

COMPUTERS AND MOBILE DEVICES: Evaluating Options for Home and Work

3



People use or interact with a variety of computers or mobile devices every day.

“I use my laptop at home and school and an all-in-one at work. I send messages and access the Internet on my smartphone, take photos with my digital camera, and read books on my e-book reader. What more do I need to know about computers and mobile devices?”

While you may be familiar with some of the content in this chapter, do you know how to ...

- Protect computers and devices from malware infections?
- Determine which mobile computer, desktop, or mobile device to purchase?
- Safely use an ATM?
- Rent a movie using a DVD kiosk?
- Help eliminate e-waste?
- Use a mobile device safely in a public area?
- Identify a DisplayPort or an HDMI port?
- Pair Bluetooth devices?
- Connect your phone to a Wi-Fi network to save data charges?
- Protect your hardware from theft, vandalism, and failure?
- Prevent technology-related tendonitis or CTS?
- Tell if you are addicted to technology?
- Manage power for your computers and mobile devices

In this chapter, you will discover how to perform these tasks along with much more information essential to this course. For additional content available that accompanies this chapter, visit the free resources and premium content. Refer to the Preface and the Intro chapter for information about how to access these and other additional instructor-assigned support materials.

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✓ Objectives

After completing this chapter, you will be able to:

- 1 Describe the characteristics and uses of laptops, tablets, desktops, and all-in-ones
- 2 Describe the characteristics and types of servers
- 3 Differentiate among POS terminals, ATMs, and self-service kiosks
- 4 Describe cloud computing and identify its uses
- 5 Describe the characteristics and uses of smartphones, digital cameras, portable and digital media players, e-book readers, and wearable devices
- 6 Describe the characteristics of and ways to interact with game devices, including gamepads, joysticks and wheels, dance pads, and motion-sensing controllers
- 7 Identify uses of embedded computers
- 8 Differentiate a port from a connector, identify various ports and connectors, and differentiate among Bluetooth, Wi-Fi, and NFC wireless device connections
- 9 Identify safeguards against hardware theft and vandalism and hardware failure
- 10 Discuss ways to prevent health-related injuries and disorders caused from technology use, and describe ways to design a workplace ergonomically

Computers and Mobile Devices



BTW

Peripheral Devices

A *peripheral device* is a device you connect to a computer or mobile device to expand its capabilities. Examples include a keyboard, mouse, microphone, monitor, printer, scanner, external hard drive, webcam, and speakers.

As Chapter 1 discussed, 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. A **mobile device** is a computing device small enough to hold in your hand. Types of computers and mobile devices include laptops, tablets, and desktops; servers and terminals; smartphones, digital cameras, e-book readers, portable and digital media players, and wearable devices; game devices; and embedded computers. Figure 3-1 shows a variety of computers and mobile devices.

In addition to discussing features, functions, and purchasing guidelines of computers and mobile devices, this chapter also presents ways to connect peripheral devices, protect computers and mobile devices from theft and failure, and minimize your health risks while using computers and mobile devices.

Mobile Computers and Desktops

A **mobile computer** is a portable personal computer, such as a laptop or tablet, designed so that a user easily can carry it from place to place, whereas a desktop is designed to be in a stationary location. A *personal computer* (PC) is a mobile computer or desktop 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. Personal computers often are differentiated by the type of operating system they use, with Windows and Mac operating systems leading the market share. Companies such as Acer, Dell, Lenovo, HP (Hewlett-Packard), and Samsung sell personal computers that use the Windows operating system, and Apple sells personal computers that use the Mac operating system. Other operating systems for personal computers include Linux and Chrome OS.

Read Secure IT 3-1 for suggestions about how to avoid malware infections on your computers and mobile devices.



BTW

The term PC sometimes is used to describe a computer that runs a Windows operating system.



Computers and Mobile Devices

Figure 3-1 Computers and mobile devices are available in a variety of shapes and sizes.

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SECURE IT 3-1

Avoid Malware Infections

Some websites contain tempting offers to download free games and music, install toolbars that offer convenience, enter contests, and receive coupons on your computers or mobile devices. Danger, however, may lurk in those files, for they secretly could install malware with effects ranging from a mild annoyance to a severe problem such as identity theft. Recall that malware is malicious software that acts without your knowledge and deliberately alters operations of your computer or mobile device. As a general rule, do not install or download unfamiliar software. Follow these guidelines to minimize the chance of your computer or mobile device becoming infected with malware:

- **Social media:** Malware authors often focus on social media, with the goal of stealing personal information, such as passwords, profiles, contact lists, and credit card account details. Their websites urge unsuspecting users to take surveys, tap or click links to obtain free merchandise and games, and download antivirus programs. Ignore these deceitful tactics.
- **Email:** Spam (unsolicited email messages) can be loaded with malware, but even email messages from friends can be a culprit. If the message does not contain a subject line or contains links or an attachment, exercise caution. One option is to save the attachment to your computer so that antivirus software can scan the file for possible malware before you open it. Your best practice is to avoid opening suspicious messages at all costs.
- **Flash memory storage:** Colleagues and friends may hand you a USB flash drive or memory card with software, photos, and other files. Scan these media with security software before opening any files.
- **Pop-up windows:** At times, a window may open suddenly (called a pop-up window), with a warning that your computer is infected with a virus or that a security breach has occurred, and then make an urgent request to download free software to scan your computer or mobile device and correct the alleged problem. Beware. Many of these offers actually are rogue security software that will infect a computer.
- **Websites:** Websites you visit or pop-up windows may present instructions to download new software or update current programs installed on a computer or mobile device. If you are uncertain of their legitimacy, exit and research the software by reading reviews online before you decide to install it.

- **Software:** Occasionally, some seemingly safe software attempts to install malware. Even worse, some software touted as offering malware protection actually installs more malware. Always obtain software from reputable sources and, if possible, update software directly from manufacturers' websites. Consider using the custom installation option to ensure that only the desired software is installed. Read the permissions dialog boxes that are displayed on your screen before tapping or clicking the OK or Agree buttons. If you are uncertain about the messages you are viewing, cancel the installation.
- **Smartphones:** Malware creators are targeting smartphones, particularly those using the Android operating system. While an estimated 80 percent of all smartphones are unprotected now, savvy users are obtaining protection from malware attacks. Read reviews before downloading antimalware apps from trusted sources.

Consider This: What online activities might cause malware to be installed on your computer? Which specific websites provide reputable antimalware apps for mobile devices? What new techniques will you use to avoid malware?

CONSIDER THIS

What is inside a personal computer?

The electronic components and circuitry of a personal computer usually are part of or are connected to a motherboard (Figure 3-2). A *motherboard*, sometimes called a system board, is the main circuit board of the personal computer. Many electronic components attach to the motherboard; others are built into it. Two main components on the motherboard are the processor and memory. Many motherboards also integrate sound, video, and networking capabilities. A *processor*, also called a *CPU* (central processing unit), is the electronic component that interprets and carries out the basic instructions that operate a computer. Memory consists of electronic components that store instructions waiting to be executed and data needed by those instructions.

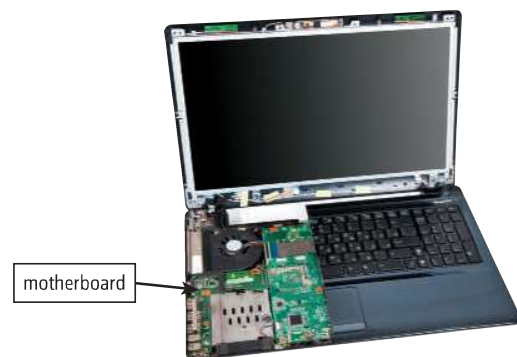


Figure 3-2 Shown here is a partial motherboard in a laptop.

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Internet Research

What is a computer chip?

Search for: computer chip

Laptops, Tablets, and Other Mobile Computers

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 (Figure 3-3). Designed to fit on your lap and for easy transport, most laptops weigh up to 7 pounds (varying by manufacturer and specifications) and can be as powerful as the average desktop.

Laptops have input devices, such as a keyboard, touchpad, and webcam; output devices, such as a screen and speakers; a storage device(s), such as a hard drive and maybe an optical disc drive; and usually built-in wireless communications capability. Some laptops have touch screens. Most can operate on batteries or a power supply or both. Read Ethics & Issues 3-1 to consider issues related to laptops and other devices with cameras.



Technology Innovator

Discover More: Visit this chapter's free resources to learn about Samsung (multinational technology company).



Figure 3-3 Traditional laptops weigh more than ultrathin laptops.

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ETHICS & ISSUES 3-1



What Punishment for Webcam Spying Is Appropriate?

Microphones, digital cameras, and webcams have many practical and harmless uses. These technologies also can leave you open to spying. For example, one school district used software, which was supposed to track the school-distributed laptops in case of theft, to take photos and screen captures of students. In another instance, a person noticed that when she gave a customer service rep access to her computer, he turned on her webcam without asking for her permission.

Cybercriminals can use spy tools that take photos, or record video or audio, without turning on a light or other notification that

indicates your camera or microphone is in use. The Flame virus is one way for spy tools to infect your computer. Security experts recommend using a sticker to cover your webcam, and inserting a dummy plug in the microphone port when you are not using it. These technologies also allow people to take photos or videos in a public setting and share them without your knowledge. A director at the American Civil Liberties Union stated that when you are in a public place, people have the right to photograph you. Privacy advocates criticize *Google Street View*, however, which takes images captured using moving vehicles equipped with GPS and cameras and then creates a

panoramic view of an area, including people entering and exiting buildings or relaxing on a beach.

Many states' laws do not cover these types of acts. Massachusetts, however, recently passed a law that made secretly taking photos or videos that focused on people's private body parts a criminal offense. Lawmakers continue to debate and expand current laws, as well as pass new ones.

Consider This: Should webcam spying punishments be comparable to other types of spying? Why or why not? What kind of privacy should you expect when you are in a public place?

Ultrathin laptops weigh less than traditional laptops, usually have a longer battery life, and generally run the Windows operating system. In order to minimize their thickness, many ultrathin laptops have fewer ports than traditional laptops, do not include an optical disc drive, and often require the use of special dongles to attach cables that connect to external displays or a network. (Recall that a dongle is a small device that connects to a computer and enables additional functions when attached.)



Ultrabooks

An ultrathin laptop that uses a low-power Intel processor often is called an *ultrabook*.

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.

Two popular form factors (shapes and sizes) of tablets are the slate and convertible (Figure 3-4). Resembling a letter-sized pad, a *slate tablet* is a type of tablet that does not contain a physical keyboard. A *convertible tablet* is a tablet that has a screen in its lid and a keyboard in its base, with the lid and base connected by a swivel-type hinge. You can use a convertible tablet like a traditional laptop, or you can rotate the display and fold it down over the keyboard so that it looks like a slate tablet. As with laptops, tablets run on batteries or a power supply or both; however, batteries in a tablet typically last longer than those in laptops.

Some tablets include a *stylus*, which looks like a small ink pen, that you can use instead of a fingertip to enter data, make selections, or draw on a touch screen. A stylus may include buttons you can press to simulate clicking a mouse. As an alternative to interacting with the touch screen, some users prefer to purchase a separate physical keyboard that attaches to or wirelessly communicates with the tablet (shown with the slate tablet in Figure 3-4).

Tablets are useful especially for taking notes in class, at meetings, at conferences, and in other forums where the standard laptop is not practical. Because slate tablets can have a more durable construction, they often are used in the medical field and other areas where exposure to germs, heat, humidity, dust, and other contaminants is greater.

BTW
Pens
Some tablet manufacturers refer to a stylus as a pen.

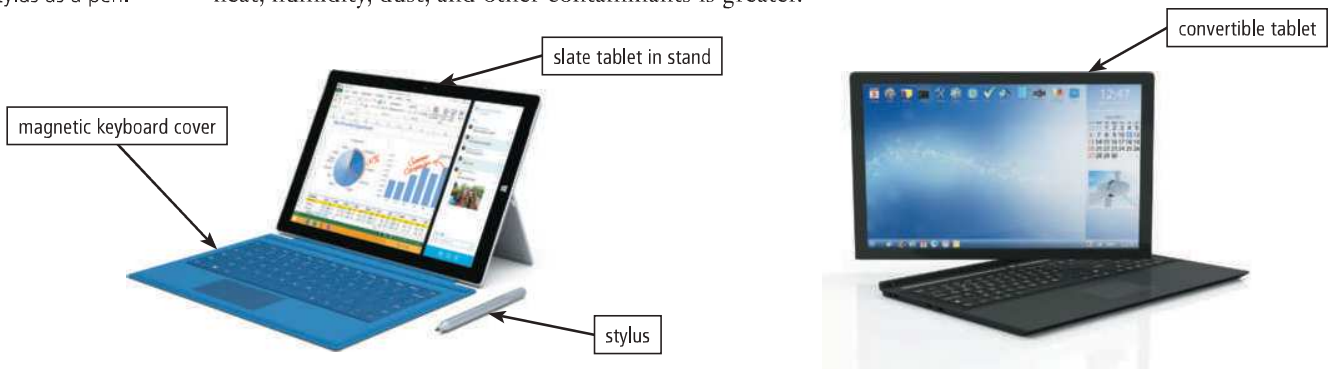


Figure 3-4 Examples of slate and convertible tablets.
Courtesy of Microsoft; © iStockPhoto / rasslava

CONSIDER THIS

What is a phablet?

Some manufacturers use the term, *phablet*, to refer to a device that combines features of a smartphone with a tablet (Figure 3-5). These devices are larger than smartphones but smaller than full-sized tablets. The screen on a phablet usually measures five to seven inches diagonally. Some include a stylus.



Figure 3-5 A phablet combines features of a smartphone and a tablet.

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Handheld Computers

A *handheld computer* is a computer small enough to fit in one hand. Many handheld computers communicate wirelessly with other devices or computers. Some handheld computers have miniature or specialized keyboards. Others have a touch screen and also include a stylus for input.

Many handheld computers are industry-specific and serve the needs of mobile employees, such as parcel delivery people or warehouse employees (Figure 3-6), whose jobs require them to move from place to place. Handheld computers often send data wirelessly to central office computers.



Figure 3-6 This handheld computer is a lightweight computer that enables warehouse employees to take inventory and check supplies.

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Mini Feature 3-1: Mobile Computer Buyer's Guide

If you need computing capability while traveling and during lectures or meetings, you may find a laptop or tablet to be an appropriate choice. Read Mini Feature 3-1 for tips to consider when purchasing a mobile computer.

MINI FEATURE 3-1

Mobile Computer Buyer's Guide


With the abundance of mobile computer manufacturers, research each before making a purchase. The following are purchasing considerations unique to mobile computers.

- Determine which mobile computer form factor fits your needs.** Consider a tablet or ultrathin laptop if you require a lightweight device and the most mobility. If you require additional ports or want the computer's capabilities to be more comparable to a desktop, consider purchasing a traditional laptop.
- Consider a mobile computer with a sufficiently large screen.** Laptops and tablets are available with various screen sizes. For example, most traditional and ultrathin laptop screens range in size from 11 to 18 inches, while most tablet screens range in size from 7 to 12 inches.
- Experiment with different keyboards and pointing devices.** Mobile computers often vary in size, and for that reason have different keyboard layouts. Familiarize yourself with the keyboard layout of the computer you want to purchase, and make sure it is right for you. If you have large fingers, for example, you should not purchase a computer with a small, condensed keyboard. Laptops typically include a touchpad to control the pointer. Tablets have a touch screen and an on-screen keyboard.
- Consider processor, memory, and storage upgrades at the time of purchase.** As with a desktop, upgrading a mobile computer's memory and internal storage may be less expensive at the time of initial purchase. Some internal storage is custom designed for mobile computer manufacturers, meaning an upgrade might not be available in the future.
- The availability of built-in ports and slots is important.** Determine which ports and slots (discussed later in this chapter) you require on the mobile computer. If you plan to transfer photos from a digital camera using a memory card, consider a mobile computer with a built-in card slot compatible with your digital camera's memory card. If you plan to connect devices such as a printer or USB flash drive to your mobile computer, consider purchasing one with a sufficient number of USB ports. In addition, evaluate mobile computers with ports enabling you to connect an external monitor.
- If you plan to use your mobile computer for a long time without access to an electrical outlet, or if the battery life for the mobile computer you want to purchase is not sufficient, consider purchasing a second battery.** Some mobile computers, such as most tablets and ultrathin laptops, have built-in batteries that can be replaced only by a qualified technician. In that case, you might look into options for external battery packs or power sources.
- Purchase a well-padded and well-designed carrying case that is comfortable and ergonomic.** An amply padded carrying case will protect your mobile computer from the bumps it may receive while traveling. A well-designed carrying case will have room for accessories such as USB flash drives, pens, and paperwork. Although a mobile computer may be small enough to fit in a handbag, make sure that the bag has sufficient padding to protect the computer. Test the carrying case with the laptop inside to ensure it is comfortable and ergonomic.
- If you plan to connect your mobile computer to a video projector, make sure the mobile computer is compatible with the video projector.** You should check, for example, to be sure that your mobile computer will allow you to display an image on the screen and projection device at the same time. Also, ensure that the mobile computer has the ports required or that you have the necessary dangle and cables to connect to the video projector.



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Discover More: Visit this chapter's free resources to learn more about mobile computer manufacturers, form factors, screens, keyboards, pointing devices, upgrades, batteries, carrying cases, and video projectors.

 **Consider This:** Based on your current computing needs, should you purchase a traditional laptop, ultrathin laptop, or tablet? What are the specifications of the mobile computer you would purchase?



Monitor Speakers

Many monitors have integrated speakers.



Technology Innovators

Discover More: Visit this chapter's free resources to learn about Dell and its founder, Michael Dell.

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 (Figure 3-7). Components that typically occupy space outside of a desktop include peripheral devices such as a keyboard, mouse, and webcam (input devices); speakers and printer (output devices); external hard drive (storage device); and possibly a router and/or modem (communications devices). Depending on the form factor of the desktop, it may also require an external monitor.

Some people use the term, *system unit*, to refer to the case that contains and protects the motherboard, internal hard drive, memory, and other electronic components of the computer from damage. A desktop may have a system unit tower that is a separate device from a monitor. A *tower*, which is made of metal or plastic, is a frame that houses the system unit on a desktop. Towers are available in a variety of form factors. Although they can range in height from 12 inches to 30 inches or more, the trend is toward smaller desktop tower form factors. An **all-in-one** (AIO) or *all-in-one desktop*, by contrast, does not have a tower and instead houses the display, system unit, and possibly an optical drive, in the same case.



Figure 3-7 The desktop with a tower shown in this figure is a Windows computer, and the all-in-one is a Mac computer.

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CONSIDER THIS

Who uses desktops?

Home and business users who do not require the portability of a mobile computer may work with desktops for their everyday computing needs. Gaming enthusiasts often choose a *gaming desktop*, which offers high-quality audio, video, and graphics with optimal performance for sophisticated single-user and networked or Internet multiplayer games. Power users may work with a high-end desktop, sometimes called a *workstation*, that is designed to handle intense calculations and sophisticated graphics. For example, architects use powerful desktops to design buildings and homes, and graphic artists use them to create computer-animated special effects for full-length motion pictures and video games. Some users configure a desktop to function as a server on a network (servers are discussed later in this chapter).

Internet Research

Which movies use computer animation?

Search for: movies using computer animation

Mini Feature 3-2: Desktop Buyer's Guide

Desktops are a suitable option if you work mostly in one place and have plenty of space in a work area. Read Mini Feature 3-2 for tips to consider when purchasing a desktop.

MINI FEATURE 3-2

Desktop Buyer's Guide

Today, desktop manufacturers emphasize desktop style by offering bright colors, trendy displays, and theme-based towers so that the computer looks attractive if it is in an area of high visibility. If you have decided that a desktop is most suited to your technology needs, the next step is to determine specific software, hardware, peripheral devices, and services to purchase, as well as where to buy the computer. The following considerations will help you determine the appropriate desktop to purchase.

- 1. Determine the specific software to use on the desktop.** Decide which software contains the features necessary for the tasks you want to perform. Your hardware requirements depend on the minimum requirements of the software you plan to use on the desktop.
- 2. Know the system requirements of the operating system.** Determine the operating system you want to use because this also dictates hardware requirements. If, however, you purchase a new desktop, chances are it will include the latest version of your preferred operating system (Windows, Mac OS, or Linux).
- 3. Look for bundled software.** Purchasing software at the same time you purchase a desktop may be less expensive than purchasing the software at a later date.
- 4. Avoid purchasing the least powerful desktop available.** Technology changes rapidly, which means a desktop that seems powerful enough today may not serve your computing needs in the future. Purchasing a desktop with the most memory, largest hard drive capacity, and fastest processor you can afford will help delay obsolescence.
- 5. Consider upgrades to the keyboard, mouse, monitor, printer, microphone, and speakers.** You use these peripheral devices to interact with the desktop, so make sure they meet your standards.
- 6. Consider a touch screen monitor.** A touch screen monitor will enable you to interact with the latest operating systems and apps using touch input.
- 7. Evaluate all-in-ones, which may be less expensive than purchasing a tower and monitor separately.** In addition, all-in-ones take up less space and often look more attractive than desktops with separate towers.
- 8. If you are buying a new desktop, you have several purchasing options:** buy directly from a school bookstore, a local computer dealer, or a large retail store, or order from a vendor by mail, phone, or the web. Each purchasing option has its advantages. Explore each option to find the best combination of price and service.
- 9. Be aware of additional costs.** Along with the desktop itself, you also may need to make extra purchases. For example, you might purchase computer furniture, an uninterruptable power supply (UPS) or surge protector (discussed later in the chapter), an external hard drive, a printer, a router, or a USB flash drive.
- 10. If you use your computer for business or require fast resolution of major computer problems, consider purchasing an extended warranty or a service plan through a local dealer or third-party company.** Most extended warranties cover the repair and replacement of computer components beyond the standard warranty.



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High-Tech Talk

Discover More: Visit this chapter's free resources to learn how touch screens use capacitive, resistive, surface wave, and other technologies to sense touch.

Discover More: Visit this chapter's free resources to learn more about desktop manufacturers, software, upgrades, touch screen monitor options, all-in-ones, hidden costs, and warranties.


 **Consider This:** Shop around for a desktop that meets your current needs. Which desktop would you purchase? Why?

Table 3-1 Dedicated Servers

Type	Main Service Provided
Application server	Stores and runs apps
Backup server	Backs up and restores files, folders, and media
Database server	Stores and provides access to a database
Domain name server	Stores domain names and their corresponding IP addresses
File server (or storage server)	Stores and manages files
FTP server	Stores files for user upload or download via FTP
Game server	Provides a central location for online gaming
Home server	Provides storage, Internet connections, or other services to computers and devices in a household
List server	Stores and manages email lists
Mail server	Stores and delivers email messages
Network server	Manages network traffic
Print server	Manages printers and documents being printed
Web server	Stores and delivers requested webpages to a computer via a browser

Servers

A **server** is a computer dedicated to providing one or more services to other computers or devices on a network. Services provided by servers include storing content and controlling access to hardware, software, and other resources on a network. In many cases, a server accesses data, information, and programs on another server. In other cases, personal computers, devices, or terminals (discussed in the next section) access data, information, and programs on a server. Servers can support from two to several thousand connected computers or devices at the same time.

Some servers, called dedicated servers, perform a specific service and can be placed with other dedicated servers to perform multiple services (Table 3-1). Each type of dedicated server uses software designed specifically to manage its service. Dedicated servers typically require a faster processor, more memory, and additional storage.

Servers typically include a processor, memory, storage, and network connections. Depending on its function, a server may or may not require a monitor or an input device. Some servers are controlled from remote computers. Form factors for servers include rack server, blade server, and tower server, which are shown in Figure 3-8 and briefly described below.

- A *rack server*, sometimes called a rack-mounted server, is a server that is housed in a slot (bay) on a metal frame (rack). A rack can contain multiple servers, each in a different bay. The rack is fastened in place to a flat surface.
- A *blade server* is a server in the form of a single circuit board, or blade. The individual blades insert in a blade server chassis that can hold many blades. Like a rack server, the chassis is fastened in place to a flat surface.
- A *tower server* is a server built into an upright cabinet (tower) that stands alone. The tower can be similar in size and shape to a desktop tower or larger.

CONSIDER THIS

Which server should you use?

Home or small business users and organizations with ample floor space often choose tower servers. (Some home users even use a desktop tower or powerful laptop to act as a home server.) Data centers and other organizations looking to conserve floor space often choose rack servers or blade servers. Organizations that require a large quantity of servers usually opt for blade servers.

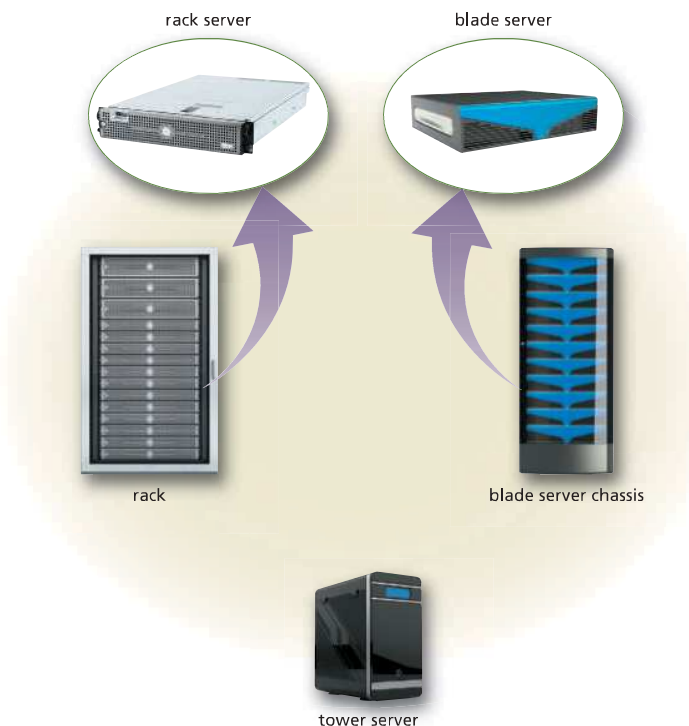


Figure 3-8 Shown here are a rack server, blade server, and tower server.

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Some organizations use virtualization to improve utilization of technology. *Virtualization* is the practice of sharing or pooling computing resources, such as servers and storage devices. *Server virtualization* uses software to enable a physical server to emulate the hardware and computing capabilities of one or more servers, known as virtual servers. Users can use software to configure the storage, processing power, memory, operating system, and other characteristics of virtual servers. From the end user's point of view, a virtual server behaves just like a physical server. The advantages are that a virtual server can be created and configured quickly, does not require a new physical server, and is easier to manage. Cloud computing, discussed later in this chapter, uses server virtualization.

Major corporations use server farms, mainframes, or other types of servers for business activities to process everyday transactions (Figure 3-9). A *server farm* is a network of several servers together in a single location. Server farms make it possible to combine the power of multiple servers. A *mainframe* is a large, expensive, powerful server that can handle hundreds or thousands of connected users simultaneously. Enterprises use server farms, mainframes, or other large servers to bill millions of customers, prepare payroll for thousands of employees, and manage millions of items in inventory.



Figure 3-9 Server farms and mainframes can handle thousands of connected computers and process millions of instructions per second.

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Terminals

A *terminal* is a computer, usually with limited processing power, that enables users to send data to and/or receive information from a server, or host computer. The host computer processes the data and then, if necessary, sends information (output) back to the terminal. Terminals may include a monitor and/or touch screen, keyboard, and mouse.

A *thin client* is a terminal that looks like a desktop but has limited capabilities and components. Because thin clients typically do not contain a hard drive, they run programs and access data on a network or the Internet. Public locations, such as libraries and schools, and enterprises sometimes use thin clients because they cost less, are easier to maintain, last longer, use less power, and are less susceptible to malware attacks than desktops.

Special-purpose terminals perform specific tasks and contain features uniquely designed for use in a particular industry. Three widely used special-purpose terminals are point-of-sale (POS) terminals, ATMs, and self-service kiosks.

Point-of-Sale Terminals

The location in a retail or grocery store where a consumer pays for goods or services is the point of sale (POS). Most retail stores use a *POS terminal* to record purchases, process credit or debit cards, and update inventory.



Figure 3-10 Many grocery stores offer self-service checkouts, where consumers use POS terminals to scan purchases, scan their store or saver card and coupons, and then pay for the goods.

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Technology Trend

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the reader, the POS terminal connects to a system that authenticates the purchase. Once the transaction is approved, the terminal prints a receipt for the customer.

ATMs

An *ATM* (automated teller machine) is a self-service banking terminal that connects to a host computer through a network (Figure 3-11). Banks place ATMs in public locations, including grocery stores, convenience stores, retail outlets, shopping malls, sports and concert venues, and gas stations, so that customers can access their bank accounts conveniently.

Using an ATM, people withdraw and deposit money, transfer funds, or inquire about an account balance. Some ATMs have a touch screen; others have special buttons or keypads for entering data. To access a bank account, you insert a plastic bank card in the ATM's card reader. The ATM asks you to enter a numeric password, called a *PIN* (personal identification number), which verifies that you are the holder of the bank card. When your transaction is complete, the ATM prints a receipt for your records. Read Secure IT 3-2 for ATM safety tips.



Figure 3-11 An ATM is a self-service banking terminal that allows customers to access their bank accounts.

© bankerwin / Fotolia

SECURE IT 3-2

ATM Safety

Visiting an ATM to withdraw or deposit money is convenient, but it also is ripe with potential for criminal activity. Avoid being a victim by exercising common sense and following these guidelines.

- **Location:** Choose an ATM in a well-lit public area away from bushes and dividers and near the entrance of a building. If using a drive-up ATM, keep the engine running and doors locked, roll windows up while waiting for the ATM to process your request, and leave adequate room to maneuver between your vehicle and the one in the lane in front of you. Observe your surroundings and be suspicious of people sitting in vehicles or loitering nearby.
- **ATM card and PIN:** Handle the ATM card like cash by keeping it in a safe location and storing it in a protective sleeve. Do not write the PIN on the back of the card or store it in a text file on your smartphone; instead, memorize the numbers. (For information about password manager apps, read Secure IT 5-3 in Chapter 5.) Report a lost or stolen card immediately.
- **Transaction:** Minimize time by having the ATM card ready as you approach the machine. Do not allow people to watch your activity. Cover the keypad or screen with one hand as you enter the PIN, and use your body to block as much of the area as possible. If the ATM screen appears different, behaves unusually, or offers options with which you are unfamiliar or uncomfortable, cancel the transaction and leave the area.
- **Be suspicious of skimmers:** Thieves can capture a credit card number and PIN by placing a *skimmer* on an ATM (shown in the figure) or on other self-service stations, such as gas pumps, where users swipe their credit cards for payment. Sophisticated skimmers are Bluetooth enabled or are entire panels placed directly on top of the ATM faces and are virtually undetectable. Less-technical devices are false card readers secured to the card slot with double-sided tape and a hidden camera or an overlay on the keypad. Many ATMs have security stickers informing customers to notify attendants if the seal is broken.
- **Valuables:** Expensive clothes and jewelry can be incentives to potential assailants. Dress modestly and leave jewels at home.
- **Exiting:** Do not count cash in public; immediately put it in your pocket or fold it in your hand. If you receive a receipt, take



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it with you and do not discard it in a trash can near the area. As you leave, be certain you are not being followed. If you suspect someone is tracking you, immediately walk to a populated area or business, or drive to a police or fire station.

- **Statements:** Review your balances and bank statements frequently. Be certain all deposits and withdrawals are listed, and look for unusual or unfamiliar activity.
- **Consider This:** Which of these tips do you follow, and how will you change your behavior the next time you visit an ATM or other self-service stations? Which ATMs in your neighborhood appear to be in safe locations?

Self-Service Kiosks

A self-service *kiosk* is a freestanding terminal that usually has a touch screen for user interaction. Table 3-2 identifies several widely used self-service kiosks. Because users interact with self-service kiosks independently, without a salesperson nearby, it is important the kiosk is simple and easy to use. In many cases, a web app or mobile app can extend or enhance the capability of the kiosk. For example, you can reserve an item via the app on a computer or mobile device and then use the kiosk to finalize the transaction.

Internet Research

What is a mobile boarding pass?

Search for: mobile boarding pass

Table 3-2 Self-Service Kiosks

Type	Typical Services Provided
Financial kiosk	Pay bills, add minutes to phone plans, add money to prepaid cards, and perform other financial activities.
Photo kiosk	Print photos from digital images. Some allow editing of digital photos. Users may print directly at the kiosk or may send an order to a photo lab to be printed.
Ticket kiosk	Print tickets. Located in airports, amusement parks, movie theaters, rental companies, and train stations.
Vending kiosk	Dispense item after payment is received. Examples include DVD rentals and license plate renewals.
Visitor kiosk	Manage and track visitors upon check-in. Located in businesses, schools, hospitals, and other areas where access is controlled or registration is required.

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Figure 3-12 A DVD kiosk is a self-service DVD rental terminal.

Courtesy of Redbox

A *DVD kiosk*, for example, is a self-service DVD rental machine that connects to a host computer through a network (Figure 3-12). DVD kiosks are associated with a particular vendor. To rent a movie online, for example, a customer establishes an account or connects to an existing account on the vendor's website, selects the desired movie, and then chooses a nearby DVD kiosk where the movie will be picked up. Customers also usually can select movies directly at the DVD kiosk via a touch screen or some other input device on the kiosk. After presenting identifying information and swiping a credit card through the reader, the DVD kiosk dispenses the rented movie to the customer. The customer returns it to any of the vendor's nationwide DVD kiosks, at which time the customer's account is charged a fee based on the time elapsed.

Supercomputers

A *supercomputer* is the fastest, most powerful computer — and the most expensive (Figure 3-13). Supercomputers are capable of processing many trillions of instructions in a single second. With weights that exceed 100 tons, these computers can store more than 20,000 times the data and information of an average desktop.

Applications requiring complex, sophisticated mathematical calculations use supercomputers. For example, large-scale simulations and applications in medicine, aerospace, automotive design, online banking, weather forecasting, nuclear energy research, and petroleum exploration use a supercomputer.

Internet Research

How is the fastest supercomputer used?

Search for: fastest supercomputer



Figure 3-13 Supercomputers can process more than one quadrillion instructions in a single second.

Los Alamos National Laboratory

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Computers and Mobile Devices, Mobile Computers and Desktops, Servers, Terminals, and Supercomputers, as it relates to the chapter objectives.
Now you should know . . .

- What you should consider when purchasing a desktop or mobile computer (Objective 1)
- When you would use specific types of servers (Objective 2)
- How you use a POS terminal, ATM, and self-service kiosk (Objective 3)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Cloud Computing

Cloud computing refers to an environment that provides resources and services accessed via the Internet (Figure 3-14). Resources include email messages, schedules, music, photos, videos, games, websites, programs, web apps, servers, storage, and more. Services include accessing software, storing files online, and configuring an environment of servers for optimal performance. That is, instead of accessing these resources and services locally, you access them on the cloud. For example, you use cloud computing capabilities when you store or access documents, photos, videos, and other media online; use programs and apps online (i.e., email, productivity, games, etc.); and share ideas, opinions, and content with others online (i.e., online social networks).



The Cloud

The cloud-shaped symbol, which today universally represents cloud computing, stems from early diagrams that visually portrayed the Internet as a cloud, intangible and widespread.

Figure 3-14 Users access resources on the cloud through their Internet connections.

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Businesses use cloud computing to more efficiently manage resources, such as servers and programs, by shifting usage and consumption of these resources from a local environment to the Internet. For example, an employee working during the day in California could use computing resources located in an office in Paris that is closed for the evening. When the company uses the computing resources, it pays a fee that is based on the amount of computing time and other resources it consumes, much in the way that consumers pay utility companies for the amount of electricity used.

Cloud computing allows a company to diversify its network and server infrastructure. Some cloud computing services automatically add more network and server capacity to a company's website as demand for services of the website increases. The network and server capacity may be duplicated around the world so that, for example, an outage of a single server does not affect the company's operations.

Internet Research

How secure is the cloud?

Search for: cloud privacy issues

CONSIDER THIS

Are all cloud services available to everyone?

Some cloud services are public and others are private. A public cloud is made available free or for a fee to the general public or a large group, usually by a cloud service provider. A private cloud is dedicated to a single organization. Some cloud services are hybrid, combining two or more cloud types.

Discover More: Visit this chapter's free resources to learn more about business uses of cloud computing and cloud service providers.

Mobile 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. Popular types of mobile devices are smartphones, digital cameras, portable and digital media players, e-book readers, and wearable devices. Read Ethics & Issues 3-2 to consider issues related to recycling computers and mobile devices.

ETHICS & ISSUES 3-2



Should Recycling of Electronics Be Made Easier?

As technology advances and prices fall, many people think of computers and mobile devices as disposable. Worldwide, consumers generate an estimated 20 to 50 million tons of e-waste annually. (Recall that e-waste consists of discarded computers and mobile devices.) E-waste releases lead, mercury, barium, and other elements into soil and water.

Electronics recycling is known as eCycling. Only about 12 percent of e-waste is eCycled. Electronics recycling can take several forms: reusing parts; creating new products from old products; or melting down or reducing parts to basic elements or materials.

Many not-for-profit organizations, retail websites, mobile service providers, and big box retailers offer reselling and eCycling options. Several electronics companies allow you to trade your device for a gift certificate. The Sustainable Materials Management (SMM) Electronics Challenge promotes eCycling by certifying recycling businesses that meet or pass qualification guidelines. Other companies focus exclusively on eCycling. One business has developed automated kiosks that tell you what your device is worth, connect you to a buyer, take your device, and dispense cash back on the spot. The U.S. Environmental Protection Agency (EPA) lists eCycling, reselling, and donation resources on its website.

A large amount of e-waste pollutes developing countries that may accept the materials for profit. A proposed federal bill, supported by many electronics manufacturers and resellers, makes it illegal for companies to export e-waste to developing countries. Currently, several states have laws that mandate eCycling.

Consider This: Should the government, manufacturers, or users be responsible for recycling of obsolete equipment? Why? What impact does exporting toxic waste have on developing nations? Should the state or federal government mandate an eCycling program for electronics? Why or why not?

Smartphones

A **smartphone** is an Internet-capable phone that usually also includes a calendar, an address book, a calculator, a notepad, games, browser, and numerous other apps. In addition to basic phone capabilities, many smartphones include these features:

- Send and receive email messages and access the web — via Wi-Fi or a mobile data plan
- Communicate wirelessly with other devices or computers
- Function as a portable media player
- Include a built-in digital camera
- Talk directly into the smartphone's microphone or into a Bluetooth headset that wirelessly communicates with the phone
- Conduct live video calls, where the parties can see each other as they speak
- Receive GPS signals to determine a user's current location
- Synchronize data and information with a computer or another mobile device
- Support voice control so that you can speak instructions to the phone and it speaks responses back to you
- Connect to external devices wirelessly, such as via Bluetooth
- Serve as a wireless access point

Many smartphones have touch screens. Instead of or in addition to an on-screen keyboard, some have a built-in mini keyboard on the front of the phone or a keyboard that slides in and out from behind the phone. Others have keypads that contain both numbers and letters. Some also include a stylus.

CONSIDER THIS

How do you type text messages on a phone that has only a numeric keypad and no touch screen?

Each key on the keypad represents multiple characters, which are identified on the key. For example, the 2 key on the phone's keypad displays the letters a, b, and c on the key's face. On many phones, you cycle through the number, letters, and other symbols associated with a particular key by pressing a key on the keypad multiple times. To type the word, hi, for instance, you would press the 4 key (labeled with the letters g, h, and i) twice to display the letter h, pause momentarily to advance the cursor, and then press the 4 key three times to display the letter i.

A variety of options are available for typing on a smartphone (Figure 3-15). Many can display an *on-screen keyboard*, where you press keys on the screen using your fingertip or a stylus. Some phones support a *swipe keyboard app*, on which users enter words by tracing a path on an on-screen keyboard with their fingertip or stylus from one letter to the next in a continuous motion. With other phones, you press letters on the phone's keyboard or keypad. Some phones use *predictive text*, where you press one key on the keyboard or keypad for each letter in a word, and software on the phone predicts the word you want. Swipe keyboard apps and predictive text save users time when entering text on the phone.



 **Figure 3-15** A variety of options for typing on a smartphone.

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High-Tech Talk

Discover More: Visit this chapter's free resources to learn how voice recognition technology works.

Instead of typing on a phone's keyboard or keypad, users can enter text via a *portable keyboard*, which is a full-sized keyboard that communicates with a smartphone via a dock, cables, or wirelessly. Some portable keyboards physically attach to and remove from the device; others are wireless. Another option is a *virtual keyboard* that projects an image of a keyboard on a flat surface. Finally, some phones work with apps that convert your spoken word to text.

Messaging Services With messaging services, users can send and receive messages to and from smartphones, mobile phones, handheld game devices, other mobile devices, and computers. The type of messages you send depends primarily on the services offered by the mobile service provider that works with the phone or other mobile device you select. Many users have unlimited wireless messaging plans, while others pay a fee per message sent or received. Messaging services include text and picture/video.

With text messaging service, or *SMS (short message service)*, users can send and receive short text messages, typically fewer than 300 characters, on a phone or other mobile device or computer. Text message services typically provide users with several options for sending and receiving messages, including:

- **Mobile to mobile:** Send a message from your mobile device to another mobile device.
- **Mobile to email:** Send a message from your mobile device to any email address.
- **Mobile to provider:** Send a message by entering a *common short code (CSC)*, which is a four- or five-digit number assigned to a specific content or mobile service provider, sometimes followed by the message, for example, to a vote for a television program contestant or donate to a charity.
- **Web to mobile:** Send a message from a website to a mobile device or notification from a website to a mobile device with messages of breaking news and other updates, such as sports scores, stock prices, weather forecasts, incoming email messages, game notifications, and more.



CONSIDER THIS

What is the difference between push and pull notifications?

A *push notification*, sometimes called a server push, is a message that initiates from the sending location (such as a server) without a request from the receiver. With a *pull notification*, by contrast, receiver requests information from the sending location.

With picture messaging service, users can send photos and audio files, as well as short text messages, to a phone or other mobile device or computer. With video messaging services, users can send short video clips, usually about 30 seconds in length, in addition to all picture messaging services. Smartphones and other mobile devices with picture/video messaging services, also called *MMS (multimedia message service)*, typically have a digital camera built into the device. Users who expect to receive numerous picture/video messages should verify the phone has sufficient memory. Picture/video message services typically provide users these options for sending and receiving messages:

- **Mobile to mobile:** Send the picture/video from your mobile device to another mobile device.
- **Mobile to email:** Send the picture/video from your mobile device to any email address.

If you send a picture message to a phone that does not have picture/video messaging capability, the phone usually displays a text message directing the user to a webpage that contains the picture/video message. Some online social networks allow you to send a picture/video message directly to your online profile.



CONSIDER THIS

Do you need a messaging service to send a text or picture/video message?

Instead of using a messaging plan from your mobile service provider, you can use a mobile messaging app to send and receive text, picture, and other message from users. Many messaging apps also provide group chat capabilities. Most messaging apps can be downloaded to your mobile device at no cost.

Internet Research

What messaging apps are recommended?

Search for: best messaging apps

Voice mail, which functions much like an answering machine, allows someone to leave a voice message for one or more people. Unlike answering machines, however, a computer in the voice mail system converts an analog voice message into digital form. Once digitized, the message is stored in a voice mailbox. A voice mailbox is a storage location on a hard drive in the voice mail system. To help users manage voice mail messages, some systems offer visual voice mail. With *visual voice mail*, users can view message details, such as the length of calls and, in some cases, read message contents instead of listening to them. Some voice mail systems can convert a voice mail message to a text message for display on a computer or mobile device, such as a smartphone, which you then can manage like any other text message.

Messaging services and voice mail systems also may be able to send messages to groups of phone numbers or email addresses. Read Secure IT 3-3 for tips about safely using smartphones and other mobile devices in public.

Discover More: Visit this chapter's free resources to learn more about speech to text.



Analog vs. Digital
Human speech is analog because it uses continuous (wave form) signals that vary in strength and quality. Most computers and electronic devices are digital, which use only two discrete states: on and off.

SECURE IT 3-3

Safe Mobile Device Use in Public Areas

Sending a text message, updating a Facebook status, posting a Tweet, selecting a new playlist, and checking email messages are tasks you may perform using a mobile device many times each day. They all require some concentration as you focus on the device, usually while looking downward, and they distract you from events occurring around you. Using technology responsibly and safely can prevent theft and injuries.

One common method of thwarting a smartphone thief is to avoid using the phone to check the time. Potential thieves randomly ask people for the correct time. If a person stops and takes a phone out of a pocket or purse, the thief glances at the make and model and decides if it is worth snatching.

Bus stops and train stations are common places for mobile device theft. People in these locations tend to use their smartphones to check schedules, send text messages, and make phone calls. Headphones and earbuds are giveaways that you are using a mobile device and may not be focused on your surroundings. Recent studies show that more than 100 mobile phones are stolen every minute in the United States. Thieves are likely to snatch the devices while the doors are closing just before the train or bus departs from a station so that the victim is unable to pursue the thief. To decrease the chance of theft or pickpocketing, keep your mobile device(s) in a front pocket or in a zippered backpack. Keep your head up and stay aware of your surroundings. If possible, when in public, avoid using accessories that

indicate the type of device to which they are connected.

Cognitive psychologists have studied the effects of inattention blindness, which occurs when a person's attention is diverted while performing a natural activity, such as walking. The researchers have determined that diverted attention is particularly pronounced when people are talking on a mobile phone and, to a lesser extent, using a portable media player. Emergency room reports indicate that distracted walking accidents are on the rise, especially when people trip over cracks in sidewalks or run into fixed objects, such as parked cars and telephone poles.

Consider This: Do you know anyone who has had a mobile device stolen? If so, how did the theft occur? Have you ever experienced inattention blindness or distracted walking?

Digital Cameras

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

CONSIDER THIS

Do you need a digital camera if you have a camera built into your mobile phone?

If you use a camera only for posts on social media sites, then you may choose to use your mobile phone's built-in camera. If, however, you want increased zoom capabilities, more powerful flash, image stabilization, manual control of settings, and to reduce the drain on your phone's battery, then you may want to opt for a separate digital camera.

In addition to cameras built into phones and other devices, types of digital cameras include point-and-shoot cameras and SLR cameras (Figure 3-16). A *point-and-shoot camera* is an affordable and lightweight digital camera with lenses built into it and a screen that displays an approximation of the image to be photographed. Point-and-shoot cameras, which range in size and features, provide acceptable quality photographic images for the home or small office user. An *SLR camera* (single-lens reflex camera), by contrast, is a high-end digital camera that has interchangeable lenses and uses a mirror to display on its screen an exact replica of the image to be photographed. SLR cameras are much heavier and larger than point-and-shoot cameras. They also can be quite expensive, with a variety of available lens sizes and other attachments.



Figure 3-16 SLR digital cameras have lenses and other attachments, whereas the lenses on point-and-shoot cameras are built into the device. Many smartphones also have built-in digital cameras.

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© Pawel Gaul / Photos.com;
© iStockphoto / Stephen Krow;
Courtesy of Samsung

Internet Research
What is an SD card?
Search for: sd card information

Most point-and-shoot cameras include zoom and autofocus capability, use a built-in flash, store images on memory cards, and enable you to view and sometimes edit images directly on the camera. Many can take video in addition to still photos. Some are equipped with GPS, giving them the capability to record the exact location where a photo was taken and then store these details with the photo. Others are waterproof. Figure 3-17 illustrates how a point-and-shoot digital camera might work.

How a Digital Camera Might Work

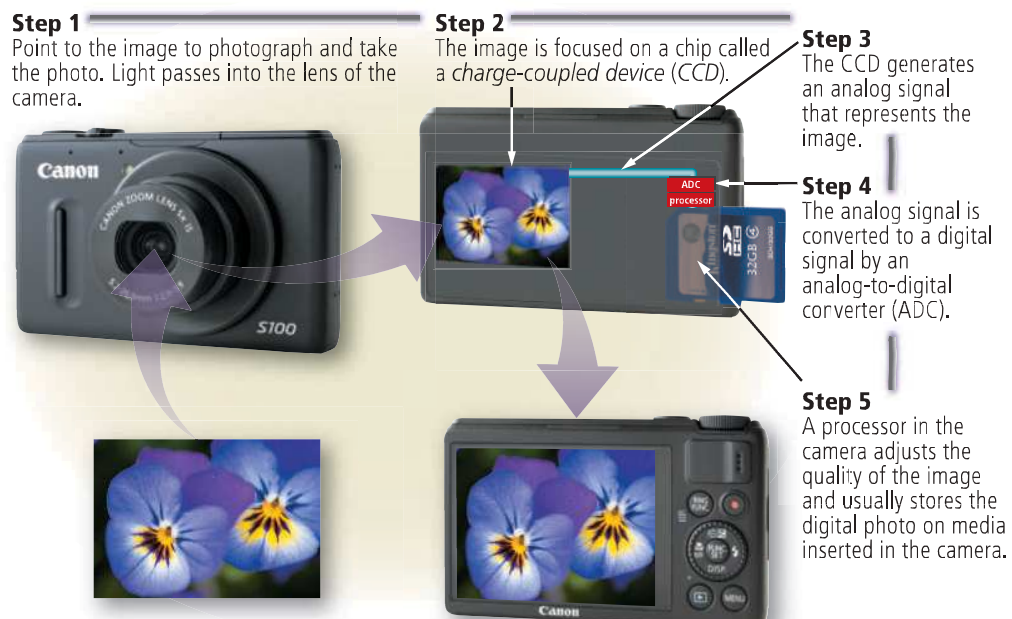


Figure 3-17 This figure shows how a point-and-shoot digital camera might work.

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Courtesy of Kingston Technology Company, Inc

Smart digital cameras include all the features of point-and-shoot cameras and also enable you to connect wirelessly via Wi-Fi. Using the wireless capability, you instantly can save captured photos or videos on a networked computer or the cloud, share them on your online social network, upload them to a video sharing site, send them via email, and more. With a smart digital camera, you typically can download apps (just like on a smartphone) from an app store.

Digital cameras store captured images on storage media in the camera or on some type of memory card. Although most cameras enable you to review, edit, print, and share photos directly from the camera, some users prefer to transfer photos from a digital camera or the memory card to a computer's hard drive to perform these tasks.

Photo Quality Resolution affects the quality of digital camera photos. **Resolution** is the number of horizontal and vertical pixels in a display. A *pixel* (short for picture element) is the smallest element in an electronic image (Figure 3-18). Digital camera resolution typically is stated in *megapixels* (MP), or millions of pixels. For example, a 16 MP resolution means 16 million pixels. The greater the number of pixels the camera uses to capture a picture, the better the quality of the picture but the larger the file size and the more expensive the camera. Most digital cameras provide a means to adjust the resolution. At a lower resolution, you can capture and store more images in the camera.

The actual photographed resolution is known as the *optical resolution*. Some manufacturers state enhanced resolution, instead of, or in addition to, optical resolution. The *enhanced resolution* usually is higher because it uses a special formula to add pixels between those generated by the optical resolution. Be aware that some manufacturers compute a digital camera's megapixels from the enhanced resolution, instead of optical resolution.

Discover More: Visit this chapter's free resources to learn more about resolution.



Technology Innovator
Discover More: Visit this chapter's free resources to learn about Sony (multinational technology corporation).

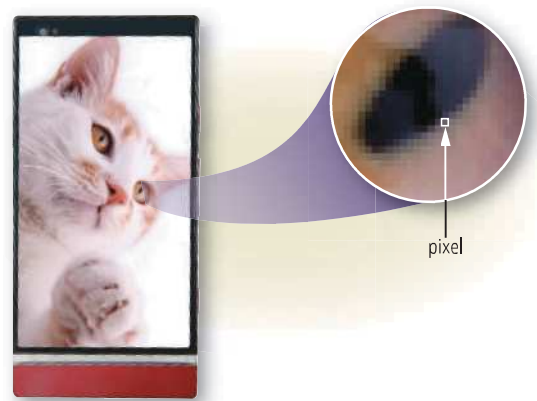


Figure 3-18 A pixel is the smallest element in an electronic image.

© Lingong / Dreamstime.com

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 3-19). Smartphones and other mobile devices often can function as a portable media player. Portable media players enable you to listen to music; view photos; watch videos, movies, and television shows; and even record audio and video. Some include a digital camera and also offer a calendar, address book, games, and other apps. Others communicate wirelessly with other devices or computers and enable you to synchronize your digital media with a computer, another mobile device, or cloud storage.



Figure 3-19 Some portable media players have touch screens; others have touch-sensitive pads or buttons that enable you to access your media library.

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EarPods

Apple uses the term, *EarPods*, to refer to earbuds they designed to match the shape of the human ear.

Portable media players usually require a set of *earbuds*, which are small speakers that rest inside each ear canal. Available in a variety of sizes and colors, some portable media player models have a touch screen. Others have a *touch-sensitive pad*, which is an input device that contains buttons and/or wheels you operate with a thumb or finger. Using the touch-sensitive pad, you can scroll through and play music; view pictures; watch videos or movies; navigate through song, picture, or movie lists; display a menu; adjust volume; customize settings; and perform other actions. Some portable media players have only button controls.



Figure 3-20 A digital media player streams media to a home entertainment device.
Courtesy of Apple, Inc.

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 3-20). Some can stream from the Internet, enabling users to access video on websites. Some users opt for a digital media player instead of subscribing to cable or satellite subscription services to watch television programs.

Your collection of stored digital media is called a *media library*. Portable media players and some digital media players house your media library on a storage device in the player and/or on some type of memory card. With most, you transfer the digital media from a computer or the Internet, if the device is Internet capable, to the player's media library. Read How To 2-3 in Chapter 2 for instructions about how to download digital media from online services.

Mini Feature 3-3: Mobile Device Buyer's Guide

When purchasing a smartphone, digital camera, or portable or digital media player, you should consider several factors. Read Mini Feature 3-3 for tips to consider when purchasing these mobile devices.

MINI FEATURE 3-3

Mobile Device Buyer's Guide

Mobile devices such as smartphones, digital cameras, and portable and digital media players are extremely popular. Research the manufacturers and then consider the following guidelines before purchasing a mobile device.

Smartphone Purchase Guidelines

1. Choose a mobile service provider and plan that satisfies your needs and budget. Choose a sufficient voice, text, and data plan that is appropriate.
2. Decide on the size, style, and weight of the smartphone that will work best for you.
3. Determine whether you prefer an on-screen keyboard, keypad, or mini keyboard.
4. Select a smartphone that is compatible with the program you want to use for synchronizing your email messages, contacts, calendar, and other data.

5. Choose a smartphone with sufficient battery life that meets your lifestyle.
6. Make sure your smartphone has enough memory and storage for contacts, email messages, photos, videos, and apps.
7. Consider purchasing accessories such as extra batteries, earbuds, screen protectors, and carrying cases.



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Digital Camera Purchase Guidelines

1. Determine the type of digital camera that meets your needs, such as a point-and-shoot camera or SLR camera.
2. Choose a camera with an appropriate resolution.
3. Evaluate memory cards, because different cameras require different memory cards...



4. Consider a camera with built-in photo editing features.
5. Make sure that you can see the screen easily.
6. If the photos you plan to take will require you to zoom, choose a camera with an appropriate optical zoom.
7. Purchase accessories such as extra batteries and battery chargers, extra memory cards, lenses, and carrying cases.



Portable or Digital Media Player Purchase Guidelines

1. Choose a device with sufficient storage capacity for your media library and apps.
2. Consider how the portable or digital media player will connect to the Internet. Some devices

connect using a wired and/or wireless connection. Choose a player that is compatible with the type of connection you can provide.

3. Read reviews about sound quality. If you are purchasing a portable device, consider higher-quality earbuds, headphones, or external speakers.



4. Select a player that is compatible with other devices you already own.
5. Consider additional memory cards to increase the storage capacity of your portable or digital media player.
6. Consider the accessories. If your portable or digital media player connects to a television or other display, consider purchasing a keyboard so that you can type easily. If the device is portable, consider additional batteries or a protective case.

Discover More: Visit this chapter's free resources to learn more about smartphone, digital camera, and portable and digital media player manufacturers and specifications.

- ☀ **Consider This:** Although most smartphones also can function as digital media players and digital cameras, would you have a separate digital media player and digital camera? Why?

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 and other digital publications (Figure 3-21). An *e-book*, or digital book, is an electronic version of a printed book, readable on computers and other mobile devices. Digital publications include books, newspapers, and magazines. Mobile computers and devices that display text also can function as e-book readers.

E-book readers usually are smaller than tablets but larger than smartphones. Most e-book reader models can store thousands of books, have a touch screen, and are Internet capable with built-in wireless technology. You use an on-screen keyboard to navigate, search, make selections, take notes, and highlight. Some have a *text-to-speech feature*, where the device speaks the contents of the printed page. E-book readers are available with an electronic paper black-and-white screen or with a color screen. Most have settings to adjust text size and



Figure 3-21 E-book readers enable you to read e-books and other digital publications such as newspapers and magazines.

© iStockPhoto / Petar Chernae

BTW

Electronic Paper Screen

Some users of e-books prefer the electronic paper black-and-white screen over the models with color screens because the electronic paper resembles a paper page from a book.

for various lighting conditions, such as bright sunlight or dim lighting. Batteries usually have a long life, providing more than 75 hours of use before needing to be recharged.

Similar to how a portable media player stores digital media, e-book readers store digital publications in a library on a storage device in the e-book reader and/or on memory cards. You typically transfer the digital publication from a computer or the Internet, if the device is Internet capable, to the e-book reader. Read How To 2-3 in Chapter 2 for instructions about how to download digital media from online services.

Discover More: Visit this chapter’s free resources to learn more about e-book readers.

CONSIDER THIS

Do you need a separate e-book reader if you have a tablet or other device that can function as an e-book reader?

If you want the flexibility of reading on one device while using a tablet or other device for separate tasks, you will want to purchase a separate e-book reader. Also, e-book readers have a design suited for optimal readability of on-screen text and a longer battery life.

Internet Research

Which activity trackers are the most widely used?

Search for: popular activity trackers

Wearable Devices

A **wearable device** or *wearable* is a small, mobile computing device designed to be worn by a consumer (Figure 3-22). These devices often communicate with a mobile device or computer using Bluetooth. Three popular types of wearable devices are activity trackers, smartwatches, and smartglasses.

An *activity tracker* is a wearable device that monitors fitness-related activities such as distance walked, heart rate, pulse, calories consumed, and sleep patterns. These devices typically sync, usually wirelessly, with a web or mobile app on your computer or mobile device to extend the capability of the wearable device.

A *smartwatch* is a wearable device that, in addition to keeping time, can communicate wirelessly 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. Most include a touch screen.

Smartglasses, also called *smart eyewear*, are wearable head-mounted eyeglass-type devices that enable the user to view information or take photos and videos that are projected to a miniature screen in the user’s field of vision. For example, the device wearer could run an app while wearing smartglasses that display flight status information when he or she walks into an airport. Users control the device

through voice commands or by touching controls on its frame. Some smartglasses also include mobile apps, such as fitness trackers and GPS.

Discover More: Visit this chapter’s free resources to learn more about wearable devices.



Figure 3-22 Three popular wearable devices include activity trackers, smartwatches, and smartglasses.

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Internet Research

How does augmented reality apply to smartglasses?

Search for: augmented reality

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 or a monitor so that they can view gameplay on the screen. Some models also allow you to listen to music and watch movies or view photos. Typically weighing between 3 and 11 pounds, many game console models include storage for games and other media. Optical disc drives in the game consoles provide access to games and movies on optical disc. Some use memory cards and accept USB flash drives. Game consoles that are Internet capable enable gamers to download games, stream games or movies, and play with others online. Some gamers connect keyboards or webcams so that they more easily can send text messages or conduct video chats with other gamers.

A **handheld game device** is a small mobile device that contains a screen, speakers, controls, and game console all in one unit. Some include a stylus. Some handheld game device models have touch screens and built-in digital cameras. Some are Internet capable for downloading games and apps. Most handheld game devices can communicate wirelessly with other similar devices for multiplayer gaming.

With a game console or computer video game, players direct movements and actions of on-screen objects via a controller, voice, or air gestures. Game controllers include gamepads, joysticks and wheels, dance pads, and a variety of motion-sensing controllers (Figure 3-23). The following list describes each of these types of game controllers. Most communicate via wired or wireless technology.

- A *gamepad*, which is held with both hands, controls the movement and actions of players or objects in video games or computer games. On the gamepad, users press buttons with their thumbs or move sticks in various directions to trigger events. Several gamepads can communicate with the game console simultaneously for multiplayer gaming.
- Users running flight and driving simulation software often use a *joystick* or wheel. A *joystick* is a handheld vertical lever, mounted on a base, that you move in different directions to control the actions of the simulated vehicle or player. The lever usually includes buttons, called triggers, that you press to initiate certain events. A *wheel* is a steering-wheel-type input device that users turn to simulate driving a car, truck, or other vehicle. Most wheels also include foot pedals for acceleration and braking actions.
- A *dance pad* is a flat, electronic device divided into panels that users press with their feet in response to instructions from a music video game. These games test the user's ability to step on the correct panel at the correct time, following a pattern that is synchronized with the rhythm or beat of a song.



Technology Innovator
Discover More: Visit this chapter's free resources to learn about Nintendo (multinational consumer electronics company).



Figure 3-23 Game players have a variety of ways to direct movements and actions of on-screen objects.

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Internet Research

Which video games are the most widely used?

Search for: popular video games

- *Motion-sensing game controllers* allow users to guide on-screen elements with air gestures, that is, by moving their body or a handheld input device through the air. Some motion-sensing game controllers are sold with a particular type of game; others are general purpose. Sports games, for example, use motion-sensing game controllers, such as baseball bats and golf clubs. With general-purpose motion-sensing game controllers, you simulate batting, golfing, and other actions with a universal handheld device or no device at all.
- Other controllers include those used for music and fitness games. Controllers that resemble musical instruments, such as guitars, drums, keyboards, and microphones work with music video games that enable game players to create sounds and music by playing the instrument. Fitness games often communicate with a *balance board*, which is shaped like a weight scale and contains sensors that measure a game player's balance and weight. Read Ethics & Issues 3-3 to consider whether games and apps are qualified to provide medical advice.

Discover More: Visit this chapter's free resources to learn more about game devices.

ETHICS & ISSUES 3-3



Are Fitness Video Games and Apps Qualified to Provide Medical Advice?

Most video games and smartphone apps provide a workout only for your fingers. A host of games and apps, however, attempt to track calories, suggest workout routines, and more. Because you can take your smartphone anywhere, one advantage is that apps can provide tips for eating healthfully at a restaurant, act as a pedometer to track your steps, and send reminders to exercise. Wearable fitness devices can track your steps or use GPS to trace your route when running or biking. Another advantage is you can receive instant feedback and support from fitness apps and games that

allow you to post workouts, calorie counts, and even weight loss to online social networks. Some apps even reward you for working out.

Some critics find fault with these apps, claiming that medical personnel have not evaluated either the game or app developers, or the games and apps themselves. Because they do not take into account the amount of lean muscle mass and body fat, health and weight loss goals can be miscalculated. Experts say that games that simulate sports, such as tennis, burn half the calories you would burn if you participated in the actual sport. Some medical professionals also note that apps do not consider a participant's

medical history when recommending activities. Proponents of fitness-related games and apps say that the games encourage people to be more active and can provide positive feedback, especially the elderly and children who might otherwise not get much physical activity.

Consider This: Should game and app developers provide medical advice? Why or why not? Can fitness-related games provide a quality workout? Can an app give accurate calorie recommendations? Why or why not? As long as the games make people more active, should you ignore a games' shortcomings? Why or why not?

Embedded Computers

An **embedded computer** is a special-purpose computer that functions as a component in a larger product. Embedded computers are everywhere — at home, in your car, and at work. The following list identifies a variety of everyday products that contain embedded computers.

- **Consumer electronics:** Mobile phones, digital phones, digital televisions, cameras, video recorders, DVD players and recorders, answering machines
- **Home automation devices:** Thermostats, sprinkling systems, security systems, vacuum systems, appliances, lights
- **Automobiles:** Antilock brakes, engine control modules, electronic stability control, airbag control unit, cruise control, navigation systems and GPS receivers
- **Process controllers and robotics:** Remote monitoring systems, power monitors, machine controllers, medical devices
- **Computer devices and office machines:** Keyboards, printers, fax and copy machines

Because embedded computers are components in larger products, they usually are small and have limited hardware. These computers perform various functions, depending on the requirements of the product in which they reside. Embedded computers in printers, for example, monitor the amount of paper in the tray, check the ink or toner level, signal if a paper jam has occurred, and so on. Figure 3-24 shows some of the many embedded computers in vehicles. Read Ethics & Issues 3-4 to consider whether in-vehicle technology fosters a false sense of security.



Figure 3-24 Some of the embedded computers designed to improve your safety, security, and performance in today's vehicles.

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ETHICS & ISSUES 3-4

Does In-Vehicle Technology Foster a False Sense of Security?

Embedded computers in vehicles can guide you when backing out of a driveway, warn you if a vehicle or object is in your blind spot, or alert you to unsafe road conditions. Apps can track gas mileage or notify you when your car needs an oil change or other services. Recently, all new cars were required to include electronic stability control, which can assist with steering the car in case of skidding, and backup cameras. Other technologies adjust vehicle speed or headlight usage, and can even activate the brakes.

All of this technology is intended to make driving safer.

Critics of in-vehicle technology claim that it can provide drivers with a false sense of security. If you rely on a sensor for assistance while backing up, parking, or changing lanes, for example, you may miss other obstructions that could cause a crash. Reliance on electronic stability control or other crash-avoidance technologies may cause you to drive faster than conditions allow or to pay less attention to the distance between your vehicle and others.

The effect on new, teen drivers is especially of concern. If teens learn to drive using vehicles

equipped with features such as video rearview mirrors, they may be unable to drive older, less-equipped vehicles safely. Many apps and devices help parents protect their teens while driving. Apps can program mobile devices to block incoming calls or text messages while the vehicle is moving. GPS can track a vehicle's location and speed. Sensors can monitor seatbelt usage and number of passengers in the vehicle.

Consider This: Does in-vehicle technology make driving safer? Why or why not? What basic skills should all drivers have, regardless of their vehicle's technology?

CONSIDER THIS

Can embedded computers use the Internet to communicate with other computers and devices?

Many already do, on a small scale. For example, a Smart TV enables you to browse the web, stream video from online media services, listen to Internet radio, communicate with others on social media sites, play online games, and more — all while watching a television show.

A trend, called the *Internet of Things*, describes an environment where processors are embedded in every product imaginable (things), and those 'things' communicate with one another via the Internet (i.e., alarm clocks, coffeemakers, apps, vehicles, refrigerators, phones, washing machines, doorbells, streetlights, thermostats, navigation systems, etc.). For example, when your refrigerator detects the milk is low, it sends your phone a text message that you need milk and adds a 'buy milk' task to your scheduling app. On the drive home, your phone determines the closest grocery store that has the lowest milk price and sends the address of that grocery store to your vehicle's navigation system, which, in turn, gives you directions to the store. In the store, your phone directs you to the dairy aisle, where it receives an electronic coupon from the store for the milk. Because this type of environment provides an efficient means to track or monitor status, inventory, behavior, and more — without human intervention — it sometimes is referred to as machine-to-machine (M2M) communications. For additional information about the Internet of Things, read Mini Feature 6-1 in Chapter 6.

Putting It All Together



Technology Trend

Discover More: Visit this chapter's free resources to learn about volunteer computing, where you can donate your computer's resources to promote scientific research projects.

Industry experts typically classify computers and mobile devices in six categories: personal computers (desktop), mobile computers and mobile devices, game consoles, servers, supercomputers, and embedded computers. A computer's size, speed, processing power, and price determine the category it best fits. Due to rapidly changing technology, however, the distinction among categories is not always clear-cut. Table 3-3 summarizes the categories of computers discussed on the previous pages.



Table 3-3 Categories of Computers and Mobile Devices

Category	Physical Size	Number of Simultaneously Connected Users	General Price Range
Personal computers (desktop)	Fits on a desk	Usually one (can be more if networked)	Several hundred to several thousand dollars
Mobile computers and mobile devices	Fits on your lap or in your hand	Usually one	Less than a hundred dollars to several thousand dollars
Game consoles	Small box or handheld device	One to several	Several hundred dollars or less
Servers	Small cabinet to room full of equipment	Two to thousands	Several hundred to several million dollars
Supercomputers	Full room of equipment	Hundreds to thousands	Half a million to several billion dollars
Embedded computers	Miniature	Usually one	Embedded in the price of the product

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NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Cloud Computing, Mobile Devices, Game Devices, Embedded Computers, and Putting It All Together, as it relates to the chapter objectives.

Now you should know . . .

- When you are using cloud computing (Objective 4)
- What you should consider when purchasing a mobile device (Objective 5)
- What types of controllers you might use with game consoles (Objective 6)
- When you are using an embedded computer (Objective 7)

Discover More: Visit this chapter's premium content for practice quiz opportunities.



Instead of the term, port, the term, *jack*, sometimes is used to identify audio and video ports (i.e., audio jack or video jack).

Ports and Connections

Computers and mobile devices connect to peripheral devices through ports or by using wireless technologies. A **port** is the point at which a peripheral device (i.e., keyboard, printer, monitor, etc.) attaches to or communicates with a computer or mobile device so that the peripheral device can send data to or receive information from the computer or mobile device. Most computers

and mobile devices have ports (Figure 3-25). Some ports have a micro or mini version for mobile devices because of the smaller sizes of these devices.

A **connector** joins a cable to a port. A connector at one end of a cable attaches to a port on the computer or mobile device, and a connector at the other end of the cable attaches to a port on the peripheral device. Table 3-4 shows a variety of ports you may find on a computer or mobile device. USB and Thunderbolt are more general-purpose ports that allow connections to a wide variety of devices; other ports are more specific and connect a single type of device.



Figure 3-25 Most computers and mobile devices have ports so that you can connect the computer or device to peripherals.

Courtesy of Gateway; © Ultraone / Dreamstime.com; Courtesy of Lenovo; © iStockphoto / Nikada; © eduard ionescu / Shutterstock

Table 3-4 Popular Ports and Connectors

Port Type	Connector Photo	Port Photo	Port Type	Connector Photo	Port Photo
DisplayPort (audio/video)			Mini USB		
DVI (digital video interface)			Mini HDMI (audio/video)		
HDMI (audio/video)			Network (Ethernet)		
Headphones			Speaker		
Lightning			Thunderbolt		
Microphone			USB (Type A)		
Micro USB			USB (Type B)		
Mini DisplayPort			VGA		

Discover More: Visit this chapter's free resources for an expanded list of ports and connectors.

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USB Ports

A **USB port**, short for universal serial bus port, can connect up to 127 different peripheral devices together with a single connector. Devices that connect to a USB port include the following: card reader, digital camera, external hard drive, game console, joystick, modem, mouse, optical disc drive, portable media player, printer, scanner, smartphone, digital camera, speakers, USB flash drive, and webcam. In addition to computers and mobile devices, you find USB ports in vehicles, airplane seats, and other public locations.

Several USB versions have been released, with newer versions (i.e., USB 3.0) transferring data and information faster than earlier ones (i.e., USB 2.0). Newer versions are *backward compatible*, which means they support older USB devices as well as newer ones. Keep in mind, though, that older USB devices do not run any faster in a newer USB port. In addition to transferring data, cables plugged into USB ports also may be able to transfer power to recharge many smartphones and tablets. Newer versions of USB can charge connected mobile devices even when the computer is not in use.

To attach multiple peripheral devices using a single USB port, you can use a USB hub. A *USB hub* is a device that plugs in a USB port on the computer or mobile device and contains multiple USB ports, into which you plug cables from USB devices. Some USB hubs are wireless. That is, a receiver plugs into a USB port on the computer and the USB hub communicates wirelessly with the receiver. Read Secure IT 3-4 for tips when using USB charging stations.

SECURE IT 3-4

Public USB Charging Stations — Safe or Not?

Although you might be tempted to recharge your smartphone or mobile device at a public charging station, think twice before plugging your USB cable into the charging kiosk's port. The station may be *juice jacking*, which occurs when a hacker steals data from or transfers malware to the device via a USB cable at a charging station. (A hacker is someone who accesses a computer or network illegally.)


This process is possible because the USB cable is used for two purposes: supplying power and syncing data. It can occur within one minute after plugging into the charger.

Anything on the device is susceptible, including photos, contacts, and music, and some malware can create a full backup of your data, leaving you prone to identity theft. Once the phone or mobile device is infected, it can continue to transmit data via Wi-Fi. Security experts claim that the only method of erasing this malware is to restore the device to its factory settings.

Charging stations are common in airports, business centers, and conference rooms. While most are safe, you can reduce the possibility of juice jacking by taking these precautions:

- Use a travel charger, also called a power bank, which can recharge a device several times before needing recharging itself.

- Keep the phone or mobile device locked so that it requires a password to sync data with another device. Turning off the device while charging may not provide sufficient protection against accessing the storage media.
- Use a power-only USB cable that does not allow data transmission.

 **Consider This:** Should warning signs be posted by public charging stations? Would you use a public charging kiosk if your smartphone or mobile device was running low on battery power?

Discover More: Visit this chapter's free resources to learn more about USB versions.

Port Replicators and Docking Stations

Instead of connecting peripheral devices directly to ports on a mobile computer, some mobile users prefer the flexibility of port replicators and docking stations. A *port replicator* is an external device that provides connections to peripheral devices through ports built into the device. The mobile user accesses peripheral devices by connecting the port replicator to a USB port or a special port on the mobile computer. Port replicators sometimes disable ports on the mobile computer to prevent conflicts among the devices on the computer and port replicator.

A docking station is similar to a port replicator, but it has more functionality. A *docking station*, which is an external device that attaches to a mobile computer or device, contains a power connection and provides connections to peripheral devices (Figure 3-26). Docking stations also

may include slots for memory cards, optical disc drives, and other devices. With the mobile computer or device in the docking station, users can work with a full-sized keyboard, a mouse, and other desktop peripheral devices from their laptop or tablet.

Wireless Device Connections

Instead of connecting computers and mobile devices to peripheral devices with a cable, some peripheral devices use wireless communications technologies, such as Bluetooth, Wi-Fi, and NFC.

Bluetooth Bluetooth technology uses short-range radio signals to transmit data between two Bluetooth-enabled computers or devices. In addition to computers, mobile devices and many peripheral devices, such as a mouse, keyboard, printer, or headset, and many vehicles and consumer electronics are Bluetooth enabled. Bluetooth devices have to be within about 33 feet of each other, but the range can be extended with additional equipment. If you have a computer that is not Bluetooth enabled, you can purchase a Bluetooth wireless port adapter that will convert an existing USB port into a Bluetooth port. Read How To 3-1 for instructions about setting up two Bluetooth devices to communicate with each other.



Figure 3-26 Docking stations often are used with tablets and other mobile computers, providing connections to peripheral devices.

Courtesy of Fujitsu Technology Solutions; © Cengage Learning

HOW TO 3-1

Pair Bluetooth Devices

Before two Bluetooth devices will communicate with each other, they might need to be paired. *Pairing* is the process of initiating contact between two Bluetooth devices and allowing them to communicate with each other. It is important to have the documentation for the Bluetooth devices you are pairing readily available. The following steps will help you pair two Bluetooth devices.

1. Make sure the devices you intend to pair are charged completely or plugged into an external power source.
2. Turn on the devices to pair, ensuring they are within your immediate reach.
3. If necessary, enable Bluetooth on the devices you are pairing.
4. Place one device in *discoverable mode*, which means it is waiting for another Bluetooth device to locate its signal. If you are connecting a smartphone to a Bluetooth headset, for example,

the smartphone would need to be in discoverable mode.

5. Refer to the other device's documentation and follow the necessary steps to locate the discoverable device from the other device you are pairing.
6. After no more than about 30 seconds, the devices should initiate communications.
7. You may be required to enter a passkey (similar to a PIN) on one device for the other device with which you are pairing. For example, if you are pairing a smartphone with a Bluetooth headset, you may be required to enter the Bluetooth headset's passkey on the smartphone. In this case, you would refer to the Bluetooth headset's documentation to obtain the passkey. Common passkeys are 0000 and 1234.
8. After entering the correct passkey, the two devices should be paired successfully.

Consider This: Why is a passkey required when pairing two Bluetooth devices? Do you need to pair Bluetooth devices before each use?



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Wi-Fi Short for wireless fidelity, **Wi-Fi** uses radio signals that conform to 802.11 standards, which were developed by the Institute of Electrical and Electronics Engineers (IEEE).

Computers and devices that have the appropriate Wi-Fi capability can communicate via radio waves with other Wi-Fi computers or devices. Most mobile computers and devices are Wi-Fi enabled, along with routers and other communications devices. For successful Wi-Fi communications in open or outdoor areas free from interference, the Wi-Fi computers or devices should be within 300 feet of each other. In closed areas, the wireless range is about 100 feet. To obtain communications at the maximum distances, you may need to install extra hardware. Read How To 3-2 for instructions about connecting a phone to a Wi-Fi network.


HOW TO 3-2

Connect Your Phone to a Wi-Fi Network to Save Data Charges

Many of today's data plans limit the amount of data you can transfer each month on your mobile service provider's network. Connecting a smartphone to a Wi-Fi network enables you to transfer data without using your phone's data plan and risking costly overages. The following steps describe how to connect your phone to a Wi-Fi network.

1. Make sure you are in a location where a Wi-Fi network is available. Obtain any necessary information you need to connect to the Wi-Fi network.
2. Navigate to the settings on your phone.
3. Locate and enable Wi-Fi in your phone's settings.

4. When your phone displays a list of available wireless networks, choose the network to which you want to connect.
5. If necessary, enter any additional information, such as a password, required to connect to the network.
6. Your phone should indicate when it successfully is connected to the network.
7. When you are finished using the Wi-Fi connection or are not within range of the Wi-Fi network, disable Wi-Fi on your phone to help conserve battery life.

 **Consider This:** If you have a data plan allowing unlimited data and you are within range of a Wi-Fi network, is it better to use your mobile service provider's network or the Wi-Fi network? Why?



Google Inc.

NFC **NFC** (near field communications) uses close-range radio signals to transmit data between two NFC-enabled devices. Examples of NFC-enabled devices include smartphones, digital cameras, computers, televisions, and terminals. Other objects, such as credit cards and tickets, also use NFC technology. For successful communications, the devices either touch or are within an inch or two of each other.

Discover More: Visit this chapter's free resources to learn more about transfer rates of wireless communications technologies and 802.11 standards.

CONSIDER THIS

What are some uses of NFC devices?

- Pay for goods and services (i.e., smartphone to terminal)
- Share contacts, photos, and other files (i.e., smartphone to smartphone or digital camera to television)
- Download apps (i.e., computer to smartphone)
- Gain access or admittance (i.e., smartphone to terminal)

Protecting Hardware

Users rely on computers and mobile devices to create, store, and manage important information. Thus, you should take measures to protect computers and devices from theft, vandalism, and failure.

Hardware Theft and Vandalism

Companies, schools, and other organizations that house many computers are at risk of hardware theft and vandalism, especially those with smaller computers that easily can fit in a backpack or briefcase. Mobile users are susceptible to hardware theft because the size and weight of their computers and devices make them easy to steal. Thieves may target laptops of company executives so that they can use the stolen computer to access confidential company information illegally.

To help reduce the chances of theft, companies and schools use a variety of security measures. Physical access controls, such as locked doors and windows, usually are adequate to protect the equipment. Many businesses, schools, and some homeowners install alarm systems for additional security. School computer labs and other facilities with a large number of semifrequent users often attach additional physical security devices, such as cables that lock the equipment to a desk, cabinet, or floor. Mobile users sometimes lock their mobile computers temporarily to a stationary object, for example, a table in a hotel room. Small locking devices also exist that require a key to access a hard drive or optical disc drive.

Users also can install a security or device-tracking app on their mobile computers and devices. Some security apps shut down the computer and sound an alarm if the computer moves beyond a specified distance. Others can be configured to photograph the thieves when they use the computer. Device-tracking apps use GPS, Wi-Fi, IP addresses, and other means to determine the location of a lost or stolen computer or device.

Users can configure computers and mobile devices to require identification before allowing access. For example, you can require entry of a user name and password to use the computer or device. Some computers and mobile devices have built-in or attached fingerprint readers (Figure 3-27), which can be used to verify a user's identity before allowing access. A *fingerprint reader* captures curves and indentations of a fingerprint. This type of security does not prevent theft, but it renders the computer or device useless if it is stolen.

Discover More: Visit this chapter's free resources to learn more about device-tracking apps.

Hardware Failure

Hardware can fail for a variety of reasons: aging hardware; random events, such as electrical power problems; and even errors in programs or apps. Not only could hardware failure require you to replace or repair a computer or mobile device, but it also can cause loss of software, data, and information.

One of the more common causes of system failure is an electrical power variation, which can cause loss of data and loss of equipment. If computers and mobile devices are connected to a network, a single power disturbance can damage multiple devices at once. Electrical disturbances that can cause damage include undervoltages and overvoltages.

Internet Research

How prevalent is theft of mobile devices?

Search for: mobile device theft

BTW

Lost Computers or Devices

You usually can instruct the password screen to display your name and phone number, so that a Good Samaritan can return a lost computer or device to you.



Figure 3-27 Some mobile computers and devices include fingerprint readers, which can be used to verify a user's identity.

- An **undervoltage** occurs when the electrical supply or voltage drops, often defined as more than five percent, below the normal volts. A *brownout* is a prolonged (more than a minute) undervoltage. A *blackout* is a complete power failure. Undervoltages can cause data loss but generally do not cause equipment damage.
- An **overvoltage**, or **power surge**, occurs when the incoming electrical supply or voltage increases, often defined as more than five percent, above the normal volts. A momentary overvoltage, called a *spike*, occurs when the increase in power lasts for less than one millisecond (thousandth of a second). Uncontrollable disturbances such as lightning bolts can cause spikes. Overvoltages can cause immediate and permanent damage to hardware.

To protect against electrical power variations, use a surge protector. A **surge protector**, also called a *surge suppressor*, uses electrical components to provide a stable current flow and minimize the chances of an overvoltage reaching the computer and other electronic equipment (Figure 3-28). Sometimes resembling a power strip, the computer and other devices plug in the surge protector, which plugs in the power source.



Figure 3-28 Circuits inside a surge protector safeguard against electrical power variations.

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The surge protector absorbs small overvoltages — generally without damage to the computer and equipment. To protect the computer and other equipment from large overvoltages, such as those caused by a lightning strike, some surge protectors stop working completely when an overvoltage reaches a certain level. Surge protectors also usually protect the computer from undervoltages. No surge protectors are 100 percent effective. Large power surges can bypass the protector. Repeated small overvoltages can weaken a surge protector permanently. Some experts recommend replacing a surge protector every two to three years.

For additional electrical protection, some users connect an uninterruptible power supply to the computer. An **uninterruptible power supply (UPS)** is a device that contains surge protection circuits and one or more batteries that can provide power during a temporary or permanent loss of power (Figure 3-29). A UPS connects your computer and a power source. Read How To 3-3 for purchasing suggestions regarding surge protectors and UPSs.



Figure 3-29 If power fails, a UPS uses batteries to provide electricity for a limited amount of time.

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HOW TO 3-3



Evaluate Surge Protectors and UPSs


Electrical power surges are a part of everyday life, and they are especially prevalent during thunderstorms and peak energy consumption periods. These unavoidable occurrences can damage or ruin sensitive electronic equipment. The processor in a computer is particularly sensitive to fluctuations in current. Two devices can help protect electronic components: a surge protector and an uninterruptible power supply (UPS).

Purchase the best surge protector you can afford. Typically, the amount of protection offered by a surge protector is proportional to its cost. That is, the more expensive the

surge protector, the more protection it offers. When evaluating surge protectors and UPSs, they should meet or exceed these specifications:

- Sufficient outlets to accommodate each device needing protection
- Individual on/off switch for each device
- Built-in fuse
- UL 1449 rating that ensures quality control and testing
- Joule rating of at least 600
- Indicator light showing the device is functioning properly

- Warranty for damages to any connected equipment
- Low clamping voltage
- High energy-absorption rating
- Low response time, preferably less than ten nanoseconds
- Protection for a modem, communications lines, and cables

 **Consider This:** What other factors might you consider while evaluating surge protectors? Why?

CONSIDER THIS

What other measures can organizations implement if their computers must remain operational at all times?

Some companies use duplicate components or duplicate computers to protect against hardware failure.

A *fault-tolerant computer* has duplicate components so that it can continue to operate when one of its main components fail. Airline reservation systems, communications networks, ATMs, and other systems that must be operational at all times use duplicate components, duplicate computers, or fault-tolerant computers.

Health Concerns of Using Technology

The widespread use of technology has led to some important user health concerns. You should be proactive and minimize your chance of risk.

Repetitive Strain Injuries

A *repetitive strain injury (RSI)* is an injury or disorder of the muscles, nerves, tendons, ligaments, and joints. Technology-related RSIs include tendonitis and carpal tunnel syndrome.

- Tendonitis is inflammation of a tendon due to repeated motion or stress on that tendon.
- Carpal tunnel syndrome (CTS) is inflammation of the nerve that connects the forearm to the palm of the hand.

Repeated or forceful bending of the wrist can cause tendonitis of the wrist or CTS. Symptoms of tendonitis of the wrist include extreme pain that extends from the forearm to the hand, along with tingling in the fingers. Symptoms of CTS include burning pain when the nerve is compressed, along with numbness and tingling in the thumb and first two fingers.

Long-term computer work can lead to tendonitis or CTS. Factors that cause these disorders include prolonged typing, prolonged mouse usage, or continual shifting between the mouse and the keyboard. If untreated, these disorders can lead to permanent physical damage.

CONSIDER THIS

What can you do to prevent technology-related tendonitis or CTS?

Follow these precautions:

- Take frequent breaks to exercise your hands and arms (Figure 3-30).
- Do not rest your wrists on the edge of a desk. Instead, place a wrist rest between the keyboard and the edge of your desk.
- Place the mouse at least six inches from the edge of the desk. In this position, your wrist is flat on the desk.
- Minimize the number of times you switch between the mouse and the keyboard.
- Keep your forearms and wrists level so that your wrists do not bend.
- Avoid using the heel of your hand as a pivot point while typing or using the mouse.
- Keep your shoulders, arms, hands, and wrists relaxed while you work.
- Maintain good posture.
- Stop working if you experience pain or fatigue.

Hand Exercises

- Spread fingers apart for several seconds while keeping wrists straight.
- Gently push back fingers and then thumb.
- Dangle arms loosely at sides and then shake arms and hands.

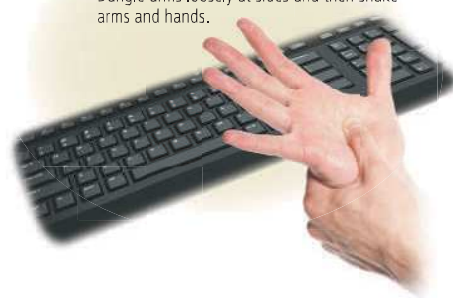


Figure 3-30 To reduce the chance of developing tendonitis or carpal tunnel syndrome, take frequent breaks during computer sessions to exercise your hands and arms.

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Other Physical Risks

With the growing use of earbuds and headphones in computers and mobile devices, some users are experiencing hearing loss. Read How To 3-4 for guidelines for evaluating earbuds and headphones.

Computer vision syndrome (CVS) is a technology-related health condition that affects eyesight. You may have CVS if you have sore, tired, burning, itching, or dry eyes; blurred or double vision after prolonged staring at a display device; headache or sore neck; difficulty shifting focus between a display device and documents; difficulty focusing on the screen image; color fringes or after-images when you look away from the display device; and increased sensitivity to light. Eyestrain associated with CVS is not thought to have serious or long-term consequences. Figure 3-31 outlines some techniques you can follow to ease eyestrain.

People who spend their workday using the computer sometimes complain of lower back pain, muscle fatigue, and emotional fatigue.

Lower back pain sometimes is caused from poor posture. Always sit properly in the chair while you work. To alleviate back pain, muscle fatigue, and emotional fatigue, take a 15- to 30-minute break every 2 hours — stand up, walk around, stretch, and relax.

Techniques to Ease Eyestrain

- Every 10 to 15 minutes, take an eye break.
 - Look into the distance and focus on an object for 20 to 30 seconds.
 - Roll your eyes in a complete circle.
 - Close your eyes and rest them for at least one minute.
- Blink your eyes every five seconds.
- Place your display about an arm's length away from your eyes with the top of the screen at or below eye level.
- Use large fonts.
- If you wear glasses, ask your doctor about computer glasses.
- Adjust the lighting.



Figure 3-31 Following these tips may help reduce eyestrain while using technology.

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HOW TO 3-4

Evaluate Earbuds and Headphones

Earbuds and headphones are used to listen to music and other audio files on computers and mobile devices. Selecting the proper product not only depends on the style you prefer, but also the type of audio you will be playing. Prices for earbuds and headphones can range from only a few dollars to several hundred dollars, so it is important to know what you are purchasing. The following guidelines describe what to look for when evaluating earbuds and headphones.

- Determine which style you prefer. Earbuds rest inside your ear, while headphones rest over your ear. Experiment with both types

and determine which is more comfortable for you.

- Determine the quality you desire. If you listen to music casually and typically do not notice variations in sound quality, a higher-end product might not be necessary. Alternatively, if sound quality is important, you may consider a more expensive set. Note that a higher price does not always indicate better quality; read online product reviews for information about the sound quality of various products.
- Decide whether you would like a noise cancelling feature. *Noise cancelling* helps block external noise while you are

listening to the audio on your device. Noise cancelling headphones sometimes require batteries, and you are able to turn the noise cancelling feature on and off. If you will be listening to audio in locations where you also need to hear what is going on around you, consider purchasing a product without this feature.

Consider This: Based on your preferences and needs, which type of product (earbuds or headphones) is best for you? Locate a product online that meets your specifications. What brand is it? How much does it cost? Where is this product available?

Internet Research

What is a text neck?

Search for: text neck

Another way to help prevent these injuries is to be sure your workplace is designed ergonomically. **Ergonomics** is an applied science devoted to incorporating comfort, efficiency, and safety into the design of items in the workplace. Ergonomic studies have shown that using the correct type and configuration of chair, keyboard, display, and work surface helps users work comfortably and efficiently and helps protect their health (Figure 3-32). You can hire an ergonomic consultant to evaluate your workplace and recommend changes.

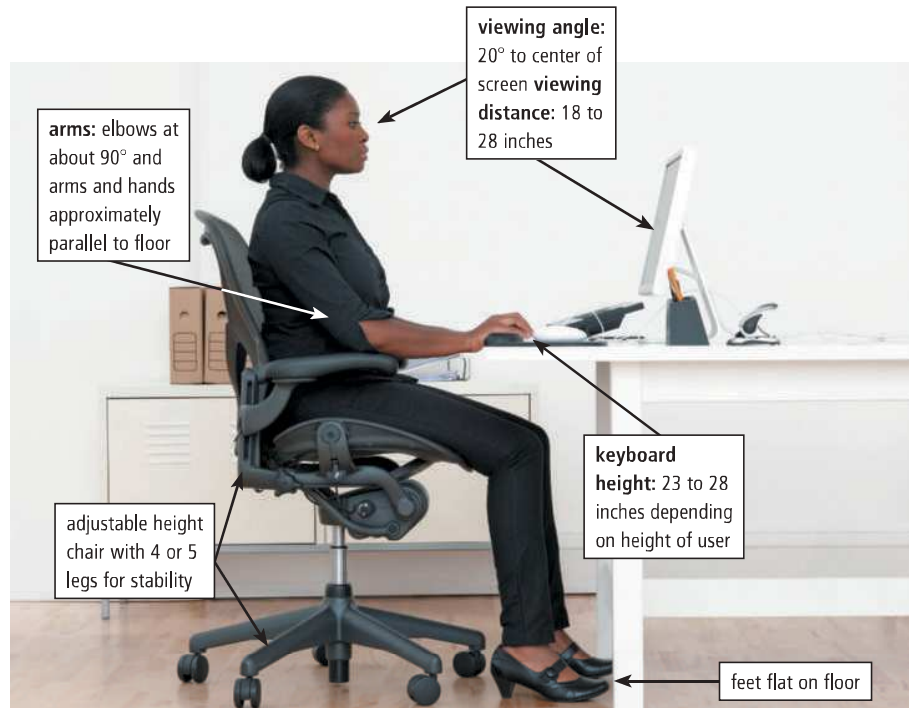


Figure 3-32 A well designed work area should be flexible to allow adjustments to the height and build of different individuals.

© Science Photo Library / Alamy

Behavioral Health Risks

Some technology users become obsessed with computers, mobile devices, and the Internet. **Technology addiction** occurs when technology use consumes someone's entire social life. Technology addiction is a growing health problem, but it can be treated through therapy and support groups.

People suffering from *technology overload* feel distressed when deprived of technology, even for a short length of time, or feel overwhelmed with the amount of technology they are required to manage. To cope with the feelings of distraction and to control the impact that technology can have on work and relationships, set aside technology-free time.

CONSIDER THIS

How can you tell if you are addicted to technology?

Symptoms of a user with technology addiction include the following:

- Craves computer time
- Overjoyed when using a computer or mobile device
- Unable to stop using technology
- Irritable when not using technology
- Neglects family and friends
- Problems at work or school

NOW YOU SHOULD KNOW

Be sure you understand the material presented in the sections titled Ports and Connections, Protecting Hardware, and Health Concerns of Using Technology as it relates to the chapter objectives.

Now you should know...


- How you can connect a peripheral device to a computer or mobile device (Objective 8)
- How you can protect your hardware from theft, vandalism, and failure (Objective 9)
- How you can minimize your risk of health-related injuries and disorders that can result from using technology (Objective 10)

Discover More: Visit this chapter's premium content for practice quiz opportunities.

Chapter Summary

This chapter presented characteristics of and purchasing guidelines for laptops, tablets, desktops, smartphones, digital cameras, and portable and digital media players. It also discussed servers, supercomputers, point-of-sale terminals, ATMs, self-service kiosks, e-book readers, wearable devices, game devices, embedded computers, and cloud computing. It presented a variety of ports and connections, ways to protect hardware, and health concerns of using technology use along with preventive measures.

Discover More: Visit this chapter's free resources for additional content that accompanies this chapter and also includes these features: Technology Innovators: Samsung, Dell/Michael Dell, Sony, and Nintendo; Technology Trends: Bitcoin and Volunteer Computing; and High-Tech Talks: Touch Screen Technology and Voice Recognition Technology.

-  Test your knowledge of chapter material by accessing the Study Guide, Flash Cards, and Practice Test resources from your smartphone, tablet, laptop, or desktop.

TECHNOLOGY @ WORK

Energy Management


When you walk into your office at the start of a new day, you give little thought to the fact that the lights are on and the temperature is comfortable. For all you know, the air conditioner and lighting were on all night; however, energy management systems are hard at work conserving energy and reducing energy costs. When you return home, you also might take for granted the fact that your dryer automatically stops when it senses that your clothes are dry, or that your dishwasher or washing machine uses only enough water to sufficiently clean its contents. Individuals in the energy management field always are looking for ways to use technology to manage energy use.

Building automation systems are devices that can control various building components, such as complex air conditioning systems and lighting systems. Building automation systems adjust these components to provide a comfortable, safe working environment without wasting energy. For example, in an office building where employees all work weekdays from 8:00 a.m. until 5:00 p.m., the

building automation system might prompt the air conditioner to turn on one or two hours before the first employees arrive. After the employees leave for the day, the air conditioner either may turn off for the evening or maintain a higher temperature to conserve energy. Some systems used in hotel rooms may include motion sensors that turn off the air conditioner if they sense no motion or noise in the room. Cruise ship cabins and hotel rooms with doors to a balcony may automatically shut down the air conditioner if the door is left open. Air conditioning systems often are one of the largest consumers of energy, and money spent toward automating one of these systems often can be recovered in smaller electricity bills. In addition to controlling the air conditioning system, building automation systems also can control and monitor lighting. Many newer buildings include motion and sound sensors in each room and automatically turn off lights when the rooms are unoccupied. Lighting in common areas of these buildings might turn off after hours when the building is unoccupied. Alternatively, if the building

has plenty of natural light coming in, sensors automatically can turn off lights when sufficient sunlight is available, or turn on the lights when the sunlight decreases.

The energy management field has made significant advancements because of computer technologies. Businesses not only are able to reduce their energy costs, but they also are conserving energy at the same time.

 **Consider This:** In what other ways do computers and technology play a role in the energy management field?



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Study Guide

The Study Guide exercise reinforces material you should know for the chapter exam.

Discover More: Visit this chapter's premium content to **test your knowledge of digital content** associated with this chapter and **access the Study Guide resource** from your smartphone, tablet, laptop, or desktop.

Instructions: Answer the questions below using the format that helps you remember best or that is required by your instructor. Possible formats may include one or more of these options: write the answers; create a document that contains the answers; record answers as audio or video using a webcam, smartphone, or portable media player; post answers on a blog, wiki, or website; or highlight answers in the book/e-book.

- List types of computers and mobile devices.
- Describe how personal computers often are differentiated.
- Explain how to avoid malware infections.
- Define the term, motherboard.
- Describe the roles of the processor and memory.
- Differentiate among traditional and ultrathin laptops, tablets, phablets, and handheld computers.
- To interact with a tablet, you may use a touch screen or a(n) _____.
- List steps to protect yourself from webcam spying.
- List considerations when purchasing a mobile computer. Explain the importance of built-in ports and slots.
- A(n) _____ desktop may be less expensive and take up less space.
- Identify types of desktop users and explain how each user's computer needs may differ.
- Identify how you can purchase the appropriate desktop computer for your needs.
- Describe the purpose and functions of a server. Differentiate among rack, blade, and tower servers.
- Define virtualization as it relates to servers. Define the terms, server farm and mainframe.
- Define the terms, terminal and thin client. List the advantages of a thin client.
- Identify situations where POS terminals, ATMs, and self-service kiosks might be used. List ATM safety guidelines.
- A(n) _____ is used to solve complex, sophisticated mathematical calculations, such as those used in petroleum exploration.
- List cloud computing resources. Describe how businesses use cloud computing to manage resources.
- List types of mobile devices. Describe features of a smartphone.
- Explain the issues surrounding the recycling of e-waste.
- Identify methods for typing on a smartphone.
- List options provided by text, picture/video message, and voicemail services.
- Distinguish between push and pull notifications.
- _____ occurs when a person's attention is diverted, such as by talking on a mobile phone.
- Describe the types of digital cameras, how they store captured images, and how to transfer photos to a computer.
- Explain how resolution affects digital picture quality.
- Identify the features of portable media and digital media players.
- List considerations when purchasing different types of mobile devices.
- List features of e-book readers and wearable devices.
- Identify types of game controllers.
- Explain whether fitness video games are an effective form of exercise.
- List products that contain embedded computers. List the disadvantages of in-vehicle technology.
- Describe the trend, the Internet of Things.
- Describe categories of computers and mobile devices, and identify general characteristics of size, user type, and price.
- Explain how a computer uses ports and connectors.
- List devices that connect to a USB port. Explain risks of using public USB charging stations.
- Define the term, backward compatible.
- Distinguish between a port replicator and a docking station.
- Describe the following technologies: Bluetooth, Wi-Fi, and NFC.
- _____ is the process of initiating contact between two Bluetooth devices.
- List steps to connect your phone to a Wi-Fi network.
- List methods for securing against hardware theft and vandalism.
- Define the terms, undervoltage and overvoltage, and explain how each can damage a computer or data.
- Describe the purposes of surge protectors and UPS devices. Explain the purpose a fault-tolerant computer.
- Identify causes and types of repetitive strain injuries. List symptoms of CVS.
- List guidelines for evaluating earbuds and headphones.
- Describe the role of ergonomics in a workplace.
- List symptoms of technology addiction. Define the term, technology overload.
- Describe how technology is used in the energy management industry.

You should be able to define the Primary Terms and be familiar with the Secondary Terms listed below.

Key Terms

Discover More: Visit this chapter's premium content to **view definitions** for each term and to **access the Flash Cards resource** from your smartphone, tablet, laptop, or desktop.

Primary Terms (shown in bold-black characters in the chapter)

all-in-one (114)	e-book reader (129)	NFC (138)	tablet (112)
Bluetooth (137)	embedded computer (132)	overvoltage (140)	technology addiction (144)
cloud computing (121)	ergonomics (144)	port (134)	undervoltage (140)
computer (108)	game console (131)	portable media player (127)	uninterruptible power supply (UPS) (140)
computer vision syndrome (143)	handheld game device (131)	power surge (140)	USB port (136)
connector (135)	laptop (111)	resolution (127)	wearable device (130)
desktop (114)	mobile computer (108)	server (116)	Wi-Fi (138)
digital camera (125)	mobile device (108)	smartphone (123)	
digital media player (128)		surge protector (140)	

Secondary Terms (shown in *italic* characters in the chapter)

<i>all-in-one desktop (114)</i>	<i>handheld computer (112)</i>	<i>rack server (116)</i>	<i>telematics (133)</i>
<i>activity tracker (130)</i>	<i>home server (116)</i>	<i>repetitive strain injury (RSI) (142)</i>	<i>terminal (117)</i>
<i>application server (116)</i>	<i>Internet of Things (133)</i>	<i>server farm (117)</i>	<i>text-to-speech feature (129)</i>
<i>ATM (118)</i>	<i>jack (134)</i>	<i>server virtualization (117)</i>	<i>thin client (117)</i>
<i>backup server (116)</i>	<i>joystick (131)</i>	<i>slate tablet (112)</i>	<i>touch-sensitive pad (128)</i>
<i>backward compatible (136)</i>	<i>juice jacking (136)</i>	<i>SLR camera (125)</i>	<i>tower (114)</i>
<i>balance board (132)</i>	<i>kiosk (119)</i>	<i>smart digital camera (125)</i>	<i>tower server (116)</i>
<i>bar code reader (118)</i>	<i>list server (116)</i>	<i>smart eyewear (130)</i>	<i>ultrabook (111)</i>
<i>blackout (140)</i>	<i>mail server (116)</i>	<i>smartglasses (130)</i>	<i>USB hub (136)</i>
<i>blade server (116)</i>	<i>mainframe (117)</i>	<i>smartwatch (130)</i>	<i>virtual keyboard (124)</i>
<i>brownout (140)</i>	<i>media library (128)</i>	<i>SMS (short message service) (124)</i>	<i>virtualization (117)</i>
<i>building automation systems (145)</i>	<i>megapixel (MP) (127)</i>	<i>spike (140)</i>	<i>visual voice mail (125)</i>
<i>charge-coupled device (CCD) (126)</i>	<i>MMS (multimedia message service) (124)</i>	<i>storage server (116)</i>	<i>voice mail (125)</i>
<i>common short code (CSC) (124)</i>	<i>motherboard (110)</i>	<i>streaming media player (128)</i>	<i>wearable (130)</i>
<i>convertible tablet (112)</i>	<i>motion-sensing game controller (132)</i>	<i>stylus (112)</i>	<i>web server (116)</i>
<i>CPU (110)</i>	<i>network server (116)</i>	<i>supercomputer (120)</i>	<i>wheel (131)</i>
<i>CVS (143)</i>	<i>noise cancelling (143)</i>	<i>surge suppressor (140)</i>	<i>workstation (114)</i>
<i>dance pad (131)</i>	<i>notebook computer (111)</i>	<i>swipe keyboard app (123)</i>	
<i>database server (116)</i>	<i>on-screen keyboard (123)</i>	<i>system unit (114)</i>	
<i>discoverable mode (137)</i>	<i>optical resolution (127)</i>	<i>technology overload (144)</i>	
<i>docking station (136)</i>	<i>pairing (137)</i>		
<i>domain name server (116)</i>	<i>peripheral device (108)</i>		
<i>DVD kiosk (120)</i>	<i>personal computer (108)</i>		
<i>earbuds (128)</i>	<i>phablet (112)</i>		
<i>EarPods (128)</i>	<i>PIN (118)</i>		
<i>e-book (129)</i>	<i>pixel (127)</i>		
<i>enhanced resolution (127)</i>	<i>point-and-shoot camera (125)</i>		
<i>e-reader (129)</i>	<i>port replicator (136)</i>		
<i>fault-tolerant computer (141)</i>	<i>portable keyboard (124)</i>		
<i>file server (116)</i>	<i>POS terminal (118)</i>		
<i>fingerprint reader (139)</i>	<i>predictive text (123)</i>		
<i>FTP server (116)</i>	<i>print server (116)</i>		
<i>game server (116)</i>	<i>processor (111)</i>		
<i>gamepad (131)</i>	<i>pull notification (124)</i>		
<i>gaming desktop (114)</i>	<i>push notification (124)</i>		
<i>Google Street View (111)</i>			



phablet (112)

Checkpoint

The Checkpoint exercises test your knowledge of the chapter concepts. The page number containing the answer appears in parentheses after each exercise. The Consider This exercises challenge your understanding of chapter concepts.

Discover More: Visit this chapter's premium content to **complete the Checkpoint exercises** interactively; complete the **self-assessment in the Test Prep resource** from your smartphone, tablet, laptop, or desktop; and then **take the Practice Test**.

True/False

Mark T for True and F for False.

- _____ 1. Malware authors often focus on social media, with the goal of stealing personal information. (110)
- _____ 2. The disadvantages of a virtual server are that it is difficult to manage and takes a long time to create and configure. (117)
- _____ 3. A mainframe is a small terminal that looks like a desktop, but has limited capabilities and components. (117)
- _____ 4. Thin clients contain powerful hard drives. (117)
- _____ 5. Applications requiring complex, sophisticated mathematical calculations use mainframes. (120)
- _____ 6. Most computers and electronic devices are analog, which use only two discrete states: on and off. (125)
- _____ 7. SLR cameras are much heavier and larger than point-and-shoot cameras. (125)
- _____ 8. Because embedded computers are components in larger products, they usually are small and have limited hardware. (132)
- _____ 9. Instead of the term, port, the term, connector, sometimes is used to identify audio and video ports. (134)
- _____ 10. Newer versions of USB are backward compatible, which means they support only new USB devices, not older ones. (136)
- _____ 11. A port replicator is an external device that provides connections to peripheral devices through ports built into the device. (136)
- _____ 12. Because the processor in a computer is particularly sensitive to fluctuations in current, you always should use a surge protector. (141)

Multiple Choice


Select the best answer.

1. Which of the following is *not* true of ultrathin laptops? (111)
 - a. They weigh less than traditional laptops.
 - b. They have a shorter battery life.
 - c. Many have fewer ports than traditional laptops.
 - d. They do not include an optical disc drive.
2. Some people use the term _____ to refer to the case that contains and protects the motherboard, internal hard drive, memory, and other electronic components of the computer from damage. (114)
 - a. system unit
 - b. phablet
 - c. thin client
 - d. USB hub
3. Power users may work with a high-end desktop, sometimes called a(n) _____, that is designed to handle intense calculations and powerful graphics. (114)
 - a. laptop
 - b. gaming desktop
 - c. server farm
 - d. workstation
4. Services provided by _____ include storing content and controlling access to hardware, software, and other resources on a network. (116)
 - a. jacks
 - b. servers
 - c. fault-tolerant computers
 - d. mainframes
5. A dedicated server that backs up and restores files, folders, and media is referred to as a _____. (116)
 - a. web server
 - b. file server
 - c. storage server
 - d. backup server
6. A four- or five-digit number assigned to a specific content or mobile service provider is referred to as a(n) _____. (124)
 - a. CSC
 - b. MMS
 - c. SMS
 - d. SLR
7. A(n) ___ is a special-purpose computer that functions as a component in a larger product. (132)
 - a. server
 - b. embedded computer
 - c. thin client
 - d. ultrabook
8. A(n) _____ can connect up to 127 different peripheral devices together with a single connector. (136)
 - a. SLR device
 - b. USB port
 - c. port replicator
 - d. docking station

Checkpoint

Matching Match the terms with their definitions.

- | | |
|---|--|
| _____ 1. peripheral device (108) | a. term used to refer to a device that combines the features of a smartphone with a tablet |
| _____ 2. motherboard (110) | b. computer with duplicate components so that it can continue to operate when one of its main components fail |
| _____ 3. CPU (110) | c. tablet that does not contain a physical keyboard |
| _____ 4. slate tablet (112) | d. component you connect to a computer or mobile device to expand its capabilities |
| _____ 5. phablet (112) | e. terminal that looks like a desktop but has limited capabilities and components |
| _____ 6. server virtualization (117) | f. the use of software to enable a physical server to emulate the hardware and computing capabilities of one or more servers |
| _____ 7. thin client (117) | g. electronic component that interprets and carries out the basic instructions that operate a computer |
| _____ 8. kiosk (119) | h. freestanding terminal that usually has a touchscreen for user input |
| _____ 9. push notification (124) | i. message that initiates from a sending location without a request from the receiver |
| _____ 10. fault-tolerant computer (141) | j. the main circuit board of a personal computer |

 **Consider This** Answer the following questions in the format specified by your instructor.


1. Answer the critical thinking questions posed at the end of these elements in this chapter: Ethics & Issues (111, 122, 132, 133), How To (137, 138, 141, 143), Mini Features (113, 115, 128), Secure IT (110, 119, 125, 136), and Technology @ Work (145).
2. How do malware authors use social media to spread infection? (110)
3. What are the two main components of the motherboard? (110)
4. How do ultrathin laptops differ from traditional laptops? (111)
5. What privacy issues have arisen with webcams in mobile devices? (111)
6. What are the two types of tablets? (112)
7. What is a stylus? (112)
8. What is in the system unit? (114)
9. What are the features of a gaming desktop? (114)
10. Who might use a workstation? (114)
11. What additional requirements are associated with a dedicated server? (116)
12. What are the three form factors for servers? (116)
13. What are the advantages of virtual servers? (117)
14. How does a POS terminal serve as input? (118)
15. What are some examples of self-serve kiosks? (119)
16. How does cloud computing allow businesses to more efficiently manage resources? (122)
17. What are three types of cloud computing? (122)
18. What information might you receive from a web to mobile text message? (124)
19. For what purpose is a common short code (CSC) used? (124)
20. How do push notifications differ from pull notifications? (124)
21. How do SLR cameras differ from point-and-shoot cameras? (125)
22. What is the difference between enhanced and optical resolution? (127)
23. What are three popular wearable devices? (130)
24. Why are embedded computers usually small with limited hardware? (132)
25. What are some types of ports you might find on a computer or mobile device? (135)
26. What is the purpose of a docking station? (137)
27. What is necessary before two Bluetooth devices can communicate? (138)
28. Why might you want to connect your phone to a Wi-Fi network? (138)
29. How does a surge protector work? What is the purpose of an uninterruptible power supply? (140)
30. How can you prevent RSIs and CTS? (142)

Problem Solving

The Problem Solving exercises extend your knowledge of chapter concepts by seeking solutions to practical problems with technology that you may encounter at home, school, or work. The Collaboration exercise should be completed with a team.

Instructions: You often can solve problems with technology in multiple ways. Determine a solution to the problems in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Describe your solution, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

Personal

- 1. Slow Computer Performance** Your computer is running exceptionally slow. Not only does it take the operating system a long time to start, but programs also are not performing as well as they used to perform. How might you resolve this?
- 2. Faulty ATM** When using an ATM to deposit a check, the ATM misreads the amount of the check and credits your account the incorrect amount. What can you do to resolve this?
- 3. Wearable Device Not Syncing**  Your wearable device synchronized with your smartphone this morning when you turned it on, but the two devices no longer are synchronized. What might be wrong, and what are your next steps?
- 4. Battery Draining Quickly** Although the battery on your smartphone is fully charged, it drains quickly. In some instances when the phone shows that the battery has 30% remaining, it shuts down immediately. What might be wrong?
- 5. Potential Virus Infection** While using your laptop, a message is displayed stating that your computer is infected with a virus and you should tap or click a link to download a program designed to remove the virus. How will you respond?

Source: Google

Professional

- 6. Excessive Phone Heat** While using your smartphone, you notice that throughout the day it gets extremely hot, making it difficult to hold up to your ear. What steps can you take to correct this problem?
- 7. Server Not Connecting** While traveling on a business trip, your phone suddenly stops synchronizing your email messages, calendar information, and contacts. Upon further investigation, you notice an error message stating that your phone is unable to connect to the server. What are your next steps?
- 8. Mobile Device Synchronization** When you plug your smartphone into your computer to synchronize the data, the computer does not recognize that the smartphone is connected. What might be the problem?
- 9. Cloud Service Provider** Your company uses a cloud service provider to back up the data on each employee's computer. Your computer recently crashed, and you need to obtain the backup data to restore to your computer; however, you are unable to connect to the cloud service provider's website. What are your next steps?
- 10. Connecting to a Projector** Your boss asked you to give a presentation to your company's board of directors. When you enter the boardroom and attempt to connect your laptop to the projector, you realize that the cable to connect your laptop to the projector does not fit in any of the ports on your laptop. What are your next steps?

Collaboration

- 11. Technology in Energy Management** Your science instructor is teaching a lesson about how technology has advanced the energy management field. Form a team of three people to prepare a brief report about how technology and energy management are connected. One team member should research how computers play a role in conserving energy. Another team member should research other types of technology present in today's homes and buildings that can conserve energy, and the third team member should research other benefits (such as cost savings) resulting from proper energy management.

The **How To: Your Turn** exercises present general guidelines for fundamental skills when using a computer or mobile device and then require that you determine how to apply these general guidelines to a specific program or situation.

Discover More: Visit this chapter's premium content to **challenge yourself with additional How To: Your Turn** exercises, which include App Adventure.

Instructions: You often can complete tasks using technology in multiple ways. Figure out how to perform the tasks described in these exercises by using one or more resources available to you (such as a computer or mobile device, articles on the web or in print, online or program help, user guides, blogs, podcasts, videos, other individuals, trial and error, etc.). Summarize your 'how to' steps, along with the resource(s) used, in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Synchronize a Device

Synchronizing a mobile device with the cloud or a computer provides a backup location for your data should your device fail, or become lost or stolen. While companies such as Google and Apple typically will allow you to download your purchased apps again free of charge, you also should synchronize your data so that it is available in the event a problem with your device arises. The following steps guide you through the process of synchronizing a device.



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Synchronize with the Cloud

- Search for an app compatible with your device that allows you to synchronize the data on your device with the cloud. Some device manufacturers, such as Apple, provide a service to synchronize your device with the cloud.
- If necessary, download and install the app.
- The first time you run the app, you may need to enter some personal information so that you are able to sign in and access your data in the future.
- Configure the app to synchronize at your desired interval. If you are synchronizing a smartphone, keep in mind that synchronizing with the cloud will require a data plan. Be sure your data plan supports the amount of data that will be synchronized.
- Once you have configured the synchronization settings successfully, select the option to manually synchronize your device at this time.

Synchronize with a Computer

- Install and run the app designed to synchronize your device with your computer. For instance, iTunes is used to synchronize Apple devices with a computer.
- Connect the device to the computer using the synchronization cable provided.

- When the synchronization is complete, a message will inform you that it is safe to disconnect the device. Do not disconnect the device before the synchronization is complete, as that may damage the data on the device.

Retrieve Synchronized Data

If you lose your device or the data on your device, you can retrieve the data previously synchronized. To retrieve data synchronized previously, follow the instructions in the program or app used to synchronize your data.

Exercises

- What type of device are you attempting to synchronize? What programs and apps are available to synchronize your device with the cloud? What programs and apps are available to synchronize your device with a computer?
- Which program or app did you use to synchronize your device? Why did you choose that program or app instead of the others?
- How long did it take to synchronize your device? What data on your device did the program or app synchronize?

2 Find, Download, and Read an E-Book on an E-Book Reader

Most e-book readers enable you to find and download new e-books without having to connect to a computer first. To search for and download an e-book, you need to establish an Internet connection through either Wi-Fi or a mobile data plan. The following steps guide you through the process of finding, downloading, and reading an e-book on an e-book reader.

- Turn on your e-book reader and establish an Internet connection.
- Navigate to the store on your e-book reader where you can search for and download e-books.
- Locate the option to search available e-books and then enter the desired search text. You usually can search by the book's title, author, or genre.

How To: Your Turn

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- Perform the search and then browse the search results for the book you want to download and install.
- Select the option to download the book. Please note that many books cost money to download. If your payment information was entered previously, you may be charged for downloading this e-book. If you do not want to be charged, locate and download an e-book that is free.
- When the download is complete, return to your list of installed e-books.
- Select the e-book you have just downloaded to read the e-book.

Exercises

- What type of e-book reader do you have? Are you happy with the selection of e-books on your e-book reader?
- In addition to e-book readers, what other types of devices allow you to read e-books?
- Do e-books cost more or less than traditional print books? What are the advantages and disadvantages of using e-books?



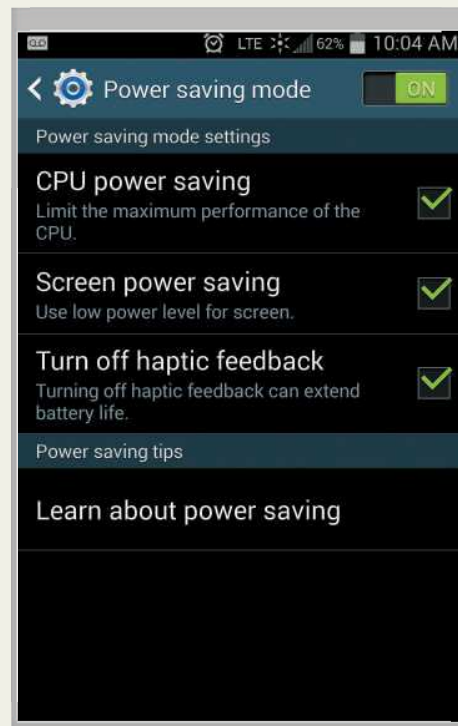
© iStockPhoto / Petar Chernaevev

through the process of configuring power management features on mobile computers and devices.

- Display the Control Panel or Settings on your mobile computer or device.
- Tap or click the option to display power management or battery settings.
- If necessary, select a power plan setting to view or modify.
- Make the necessary adjustments to the settings that affect power consumption. For example, configure the display to dim or turn off after 30 seconds of inactivity. This will allow you enough time to read what is on the screen without having to touch the screen or move the mouse.
- Save all changes.

Exercises

- What power management settings have you configured on your mobile computer or device?
- Compare battery life on your device before and after configuring power management settings. Have you noticed an improvement in battery life? If so, how much?
- What other power management settings are you able to configure on your mobile computer or device?



Google Inc.

3 Manage Power for Mobile Computers and Devices

Configuring power management settings on mobile computers and devices will help ensure your battery life is maximized. The following steps guide you

4 Use your Mobile Device Ergonomically

Individuals are using various mobile devices, such as phones and tablets, more frequently, and using these devices ergonomically can help prevent unnecessary injury. The following guidelines will help you use your mobile device ergonomically:

- Use shortcuts and abbreviations whenever possible to avoid excessive hand movement.
- Make sure your hands, wrists, and arms are at a natural angle, and avoid holding the device in a position that causes discomfort.
- Use hands-free devices and voice recognition features whenever possible to avoid hand movement.
- Do not use the device for extended periods of time without taking frequent breaks.
- Avoid resting the device on your lap during use.
- Sit in an upright position or stand when using the device.
- Consider using a separate keyboard and mouse if you will be interacting with the device extensively.
- Use the device in a setting with natural light.

Exercises

1. Have you been following the above guidelines while using mobile computers and devices? If not, what have you been doing differently?
2. What types of health risks might nonergonomic use of a mobile device pose?
3. What are some additional guidelines you can follow to help minimize health risks while using your mobile device?



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5 Transfer Media from a Mobile Device to a Computer

Many individuals take photos and record videos using mobile devices such as digital cameras, smartphones, and tablets. After taking the photos and recording the

How To: Your Turn

videos, transferring them to a computer allows you easily to create backup copies, edit the media, and create digital albums. The following steps describe multiple ways to transfer media from a mobile device to a computer.

To transfer photos from a mobile device to a computer using a memory card:

- a. Safely remove the memory card from the mobile device.
- b. Properly insert the memory card into the appropriate memory card slot on the computer.
- c. When the computer detects the memory card, navigate to the location of the media to transfer.
- d. Select the files to transfer and then drag them to the destination folder on the computer.
- e. Use the operating system's "Eject" or "Safely Remove" feature to remove the memory card from the computer safely and insert it back in the mobile device.

To transfer photos from a mobile device to a computer using a USB cable:

- a. Connect the cable to the mobile device and to the computer.
- b. When the computer detects the mobile device, navigate to the location on the mobile device containing the media to transfer.
- c. Select the files to transfer and then drag them to the destination folder on the computer.
- d. Disconnect the USB cable from the computer and from the mobile device.

Some mobile devices also allow you to transfer media using wireless technologies, such as Bluetooth and Wi-Fi. The steps required to transfer photos wirelessly vary greatly for each device. Thus, read your mobile device's documentation to see if and how you can transfer media to your computer wirelessly. Be aware that transferring photos using your mobile data plan could increase your data charges. Consider using Wi-Fi or Bluetooth to transfer the media.

Exercises

1. Of the above techniques, which way do you find is easiest to transfer media from your mobile device to a computer? Why?
2. What other technologies might you be able to use to transfer media from a mobile device to a computer?
3. Would you rather transfer media from your mobile device to a computer, or transfer it to the cloud? Why?

Internet Research

The Internet Research exercises broaden your understanding of chapter concepts by requiring that you search for information on the web.

Discover More: Visit this chapter's premium content to **challenge yourself with additional Internet Research exercises**, which include Search Sleuth, Green Computing, Ethics in Action, You Review It, and Exploring Technology Careers.

Instructions: Use a search engine or another search tool to locate the information requested or answers to questions presented in the exercises. Describe your findings, along with the search term(s) you used and your web source(s), in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1 Making Use of the Web Retail and Auctions

E-retailers are changing the ways consumers shop for goods. One market research firm reports that nearly three-fourths of shoppers complete one-half of all their transactions online. As shoppers grow increasingly loyal to e-commerce, retail websites have become more sophisticated, and brick-and-mortar stores have adapted to the online presence. Nearly 90 percent of smartphone owners use their devices to compare prices, locate promotional offers, and determine directions and store hours.

Online auctions offer another convenient method of shopping for and selling practically anything imaginable. Most auction sites organize products in categories and provide photos and descriptions. eBay is one of thousands of Internet auction websites and is the world's largest personal online trading community. In addition, craigslist is a free online equivalent of classified advertisements.

Research This: (a) Visit two retail websites and search for the latest e-book readers. Which features do these websites offer compared with the same offerings in brick-and-mortar stores? What are the advantages and disadvantages of shopping online? What policies do these websites offer for returning items? Which items have you purchased online?

(b) Visit an auction website and search for two objects pertaining to your favorite musical artist, sports team, or celebrity. For example, search for an autographed photo or ticket stubs. Describe these two items. How many people have bid on these items? Who are the sellers? What are the opening and current bids?

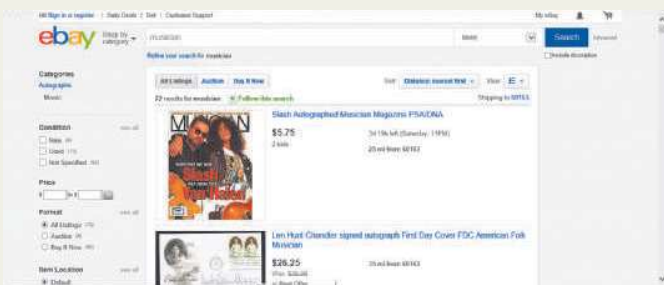
2 Social Media

Businesses know that using social media is an efficient and effective method of building brand loyalty and promoting the exchange of ideas. The informal communication between consumers and company representatives can help maintain credibility and promote trust. According to a recent study, more than 70 percent of American Internet users visit online social networks, and 65 percent of these people discover particular brands, products, and services by reading material posted on these websites. Twitter, Facebook, and other social media often are used to befriend customers, give a positive feeling about services and goods, engage readers, and market new ideas. Subscribers share their opinions, thoughts, and experiences, either positive or negative, through product and service reviews.

Research This: Visit at least three Twitter, Facebook, or other online social network sites and review the content. How many Twitter followers or Facebook 'likes' does the website have? Identify three organizations, businesses, products, or causes that have a presence on Facebook, Twitter, or other online social networks. How many followers or fans do they have? Which posts are engaging and promote positive attitudes about the company and the products or services offered? How many user-generated reviews and product ratings are shown? How do the online social networks encourage sharing opinions? In which ways do the companies respond to and interact with followers and fans? If negative posts are written, does the company respond professionally and positively?

3 Search Skills Search Operators

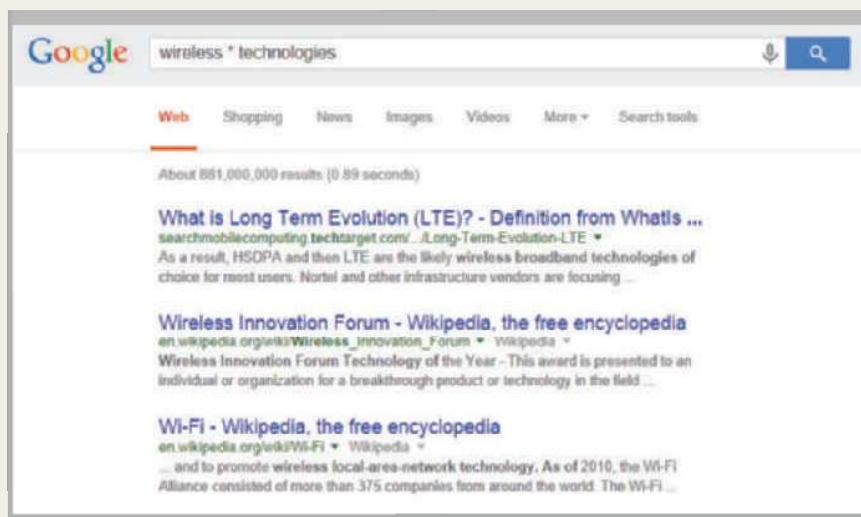
Search engines provide operators, or special symbols, that will help narrow down search results. Use quotation marks around search text to search for an exact word or phrase. For example, type the following as your search text: "wireless communications technologies" (be sure to include the quotation marks) to search for those three words in that exact order. Search results will display matching pages with the quoted search phrase highlighted or in bold.



Source: eBay

Internet Research

To match one or more words in a phrase, you can use an asterisk (*), also called a wildcard operator, as part of your search text. Each asterisk represents one or more words. For example, type the following as your search text: "wireless * technologies" (with the quotation marks) to find search results that match wireless communications technologies, wireless Internet technologies, wireless and related technologies, and others. If you are searching for a phrase or quotation with many words, consider using the asterisk wildcard operator in place of some of the words in the search text. This technique is useful if you have a quotation, and you want to find out who said it or where it may have appeared.



Source: Google

Research This: Create search queries using quotation marks and/or the wildcard operator to answer the following questions and use a search engine to find the answers. (1) Someone once said, "Life is not fair, get used to it." Who was it? (2) What are three websites containing digital camera reviews? (3) How do businesses use near field communications? (4) Find five different words that complete the phrase, handheld ___ devices, by typing appropriate search text into a search engine.

4 Security

Surge protectors and uninterruptible power supplies offer protection from electrical power surges, as you learned in the Protecting Hardware section of this chapter. While these surges are part of everyday life, they are more likely to occur during thunderstorms and peak energy consumption periods. These unavoidable occurrences can damage or ruin sensitive electronic equipment. The processor in a computer is particularly sensitive to the fluctuations in current. When shopping for a surge protector, purchase the

best product you can afford. Typically, the amount of protection offered by a surge protector is proportional to its cost. That is, the more expensive the surge protector, the more protection it offers.

Research This: Visit an electronics store or view websites with a variety of surge protectors from several manufacturers. Read the packaging or specifications to determine many of the features. Compare at least three surge protectors by creating a table using these headings: manufacturer, model, price, Joule rating (a Joule is the unit of energy the device can absorb before it can be damaged; the higher the Joule rating, the better the protection), warranty, energy-absorption rating, response time, and other features. Which surge protector do you recommend? Why?

5 Cloud Services Data Providers and Mashups (DaaS)

The web has made it possible for many information providers to make business, housing, weather, demographic, and other data available on demand to third parties. Accessing online data on demand is an example of DaaS (data as a service), a service of cloud computing that provides current data over the Internet for download, analysis, or use in new applications.

Mashups are apps that combine data from one or more online data providers. Mapping mashups are popular because users can visualize locations associated with data originating from a variety of online sources, including real estate listings, crime statistics, current Tweets, live traffic conditions, or digital photos.

Research This: (1) Use a search engine to find two different online data markets. Write a report sharing the sources or focus of information each provides, the availability of visualization tools to preview data, and how developers can access or incorporate the data into their own apps and websites. (2) Use a search engine to find a popular mapping mashup based on data from one of the sources listed above, or another topic. Identify the provider of the data and the provider of the maps on which the data is displayed. (3) Use a search engine to find an app or website that will help you create your own map mashup showing locations of your online data: Facebook friends, Flickr or Instagram photos, or Tweets. Take a screenshot of the mashup you made.

Critical Thinking

The Critical Thinking exercises challenge your assessment and decision-making skills by presenting real-world situations associated with chapter concepts. The Collaboration exercise should be completed with a team.

Instructions: Evaluate the situations below, using personal experiences and one or more resources available to you (such as articles on the web or in print, blogs, podcasts, videos, television, user guides, other individuals, electronics or computer stores, etc.). Perform the tasks requested in each exercise and share your deliverables in the format requested by your instructor (brief report, presentation, discussion, blog post, video, or other means).

1. Technology Purchases

You are the director of information technology at a company that specializes in designing and selling customizable sportswear for local high school and college sports teams. Most of the technology equipment is out of date and must be replaced. You need to evaluate the requirements of individual employees so that you can order replacements.

Do This: Determine the type of computer or mobile device that might be most appropriate for the following employees: a graphic designer who exclusively works in the office, a cashier who is responsible for assisting customers with purchases, and a sales representative who travels to various locations and needs wireless communications capabilities. Consider the varying requirements of each, including mobility, security, and processing capabilities. Discuss various options that might work for each user, and considerations when purchasing each type of device.

2. Game Devices

You manage a youth recreation center and have been given a grant to purchase a game console and accessories, along with fitness games, for use at the center.

Do This: Use the web to research three popular recent game consoles. Choose five characteristics to compare the game consoles, such as Internet capabilities, multiplayer game support, storage capacity, television connection, and game controllers. Research fitness games for each console and what accessories are needed to run the games. Determine the goals of each game, such as skill-building, weight loss, or

entertainment. Read user reviews of each game, as well as professional reviews by gaming industry experts. If possible, survey your friends and classmates to learn about their experiences with each game, such as heart rate while playing the games, any fitness goals reached, and their enjoyment of the game.

3. Case Study

Amateur Sports League You are the new manager for a nonprofit amateur soccer league. The league would like to purchase a digital camera to upload pictures of players, games, and fundraising events to its Facebook page and its website.

Do This: You need to prepare information about digital camera options to present to the board of directors. First, research the cost and quality differences between point-and-shoot cameras and SLR cameras. Use the web to find a recent model of both camera types and compare the reviews, as well as the costs, for each. Make a list of additional features, such as video capabilities, editing capabilities, lens, megapixels, GPS, flash, and zoom. Determine how each camera stores the images, the amount of storage available, and how to transfer images to a computer or mobile device. Explore whether software is included with the camera that can be used to edit, store, or organize the images after they are transferred to a computer. Compare your findings with the camera capabilities of a recent model smartphone. Determine what type of camera would be best for the league's needs and the capabilities that are most important.



Courtesy of Samsung

Collaboration

4. National Security Uses for Technology Technology is an integral part of military operations. Many military research projects use simulators that resemble civilian computer games. Your company has been contacted by the Department of Defense for a research project.

Do This: Form a four-member team, and then form two two-member groups. Assign each group one of the following topics to research: (1) How have mobile computers and cloud computing affected issues of national security? (2) How can the utilization of microchips worn by soldiers, or wearable computers, be integrated into civilian use? Meet with your team and discuss your findings. Determine any advantages or disadvantages, as well as any legal ramifications that may arise.