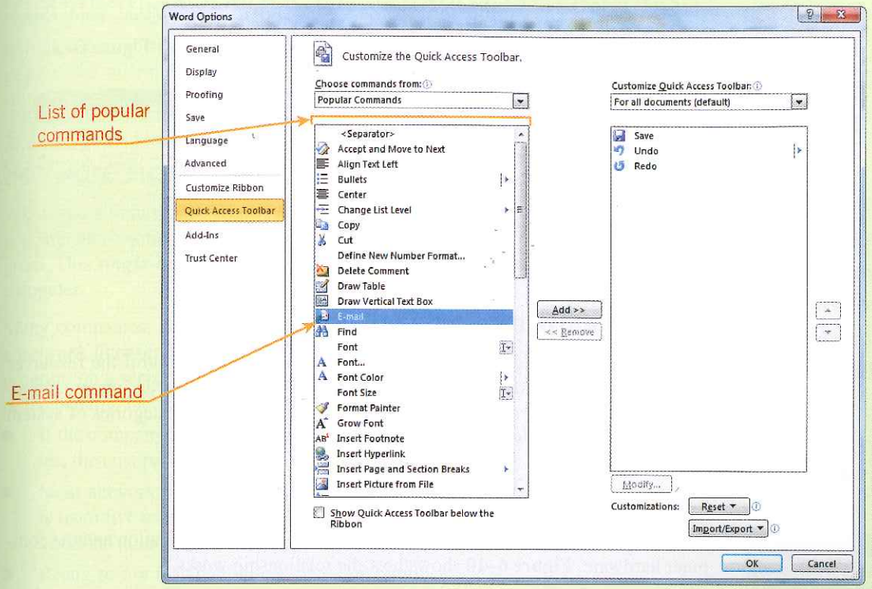


FIGURE 6–7
Selecting the E-mail command

6. Click the **Add** button to add the E-mail command to the Customize Quick Access Toolbar list (see **Figure 6–8**).

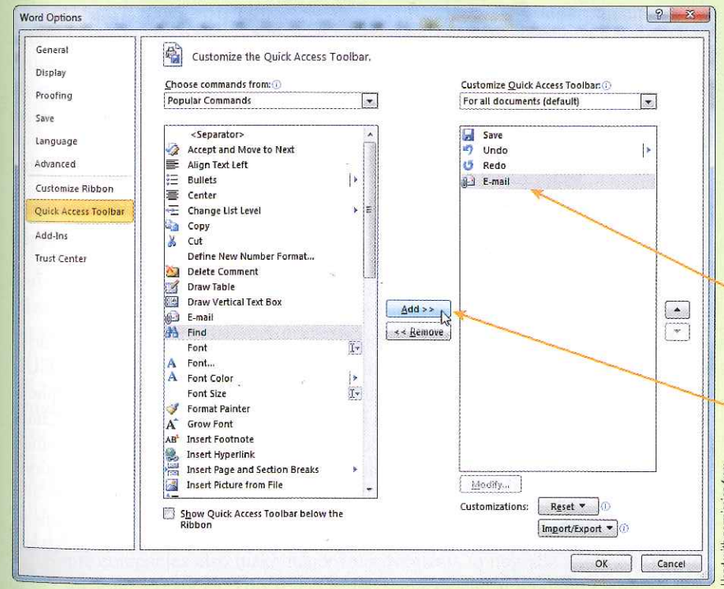
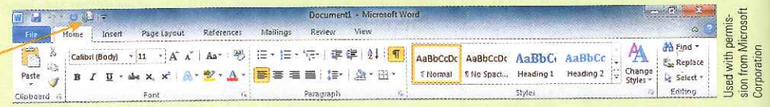


FIGURE 6–8
Adding the E-mail button to the Quick Access Toolbar

7. Click the **OK** button to add the command to the toolbar. Your Quick Access Toolbar may have fewer or additional icons (see **Figure 6–9**).



Used with permission from Microsoft Corporation

FIGURE 6–9
E-mail button on the Quick Access Toolbar

8. Close all open windows.

System Software

System software is a group of programs that coordinate and control the resources and operations of a computer system. System software enables the many components of the computer system to communicate. There are three categories of system software: operating systems, utilities, and language translators.

Operating Systems

VOCABULARY
operating system

Operating systems provide an interface between the user or application and the computer hardware. **Figure 6–10** shows how the relationship works.

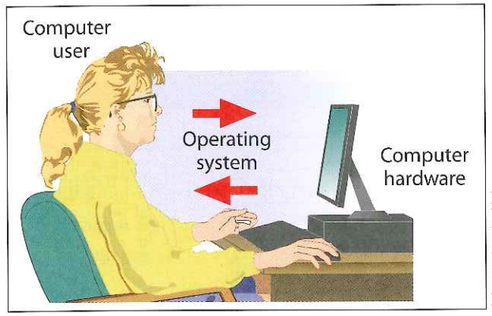


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FIGURE 6–10 Operating system: Interface between users and computers

ABOVE AND BEYOND

The history of Apple Computer and its founders, Steve Jobs and Steve Wozniak, is a fascinating story. For an overview, check out *http://inventors.about.com/od/cstartinventions/a/Apple_Computers.htm*.

As an interface between you and the hardware, an operating system contains drivers that communicate with the hardware and provides a graphical user interface (GUI) you use to control the computer. An operating system also communicates with applications. A sophisticated operating system such as Microsoft Windows, Mac OS, or Linux includes built-in applications that often include games, basic graphics editors, and e-mail software. Operating systems also communicate with other, more complex applications that are not part of the operating system itself, such as word processors, spreadsheets, and multimedia players. The operating system provides a consistent way for applications to interact with the hardware without having to know all the details of the device or driver.

Utilities and Language Translators

Utilities are programs that help to maintain computer hardware or other software, and usually perform a single task. For example, the disk defragmenting tool used in Lesson 4 is a utility. A language translator, or compiler, is a program that translates computer code written by a programmer into an executable program.

Identifying Options for Software Distribution

IC³ 1-2.1.3

Software and software licensing options are available through a variety of alternatives and distribution methods; these include single copies for installation on a single-user computer, network versions, and Internet options.

Software Licensing

When you purchase a software program, you are not just purchasing the software—you are purchasing a ***software license*** that gives you permission to use the program. This ***single-user license*** gives you the right to install the software on a single computer.

Many companies, government organizations, and educational institutions purchase a ***network license***. This type of license gives the organization the right to install a program on a server that can be accessed by a specific number of computers. Some of the benefits include the following:

- If the company purchases a network license instead of multiple single-user copies, the cost per user is lower.
- Most network licenses are offered in five-user increments. Generally the range is from five users to any multiple of five users. Usually, additional licenses can be added at any time.
- Ready-to-use installations can be set up rapidly.
- Standardizing software makes it easier to support.

Software as a Service (SaaS), typically pronounced "sass," is a recently developed software delivery method where an application is licensed for use as a service. The software is provided to customers on demand through the Internet, an intranet, or another network. The demand for SaaS is managed by a company known as an application service provider (ASP). This delivery method provides a more cost-effective alternative than traditional packaged applications. In most instances, you access the product by logging on to the site. SaaS is one of the fastest growing segments of the information technology (IT) industry. Examples of SaaS include Google Docs and Salesforce.com, which is software for tracking sales and customers.

Updating and Upgrading Software

Software development is a continuous process of updating. Users of the program often encounter errors or other problems within the software or discover that some hardware devices may not work properly with the software. When this happens, the software is updated. In most instances, users who purchased the original version of the software can download a fix for the problem. These fixes are called a ***patch***, an ***update***, or a ***service pack***. A software patch is applied over software that you already have installed. An update is a collection of files for revising released software to fix bugs or provide enhancements. A service pack is a collection of updates, fixes, or enhancements to a software program delivered as a single file. Revised versions of software that require patches or updates generally are indicated with numbers such as 1.1 or 1.2 if the modifications are minor.

Some companies also make major improvements to upgrade and modify some of the software's features. This refers to the replacement of a product with a newer version of that same product. In most instances, the modifications generally involve radical changes, so the numbers may be changed to a higher number such as 2.0. ***Upgrades*** are revised versions of a software program and require the purchase of a newer version of the software.

VOCABULARY
software license
single-user license
network license
Software as a Service (SaaS)
patch
update
service pack
upgrade

ABOVE AND BEYOND

A single-user software license is also called an end user license agreement (EULA). The EULA usually appears as you install the software and gives you the option of accepting or rejecting the agreement. If you accept, you can continue to install the software. If you reject the agreement, the installation does not continue.

VOCABULARY
Web application

Generally, you can download updates and instructions free of charge. Once downloaded, follow the instructions to update the software. Upgrades, on the other hand, might be available for downloading after purchase. Large program upgrades, such as for Microsoft Office, also might be available on DVDs.

More applications are migrating to the Web. These ***Web applications*** have no installation requirements, can be used on all operating systems, and are accessed through a Web browser over a network such as an intranet or the Internet. Web applications include Web-based e-mail, online calendars, personal information managers, and photo sharing (see **Figure 6–11**). These applications generally are updated online by the company or owner.

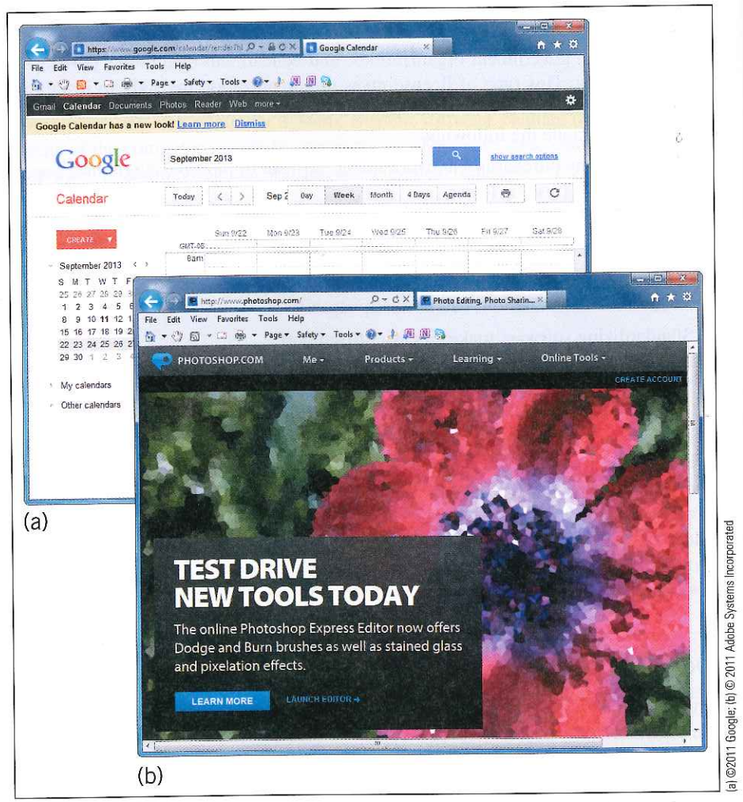


FIGURE 6–11 Web applications: (a) Google Calendar (b) Photoshop.com

In Step-by-Step 6.2, you learn how to access Windows Update information, which provides updates for the Windows operating system. Complete Step-by-Step 6.2 to learn how to apply updates.

Step-by-Step 6.2

1. Click the **Start** button on the taskbar, and then click **Help and Support** to open the Windows Help and Support window.
2. In the Search Help box, type **Windows Updates** (see **Figure 6–12**).

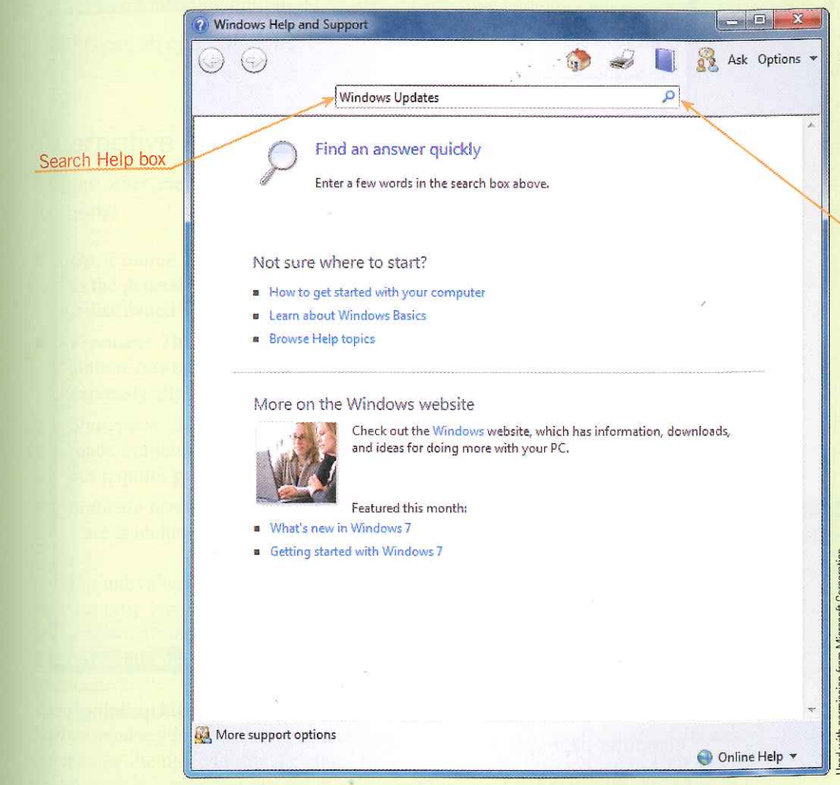
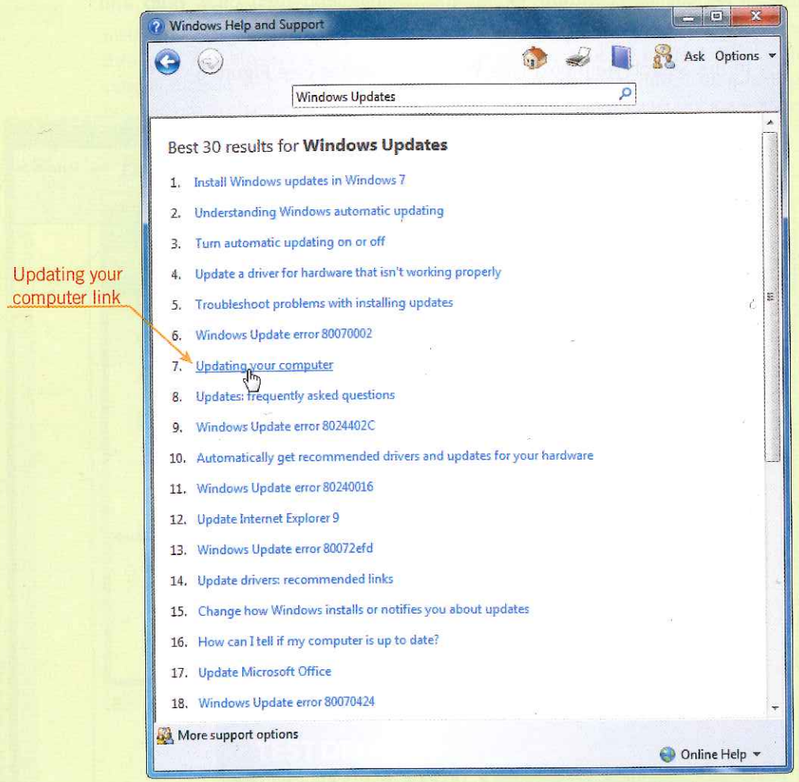


FIGURE 6–12 Searching for Help on Windows Updates

3. Click the **Search Help** button to display the results, and then point to the *Updating your computer* link (see **Figure 6–13**). Your results may differ.

FIGURE 6–13
Results of searching for "Windows Updates"



4. Click the **Updating your computer** link to display the Updating your computer page (see **Figure 6–14**).

FIGURE 6–14
Updating your computer page

5. Read the information and then click each of the links to the four general topics about updating Windows (**How can I tell if my computer is up to date?**, **Install Windows updates in Windows 7**, **Get security updates for Windows**, and **Understanding Windows automatic updating**).
6. Using your word-processing program, write a paragraph summarizing the information contained in each of the four general topics.
7. Close all open windows.

Alternative Methods of Software Distribution

Several other methods of software distribution are available. They include the following:

- *Open source*: One or more programmers create a program and make it available to the general public for use without cost; the source code can be modified and redistributed to the software user/developer community.
- *Freeware*: This is copyrighted software given away for free by the author. The author, however, retains the copyright. Code cannot be changed unless it is expressly allowed by the author.
- *Shareware*: This software, often downloadable from the Internet, is usually made available on a trial basis. Most shareware is free for an evaluation period but requires payment if you continue to use it after that.
- *Software bundled with hardware purchases*: Also called ***bundleware***, this software is included with the purchase of a new computer.

VOCABULARY
bundleware
software piracy

For individual or personal computers, it is the responsibility of the user to verify and use only legitimately licensed software. A network manager's responsibilities are somewhat more extensive. They must verify that the product is used and distributed within the terms of the license and that licensing and maintenance fees are maintained.

As indicated previously, most commercially marketed software is copyrighted. ***Software piracy*** is the unauthorized copying of software. Originally, many software companies attempted to stop the piracy by copy-protecting their software. They soon discovered, however, that this strategy was not foolproof and that software piracy is almost impossible to stop. Many software companies now require some sort of registration that generally includes a license number. This strategy works somewhat, but is not perfect and does not completely stop software piracy.

TECHNOLOGY CAREERS

Software Developer

A software developer maintains and helps develop new application and system software. When you see a software developer job listing, it could include many requirements. A company may be looking for someone to develop software using a particular programming language such as Java, Visual Basic, C, or C++, or a company may be looking for someone to develop add-ons to operating systems programs. This could include enhancements to utility programs, updates to language translators, or new additions to the operating system itself. Many companies seek employees with skills in operating systems such as UNIX and Windows 7.

If you go online to look for software developer jobs, you will find that many of them refer to Oracle, a large information technology software company. Oracle products support database technology, data design and modeling, Web applications, and much more. Salaries and educational requirements for software developers vary significantly. Educational requirements range from some college to a bachelor's or master's degree, sometimes even a Ph.D. Generally, but not always, the more education you have, the higher your starting salary. Most companies require some experience, but a few have entry-level positions.

SUMMARY

In this lesson, you learned:

- Hardware refers to anything you can touch, including objects such as the keyboard, mouse, monitor, printer, chips, disk drives, and CD/DVD recorders. Inputting refers to using an input device to enter data.
- Software is programming code written to provide instructions to the hardware so that you can perform specific tasks. Using input devices, you interact with the software by typing commands, selecting an option from a menu, or clicking a button, for example.
- Hardware and software interact as a computer processes data.
- A computer processes data by applying rules called algorithms, which are sets of clearly defined, logical steps that solve a problem.
- Software development usually begins when someone recognizes a need to perform a task more effectively using a computer. The programmer breaks down the task into an algorithm that covers all the actions needed to perform the task. The programmer often works out the logic for the steps in the algorithm by using a flowchart that shows different paths the program will take depending on what data is inputted.
- The programmer writes the steps in a computer programming language or code that uses a formal set of terms and syntax, or rules for how the words are used together. The computer translates the code into language it can understand, and uses the translated commands to execute the program.
- Software development also requires quality control, which involves running systematic tests, debugging (finding and correcting errors in the code), and beta testing.
- The two types of software are application software and system software. Application software helps you perform a specific task. System software refers to the operating system and all utility programs that manage computer resources.
- Operating systems provide an interface between the user or application and the computer hardware.
- When you purchase software, you are purchasing a license that gives you permission to use the program. A single-user license gives you the right to install the software on a single computer. Organizations using networks can purchase network licenses.

LESSON REVIEW

TRUE / FALSE

Circle T if the statement is true or F if the statement is false.

T F **1.** Freeware is copyrighted software.

T F **2.** Web-based e-mail is considered a type of Web application.

T F **3.** Most computers do not need operating system software.

T F **4.** Application software also is called productivity software.

T F **5.** Technology has not changed much in the past 50 years.

MULTIPLE CHOICE

Select the best response for the following statements.

1. _____ is the process of using an input device to enter data.
   A. Outputting C. Inputting
   B. Revising D. Interacting
2. Web applications are _____.
   A. upgrades C. programs that run on any operating system
   B. productivity applications D. all of the above
3. A computer processes data by applying rules called _____.
   A. networks C. hardware
   B. applications D. algorithms
4. When you purchase software, you are purchasing _____.
   A. a flowchart C. a language translator
   B. a license D. the user interface
5. SaaS is licensed for use as a(n) _____.
   A. upgrade C. service
   B. patch D. all of the above

FILL IN THE BLANK

Complete the following sentences by writing the correct word or words in the blanks provided.

1. Software _____ requires quality control.
2. A(n) _____ is used to show different paths a computer program can take.
3. _____ is programming code.
4. Software _____ is the unauthorized copying of software.
5. Software _____ are revised versions of an existing software program.

PROJECTS

PROJECT 6–1

Operating systems can be classified as follows: multiuser, multiprocessing, multitasking, multithreading, and real-time. Use the Internet to find information regarding these types of operating systems. Then complete the following list by writing a sentence or two describing each type.

- Multiuser:
- Multiprocessing:
- Multitasking:
- Multithreading:
- Real-time:

PROJECT 6–2

IC³ 1-2.1.2

Webopedia provides a complete overview of an operating system. Access this Web site located at *www.webopedia.com/TERM/O/operating_system.html*. Review the information and then write a summary about operating systems, using your Webopedia research and the information contained in your textbook.

PROJECT 6–3

IC³ 1-2.1.1

You are part of a team writing the program for an interactive children's game. The object of the game is similar to the poem Jack and Jill. (See *www.poetryfoundation.org/poem/176353* for the complete text.) Your part is to develop the basic flowchart or algorithm for the poem. Complete the following:

1. Identify the steps in the poem.
2. Using the algorithm shown in Figure 6–3 or the flowchart shown in Figure 6–4, write or sketch the steps of the poem.

TEAMWORK PROJECT

IC³ 1-2.1.3

You and two team members have been asked to create a proposal to purchase equipment for a new computer lab for your classroom. Your job is to determine the operating system, the distribution method you will use for software access, and the minimum number of applications you need to accomplish the goals of your computer literacy course. Describe the operating system you will use and explain why your team selected it. Research the distribution method and applications you need, and then organize your findings into a one-page report and a presentation to present to your class.

CRITICAL THINKING

As mentioned in this lesson, software piracy is the unauthorized copying of software. Assume that your responsibility is to protect your organization from software piracy. Access the Microsoft Protect Yourself from Piracy Web site at *www.microsoft.com/piracy* and the Webopedia software piracy definition page at *www.webopedia.com/TERM/S/software_piracy.html*. Review the information contained on both of these sites, and then write a report describing these terms: *copy-protecting, shareware, OEM unbundling, counterfeit software,* and *Certificate of Authenticity (COA)*. Describe the approach you would use to protect your organization's software.

IC³ 1-2.1.3

ONLINE DISCOVERY

Open source, freeware, and shareware are three categories of software described in this lesson. Complete the following:

1. Use the Internet and Web sites such as *download.cnet.com*, *directory.fsf.org*, and *freewarefiles.com* to find a minimum of two examples of software in each category.
2. Use your word processing program and create a table listing the name of the software program, the Web site address, a short description, and the software category.

IC³ 1-2.1.3

JOB SKILLS

Computer software engineer is one of the occupations projected to grow the fastest and add the most new jobs during the current decade. You are considering a career as a software engineer and want to learn more about this profession. Using the Internet and other resources, prepare a report of at least one page describing the level of skill and educational requirements required for this type of career. Use a minimum of three Web sites.

Estimated Time: 1.5 hours

LESSON 7

Software Fundamentals

OBJECTIVES

Upon completion of this lesson, you should be able to:

- Use word-processing software.
- Work with spreadsheet software.
- Work with presentation software.
- Use database software.
- Work with graphics and multimedia software.
- Use other types of software, including education, entertainment, utility, and miscellaneous programs.
- Select the right software for the task.
- Integrate software.

DATA FILES

You do not need data files to complete this lesson.

WORDS TO KNOW

bitmapped graphics
cell
database
datasheet
field
multimedia
object
object linking and embedding (OLE)
presentation software
primary key
query
record
table
text editor
utility program
vector graphics
word-processing software
workbook
worksheet