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DISCOVERING COMPUTERS 2018

Digital Technology, Data, and Devices

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DISCOVERING COMPUTERS 2018

Digital Technology, Data, and Devices

Misty E. Vermaat
Susan L. Sebok
Steven M. Freund
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CENGAGE Learning

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CENGAGE Learning

Discovering Computers: Digital Technology, Data, and Devices
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DISCOVERING COMPUTERS 2018

Digital Technology, Data, and Devices

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DISCOVERING COMPUTERS 2018

Digital Technology, Data, and Devices

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1

Introducing Today's Technologies: Computers, Devices, and the Web

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OBJECTIVES

After completing this module, you will be able to:

1. Differentiate among laptops, tablets, desktops, and servers
2. Describe the purpose and uses of smartphones, digital cameras, portable and digital media players, e-book readers, wearable devices, and game devices
3. Describe the relationship between data and information
4. Briefly explain various input options (keyboards, pointing devices, voice and video input, and scanners), output options (printers, displays, and speakers), and storage options (hard disks, solid-state drives, USB flash drives, memory cards, optical discs, and cloud storage)
5. Differentiate the web from the Internet, and describe the relationship among the web, webpages, websites, and web servers
6. Explain the purpose of a browser, a search engine, and an online social network
7. Briefly describe digital security risks associated with viruses and other malware, privacy, your health, and the environment
8. Differentiate between an operating system and applications
9. Differentiate between wired and wireless network technologies, and identify reasons individuals and businesses use networks
10. Discuss how society uses technology in education, government, finance, retail, entertainment, health care, science, travel, publishing, and manufacturing
11. Identify technology used by home users, small/home office users, mobile users, power users, and enterprise users

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Today's Technology

In the course of a day, you may ... complete a homework assignment and watch a streaming video using your laptop, flip through news headlines and make dinner reservations using your tablet, search for directions and the local weather forecast while listening to music on your smartphone, edit a video on a desktop computer, and share photos online from your digital camera with family and friends. These and many other technologies are an integral part of everyday life: at school, at home, and at work (Figure 1-1).

Technology can enable you to more efficiently and effectively access and search for information; share personal ideas, photos, and videos with friends, family, and others; communicate with and meet other people; manage finances; shop for goods and services; play games or access other sources of entertainment; keep your life and activities organized; and conduct business activities. People who can accomplish these types of tasks using technology often are said to be tech savvy.

Figure 1-1 People use a variety of computers, mobile devices, and apps every day.
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Because technology changes, you must keep up with the changes to remain digitally literate. *Digital literacy* involves having a current knowledge and understanding of computers, mobile devices, the web, and related technologies. This book presents the knowledge you need to be digitally literate today.

As you read this first module, keep in mind it is an overview. Most of the terms and concepts introduced in this module will be discussed in more depth later in the book.

Computers

A **computer** is an electronic device, operating under the control of instructions stored in its own memory, that can accept data (*input*), process the data according to specified rules, produce information (*output*), and store the information for future use (Figure 1-2). Computers contain many electric, electronic, and mechanical components known as *hardware*.

Figure 1-2 A laptop is a widely used type of computer.
mama_mia / Shutterstock.com

Electronic components in computers process data using instructions, which are the steps that tell the computer how to perform a particular task. A collection of related instructions organized for a common purpose is referred to as software or a program. Using software, you can complete a variety of activities, such as search for information, type a paper, balance a budget, create a presentation, or play a game.

One popular category of computer is the personal computer. A *personal computer* (PC) is a computer that can perform all of its input, processing, output, and storage activities by itself and is intended to be used by one person at a time. Most personal computers today also can communicate with other computers and devices.

Types of personal computers include laptops, tablets, and desktops, with the first two sometimes called mobile computers. A *mobile computer* is a portable personal computer, designed so that a user can carry it from place to place. A *user* is anyone who interacts with a computer or mobile device, or utilizes the information it generates.

Laptops

A **laptop**, also called a *notebook computer*, is a thin, lightweight mobile computer with a screen in its lid and a keyboard in its base (shown in Figure 1-2). Designed to fit on your lap and for easy transport, most laptops weigh up to 7 pounds (varying by manufacturer and specifications). A laptop that is less than one inch thick and weighs about three pounds or less sometimes is referred to as an ultrathin laptop. Most laptops can operate on batteries or a power supply or both.

Tablets

Usually smaller than a laptop but larger than a phone, a **tablet** is a thin, lighter-weight mobile computer that has a touch screen (read How To 1-1 for ways to interact with a touch screen). A popular style of tablet is the slate, which does not contain a physical keyboard (Figure 1-3). Like laptops, tablets run on batteries or a power supply or both; however, batteries in a tablet typically last longer than those in laptops.

Figure 1-3 A slate tablet.
Denys Prykhodov / Shutterstock.com

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CONSIDER THIS

If a slate tablet has no keyboard, how do you type on it?

You can use your fingers to press keys on a keyboard that appears on the screen, called an on-screen keyboard, or you can purchase a separate physical keyboard that attaches to or wirelessly communicates with the tablet. You also may be able to speak into the tablet, and your spoken words will translate to typed text.

HOW TO 1-1

Interact with a Touch Screen

You usually can interact with a touch screen using gestures. A *gesture* is a motion you make on a touch screen with the tip of one or more fingers or your hand. Touch screens are convenient because they do not require a separate device for input. Tablets and smartphones typically have touch screens.

The table below presents common ways to interact with a touch screen.

Touch Screen Gestures

Motion	Description	Common Uses
Tap 	Quickly touch and release one finger one time	Activate a link (built-in connection) Press a button Run a program or app
Double-tap 	Quickly touch and release one finger two times	Run a program or app Zoom in (show a smaller area on the screen, so that contents appear larger) at the location of the double-tap
Press and hold 	Press and hold one finger to cause an action to occur, or until an action occurs	Display a shortcut menu (immediate access to allowable actions) Activate a mode enabling you to move an item with one finger to a new location
Drag, or slide 	Press and hold one finger on an object and then move the finger to the new location	Move an item around the screen Scroll
Swipe 	Press and hold one finger and then move the finger horizontally or vertically on the screen	Scroll Display a bar that contains commands on an edge of the screen
Stretch 	Move two fingers apart	Zoom in (show a smaller area on the screen, so that contents appear larger)
Pinch 	Move two fingers together	Zoom out (show a larger area on the screen, so that contents appear smaller)

Consider This: In addition to the motions listed in the table, what other motions do you think a touch screen should support?

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Desktops and All-in-Ones

A **desktop**, or desktop computer, is a personal computer designed to be in a stationary location, where all of its components fit on or under a desk or table. On many desktops, the screen is housed in a display device (or simply display) that is separate from a tower, which is a case that contains the processing circuitry (Figure 1-4a). Another type of desktop called an **all-in-one** does not contain a tower and instead uses the same case to house the display and the processing circuitry (Figure 1-4b). Some desktops and all-in-ones have displays that support touch.

BTW
Desktop
The term, desktop, also sometimes is used to refer to an on-screen work area on laptops, tablets, and desktops.

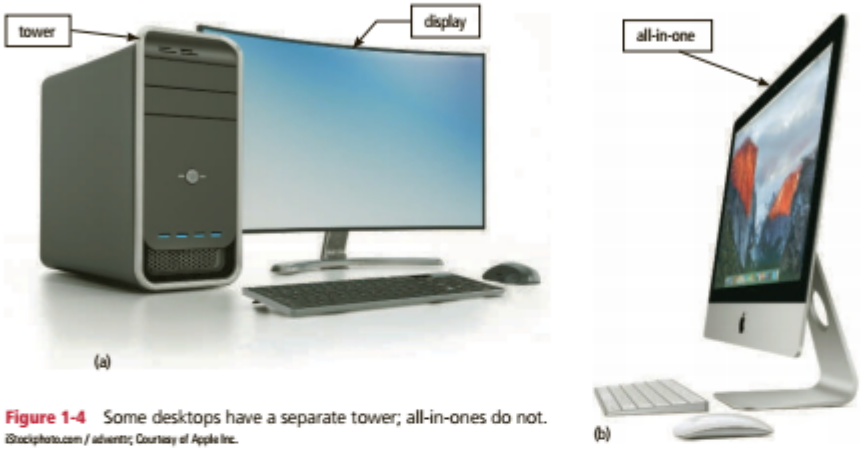

Figure 1-4 Some desktops have a separate tower; all-in-ones do not.
iStockphoto.com / adventtr; Courtesy of Apple Inc.

CONSIDER THIS

Which type of computer — laptop, tablet, or desktop — is best?
It depends on your needs. Because laptops can be as powerful as the average desktop, more people today choose laptops over desktops so that they have the added benefit of portability. Tablets are ideal for those not needing the power of a laptop or for searching for information, communicating with others, and taking notes in lectures, at meetings, conferences, and other forums where a laptop is not practical. Desktops and all-in-ones often have larger displays than laptops or tablets, which make them well suited for developing software, editing large documents, or creating images and videos.

Servers

A **server** is a computer dedicated to providing one or more services to other computers or devices on a network. A **network** is a collection of computers and devices connected together, often wirelessly. Services provided by servers include storing content and controlling access to hardware, software, and other resources on a network.

A server can support from two to several thousand connected computers and devices at the same time. Servers are available in a variety of sizes and types for both small and large business applications (Figure 1-5). Smaller applications, such as at home, sometimes use a high-end desktop as a server. Larger corporate, government, and web applications use powerful, expensive servers to support their daily operations.

BTW
Online
When a computer or device connects to a network, it is said to be online.

Figure 1-5 A server provides services to other computers or devices on a network.
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Mobile and Game Devices

A *mobile device* is a computing device small enough to hold in your hand. Because of their reduced size, the screens on mobile devices are small — often between 3 and 5 inches.

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Figure 1-6 Most smartphones have a touch screen.
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Some mobile devices are Internet capable, meaning that they can connect to the Internet wirelessly. You often can exchange information between the Internet and a mobile device or between a computer or network and a mobile device. Popular types of mobile devices are smartphones, digital cameras, portable and digital media players, e-book readers, and wearable devices.

CONSIDER THIS

Are mobile devices computers?
The mobile devices discussed in this section can be categorized as computers because they operate under the control of instructions stored in their own memory, can accept data, process the data according to specified rules, produce or display information, and store the information for future use.

Smartphones

A **smartphone** is an Internet-capable phone that usually also includes a calendar, an address book, a calculator, a notepad, games, and several other apps (which are programs on the smartphone). Other apps are available through an app store that typically is associated with the phone.

Smartphones typically communicate wirelessly with other devices or computers. With most smartphone models, you also can listen to music, take photos, and record videos. Most smartphones have a touch screen (Figure 1-6). A few models have built-in mini keyboards or keypads that contain both numbers and letters.

Instead of calling someone's phone to talk, you can send messages to others by pressing images of keys and icons on an on-screen keyboard on the phone. Four popular types of messages that you can send with smartphones include voice messages, text messages, picture messages, and video messages.

- A *voice mail message* is a short audio recording sent to or from a smartphone or other mobile device.
- A *text message* is a short note, typically fewer than 300 characters, sent to or from a smartphone or other mobile device.
- A *picture message* is a photo or other image, sometimes along with sound and text, sent to or from a smartphone or other mobile device.
- A *video message* is a short video clip, usually about 30 seconds, sent to or from a smartphone or other mobile device.

BTW

Messaging Services
Mobile service providers may charge additional fees for sending text, picture, or video messages, depending on the messaging plan.

Read Ethics & Issues 1-1 to consider whether it should be legal to use a hands-free device, such as a smartphone, while driving.

ETHICS & ISSUES 1-1

Should It Be Legal to Use a Hands-Free Device while Driving?
Your new vehicle includes a sophisticated hands-free system that enables you to connect a mobile device to the vehicle's sound system. In addition to making phone calls without holding your device, you also can use this technology to read and respond to text messages or to update your Facebook status using speech-to-text, which converts your spoken words to text. Is this technology safe to use?

The debate about hands-free device safety elicits different points of view from vehicle insurance companies, consumer safety groups, and the telecommunications industry. AAA (American Automobile Association) conducted a study to measure the mental effect of using hands-free devices while driving. The conclusions indicated that drivers using hands-free devices are distracted, miss visual clues, and have slower reaction times. Others claim that drivers can be just as easily distracted if they are discussing business or emotional matters with passengers in the vehicle. The National Highway Traffic Safety Administration estimates that more than 3,000 fatalities occur each year due to "distracted driving."

Some states have outlawed any use of mobile phones while driving, while others ban users from sending text messages and/or require drivers to use hands-free devices while driving. Some vehicles contain technology that can restrict or block mobile phone usage while the vehicle is in motion.

Consider This: Do you believe you are distracted if you use hands-free devices while driving? Why or why not? Do you think auto manufacturers should continue to include hands-free device technology in vehicles? Why or why not? Would you use in-vehicle technology that limited your device usage while driving?

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Digital Cameras

A **digital camera** is a device that allows you to take photos and store the photographed images digitally (Figure 1-7). A smart digital camera also can communicate wirelessly with other devices and include apps similar to those on a smartphone. Many mobile computers and devices, such as tablets and smartphones, include at least one integrated digital camera.

Digital cameras typically allow you to review, and sometimes modify, images while they are in the camera. You also can transfer images from a digital camera to a computer or device, so that you can review, modify, share, organize, or print the images. Digital cameras often can connect to or communicate wirelessly with a computer, a Smart TV (discussed later in the module), a printer, or the Internet, enabling you to access the photos on the camera without using a cable. Some also can record videos. Many digital cameras also have built-in GPS (discussed later in this module), giving them the capability to record the exact location where a photo was taken and store these details with the photo.

Figure 1-7 With a digital camera, you can view photographed images immediately through a small screen on the camera to see if the photo is worth keeping.
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Portable and Digital Media Players

A **portable media player** is a mobile device on which you can store, organize, and play or view digital media (Figure 1-8). *Digital media* includes music, photos, and videos. Thus, portable media players enable you to listen to music, view photos, and watch videos, movies, and television shows. With most, you transfer the digital media from a computer or the web, if the device is Internet capable, to the portable media player. Some enable you to play the media while it streams, that is, while it transfers to the player.

Portable media players usually require a set of *earbuds*, which are small speakers that rest inside each ear canal. Some portable media player models have a touch screen, while others have a pad that you operate with a thumb or finger, so that you can navigate through digital media, adjust volume, and customize settings. Some portable media players also offer a calendar, address book, games, and other apps (discussed later in this module).

Portable media players are a mobile type of digital media player. A *digital media player* or *streaming media player* is a device, typically used in a home, that streams digital media from a computer or network to a television, projector, or some other entertainment device.

Figure 1-8 Portable media players typically include a set of earbuds. Digital media players stream media to a home entertainment device.
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E-Book Readers

An **e-book reader** (short for electronic book reader), or *e-reader*, is a mobile device that is used primarily for reading e-books (Figure 1-9). An *e-book*, or digital book, is an electronic version of a printed book, readable on computers and other digital devices. In addition to books, you typically can purchase and read other forms of digital media such as newspapers and magazines.

Most e-book reader models have a touch screen, and some are Internet capable. These devices usually are smaller than tablets but larger than smartphones.

Figure 1-9 An e-book reader.
iStockphoto.com / hocus-focus

Wearable Devices

A **wearable device** or *wearable* is a small, mobile computing consumer device designed to be worn (Figure 1-10). These devices often communicate with a mobile device or computer.

Two popular wearable devices are activity trackers and smartwatches. Activity trackers monitor heart rate, measure pulse, count steps, and track sleep patterns. In addition to keeping time, a smartwatch can communicate with a smartphone to make and answer phone calls, read and send messages, access the web, play music, work with apps, such as fitness trackers and GPS, and more.

Figure 1-10 Activity trackers and smartwatches are popular types of wearable devices.
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Game Devices

A **game console** is a mobile computing device designed for single-player or multiplayer video games. Gamers often connect the game console to a television so that they can view their game-play on the television's screen (Figure 1-11). Many game console models are Internet capable and also allow you to listen to music and watch movies or view photos. Typically weighing between three and eleven pounds, the compact size of game consoles makes them easy to use at home, in the car, in a hotel, or any location that has an electrical outlet and a television screen.

Figure 1-11 Game consoles often connect to a television; handheld game devices contain a built-in screen.
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A handheld game device is small enough to fit in one hand, making it more portable than the game console. Because of their reduced size, the screens are small — similar in size to some smartphone screens. Some handheld game device models are Internet capable and also can communicate wirelessly with other similar devices for multiplayer gaming.

CONSIDER THIS

Are digital cameras, portable media players, e-book readers, and handheld game devices becoming obsolete as more and more smartphones and tablets include their functionality?

Many smartphones and tablets enable you to take and store photos; store, organize, and play or view your digital media; read e-books; and play games. This trend of computers and devices with technologies that overlap, called **digital device convergence**, means that consumers may need fewer devices for the functionality that they require.

Still, consumers may purchase separate stand-alone devices (i.e., a separate digital camera, portable media player, etc.) for a variety of reasons. The stand-alone device (i.e., a digital camera) may have more features and functionality than the combined device offers (i.e., a smartphone). You might want to be able to use both devices at the same time; for example, you might send text messages on the phone while reading a book on an e-book reader. Or, you might want protection if your combined device (i.e., smartphone) breaks. For example, you still can listen to music on a portable media player if your smartphone becomes nonfunctional.

Tech Feature 1-1: Gaming and Digital Home

Technology has made homes entertaining, efficient, and safe. Read Tech Feature 1-1 to learn how game devices provide entertainment and education, and home automation offers convenience and significant cost savings.

TECH FEATURE 1-1

Gaming and Digital Home

Academic researchers developed the first video games in the 1950s as part of their studies of artificial intelligence and simulations, and their work was applied and expanded commercially to early home consoles and arcade games. The concept of home automation can be traced back to 1898 when Nikola Tesla invented the first remote control. The following sections describe how these two technologies are used today.

Gaming

Video gamers spend billions of dollars each year making the most of their downtime with game consoles and devices. An estimated 1.2 billion people worldwide are active video gamers, half of whom play at least 2 hours per day. The popularity is due, in large part, to the social aspect of gathering families and friends to play together as a group or online with one another and those around the world. The wide variety of categories offers a gaming experience for practically everyone in genres such as adventure, education, fitness, puzzles, sports, role-playing, and simulation.

- **Obtaining Games:** Gamers have several options available for obtaining games. For tablets and smartphones, they can download games from an app store to a mobile computer or device. For game consoles, they can purchase or rent discs or other media that contain games, download or transfer them from online stores, or sign up for cloud services that stream or transfer games on demand.
- **Accessories and Input Techniques:** The more popular game consoles work with a wide variety of accessories and input techniques for directing movements and actions of on-screen players and objects. They include gamepads, voice commands, and fitness accessories, some of which are shown here. Although many games are played using a controller, several game consoles operate by allowing the player to be the controller.

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Home Automation

New home builders and existing homeowners are integrating features that automate a wide variety of tasks, save time and money, and enhance the overall at-home environment.

(continued)

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- **Lighting:** Controlling lighting is one of the more common uses of technology in the home. Remotes turn light fixtures on and off, and motion sensors turn on lights when a car or a visitor approaches the driveway or walkway.
- **Thermostats:** Programmable thermostats adjust to seasonal needs and can be set to control temperatures in individual rooms. Homeowners can use their smartphones to monitor heating and cooling systems, adjust temperatures, and manage energy consumption.
- **Appliances:** Smart appliances, such as dishwashers, can be programmed to run at nonpeak electrical times. Coffeemakers can turn on at set times and shut off if an overheating coffeepot has been left on accidentally. Refrigerators can track expiration dates and create shopping lists.
- **Security:** Security systems can detect break-ins at doors and heat from fires, and they can send text and email messages to alert a homeowner when someone has entered or left the home. Surveillance cameras keep a watchful eye on the premises and interior rooms; homeowners can view the images on televisions and computers within the house or on a webpage when they are away from home.
- **Remotes:** Many people are turning to using their smartphones and tablets to control all the devices in the room. Users enjoy the convenience of customizing apps to operate their television, DVR, and security system and to perform other functions anywhere in the home.

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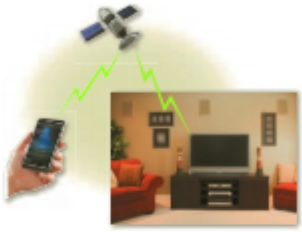

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Consider This: How has your life become more efficient, safe, and enjoyable by using home automation and entertainment features? Why do you think gaming is so popular? Can you think of any downsides?

Data and Information

Computers process data (input) into information (output) and often store the data and resulting information for future use. *Data* is a collection of unprocessed items, which can include text, numbers, images, audio, and video. *Information* conveys meaning to users. Both business and home users can make well-informed decisions because they have instant access to information from anywhere in the world.

Many daily activities either involve the use of or depend on information from a computer. For example, as shown in Figure 1-12, computers process several data items to print information in the form of a cash register receipt.

BTW

Mobile Computer Input

If you prefer a full-sized keyboard to a laptop's keyboard or a tablet's on-screen keyboard, you can use a full-sized keyboard with your mobile computer. Likewise, if you prefer using a mouse instead of a touchpad, you can use a mouse with your mobile computer.

CONSIDER THIS

What is another example of data and its corresponding information?

Your name, address, term, course names, course sections, course grades, and course credits all represent data that is processed to generate your semester grade report. Other information on the grade report includes results of calculations, such as total semester hours, grade point average, and total credits.

Input

Users have a variety of input options for entering data into a computer, many of which involve using an input device. An **input device** is any hardware component that allows you to enter data and instructions into a computer or mobile device. The following sections discuss common input methods.

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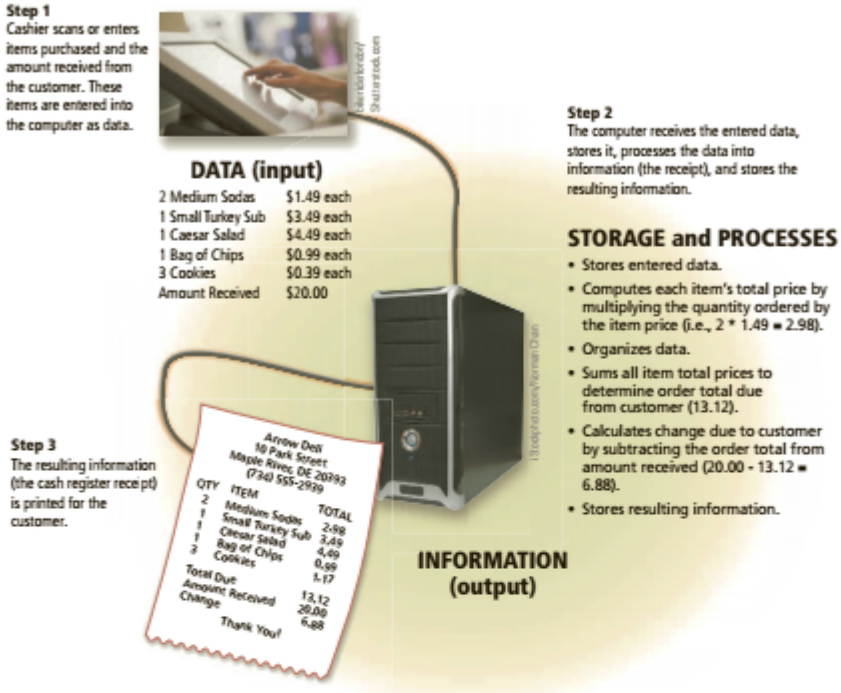

Figure 1-12 A computer processes data into information. In this simplified example, the item ordered, item price, quantity ordered, and amount received all represent data (input). The computer processes the data to produce the cash register receipt (information, or output).

Keyboards A *keyboard* contains keys you press to enter data and instructions into a computer or mobile device (Figure 1-13). All desktop keyboards have a typing area that includes letters of the alphabet, numbers, punctuation marks, and other basic keys. Some users prefer a wireless keyboard because it eliminates the clutter of a cord.

Keyboards for desktops contain more keys than keyboards on mobile computers and devices. To provide the same functionality as a desktop keyboard, many of the keys on mobile computers and devices serve two or three purposes. On a laptop, for example, you often use the same keys to type numbers and to show various areas on a screen, switching a key's purpose by pressing a separate key first.

Instead of a physical keyboard, users also can enter data via an on-screen keyboard or a virtual keyboard, which is a keyboard that projects from a device to a flat surface.

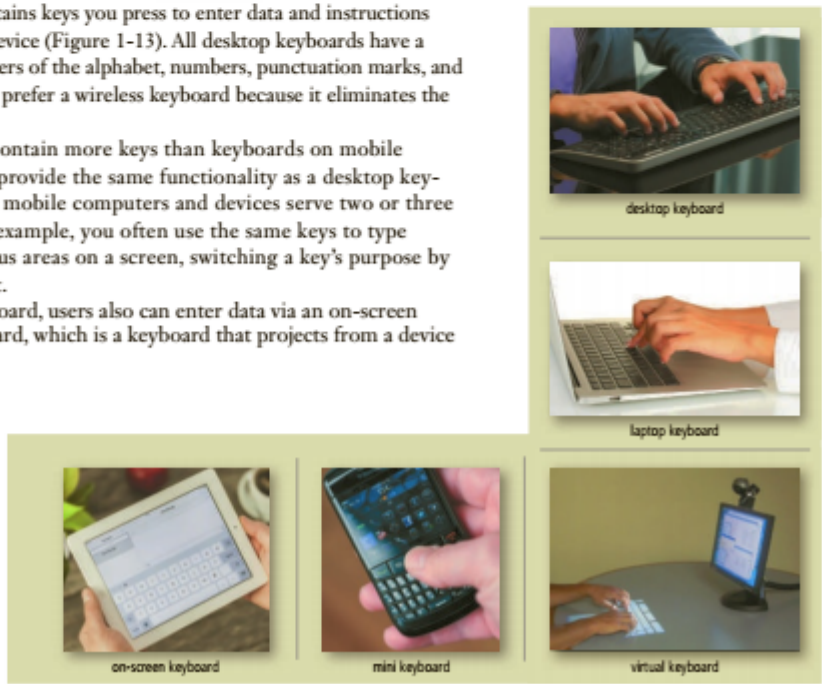

Figure 1-13 Users have a variety of options for entering typed text.

skyfotostock / Shutterstock.com; Africa Studio / Shutterstock.com; Billion Photos / Shutterstock.com; David Lichtneker / Alamy Stock Photo; Courtesy of Virtual Devices

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Figure 1-14 A mouse and a touchpad.
iStockphoto.com / PhotoTalk; iStockphoto.com / deepblue4you

Pointing Devices A pointing device is an input device that allows a user to control a small symbol on a screen, called the pointer. Desktops typically use a mouse as their pointing device, and laptops use a touchpad (Figure 1-14).

A *mouse* is a pointing device that fits under the palm of your hand comfortably. With the mouse, you control movement of the pointer and send instructions to the computer or mobile device. Table 1-1 identifies some of the common mouse operations. Like keyboards, some users prefer working with a wireless mouse.

A *touchpad* is a small, flat, rectangular pointing device that is sensitive to pressure and motion. To control the pointer with a touchpad, slide your fingertip across the surface of the pad. On most touchpads, you also can tap the pad's surface to imitate mouse operations, such as clicking.

Table 1-1 Mouse Operations

Operation	Description	Common Uses
Point	Move the mouse until the pointer is positioned on the item of choice.	Position the pointer on the screen.
Click	Press and release the primary mouse button, which usually is the left mouse button.	Select or deselect items on the screen or run a program or feature.
Right-click	Press and release the secondary mouse button, which usually is the right mouse button.	Display a shortcut menu.
Double-click	Quickly press and release the primary mouse button twice without moving the mouse.	Run a program or program feature.
Drag	Point to an item, hold down the primary mouse button, move the item to the desired location on the screen, and then release the mouse button.	Move an object from one location to another or draw pictures.

Voice and Video Input Some mobile devices and computers enable you to speak data instructions using voice input and to capture live full-motion images using video input. With your smartphone, for example, you may be able to use your voice to send a text message, schedule an appointment, and dial a phone number. Or, you may opt for video calling instead of a voice phone call, so that you and the person you called can see each other as you chat on a computer or mobile device. As in this example, video input usually works in conjunction with voice input. For voice input, you use a microphone, and for video input you use a webcam (Figure 1-15).

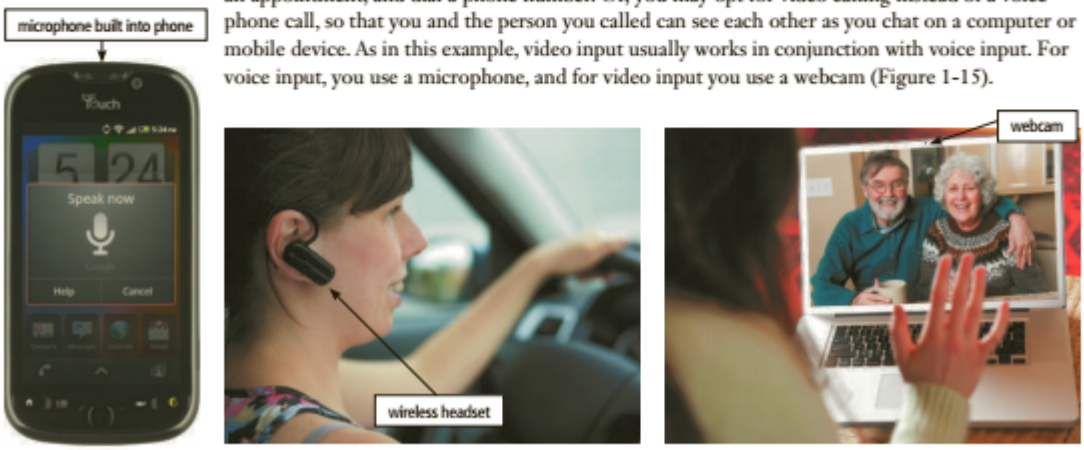

Figure 1-15 You can speak instructions into a microphone or wireless headset and capture live video on a webcam for a video call.
iStockphoto.com / Stephen Krow; iStockphoto.com / pierrephoto; iStockphoto.com / SuprijonoSuharjoto

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A *microphone* is an input device that enables you to speak into a computer or mobile device. Many computers and most mobile devices contain built-in microphones. You also can talk into a *headset*, which contains both a microphone and a speaker. Many headsets can communicate wirelessly with the computer or mobile device. A *webcam* is a digital video (DV) camera that allows you to capture video and usually audio input for your computer or mobile device.

Scanners A *scanner* is a light-sensing input device that converts printed text and images into a form the computer can process (Figure 1-16). A popular type of scanner works in a manner similar to a copy machine, except that instead of creating a paper copy of the document or photo, it stores the scanned document or photo electronically.

Figure 1-16 A scanner.
iStockphoto.com / EdgaraMarcos

Output

Users have a variety of output options to convey text, graphics, audio, and video — many of which involve using an output device. An **output device** is any hardware component that conveys information from a computer or mobile device to one or more people. The following sections discuss common output methods.

Printers A **printer** is an output device that produces text and graphics on a physical medium, such as paper or other material (Figure 1-17). Printed content sometimes is referred to as a *hard copy* or *printout*. Most printers today print text and graphics in both black-and-white and color on a variety of paper types with many capable of printing lab-quality photos. A variety of printers support wireless printing, where a computer or other device communicates wirelessly with the printer.

A *3-D printer* can print solid objects, such as clothing, prosthetics, eyewear, implants, toys, parts, prototypes, and more. 3-D (three-dimensional) printers may use a variety of substances, including plastic, nylon, wood, bronze, and copper, to print the layers that create a 3-D model.

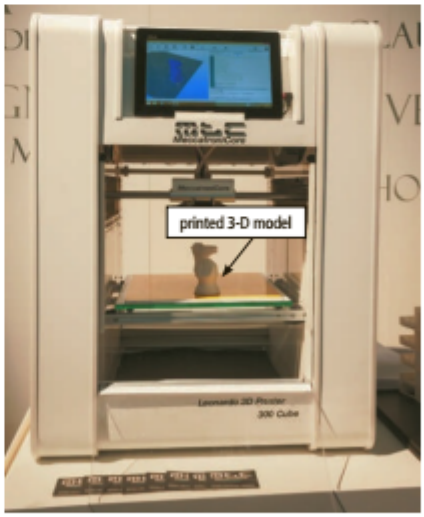

Figure 1-17 A printer can produce a variety of printed output including photos and 3-D solid objects.
Courtesy of Epson America, Inc.; Tinxi / Shutterstock.com

Displays A display is an output device that visually conveys text, graphics, and video information. Displays consist of a screen and the components that produce the information on the screen. The display for a desktop usually is a monitor, which is a separate, physical device. Mobile computers and devices typically integrate the display in their same physical case (Figure 1-18). Many displays have touch screens.

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Figure 1-18 Displays vary depending on the computer or mobile device.
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Home users sometimes use a digital television or a Smart TV as a display. A *Smart TV* is an Internet-capable high-definition television (HDTV) on which you can use the Internet to watch video, listen to the radio, play games, and communicate with others — all while watching a television show.

CONSIDER THIS

What can you do to ease eyestrain while using a computer or mobile device?
Position the display about 20 degrees below eye level. Clean the screen regularly. Blink your eyes every five seconds. Adjust the room lighting. Face into an open space beyond the screen. Use larger fonts or zoom the display. Take an eye break every 30 minutes. If you wear glasses, ask your doctor about computer glasses.

Figure 1-19 In a crowded environment where speakers are not practical, users can wear headphones to hear music, voice, and other audio.
iStockphoto.com / Photo_Alto

Speakers, Earbuds, and Headphones Speakers allow you to hear audio, that is, music, voice, and other sounds. Most personal computers and mobile devices have a small internal speaker. Many users attach higher-quality speakers to their computers and mobile devices, including game consoles.

So that only you can hear sound, you can listen through earbuds (shown earlier in this module in Figure 1-8) or headphones, which cover or are placed outside of the ear (Figure 1-19). Both earbuds and headphones usually include noise-cancelling technology to reduce the interference of sounds from the surrounding environment. To eliminate the clutter of cords, users can opt for wireless speakers or wireless headphones.

CONSIDER THIS

How can you protect your hearing when using earbuds or headphones?
The lower the volume levels, the less potential hearing damage. Decrease the volume until people near you cannot hear the sound from your earbuds or headphones. Consider using a high-quality set of headphones with noise-cancelling technology. These headphones have improved sound quality so that you do not need to turn up the volume as loud. They also have a better design with a closer fit, which reduces the volume required for optimal listening. Noise-cancelling technology eliminates the external noise, allowing you to reduce the volume level needed. Lastly, if you intend to listen to music through earbuds or headphones for hours at a time, consider listening at only 30 percent maximum volume, because listening for extended periods of time at a high volume may be unsafe for your ears.

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Memory and Storage

Memory consists of electronic components that store instructions waiting to be executed and the data needed by those instructions. Although some forms of memory are permanent, most memory keeps data and instructions temporarily, which means its contents are erased when the computer is shut off.

Storage, by contrast, holds data, instructions, and information for future use. For example, computers can store hundreds or millions of student names and addresses permanently. A computer keeps data, instructions, and information on **storage media**. Examples of local storage media includes hard disks, solid-state drives, USB (universal serial bus) flash drives, memory cards, and optical discs. The amount of storage for each type of storage media varies, but hard disks and solid-state drives generally have the largest capacities, followed by optical discs, USB flash drives, and memory cards. Some storage media are portable, meaning you can remove the medium from one computer and carry it to another computer.

A **storage device** records (writes) and/or retrieves (reads) items to and from storage media. Storage devices often also function as a source of input and output because they transfer items from storage to memory and vice versa. Drives and readers/writers, which are types of storage devices, accept a specific kind of storage media. For example, a DVD drive (storage device) accepts a DVD (storage media).

BTW
Disk vs. Disc
Disk is the term used to describe hard disks and other magnetic media, and disc is the term used to describe CDs, DVDs, and other optical media.

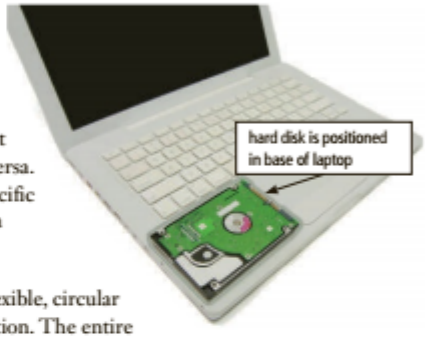

Figure 1-20 A hard disk mounted inside a laptop's case.
iStockphoto.com / Brian Balster

Hard Disks A *hard disk* is a storage device that contains one or more inflexible, circular platters that use magnetic particles to store data, instructions, and information. The entire device is enclosed in an airtight, sealed case to protect it from contamination. Laptops and desktops often contain at least one hard disk that is mounted inside the computer's case (Figure 1-20).

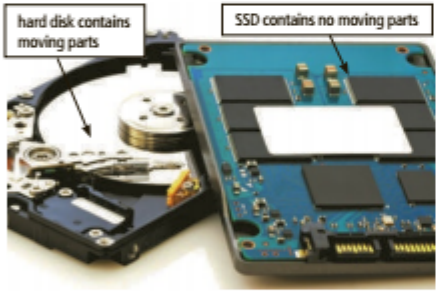

Figure 1-21 A solid-state drive (SSD) is about the same size as a laptop hard disk.
iStockphoto.com / ludinko

Solid-State Drives A *solid-state drive* (SSD) is a storage device that typically uses flash memory to store data, instructions, and information. Flash memory contains no moving parts, making it more durable and shock resistant than other types of media. For this reason, manufacturers typically offer SSDs as an option instead of hard disks in their laptops, tablets, and desktops (Figure 1-21).

CONSIDER THIS

What is an external hard drive?
An external hard drive is a separate, portable, freestanding hard disk or SSD that usually connects to the computer with a cable (Figure 1-22). As with an internal hard disk or SSD, the entire external hard drive is enclosed in an airtight, sealed case.

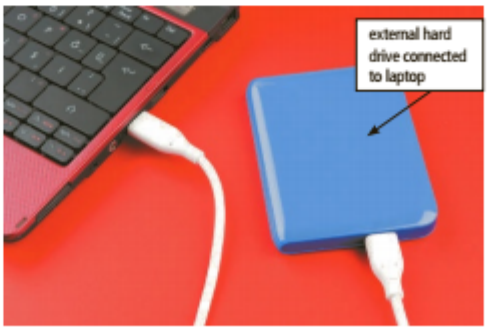

Figure 1-22 A external hard drive is a separate, freestanding storage device.
iStockphoto.com / muratsarica

BTW
Hard Drives
The term **hard drive** is used to collectively refer to hard disks and SSDs.

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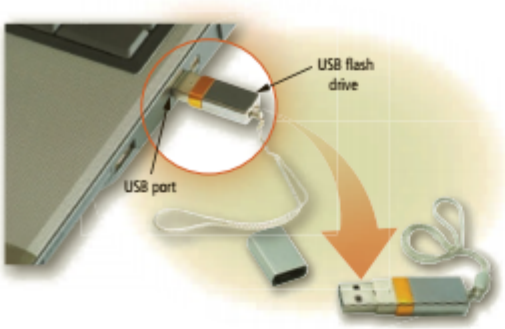

Figure 1-23 You insert a USB flash drive in a USB port on a computer.
Pakhnyushchy / Shutterstock.com

USB Flash Drives A *USB flash drive* is a portable flash memory storage device that you plug in a USB port, which is a special, easily accessible opening on a computer or mobile device (Figure 1-23). USB flash drives are convenient for mobile users because they are small and lightweight enough to be transported on a keychain or in a pocket.

Memory Cards A *memory card* is removable flash memory, usually no bigger than 1.5 inches in height or width, that you insert in and remove from a slot in a computer, mobile device, or card reader/writer (Figure 1-24). With a card reader/writer, you can transfer the stored items, such as digital photos, from a memory card to a computer or printer that does not have a built-in card slot.

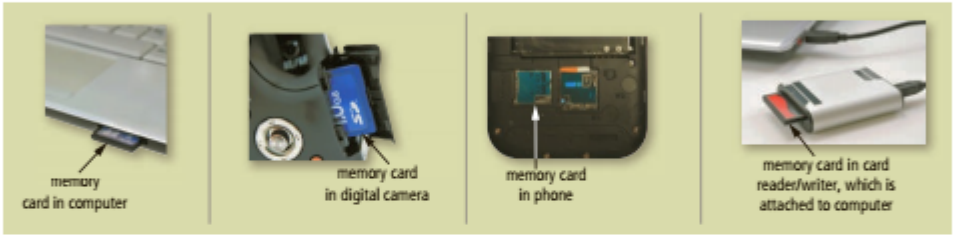

Figure 1-24 Computers and mobile devices use a variety of styles of memory cards to store documents, photos, and other items.
Verisakeet / Fotolia LLC; Sonar / Fotolia LLC; Courtesy of Mark Frydenberg; uvimages / Fotolia LLC

CONSIDER THIS

What is the general use for each type of local storage media?
Hard disks and SSDs store software and all types of user files. A *file* is a named collection of stored data, instructions, or information and can contain text, images, audio, and video. Memory cards and USB flash drives store files you intend to transport from one location to another, such as a homework assignment or photos. Optical discs generally store software, photos, movies, and music.

Figure 1-25 You can insert a DVD in a DVD drive on a computer. Some computers have DVD slots instead of DVD drives.
iStockphoto.com / MagMos

Optical Discs An *optical disc* is a type of storage media that consists of a flat, round, portable metal disc made of metal, plastic, and lacquer that is written and read by a laser. CDs (compact discs) and DVDs (digital versatile discs) (Figure 1-25) are two types of optical discs.

Cloud Storage Instead of storing data, instructions, and information locally on a hard drive or other media, some users opt for cloud storage. **Cloud storage** is an Internet service that provides remote storage to computer users. For example, Figure 1-26 shows JustCloud, which provides cloud storage solutions to home and business users.

Types of services offered by cloud storage providers vary. Some provide storage for specific types of media, such as photos, whereas others store any content and provide backup services. A **backup** is a duplicate of content on a storage medium that you can use in case the original is lost, damaged, or destroyed. Read Secure IT 1-1 for suggestions for backing up your computers and mobile devices.

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Figure 1-26 JustCloud is an example of a website that provides cloud storage solutions to home and business users.
Source: JustCloud.com

SECURE IT 1-1

Backing Up Computers and Mobile Devices

Power outages, hardware failure, theft, and many other factors can cause loss of data, instructions, or information on a computer or mobile device. To protect against loss, you should back up the contents of storage media regularly. Backing up can provide peace of mind and save hours of work attempting to recover important material in the event of a mishap.

A backup plan for laptop and desktop computers could include the following:

- Use a backup program, either included with your computer's operating system or one that you purchased separately, to copy the contents of your entire hard drive to a separate device.
- Regularly copy music, photos, videos, documents, and other important items to an external hard drive, a USB flash drive, or a DVD.
- Subscribe to a cloud storage provider.
- Schedule your files to be backed up regularly.

Backup plans for mobile devices are less specific. Apps for backing up your smartphone or tablet's content are available. You also can back up a mobile device to your computer's hard drive using synchronization software that runs on your computer (synchronization software is discussed later in this module). Some mobile device manufacturers, such as Apple, provide cloud storage solutions to owners of their devices. Other services allow subscribers to use another computer as a backup storage location. Overall, the best advice is to back up often using a variety of methods.

Consider This: Do you back up files regularly? If not, why not? What would you do if you had no backup and then discovered that your computer or mobile device had failed?

Courtesy of Western Digital Corporation; iStockphoto.com / Stephen Know

The Web

The World Wide Web (or web, for short) is a global library of information available to anyone connected to the Internet. The **Internet** is a worldwide collection of computer networks that connects millions of businesses, government agencies, educational institutions, and individuals (Figure 1-27).

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Figure 1-27 The Internet is the largest computer network, connecting millions of computers and devices around the world.

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CONSIDER THIS

How do I access the Internet?

Businesses, called Internet service providers (ISPs), offer users and organizations access to the Internet free or for a fee. By subscribing to an ISP, you can connect to the Internet through your computers and mobile devices.

Many everyday devices and objects or "things" are equipped with sensors that transmit data to and from the Internet. The term, the Internet of Things (IoT), is used to collectively refer to this communications capability. The IoT includes activity trackers, smartwatches, thermostats, alarm clocks, coffeemakers, appliances, and more.

CONSIDER THIS

Are the web and Internet the same?

No. The Internet provides more than 3.5 billion home and business users around the world access to a variety of services. The web is one of the widely used services of the Internet. Other popular services include email, instant messaging, VoIP, and FTP (all discussed later in this module).

People around the world access the web to accomplish the following types of online tasks:

- Search for information
- Conduct research
- Communicate with and meet other people
- Share information, photos, and videos with others
- Access news, weather, and sports
- Participate in online training
- Shop for goods and services
- Play games with others
- Download or listen to music
- Watch videos
- Download or read books
- Make reservations

BTW

Downloading

Downloading is the process of transferring existing content stored on a server or other computer or device to your device via a network.

The **web** consists of a worldwide collection of electronic documents. Each electronic document on the web is called a **webpage**, which can contain text, graphics, audio, and video (Figure 1-28). A **website** is a collection of related webpages, which are stored on a web server. A **web server** is a computer that delivers requested webpages to your computer or mobile device.

Webpages often contain links. A *link*, short for *hyperlink*, is a built-in connection to other documents, graphics, audio files, videos, webpages, or websites. To activate an item associated with a link, you click the link. In Figure 1-28, for example, clicking the audio link connects to a live radio show so that you can hear the broadcast. A text link often changes color after you click it to remind you visually that you previously have visited the webpage or downloaded the content associated with the link.

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Figure 1-28 Webpages, such as the one shown here, can display text, graphics, audio, and video on a computer or mobile device. Pointing to a link on the screen typically changes the shape of the pointer to a small hand with a pointing index finger.
Source: WTMJ

Links allow you to obtain information in a nonlinear way. That is, instead of accessing topics in a specified order, you move directly to a topic of interest. Some people use the phrase *surfing the web* to refer to the activity of using links to explore the web.

Browsing the Web

A **browser** is software that enables users with an Internet connection to access and view webpages on a computer or mobile device. Some widely used browsers include Chrome, Edge, Firefox, and Safari. Read How To 1-2 for instructions about using a browser to display a webpage on a computer or mobile device.

HOW TO 1-2

Use a Browser to Display a Webpage

The following steps describe how to use a browser to display a webpage on a computer or mobile device:

1. Run a browser. (Running programs and apps is discussed later in this module.)
2. If necessary, click the address bar to select it and any previously displayed web address it may contain. (A *web address* is a unique address that identifies a webpage.)
3. In the address bar, type the web address of the webpage you want to visit and then press the ENTER key or click the Go (or similar) button to display the webpage. For example, www.cengagebrain.com is a valid web address, which displays the CengageBrain webpage shown in the figure below. (Module 2 discusses the components of a web address.)
4. If necessary, scroll to view the entire webpage. You can scroll either by sliding your finger across a touch screen or by using a pointing device, such as a mouse, to drag the scroll bar.
5. Click links on the webpage to navigate to the link's destination.

Consider This: What should you do if the web address you enter does not display a webpage or you receive an error message?

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