Software and Hardware Interaction– Lesson 6

Computer Literacy Basics 4E

Objectives

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

+ Identify how hardware and software interact.

+ Explain how a software program works.

+ Describe the difference between application software and system software.

+ Describe the software distribution process.

Words to Know

- algorithm
- application software
- beta testing
- bundleware
- flowchart
- inputting

- network license
- operating systems
- patch
- service pack
- single-user license
- software

- **+** Software as a Service (SaaS)

- **+** software development

- **+** software license

- **+** software piracy

- **+** system software

- **+** update

- **+** upgrades

- **+** Web applications

Competencies

6620-47 Identify the basic parts of a computer system and the relationships among components.

6620-58 Install and configure hardware in a computer system.

6620-60 Perform basic software configuration operations.

6620-63 Describe risk-mitigation techniques (e.g., policies, procedures, hardware, and software).

6620-64 Identify basic security risks inherent to computer hardware and software.

Introduction to Lesson

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. Some of the more popular input devices are 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).

Using input devices, you interact with software by typing commands such as providing a name for a word-processing document, selecting an option from a menu, or clicking a button, such as the Save button in most software programs

Extra for Experts

An early computer called the Univac I was a sensation in 1952 when it correctly predicted that Dwight D. Eisenhower should win the presidential election in a landslide victory. The election results were remarkably close to the computer's predication, 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.

The Role of Software

You cannot touch software because it has no substance. *Software* (or 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.
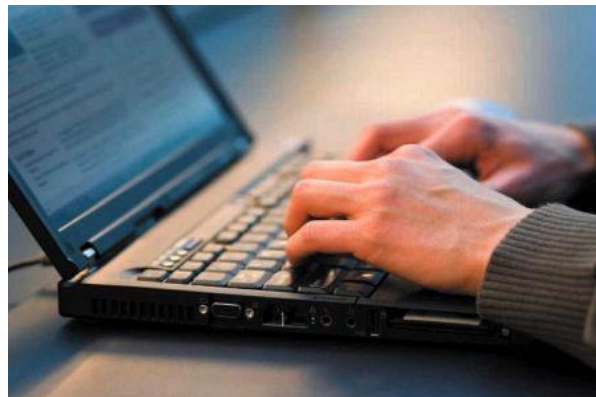
You use input devices—hardware—to enter data. Then specific programmed instructions tell the computer how to process that data—this is the software component that tells the hardware what to do. Finally, other software instructions format the data correctly so you can understand it when you see it on 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 file and download music 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.

+ 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.

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

You may have heard people say they 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: the way in which the two interact allows us to use the computer to complete many different tasks.

How a Software Program Works

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.

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.

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 steps 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 output the average of three numbers, the program must break this down into many steps. For example:

1. Let A equal 95.
2. Let B equal 102.
3. Let C equal 88.
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.

Software Development

Software development is a multistep process that usually begins when someone recognizes a need to perform a task more effectively and/or efficiently using a computer. As you have seen, the first thing the programmer must do is break down the task into an algorithm or series of steps that will cover all the individual 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.
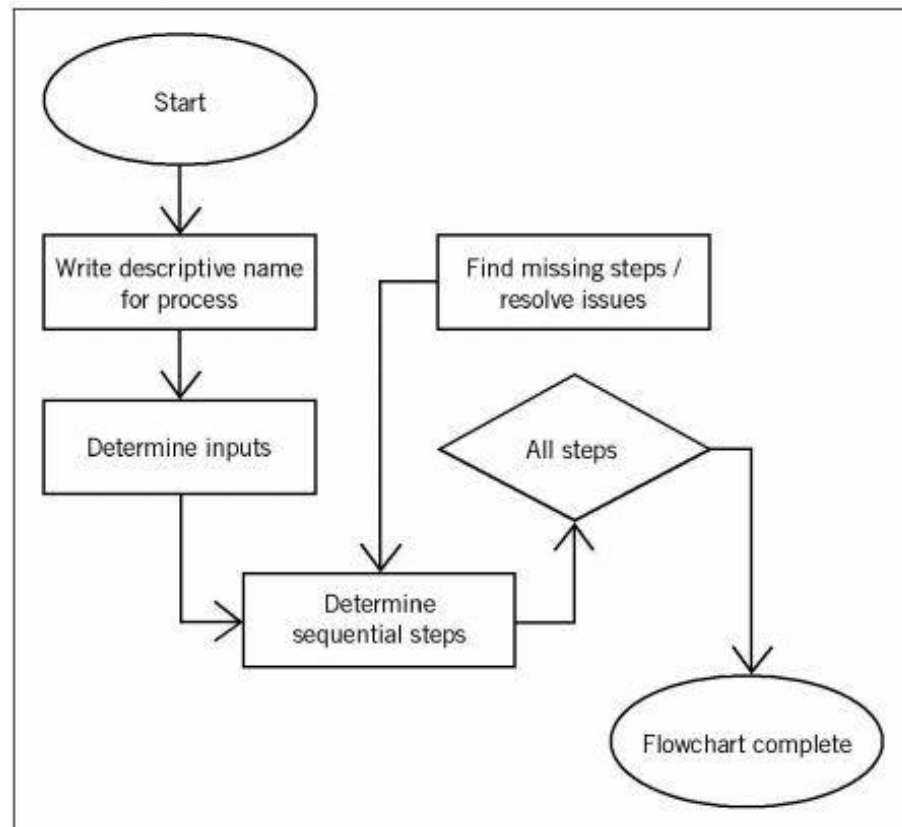
Next, the programmer writes the steps in a computer programming language or code that uses a formal set of terms and syntax, or rules for how the words are used together. The computer then will take that code, translate it into language it can understand, and use the translated commands to execute the program.

This, however, is not the end of the process. Computer programs are written by a person or people who can make mistakes. Someone might enter a line of code with a small error in syntax or spelling, and it can result in very different results than 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.

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 at a low level. 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. Some of the more commonly used 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 to modify and apply 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 view this information. Complete Step-by-Step 6.1 to modify the Quick Access Toolbar, which is the toolbar that appears to the right of the Office button on the title bar in Microsoft Office programs.

Step-by-step6.1

1. Click the Start button   on the taskbar, point to All Programs, and then click Microsoft Office.

2. Click Microsoft Office Word 2007 to open the program and display a new, blank document.

3. Click the Office button   and then point to the Word Options button

4. Click the Word Options button to display the Word Options dialog box. Click Customize in the left pane . You use the Customize 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.

5. Review the options in the list of commands on the left, and then click E-mail

6. Click the Add button to add the E-mail command to the Customize Quick Access Toolbar list

7. Click the OK button to add the command to the toolbar. Your Quick Access Toolbar may have fewer or additional icons

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

Operating systems provide an interface between the user or application program and the computer hardware.
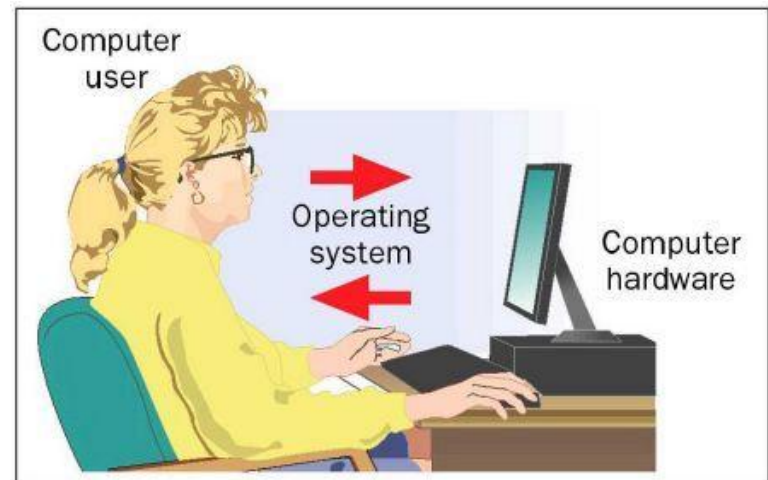
As an interface between you and the hardware, an operating system contains drivers that communicate with the hardware and provides a graphical user interface (GUI) you use to control the computer. An operating system also communicates with application software. A sophisticated operating system such as Microsoft Windows, Mac OS, or Linux includes built-in applications, such as 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.

Extra for Experts

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

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

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 which can be accessed by a specific number of computers.

Some of the benefits include the following:

+ Lower pricing can decrease a company's per-user cost by purchasing a network license versus purchasing multiple single-user copies, therefore making it more cost effective.

+ Most network licenses are offered in five-users 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 deployed rapidly.

+ Standardization provides the administration more control.

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 through a network. The demand for SaaS is managed by a company known as Application Service Provider (ASP).

This delivery method provides a more cost-effective alternative than traditional packaged applications. In most instances, the product is accessed through a user login. 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.

Extra for Experts

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.

Updating and Upgrading Software

Software development is a continuous process of updating. Users of the program often discover errors or other problems within the software, or 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. Revised versions 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.

Generally, you can download updates along with instructions. Once downloaded, follow the instructions to update the software. Upgrades, on the other hand, might be available for downloading after purchasing. Large programs, such as Microsoft Office, generally are installed from CDs or DVDs.

More applications are migrating to the Web. These **Web applications** are without platform constraints or installation requirements and are accessed through a Web browser over a network such as an intranet or the Internet. Some of the more common Web applications include Web-based e-mail, online calendars, personal information managers, photo sharing, as well as many other applications. These applications generally are updated online by the company or owner.

In Step-by-Step 6.2, you learn how to access Windows update information. Complete Step-by-Step 6.2 to learn how to apply updates.

(A)

(B)

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

3. Click the Search Help button to display the results (see Figure 6–13), and then point to the What are updates? link.

4. Click the What are updates? links to display the What are updates? page (see Figure 6–14).

5. Read the information and then click each of the three bulleted See also links (Turn automatic updating on or off; How can I tell if my computer is up to date?, and Updates: frequently asked questions).

6. Using your word-processing program, write a paragraph summarizing the information contained in each of the three bulleted items.

Alternative Methods of Software Distribution

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

+ Open source: A programmer or 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, usually 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.

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 job listing for software developer, 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 Vista.

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. There is a great variation in salaries and educational requirements for software developers. 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

+ 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.

Cont. Summary

+ 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.

Cont. Summary

+ 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 at a low level.

Continue Summary

+ Operating systems provide an interface between the user or application program and the computer hardware.

+ When you purchase a software program, you are purchasing a software 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.

+ Software as a Service (SaaS), is a recent 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 local network.

Continue Summary

+ A software update is a fix called a patch, an update, or a service pack. A software patch is applied over software that you already have installed.

+ Software upgrades are revised versions of a software program and require the purchase of a newer version of the software.

+ Web applications do not have platform constraints or installation requirements and are accessed through a Web browser over a network such as an intranet or the Internet. Common Web applications include Web mail and online calendars.

+ Alternative methods of software distribution include open source, freeware, shareware, and bundleware.

Lesson Review

True/False

1. The first step in programming is to develop machine language code.

2. An operating system is generally referred to as productivity software.

3. Debugging a program means looking for errors in the instructions to the computer.

4. Computer hardware is anything you can touch.

5. There are five categories of system software.

Multiple Choice (slide 1 of 3)

1. Another word for software is _____ A. hardware B. program C. algorithm D. interface

2. The two basic types of computer software are _____ and.

   A. program, application B. productivity, application C. application, system D. system, networking systems

Multiple Choice (2 of 3)

3. A group of programs that coordinate and control the resources of a computer system is called _____ A. system software B. application software C. shareware D. network

4. When you purchase a software program, you are purchasing _____ A. the programming code B. a license C. a language translator D. the user interface

Multiple Choice (3 of 3)

5. A software fix is called a(n) _____ A. patch B. update C. service pack D. any of the above

Fill In the Blank

1.   The _____ software delivery method provides a more cost-effective alternative than traditional packaged applications.

2.   With a(n) _____ program, the source code can be modified and redistributed to the software user and developer community.

3.   _____ is the unauthorized copying of software.

4.   A(n) _____ is a set of clearly defined, logical steps that solve a problem.

5.   A(n) _____ shows different paths the program will take depending on what data is inputted.

Projects

Project 6-1

Operating systems have come a long way over the last few years. They are much easier to use and support many more features. Suppose you are designing an operating system for computers for the year 2012. Answer the following questions, and then perform the following task:

1. What features would you include?

2. How would your operating system be different from those that currently are available?

3. Would your operating system be an open source operating system? Why or why not?

4. Use your word-processing program to write a one-page report or give an oral report to your class.

Project 6-2

You are part of a team that is going to write the program for an interactive children's game. The object of the game is similar to the poem Jack and Jill. 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.

Project 6-3

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.com, directory.fsf.org, and freewarefiles. com and find a minimum of two examples of each of these types of software.

2. Use your word-processing program and create a report listing the name of the software program, the location from where it was downloaded, a short description, and the software category.

Teamwork Project

You and two team members have been given the responsibility for purchasing new computers for a small accounting firm. You and your team members are responsible for determining the operating system, the distribution method you will use for software access, and the minimum application software you will need within this company. Research these options online, and then organize your findings into a one-page report and a presentation to present to your class.

Online Discovery

Computer software engineers are one of the occupations projected to grow the fastest and add the most new jobs over the 2006-16 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. A minimum of three Web sites should be used.