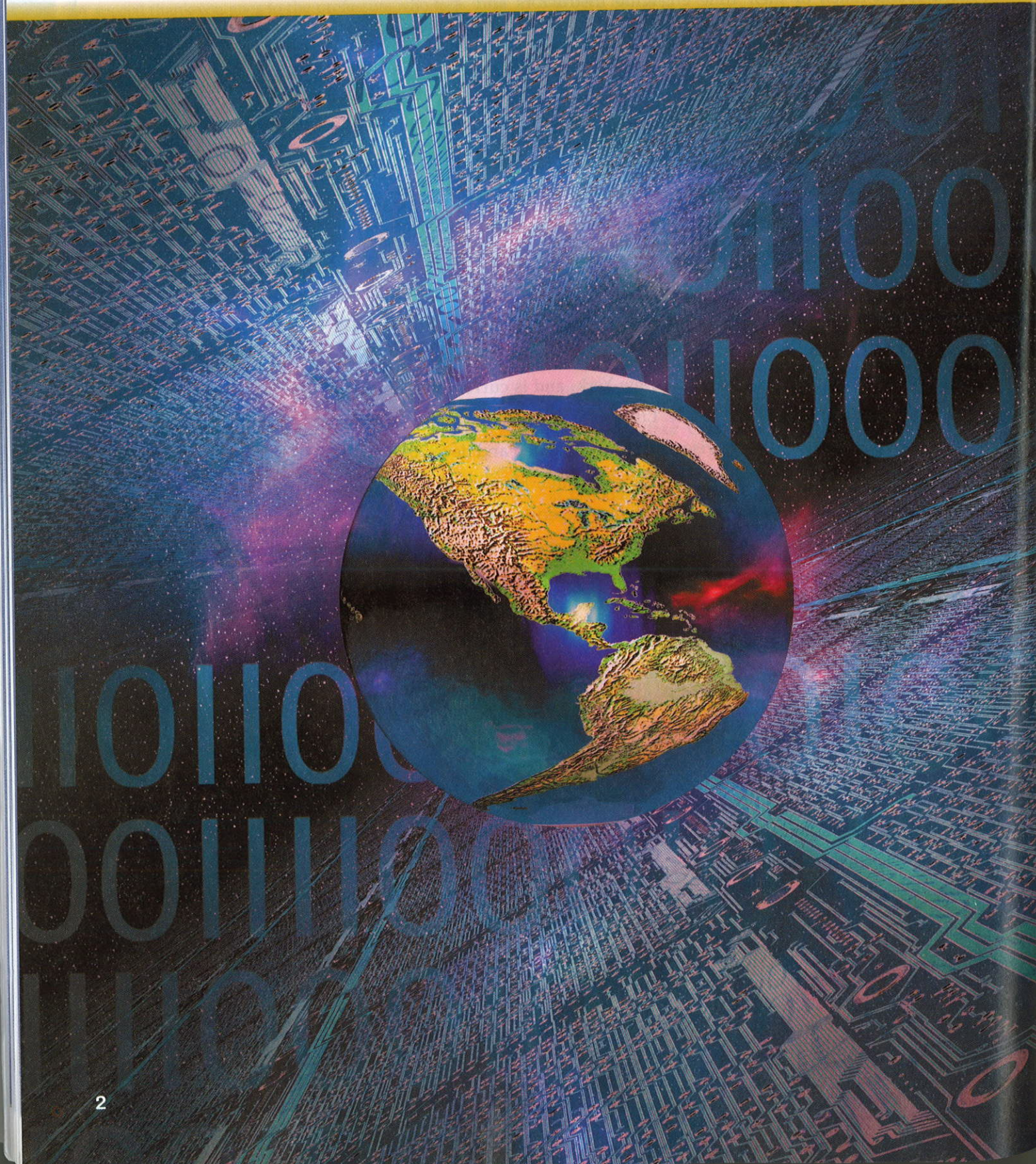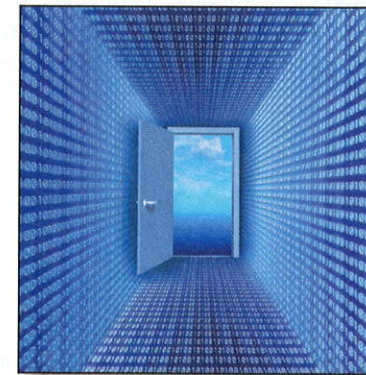# chapter 1

Information Technology, the Internet, and You

Why should I read this chapter?

The future of computers and digital technology promises exciting challenges and opportunities. Powerful software and hardware systems are changing the way people and organizations interact in their daily life and on the Internet.

This chapter introduces you to the skills and concepts you need to be prepared for this ever-changing digital world, including:

- Information systems—how the critical parts of technology interact.
- Efficiency and effectiveness—how to maximize the use of technology.
- Privacy, ethics, and environment—how to integrate technology with people.
- Connectivity and cloud computing—how the Internet, web, and the wireless revolution are changing how we communicate and interact.

Learning Objectives

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

1. Explain the parts of an information system: people, procedures, software, hardware, data, and the Internet.

2. Distinguish between system software and application software.

3. Differentiate between the three kinds of system software programs.

4. Define and compare general-purpose, specialized, and mobile applications.

5. Identify the four types of computers and the five types of personal computers.

6. Describe the different types of computer hardware, including the system unit, input, output, storage, and communication devices.

7. Define data and describe document, worksheet, database, and presentation files.

8. Explain computer connectivity, the wireless revolution, the Internet, cloud computing, and IoT.

Introduction
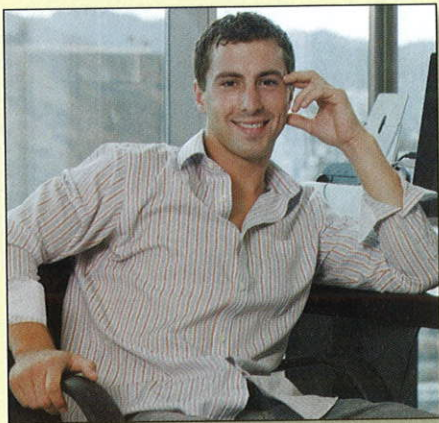
The purpose of this book is to help you become a highly efficient and effective computer user. This includes how to use (1) apps and application software; (2) all types of computer hardware including mobile devices like smartphones, tablets, and laptops; and (3) the Internet. Becoming a highly efficient and effective computer user also requires a full understanding of the potential impact of technology on privacy and the environment as well as the role of personal and organizational ethics.

To effectively and efficiently use computers, you need to know the parts of an information system: people, procedures, software, hardware, data, and *the Internet.* You also need to understand the wireless revolution, the mobile Internet, and the web and to recognize the role of information technology in your personal and professional life.
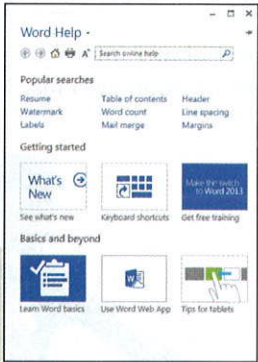
Information Systems

When you think of a personal computer, perhaps you think of just the equipment itself. That is, you think of the screen or the keyboard. Yet, there is more to it than that. The way to think about a personal computer is as part of an information system. An **information system** has several parts: *people, procedures, software, hardware, data,* and *the Internet.* (See Figure 1-1.)

- **People:** It is easy to overlook people as one of the parts of an information system. Yet this is what personal computers are all about—making **people, end users** like you, more productive.
- **Procedures:** The rules or guidelines for people to follow when using software, hardware, and data are **procedures.** These procedures are typically documented in manuals written by computer specialists. Software and hardware manufacturers provide manuals with their products. These manuals are provided in either printed or electronic form.
- **Software:** A **program** consists of the step-by-step instructions that tell the computer how to do its work. **Software** is another name for a program or programs. The purpose of software is to convert **data** (unprocessed facts) into **information** (processed facts). For example, a payroll program would instruct the computer to take the number of hours you worked in a week (data) and multiply it by your pay rate (data) to determine how much you are paid for the week (information).
- **Hardware:** The equipment that processes the data to create information is called **hardware.** It includes smartphones, tablets, keyboards, mice, displays, system units, and other devices. Hardware is controlled by software.
- **Data:** The raw, unprocessed facts, including text, numbers, images, and sounds, are called data. Processed data yields information. Using the previous example of a payroll program, the data (number of hours worked and pay rate) is processed (multiplied) to yield information (weekly pay).
- **Internet:** Almost all information systems provide a way to connect to other people and computers, typically using the Internet. This **connectivity** greatly expands the capability and usefulness of information systems.
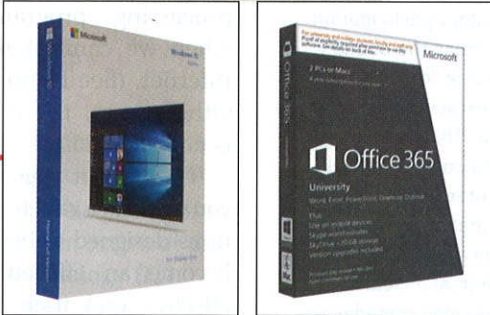
People
are end users who use computers to make themselves more productive.

Software
provides step-by-step instructions for computer hardware.

Procedures
specify rules or guidelines for computer operations.

Hardware
includes keyboard, mouse, display, system unit, tablets, smartphones, and other devices.

Data
consists of unprocessed facts including text, numbers, images, and sounds.

Internet
allows computers to connect to people and other computers.

Figure 1-1 Parts of an information system

concept check

What are the parts of an information system?

What is a program?

What is the difference between data and information?

running smoothly to how to protect your privacy while surfing the web. For a partial list of the tips presented in the following chapters, see Figure 1-4.

- **Privacy.** One of the most critical issues today is how to protect the privacy of our personal information. Throughout this book you will find Privacy boxes in the margin that present information about protecting our privacy.

- **Environment.** Today it is more important than ever that we be aware of our impact on the environment. In this chapter and the following ones, you will find Environment boxes in the margin that present important relevant environmental information.

- **Ethics.** Most people agree that we should behave ethically. That is, we should follow a system of moral principles that direct our everyday lives. However, for any given circumstance, people often do not agree on the ethics of the situation. Throughout this book you will find numerous Ethics boxes posing a variety of different ethical/unethical situations for your consideration.

- **Careers in IT.** One of the most important decisions of your life is to decide upon your life's work or career. Perhaps you are planning to be a writer, an artist, or an engineer. Or you might become a professional in **information technology (IT)**. Each of the following chapters highlights a specific career in information technology. This feature provides job descriptions, projected employment demands, educational requirements, current salary ranges, and advancement opportunities.

1. **Low battery.** Do you find that your laptop's battery keeps its charge for less time than it used to? Here are some ways to make your battery last longer. See page 128.

2. **Language translation.** Have you had trouble communicating with someone who does not speak English? If so, Google Translate may be just what you need. See page 148.

3. **Lost files.** Have you ever accidentally deleted or lost important files from your flash drive? Here are a few suggestions that might help. See page 178.

4. **Protecting your identity.** Identity theft is a growing problem and can be financially devastating if you are a victim. Some steps to protect your identity are on page 233.

5. **Wireless networks.** Do you use your laptop to connect to wireless networks at school, coffee shops, airports, or hotels? If so, it is important to use caution to protect your computer and your privacy. A few suggestions are on page 208.

Figure 1-4 Selected tips

Did you know that over 10 million tons of material was diverted from landfills last year alone as a result of recycling efforts? This success is largely due to voluntary participation of people across the country, who have made "reduce, reuse, and recycle" a personal commitment. This includes recycling old computers, cell phones, printers, and displays. Your participation in recycling means fewer one-use products, cleaner water, and cleaner air. But recycling may someday pay off financially too. Many now see waste as a resource, and one that we shouldn't squander by filling up the garbage can instead of the recycling bin. Imagine a future where the garbage collector drops off a check for your contributions to going green.

People

People are surely the most important part of any information system. Our lives are touched every day by computers and information systems. Many times the contact is direct and obvious, such as when we create documents using a word processing program or when we connect to the Internet. (See Figure 1-2.) Other times, the contact is not as obvious.

Throughout this book you will find a variety of features designed to help you become an efficient and effective end user. These features include Making IT Work for You, Tips, Privacy, Environment, Ethics, and Careers in IT.

Figure 1-2 People and computers

- **Making IT Work for You.** Throughout this book you will find Making IT Work for You features that present numerous interesting and practical IT applications. For just a few of the Making IT Work for You topics, see Figure 1-3.

- **Tips.** We all can benefit from a few tips or suggestions. Throughout this book you will find numerous tips to make your computing safer, more efficient, and more effective. These tips range from the basics of keeping your computer system

concept check

Which part of an information system is the most important?

Describe the Making IT Work for You, Tips, and Privacy features.

Describe the Environment, Ethics, and Careers in IT features.

Application	Description
Free Antivirus Program	Protect your computer by installing and using a free antivirus program. See page 9.
Online Entertainment	Use your computer to watch your favorite television programs, movies, and other video content. See page 30.
Google Docs	Create, collaborate, and access documents from almost anywhere with a free online office suite. See page 78.
Skype	Visit face to face with friends and family located almost anywhere at little or no cost. See page 157.
Cloud Storage	Send large files using a free tool and the cloud. See page 182.

Figure 1-3 Making IT Work for You applications

Software

Software, as we mentioned, is another name for programs. Programs are the instructions that tell the computer how to process data into the form you want. In most cases, the words *software* and *programs* are interchangeable. There are two major kinds of software: *system software* and *application software*. You can think of application software as the kind you use. Think of system software as the kind the computer uses.

System Software

The user interacts primarily with application software. **System software** enables the application software to interact with the computer hardware. System software is "background" software that helps the computer manage its own internal resources.
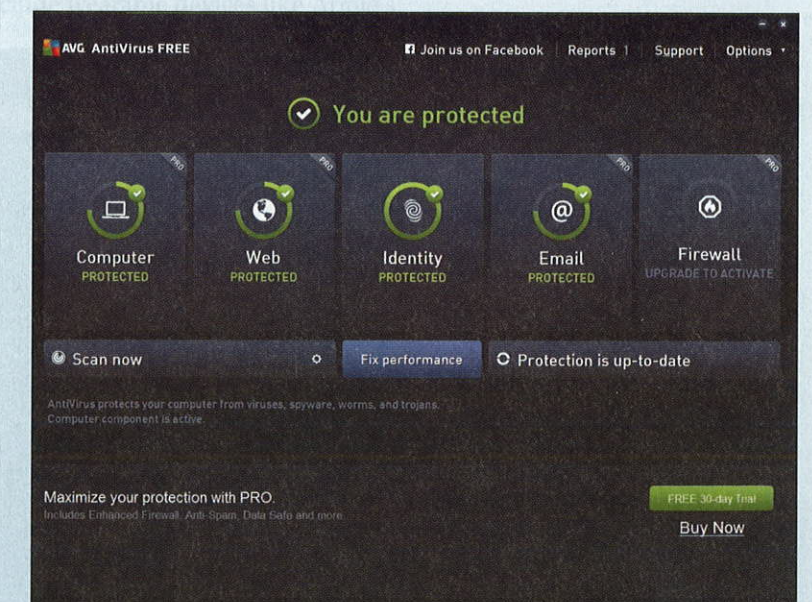
Figure 1-5 Windows 10

Figure 1-6 Mac OS X

System software is not a single program. Rather, it is a collection of programs, including the following:

- **Operating systems** are programs that coordinate computer resources, provide an interface between users and the computer, and run applications. Smartphones, tablets, and many other mobile devices use **embedded operating systems,** also known as **real-time operating systems (RTOS).** Desktop computers use **stand-alone operating systems** like Windows 10 or Mac OS. (See Figures 1-5 and 1-6.) Networks use **network operating systems (NOS).**
- **Utilities** perform specific tasks related to managing computer resources. One of the most essential utility programs that every computer system should have is an antivirus program. These programs protect your computer system from **viruses** or malicious programs that are all too often deposited onto your computer from the Internet. These programs can damage software and hardware, as well as compromise the security and privacy of your personal data. If your computer does not have an antivirus program installed on it, you need to get one. To see how you can install a free antivirus program on your computer, see Making IT Work for You: Free Antivirus Program on page 9.

Application Software

Application software might be described as end user software. Three types of application software are *general-purpose, specialized,* and *apps.*

General-purpose applications are widely used in nearly all career areas. They are the kinds of programs you have to know to be considered an efficient and effective end user. Some of the best known are presented in Figure 1-7.

Specialized applications include thousands of other programs that are more narrowly focused on specific disciplines and occupations. Two of the best known are graphics and web authoring programs.

Mobile apps, also known as **mobile applications** or simply **apps,** are small programs primarily designed for mobile devices such as smartphones and for tablet computers. There are over half a million apps. The most popular mobile apps are for social networking, playing games, and downloading music and videos.

Type	Description
Browsers	Connect to websites and display web pages
Word processors	Prepare written documents
Spreadsheets	Analyze and summarize numerical data
Database management systems	Organize and manage data and information
Presentation graphics	Communicate a message or persuade other people

Figure 1-7 General-purpose applications

Making IT work for you

FREE ANTIVIRUS PROGRAM

Have you or someone you know had a slower computing experience due to a spyware infection? Even worse, perhaps a malicious piece of software stole crucial, personal information or caused a total system failure. Most of these problems can be averted by having an up-to-date antivirus program running in your computer's memory at all times. This exercise shows you how to download and install a free antivirus program if your computer does not yet have one. (Please note that the web is continually changing, and some of the specifics presented below may have changed.)

Getting Started First, make sure your computer does not have an antivirus or security suite running. If it does, be sure to completely uninstall that program, even if the subscription is expired. Now, follow these steps to install AVG, a popular, free antivirus program:

1 • Visit http://free.avg.com and click the *Download* button. You will be asked to confirm that you want the free edition and then redirected to a download site.

2 • Run the installation file and follow the prompts.

3 • Select *basic protection* if you are asked which product you would like to install.

Using AVG Generally speaking, your antivirus program watches your system for malware and updates itself automatically. However, you can always download updates manually, set a schedule for full-system scans, and change basic settings for various components of the software.

1 • Click *Scan now* to run a full scan on your computer.

2 • Just to the right of that, click the button with the white cog to see the scan options where you can set a schedule for automated scans.

3 • Click the *back arrow* to reach the main screen, where you can click various elements of the program to configure them. For example, clicking *Web* will allow you to turn on a feature that detects cookies that may be used to track your online activity.

- Describe the two major kinds of software.

- Describe two types of system software programs.

- Define and compare general-purpose applications, specialized applications, and mobile apps.

Hardware

Computers are electronic devices that can follow instructions to accept input, process that input, and produce information. This book focuses principally on personal computers. However, it is almost certain that you will come in contact, at least indirectly, with other types of computers.

Types of Computers

There are four types of computers: supercomputers, mainframe computers, midrange computers, and personal computers.

- **Supercomputers** are the most powerful type of computer. These machines are special, high-capacity computers used by very large organizations. Supercomputers are typically used to process massive amounts of data. For example, they are used to analyze and predict worldwide weather patterns. IBM's Blue Gene supercomputer is one of the fastest computers in the world. (See Figure 1-8.)

- **Mainframe computers** occupy specially wired, air-conditioned rooms. Although not nearly as powerful as supercomputers, mainframe computers are capable of great processing speeds and data storage. For example, insurance companies use mainframes to process information about millions of policyholders.

- **Midrange computers,** also referred to as **servers,** are computers with processing capabilities less powerful than a mainframe computer yet more powerful than a
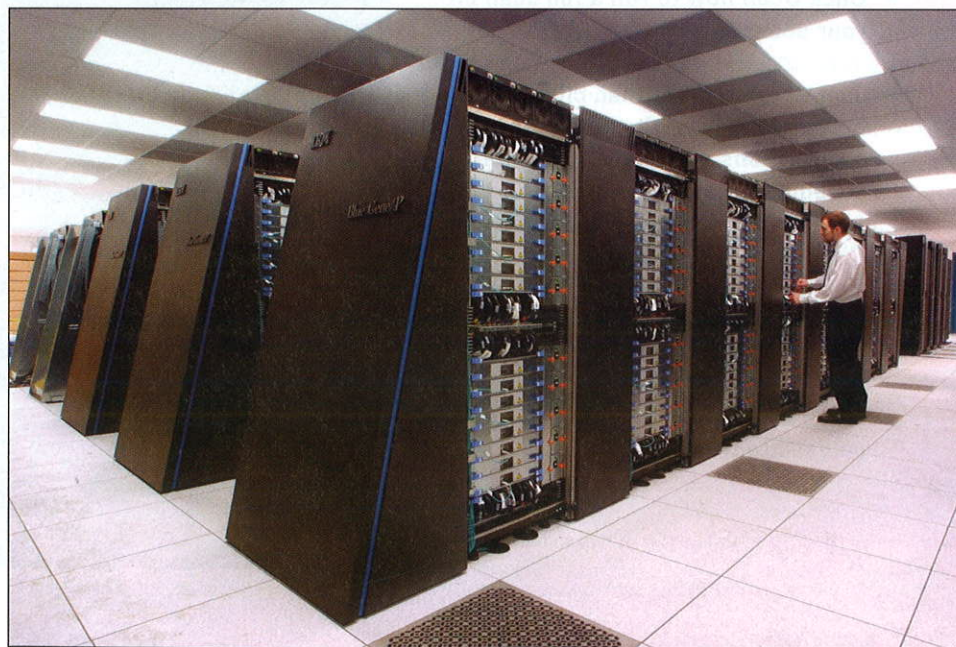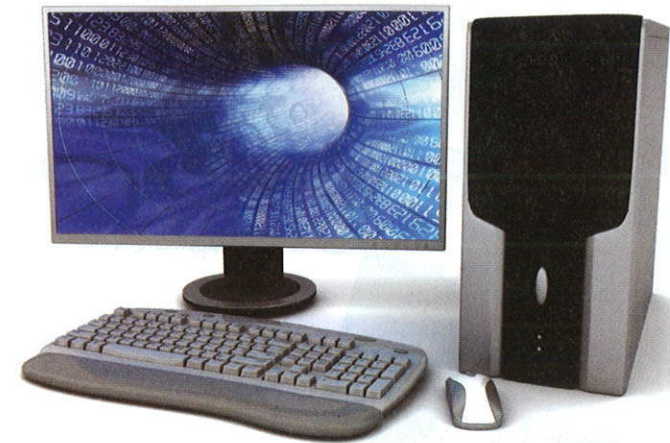

Figure 1-8 **Supercomputer**

Figure 1-9 **Desktop**

Figure 1-10 **Laptop**

personal computer. Originally used by medium-size companies or departments of large companies to support their processing needs, today midrange computers are most widely used to support or serve end users for such specific needs as retrieving data from a database or supplying access to application software.

- **Personal computers,** also known as **PCs,** are the least powerful, yet the most widely used and fastest-growing type of computer. There are five types of personal computers: *desktops, laptops, tablets, smartphones,* and *wearables.* **Desktop computers** are small enough to fit on top of or alongside a desk yet are too big to carry around. (See Figure 1-9.) **Laptop computers,** also known as **notebook computers,** are portable and lightweight and fit into most briefcases. (See Figure 1-10.) **Tablets,** also known as **tablet computers,** are smaller, lighter, and generally less powerful than laptops. Like a laptop, tablets have a flat screen but typically do not have a standard keyboard. (See Figure 1-11.) Instead, tablets typically use a virtual keyboard that appears on the screen and is touch-sensitive.

  Smartphones are the most widely used handheld computers. Smartphones are cell phones with wireless connections to the Internet and processing capabilities. (See Figure 1-12.) Other mobile computers include **wearable devices** like Apple's watch. (See Figure 1-13.)

Figure 1-11 **Tablet**

Personal Computer Hardware

Hardware for a personal computer system consists of a variety of different devices. This physical equipment falls into four basic categories: system unit, input/output, secondary storage, and communication. Because we discuss hardware in detail later in this book, here we will present just a quick overview of the four basic categories.

- **System unit:** The **system unit** is a container that houses most of the electronic components that make up a computer system. Two important components of the system unit are *microprocessors* and *memory.* (See Figure 1-14.) The **microprocessor** controls and manipulates data to produce information. **Memory** is a holding area for data, instructions, and information. One type, **random-access memory (RAM),** holds the program and data that is currently being processed. This type of memory is sometimes referred to as *temporary storage* because its contents will typically be lost if the electric power to the computer is disrupted.

Figure 1-12 **Smartphone**

- **Input/output: Input devices** translate data and programs that humans can understand into a form that the computer can process. The most common input devices are the **keyboard** and the **mouse. Output devices** translate the processed information from the computer into a form that humans can understand. The most common output device is the **display,** also known as a **monitor.**
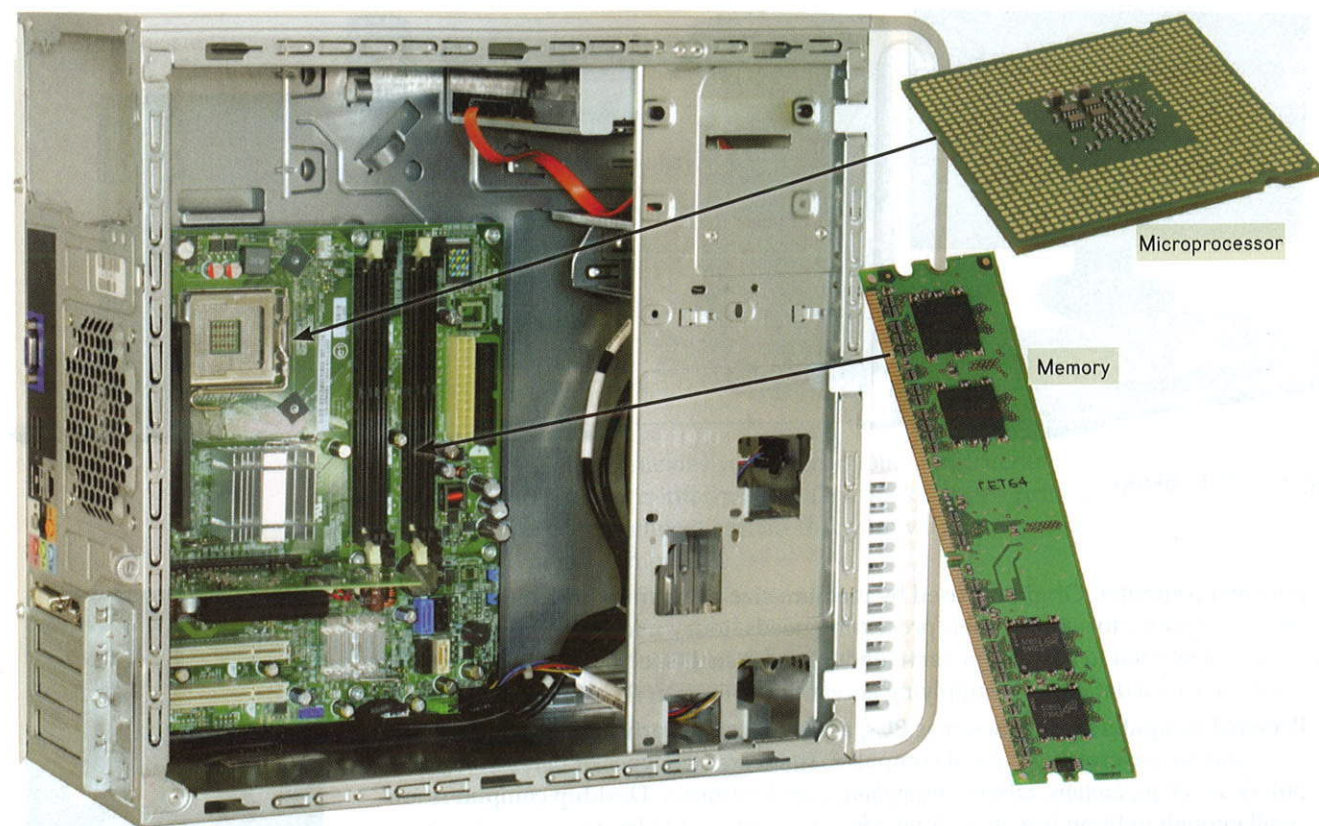

Figure 1-13 **Wearable**

Figure 1-14 System unit

Figure 1-15 Solid-state storage

- **Secondary storage:** Unlike memory, **secondary storage** holds data and programs even after electric power to the computer system has been turned off. The most important kinds of secondary media are *hard disks, solid-state storage,* and *optical discs.*

  Hard disks are typically used to store programs and very large data files. Using rigid metallic platters and read/write heads that move across the platters, data and information are stored using magnetic charges on the disk's surface. In contrast, **solid-state storage** does not have any moving parts, is more reliable, and requires less power. It saves data and information electronically similar to RAM except that it is not volatile. (See Figure 1-15.) **Optical discs** use laser technology to store data and programs. Three types of optical discs are **compact discs (CDs), digital versatile** (or **video**) **discs (DVDs),** and **Blu-ray discs (BD).**
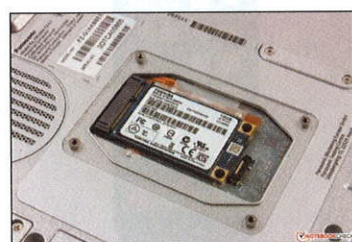
- **Communication:** At one time, it was uncommon for a personal computer system to communicate with other computer systems. Now, using **communication devices,** a personal computer routinely communicates with other computer systems located as near as the next office or as far away as halfway around the world, using the Internet. A **modem** is a widely used communication device that modifies audio, video, and other types of data into a form that can be transmitted across the Internet.

concept check

What are the four types of computers?

Describe the five types of personal computers.

Describe the four basic categories of personal computer hardware.

Figure 1-16 Four types of files: document, worksheet, database, and presentation

Data

Data is raw, unprocessed facts, including text, numbers, images, and sounds. As we mentioned earlier, processed data becomes information. When stored electronically in files, data can be used directly as input for the system unit.

Four common types of files (see Figure 1-16) are

- **Document files,** created by word processors to save documents such as memos, term papers, and letters.
- **Worksheet files,** created by electronic spreadsheets to analyze things like budgets and to predict sales.
- **Database files,** typically created by database management programs to contain highly structured and organized data. For example, an employee database file might contain all the workers' names, Social Security numbers, job titles, and other related pieces of information.
- **Presentation files,** created by presentation graphics programs to save presentation materials. For example, a file might contain audience handouts, speaker notes, and electronic slides.

Figure 1-17 Wireless communication devices

Connectivity and the Mobile Internet

Connectivity is the capability of your personal computer to share information with other computers. Central to the concept of connectivity is the **network.** A network is a communications system connecting two or more computers. The largest network in the world is the **Internet.** It is like a giant highway that connects you to millions of other people and organizations located throughout the world. The **web** provides a multimedia interface to the numerous resources available on the Internet.

The Internet has driven the evolution of computers and their impact on our daily lives. In fact, the rate of technological change is accelerating at an ever faster pace. Along with the Internet, three things that are driving the impact of technology on our lives are cloud computing, wireless communication, and the Internet of Things.

- **Cloud computing** uses the Internet and the web to shift many computer activities from a user's computer to computers on the Internet. Rather than relying solely on their computer, users can now use the Internet to connect to the cloud and access more powerful computers, software, and storage.
- **Wireless communication** has changed the way we communicate with one another. The rapid development and widespread use of wireless communication devices like tablets, smartphones, and wearable devices has led many experts to predict that wireless applications are just the beginning of the **wireless revolution,** a revolution that will dramatically affect the way we communicate and use computer technology.
- The **Internet of Things (IoT)** is the continuing development of the Internet that allows everyday objects embedded with electronic devices to send and receive data over the Internet. It promises to connect all types of devices from computers to smartphones to watches to any number of everyday devices.

Wireless communication, cloud computing, and IoT are driving the mobile Internet. They promise to continue to dramatically affect the entire computer industry and how you and I will interact with computers and other devices. Each will be discussed in detail in the following chapters. For just a few of these mobile devices, see Figure 1-17.
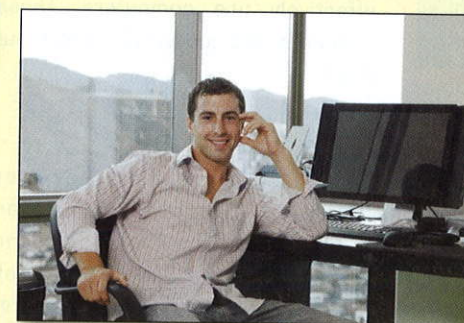
☑ concept check

- Define data. List four common types of files.
- Define connectivity and networks.
- What is cloud computing? Wireless revolution? IoT?

Careers in IT

Now that you know the basic outline and important features of this book, I'd like to talk about some of the most exciting and well-paid careers in information technology.

As mentioned previously, each of the following chapters highlights a specific career in information technology. Each provides specific job descriptions, salary ranges, advancement opportunities, and more. For a partial list of these careers, see Figure 1-18.

Career	Description
Webmaster	Develops and maintains websites and web resources. See page 48.
Software engineer	Analyzes users' needs and creates application software. See page 77.
Computer support specialist	Provides technical support to customers and other users. See page 104.
Computer technician	Repairs and installs computer components and systems. See page 130.
Technical writer	Prepares instruction manuals, technical reports, and other scientific or technical documents. See page 161.
Network administrator	Creates and maintains computer networks. See page 212.

Figure 1-18 Careers in information technology

A LOOK TO THE FUTURE

Using and Understanding Information Technology

The purpose of this book is to help you use and understand information technology. We want to help you become proficient and to provide you with a foundation of knowledge so that you can understand how technology is being used today and anticipate how technology will be used in the future. This will enable you to benefit from six important information technology developments.

The Internet and the Web

The Internet and the web are considered to be the two most important technologies for the 21st century. Understanding how to efficiently and effectively use the Internet to browse, communicate, and locate information is an essential skill. These issues are presented in Chapter 2, The Internet, the Web, and Electronic Commerce.

Powerful Software

The software that is now available can do an extraordinary number of tasks and help you in an endless number of ways. You can create professional-looking documents, analyze massive amounts of data, create dynamic multimedia web pages, and much more. Today's employers are expecting the people they hire to be able to effectively and efficiently use a variety of different types of software. General-purpose, specialized, and mobile applications are presented in Chapter 3. System software is presented in Chapter 4.

Powerful Hardware

Personal computers are now much more powerful than they used to be. Smartphones, tablets, and communication technologies such as wireless networks are dramatically changing the ways to connect to other computers, networks, and the Internet. However, despite the rapid change of specific equipment, their essential features remain unchanged. To become an efficient and effective end user, you should focus on these features. Chapters 5 through 8 explain what you

need to know about hardware. For those considering the purchase of a computer, an appendix—The Computer Buyer's Guide—is provided at the end of this book. This guide provides a very concise comparison of desktops, laptops, tablets, and smartphones.

Privacy, Security, and Ethics

What about people? Experts agree that we as a society must be careful about the potential of technology to negatively affect our lives. Specifically, we need to be aware of how technology can impact our personal privacy and our environment. Also, we need to understand the role and the importance of organizational and personal ethics. These critical issues are integrated in every chapter of this book as well as extensively covered in Chapter 9.
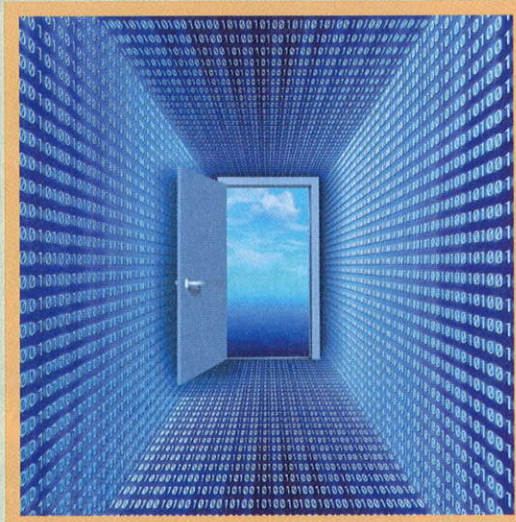
Organizations

Almost all organizations rely on the quality and flexibility of their information systems to stay competitive. As a member or employee of an organization, you will undoubtedly be involved in these information systems. In order to use, develop, modify, and maintain these systems, you need to understand the basic concepts of information systems and know how to safely, efficiently, and effectively use computers. These concepts are covered throughout this book.

Changing Times

Are the times changing any faster now than they ever have? Almost everyone thinks so. Whatever the answer, it is clear we live in a fast-paced age. The Evolution of the Computer Age section presented at the end of this book tracks the major developments since computers were first introduced.

After reading this book, you will be in a very favorable position compared with many other people in industry today. You will learn not only the basics of hardware, software, connectivity, the Internet, and the web but also the most current technology. You will be able to use these tools to your advantage.

VISUAL SUMMARY — Information Technology, the Internet, and You

INFORMATION SYSTEMS

The way to think about a personal computer is to realize that it is one part of an **information system.** There are several parts of an information system:

- **People** are an essential part of the system. The purpose of information systems is to make people, or **end users** like you, more productive.
- **Procedures** are rules or guidelines to follow when using software, hardware, and data. They are typically documented in manuals written by computer professionals.
- **Software (programs)** provides step-by-step instructions to control the computer to convert **data** into **information.**
- **Hardware** consists of the physical equipment. It is controlled by software and processes data to create information.
- **Data** consists of unprocessed facts including text, numbers, images, and sound. **Information** is data that has been processed by the computer.
- The **Internet** allows computers to connect and share information.

To efficiently and effectively use the computer, you need to understand **information technology (IT),** including software, hardware, data, and connectivity.

PEOPLE

People are the most important part of an information system. This book contains several features to demonstrate how people just like you use computers. These features include the following:

- **Making IT Work for You** presents several interesting and practical applications. Topics include using digital video editing and locating job opportunities.
- **Tips** offer a variety of suggestions on such practical matters as how to improve slow computer performance and how to protect your privacy while on the web.
- **Privacy** marginal boxes discuss threats to your personal privacy and suggest ways to protect yourself.
- **Environment** boxes discuss important and relevant environmental issues. The impact of computers and other technologies is more critical today than ever before.
- **Ethics** boxes pose a variety of different ethical/unethical situations for your consideration.
- **Careers in IT** presents job descriptions, employment demands, educational requirements, salary ranges, and advancement opportunities.

To efficiently and effectively use computers, you need to understand the basic parts of an information system: people, procedures, software, hardware, data, and connectivity. You also need to understand the Internet and the web and to recognize the role of technology in your professional and personal life.

SOFTWARE
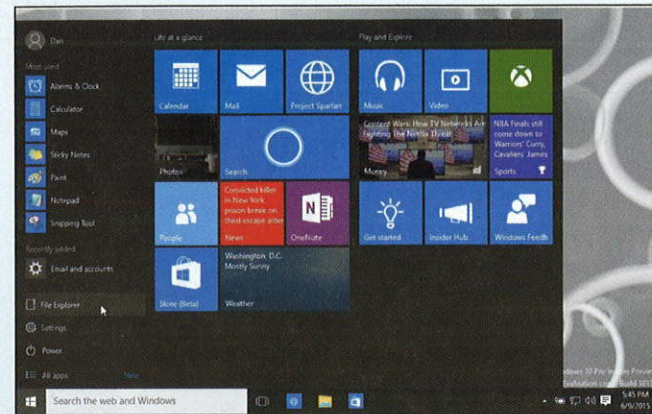
Software, or **programs**, consists of system and application software.

System Software

System software enables application software to interact with computer hardware.

- **Operating systems** coordinate resources, provide an interface, and run applications. Three types are **embedded (real-time, RTOS)**, **stand-alone**, and **network (NOS)**.
- **Utilities** perform specific tasks to manage computer resources.

Application Software

Application software includes general-purpose, specialized, and mobile applications.

- **General purpose**—widely used in nearly all career areas; programs include browsers, word processors, spreadsheets, database management systems, and presentation graphics.
- **Specialized**—focus more on specific disciplines and occupations; programs include graphics and web authoring.
- **Apps (mobile apps, mobile applications)**—designed for mobile devices; most popular are for text messaging, Internet browsing, and connecting to social networks.

HARDWARE

Hardware consists of electronic devices that can follow instructions to accept input, process the input, and produce information.

Types of Computers

Supercomputer, mainframe, midrange (server), and **personal computers (PCs)** are four types of computers. Personal computers can be **desktop, laptop (notebook computer), tablet, smartphone**, and **wearable**.

Personal Computer Hardware

There are four basic categories of hardware devices.

- **System unit** contains electronic circuitry, including **microprocessors** and **memory**. **Random-access memory (RAM)** holds the program and data currently being processed.
- **Input/output devices** are translators between humans and computers. **Input devices** include the **keyboard** and **mouse**. The most common output device is the computer **display (monitor)**.
- **Secondary storage** holds data and programs. Typical media include **hard disks, solid-state storage,** and **optical discs (CD, DVD, and Blu-ray)**.
- **Communication devices** allow personal computers to communicate with other computer systems. **Modems** modify audio, video, and other types of data for transmission across the Internet.
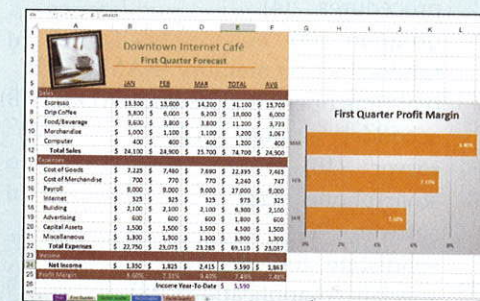
DATA

Data is the raw unprocessed facts about something. Common file types include

- **Document files** created by word processors.

- **Worksheet files** created by spreadsheet programs.

- **Database files** created by database management programs.

- **Presentation files** created by presentation graphics programs.

CONNECTIVITY AND MOBILE INTERNET

Connectivity describes the ability of end users to use resources well beyond their desktops. Central to the concept of connectivity is the **network** or communication system connecting two or more computers. The **Internet** is the world's largest computer **network**. The **web** provides a multimedia interface to resources available on the Internet.

Along with the Internet, three other things are driving the impact of technology:

- **Cloud computing** uses the Internet and the web to shift many computer activities from a user's computer to computers on the Internet.
- **Wireless revolution** has changed the way we communicate and use computer technology. Wireless devices include tablets, smartphones, and watches.
- The **Internet of Things (IoT)** is the continuing development of the Internet that allows everyday objects embedded with electronic devices to send and receive data over the Internet.

CAREERS in IT

Career	Description
Webmaster	Develops and maintains websites and web resources. See page 48.
Software engineer	Analyzes users' needs and creates application software. See page 77.
Computer support specialist	Provides technical support to customers and other users. See page 104.
Computer technician	Repairs and installs computer components and systems. See page 130.
Technical writer	Prepares instruction manuals, technical reports, and other scientific or technical documents. See page 161.
Network administrator	Creates and maintains computer networks. See page 212.

KEY TERMS

application software   (8)
apps   (8)
Blu-ray disc (BD)   (12)
cloud computing   (15)
communication device   (12)
compact disc (CD)   (12)
connectivity (4, 14)
data   (4)
database file   (13)
desktop computer   (11)
digital versatile disc (DVD)   (12)
digital video disc (DVD)   (12)
display   (12)
document file   (13)
embedded operating systems (RTOS)   (8)
end user   (4)
general-purpose application   (8)
hard disk   (12)
hardware   (4)
information   (4)
information system   (4)
information technology (IT)   (7)
input device   (11)
Internet   (14)
IoT (Internet of Things)   (15)
keyboard   (11)
laptop computer   (11)
mainframe computer   (10)
memory   (11)
microprocessor   (11)
midrange computer   (10)
mobile app (application)   (8)
modem   (12)
monitor   (11)

mouse   (11)
network   (14)
network operating systems (NOS)   (8)
notebook computer   (11)
operating system   (8)
optical disc   (12)
output device   (11)
PC   (11)
people   (4)
personal computer   (11)
presentation file   (13)
procedures   (4)
program   (4)
random-access memory (RAM)   (11)
real-time operating system (RTOS)   (8)
secondary storage   (12)
server   (10)
smartphone   (11)
software   (4)
solid-state storage   (12)
specialized application   (8)
stand-alone operating system   (8)
supercomputer   (10)
system software   (7)
system unit   (11)
tablet   (11)
tablet computer   (11)
utility   (8)
virus   (8)
wearable device   (11)
web   (14)
wireless communication   (15)
wireless revolution   (15)
worksheet file   (13)

MULTIPLE CHOICE

Circle the letter of the correct answer.

1. The keyboard, mouse, display, and system unit are:
   a. hardware   c. storage devices
   b. output devices   d. software

2. Programs that coordinate computer resources, provide an interface, and run applications are known as:
   a. application programs   c. storage systems
   b. operating systems   d. utility programs

3. A browser is an example of a:
   a. general-purpose application   c. system application
   b. specialized program   d. utility program

4. Although not as powerful as a supercomputer, this type of computer is capable of great processing speeds and data storage.
   a. mainframe   c. laptop
   b. midrange   d. tablet

5. Apple's Watch is what type of computer?
   a. laptop   c. tablet
   b. smartphone   d. wearable

6. RAM is a type of:
   a. computer   c. network
   b. memory   d. secondary storage

7. Unlike memory, this type of storage holds data and programs even after electric power to the computer system has been turned off.
   a. primary   c. ROM
   b. RAM   d. secondary

8. The type of file created by word processors, for example, memos, term papers, and letters.
   a. database   c. presentation
   b. document   d. worksheet

9. Uses the Internet and the web to shift many computer activities from a user's computer to computers on the Internet.
   a. cloud computing   c. network
   b. high definition   d. solid-state storage

10. The largest network in the world is [the]:
    a. Facebook   c. supercomputer
    b. Internet   d. web

MATCHING

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

a. desktop
b. modem
c. network
d. output
e. presentation
f. program
g. software
h. solid-state
i. system software
j. system unit

____ 1. Consists of the step-by-step instructions that tell the computer how to do its work.

____ 2. Another name for a program.

____ 3. Enables the application software to interact with the computer hardware.

____ 4. Type of computer that is small enough to fit on top of or alongside a desk yet is too big to carry around.

____ 5. A container that houses most of the electronic components that make up a computer system.

____ 6. Devices that translate the processed information from the computer into a form that humans can understand.

____ 7. Unlike hard disks, this type of storage does not have any moving parts, is more reliable, and requires less power.

____ 8. The most widely used communication device.

____ 9. A type of a file that might contain, for example, audience handouts, speaker notes, and electronic slides.

____ 10. A communications system connecting two or more computers.

OPEN-ENDED

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

1. Explain the parts of an information system. What part do people play in this system?

2. What is system software? What kinds of programs are included in system software?

3. Define and compare general-purpose applications, specialized applications, and apps. Describe some different types of general-purpose applications. Describe some types of specialized applications.

4. Describe the different types of computers. What is the most common type? What are the types of personal computers?

5. What is connectivity? What is a computer network? What are the Internet and the web? What are cloud computing, the wireless revolution, and IoT?

DISCUSSION

Respond to each of the following questions.

1 Making IT Work for You

Making it a habit of keeping current with technology applications can be a key to your success. Numerous full-page spreads identified as *Making IT Work for You* are presented in the following chapters. These sections address some of today's most interesting and useful applications. They include online entertainment in Chapter 2, Skype in Chapter 6, and cloud storage in Chapter 7. Select one that you find the most interesting, and then respond to the following: (a) Why did you select this application? (b) Have you used this application? If so, when and how? If not, do you plan to in the near future? (c) Go to the chapter containing your selected application, and locate the application's Making IT Work for You coverage. Review and briefly describe its contents. (d) Did you find the coverage useful? Why or why not?
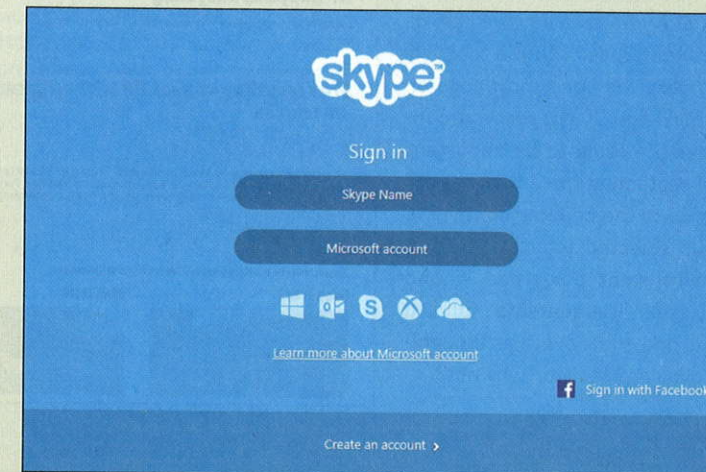
2 Privacy

Privacy is one of the most critical issues facing society today. Numerous Privacy boxes appear in the margins of the upcoming chapters presenting a variety of privacy issues. These issues include apps that track smartphone and tablet user locations without their knowledge or consent in Chapter 3, access by government and organization networks to obtain unauthorized detailed personal information in Chapter 8, and protection of personal privacy while using social networking sites such as Facebook in Chapter 9. Select one that you find the most interesting, and then respond to the following: (a) Why did you select this issue? (b) Do you have knowledge of or experience with the issue? If so, describe your knowledge or experience. If not, do you consider the issue to be important for protecting your privacy? (c) Go to the chapter containing your selected issue, locate the Privacy box, read it, and describe its contents. (d) Did you find the coverage thought-provoking? Why or why not?
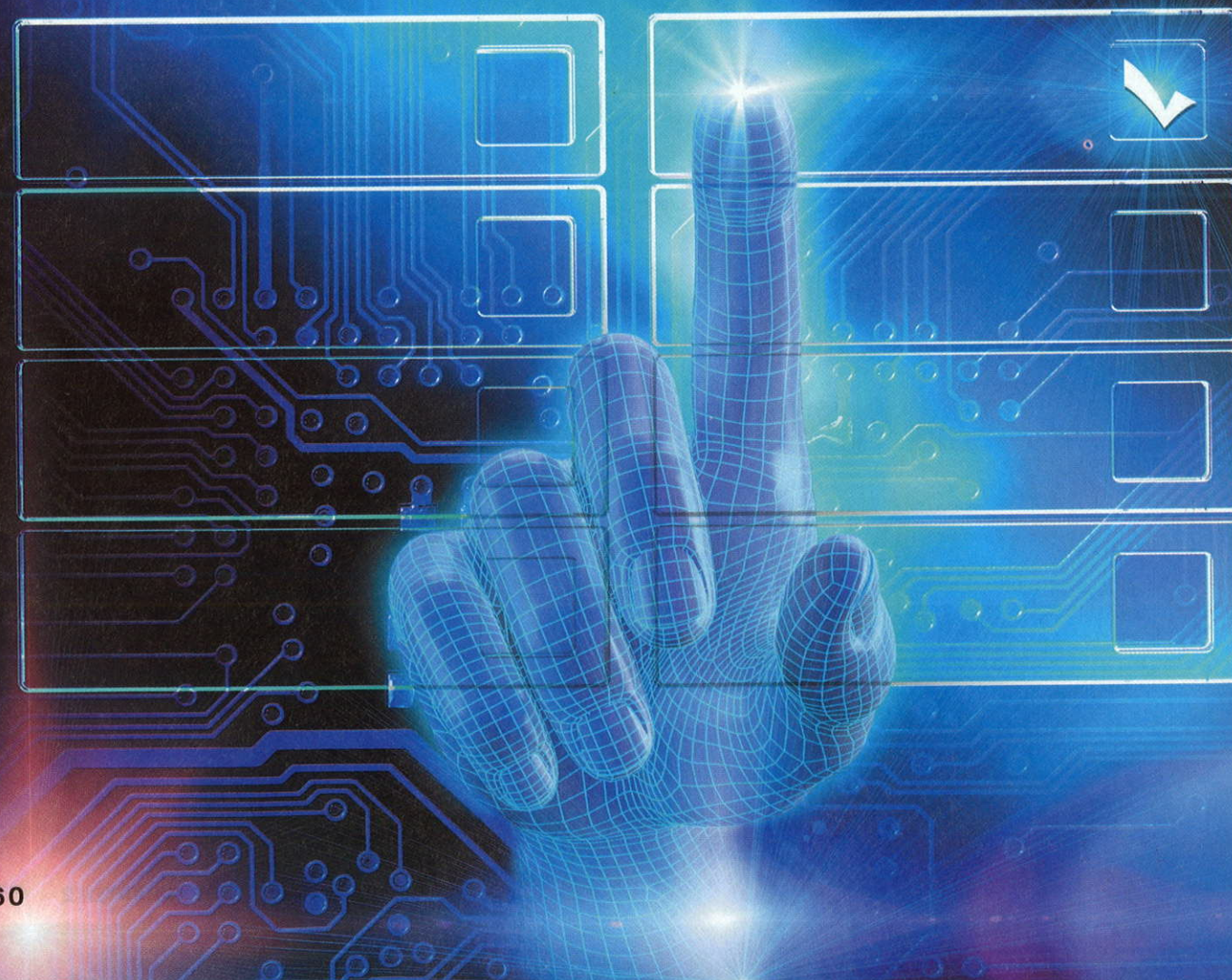
3 Environment

Almost everyone agrees that protecting our environment today is more important than ever before. Numerous Environment boxes appear in the margins of the upcoming chapters. These boxes present a variety of environmental topics including e-mail benefits in Chapter 2, operating systems reducing energy consumption in Chapter 4, and recycling old inkjet cartridges in Chapter 6. Select one that you find the most interesting, and then respond to the following: (a) Why did you select this topic? (b) Do you have knowledge of or experience with the topic? If so, describe your knowledge or experience. If not, do you consider the topic to be important for protecting the environment? (c) Go to the chapter containing your selected topic, locate the Environment box, read it, and describe its contents. (d) Did you find the coverage thought-provoking? Why or why not?

4 Ethics

Computer ethics are guidelines for the morally acceptable use of computers in our society. Numerous Ethics boxes appear in the margins of the upcoming chapters presenting a variety of ethical issues. These issues include image editing in Chapter 3, unauthorized use of webcams in Chapter 6, and unauthorized monitoring or eavesdropping of Internet activity in Chapter 8. Select one issue that you find the most interesting, and then respond to the following: (a) Why did you select this issue? (b) Do you have knowledge of or experience with the issue? If so, describe your knowledge or experience. If not, do you consider the issue critical for individuals or organizations? (c) Go to the chapter containing your selected issue, locate the Ethics box, read it, and describe its contents. (d) Did you find the coverage thought-provoking? Why or why not?

PHOTO CREDITS

CHAPTER 1

chapter 3

Application Software

Why should I read this chapter?

The power and capability of application software is exploding. We can expect applications beyond our imagination and to control these applications entirely with our voice, gestures, and thoughts.

This chapter covers the things you need to know to be prepared for this ever-changing digital world, including:

- General-purpose applications—how to create documents, analyze data, make presentations, and organize information.
- Special-purpose applications—how to use graphics programs for image editing and creating web pages and how to locate and use mobile apps.
- Software suites—how to use suites and cloud-based applications.

Learning Objectives

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

1 Identify general-purpose applications.

2 Describe word processors, spreadsheets, presentation programs, and database management systems.

3 Identify specialized applications.

4 Describe graphics programs, web authoring programs, and other specialized professional applications.

5 Describe mobile apps and app stores.

6 Identify software suites.

7 Describe office suites, cloud suites, specialized suites, and utility suites.

Introduction

Not long ago, trained specialists were required to perform many of the operations you can now do with a personal computer. Market analysts used calculators to project sales. Graphic artists created designs by hand. Data processing clerks created electronic files to be stored on large computers. Now you can do all these tasks—and many others—with a personal computer and the appropriate application software.

Think of the personal computer as an electronic tool. You may not consider yourself very good at typing, calculating, organizing, presenting, or managing information. However, a personal computer can help you do all these things and much more. All it takes is the right kinds of software.

To efficiently and effectively use computers, you need to understand the capabilities of general-purpose application software, which includes word processors, spreadsheets, presentation programs, and database management systems. You also need to know about integrated packages and software suites.

Figure 3-1 Traditional graphical user interface

Application Software

As we discussed in Chapter 1, there are two kinds of software. **System software** works with end users, application software, and computer hardware to handle the majority of technical details. **Application software** can be described as end user software and is used to accomplish a variety of tasks.

Application software can be divided into three categories. One category, **general-purpose applications,** includes word processing programs, spreadsheets, presentation graphics, and database management systems. Another category, **specialized applications,** includes thousands of other programs that tend to be more narrowly focused and used in specific disciplines and occupations. The third category, **mobile apps,** is add-on features or programs typically designed for smartphones and tablets.

User Interface

A **user interface** is the portion of the application that allows you to control and to interact with the program. Depending on the application, you can use a mouse, a pointer, a keyboard, and/or your voice to communicate with the application. Most general-purpose applications use a mouse and a **graphical user interface (GUI)** that displays graphical elements called **icons** to represent familiar objects. The mouse controls a **pointer** on the screen that is used to select items such as icons. Another feature is the use of windows to display information. A **window** is simply a rectangular area that can contain a document, program, or message. (Do not confuse the term *window* with the various versions of Microsoft's Windows operating systems, which are programs.) More than one window can be opened and displayed on the computer screen at one time.

Traditionally, most software programs use a system of menus, toolbars, and dialog boxes. (See Figure 3-1.)

- **Menus** present commands that are typically displayed in a **menu bar** at the top of the screen.
- **Toolbars** typically appear below the menu bar and include small graphic elements called **buttons** that provide shortcuts for quick access to commonly used commands.
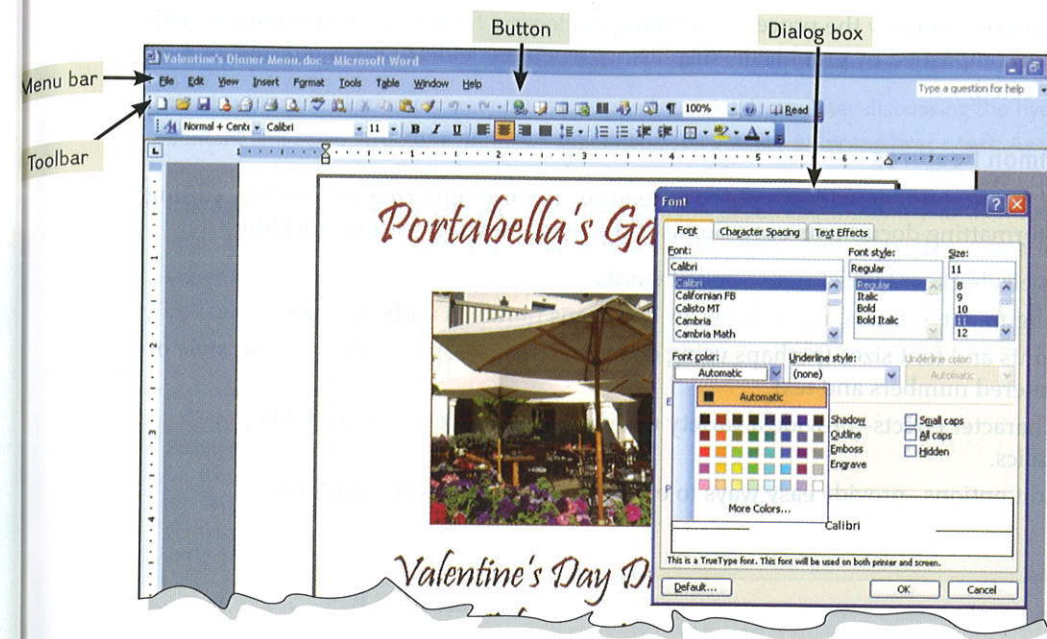- **Dialog boxes** provide additional information and request user input.

Many applications, and Microsoft applications in particular, use an interface known as the **Ribbon GUI** to make it easier to find and use all the features of an application; this GUI uses a system of ribbons, tabs, and galleries. (See Figure 3-2.)

- **Ribbons** replace menus and toolbars by organizing commonly used commands into a set of tabs. These tabs display command buttons that are the most relevant to the tasks being performed by the user.
- **Tabs** are used to divide the ribbon into major activity areas. Each tab is then organized into **groups** that contain related items. Some tabs, called **contextual tabs,** appear only when they are needed and anticipate the next operation to be performed by the user.
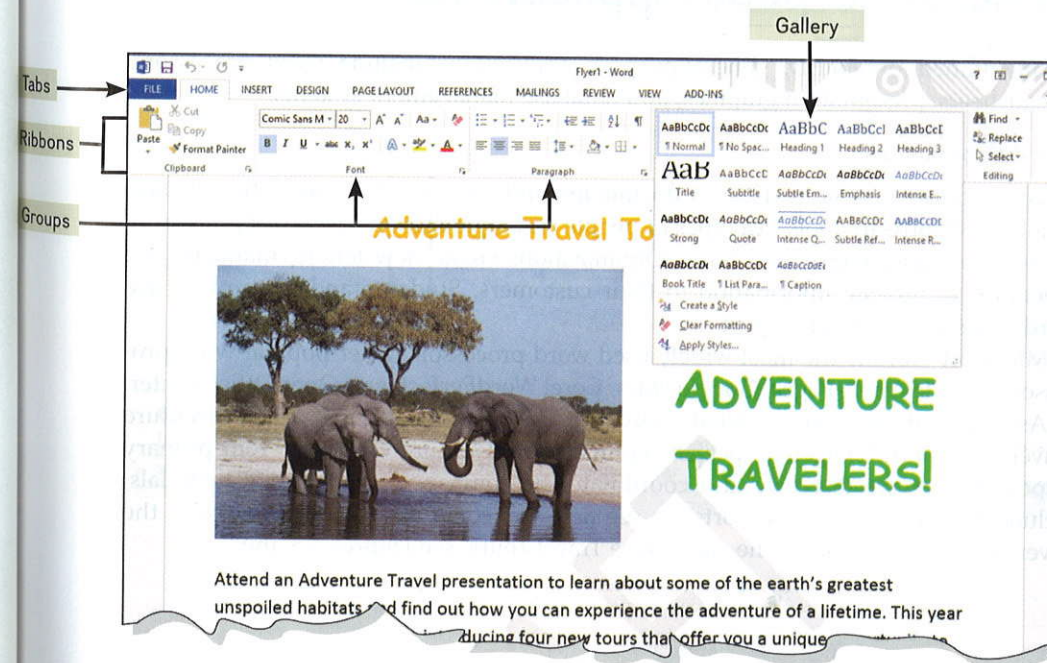
Figure 3-2 Ribbon GUI

- **Galleries** simplify the process of making a selection from a list of alternatives. This is accomplished by graphically displaying the effect of alternatives before being selected.

Common Features

Most applications provide a variety of features to make entering/presenting, editing, and formatting documents easy. Some of the most common features include

- Spell checker—looks for misspelled words.
- Alignment—centers, right-aligns, or left-aligns numbers and characters.
- Fonts and font sizes (perhaps using character effects)—specify the size and style of entered numbers and text.
- Character effects—provide a variety of different typefaces, such as bold or italics.
- Edit options—provide easy ways to edit text, such as cut, copy, and paste.

☑ concept check

List three categories of application software.

What is a graphical user interface? What are windows, menus, toolbars, and dialog boxes?

What is the Ribbon GUI? What are ribbons, tabs, and galleries?

Discuss some of the most common features in application programs.

General-Purpose Applications

As mentioned previously, general-purpose applications include word processors, spreadsheets, presentation graphics, and database management systems.

Word Processors

Word processors create text-based **documents** and are one of the most flexible and widely used software tools. All types of people and organizations use word processors to create memos, letters, and faxes. Organizations create newsletters, manuals, and brochures to provide information to their customers. Students and researchers use word processors to create reports.

Microsoft Word is the most widely used word processor. Other popular word processors include Apple Pages, Google Docs, Corel WordPerfect, and OpenOffice Writer.

Assume that you have accepted a job as an advertising coordinator for Adventure Travel Tours, a travel agency specializing in active adventure vacations. Your primary responsibilities are to create and coordinate the company's promotional materials, including flyers and travel reports. To see how you could use Microsoft Word as the advertising coordinator for the Adventure Travel Tours, see Figures 3-3 and 3-4.

You have been asked to create a promotional advertising flyer. After discussing the flyer's content and basic structure with your supervisor, you start to enter the flyer's text. As you enter the text, the spelling checker and grammar checker catch some spelling and grammatical errors. Once the text has been entered, you proofread the text and then focus your attention on enhancing the visual aspects of the flyer. You add a photograph and experiment with different character and paragraph formats, including fonts, font sizes, colors, and alignments.

Spelling Checker
Correcting spelling and typing errors identified by the **spelling checker** creates an error-free and professional-looking document.

Fonts and Font Size
Using interesting **fonts** and a large **font size** in the flyer's title grabs the reader's attention.

Center-Aligning
Center-aligning all of the text in the flyer creates a comfortable, balanced appearance.

Character Effects
Adding **character effects** such as bold and color makes important information stand out and makes the flyer more visually interesting.
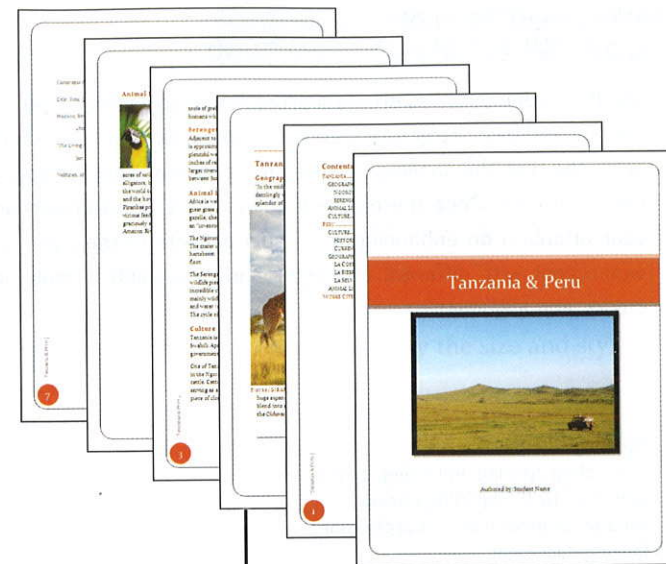
Grammar Checker
Incomplete sentences, awkward wording, and incorrect punctuation are identified and corrections are offered by the **grammar checker.**

Adventure Travel Tours
New Adventures

Attention adventure travelers! Attend an Adventure presentation to learn about some of the earth's greatest unspoiled habitats and find out how you can experience the adventure of a lifetime. This year we are offering four new tours:

- *India Wildlife Adventure*
- *Inca Trail to Machu Picchu*
- *Safari in Tanzania*
- *Costa Rica Rivers and Rainforests*

Call Student Name at 1-800-555-0004 for presentation locations, full color brochures, itinerary information, costs, and trip dates.

Figure 3-3 Flyer

Creating a Report

Your next assignment is to create a report on Tanzania and Peru. After conducting your research, you start writing your paper. As you enter the text for the report, you notice that the AutoCorrect feature automatically corrects some grammar and punctuation errors. Your report includes several figures and tables. You use the captions feature to keep track of figure and table numbers, to enter the caption text, and to position the captions. You use the footnote feature to assist in adding notes to further explain or comment on information in the report.

Finally, you prepare the report for printing by adding header and footer information. ●

Captions
Identifying figures with **captions** in a report makes the report easier to read and more professional.

AutoCorrect
As you enter text, you occasionally forget to capitalize the first word in a sentence. Fortunately, **AutoCorrect** recognizes the error and automatically capitalizes the word.

Tanzania & Peru

Tanzania

Geography and Climate

"In the midst of a great wilderness, full of wild beasts...I fancied I saw a summit...covered with a dazzlingly white cloud (qtd. in Cole 56). This is how Johann Krapf, the first outsider to witness the splendor of Africa's highest mountain, described Kilimanjaro. The peak was real, though the white clouds he "fancied" he saw were the dense layer of snow that coats the mountain.[1]

Tanzania is primarily a plateau that slopes gently downward into the country's five hundred miles of Indian Ocean coastline. Nearly three-quarters of Tanzania is dry savannah, so much so that the Swahili word for the central plateau is *nyika*, meaning "wasteland." Winding through these flatlands is the Great Rift Valley, which forms narrow and shallow lakes in its long path. Several of these great lakes form a belt-like oasis of green vegetation. Contrasting with the severity of the plains are the coastal areas, which are lush with ample rainfall. In the north the plateau slopes dramatically into Mt. Kilimanjaro.

Ngorongoro Conservation Area

Some of Tanzania's most distinguishing geographical features are found in the Ngorongoro Conservation Area.[2] The park is composed of many craters and gorges, as well as lakes, forest, and plains. Among these features is the area's namesake, the Ngorongoro Crater. The Crater is a huge expanse, covering more than one hundred square miles. On the Crater's floor, grasslands blend into swamps, lakes, rivers, and woodland. Also within the Conservation Area's perimeter is the Olduvai Gorge, commonly referred to as the "Cradle of Mankind," where in 1931 the stone

FIGURE 1 GIRAFFE IN SERENGETI

[1] Mt. Kilimanjaro is 19,340 feet high, making it the fourth tallest mountain in the world.
[2] The Conservation Area is a national preserve spanning 3,196 square miles.

Header or Footer
Page numbers and other document-related information can be included in a **header** or **footer**.

Footnote
To include a note about Mt. Kilimanjaro, you use the footnote feature. This feature inserts the **footnote** superscript number and automatically formats the bottom of the page to contain the footnote text.

Figure 3-4 Report

Spreadsheets

Spreadsheets organize, analyze, and graph numeric data such as budgets and financial reports. Once used exclusively by accountants, spreadsheets are widely used by nearly every profession. Marketing professionals analyze sales trends. Financial analysts evaluate and graph stock market trends. Students and teachers record grades and calculate grade point averages.

The most widely used spreadsheet program is Microsoft Excel. Other spreadsheet applications include Apple Numbers, Corel Quattro Pro, Google Sheets, and OpenOffice Calc.

Assume that you have just accepted a job as manager of the Downtown Internet Café. This café provides a variety of flavored coffees as well as Internet access. One of your responsibilities is to create a financial plan for the next year. To see how you could use Microsoft Excel as the manager for the Downtown Internet Café, see Figures 3-5 and 3-6.

Creating a Sales Forecast

Your first project is to develop a first-quarter sales forecast for the café. You begin by studying sales data and talking with several managers. After obtaining sales and expense estimates, you are ready to create the first-quarter forecast. You start structuring the worksheet by inserting descriptive text entries for the row and column headings. Next, you insert numeric entries, including formulas and functions to perform calculations. To test the accuracy of the worksheet, you change the values in some cells and compare the recalculated spreadsheet results with hand calculations. ●

Worksheets
Worksheets are used for a wide range of different applications. One of the most common uses is to create, analyze, and forecast budgets.

Text Entries
Text entries provide meaning to the values in the worksheet. The rows are labeled to identify the various sales and expense items. The columns are labeled to specify the months.

Functions
Functions are prewritten formulas. In this case, cell C22 (Total Expenses for February) contains the function SUM(C14:C21) rather than the formula = C14 + C15 + C16 + C17 + C18 + C19 + C20 + C21.

Cells
Cells can contain labels, numbers, formulas, and functions. A cell's content is indicated by the row and column labels. For example, cell D16 contains a number for the Payroll expense expected for March.

Formulas
Formulas provide a way to perform calculations in the worksheet. In this case, cell C24 contains the formula = C12 (Total Sales for February) – C22 (Total Expenses for February) and displays the result of the calculation for the Net Income for February.

C22   =SUM(C14:C21)

Downtown Internet Café
First Quarter Forecast

	A	B	JAN	C	FEB	D	MAR	E	TOTAL	F	AVG
6	Sales										
7	Espresso	$	13,300	$	13,600	$	14,200	$	41,100	$	13,700
8	Drip Coffee	$	5,800	$	6,000	$	6,200	$	18,000	$	6,000
9	Food/Beverage	$	3,600	$	3,800	$	3,800	$	11,200		
10	Merchandise	$	1,000	$	1,100	$	1,100	$	3,200		
11	Computer	$	400	$	400	$	400	$	1,200		
12	Total Sales	$	24,100	$	24,900	$	25,700	$	74,700		
13	Expenses										
14	Cost of Goods	$	7,225	$	7,480	$	7,690	$	22,395		
15	Cost of Merchandise	$	700	$	770	$	770	$	2,240		
16	Payroll	$	9,000	$	9,000	$	9,000	$	27,000	$	9,000
17	Internet	$	325	$	325	$	325	$	975	$	325
18	Building	$	2,100	$	2,100	$	2,100	$	6,300	$	2,100
19	Advertising	$	600	$	600	$	600	$	1,800	$	600
20	Capital Assets	$	1,500	$	1,500	$	1,500	$	4,500	$	1,500
21	Miscellaneous	$	1,300	$	1,300	$	1,300	$	3,900	$	1,300
22	Total Expenses	$	22,750	$	23,075	$	23,285	$	69,110	$	23,037
23	Income										
24	Net Income	$	1,350	$	1,825	$	2,415	$	5,590	$	1,863
25	Profit Margin		5.60%		7.33%		9.40%		7.48%		7.48%
26						Income Year-To-Date	$	5,590			

Figure 3-5 First-quarter forecast

Analyzing Your Data

After presenting the First-Quarter Forecast to the owner, you revise the format and expand the workbook to include worksheets for each quarter and an annual forecast summary. You give each worksheet a descriptive sheet name. At the request of the owner, you perform a what-if analysis to test the effect of different estimates for payroll, and you use a chart to visualize the effect. ●

Workbook
The first worksheet in a **workbook** is often a summary of the following worksheets. In this case, the first worksheet presents the entire year's forecast. The subsequent worksheets provide the details.

Sheet Name
Each worksheet has a unique **sheet name**. To make the workbook easy to navigate, it is a good practice to always use simple yet descriptive names for each worksheet.

What-If Analysis
What-if analysis is a very powerful and simple tool to test the effects of different assumptions in a spreadsheet.

Chart
Once data is in the worksheet, it is very easy to **chart** the data. All you need to do is to select the data to chart, select the chart type, and add some descriptive text.

Figure 3-6 Annual forecast and analysis

Presentation Graphics

Research shows that people learn better when information is presented visually. **Presentation graphics** are programs that combine a variety of visual objects to create attractive, visually interesting presentations. They are excellent tools to communicate a message and to persuade people.

People in a variety of settings and situations use presentation graphics programs to make their presentations. For example, marketing managers use presentation graphics to present proposed marketing strategies to their superiors. Salespeople use these programs to demonstrate products and encourage customers to make purchases. Students use presentation graphics programs to create high-quality class presentations.

Six of the most widely used presentation graphics programs are Microsoft PowerPoint, Apple Keynote, Google Slides, Corel Presentations, OpenOffice Impress, and Prezi.

Assume that you have volunteered for the Animal Rescue Foundation, a local animal rescue agency. You have been asked to create a powerful and persuasive presentation to encourage other members from your community to volunteer. To see how you could use Microsoft PowerPoint, see Figure 3-7.

Creating a Presentation

You have been asked to create a powerful and persuasive presentation for the director of the foundation designed to encourage other members from your community to volunteer. The first step is to meet with the director of the foundation to determine the content of the presentation. Then using PowerPoint, you begin creating the presentation by selecting a presentation template and document theme. After entering the content, you add interest to the presentation by adding animation to selected objects and using slide transition effects. ●

Templates
Templates provide an excellent way to quickly create a presentation by providing predesigned styles and layouts as well as suggested content based on the type of template you select.

Document Theme
To make your presentation more professional and eye-catching, you select a **document theme**, built-in sets of colors, fonts, and effects that can be quickly applied to your entire presentation.

Animation
To provide additional emphasis to items or show the information on a slide in phases, you add **animation** to text and objects. Finally, you use slide **transition** effects to animate the transition from one slide to the next.
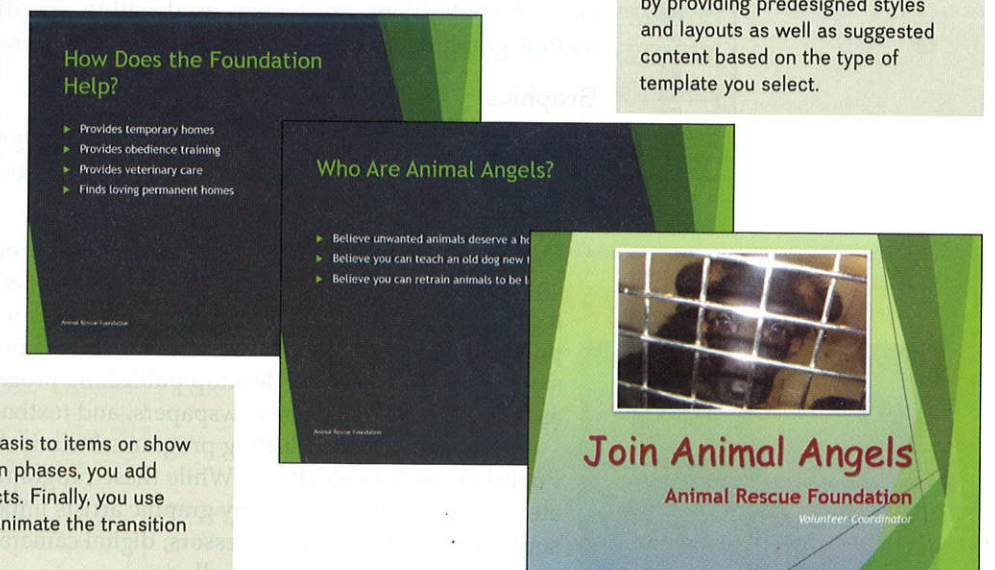
Figure 3-7 Presentation

Database Management Systems

A **database** is a collection of related data. It is the electronic equivalent of a file cabinet. A **database management system (DBMS)** or **database manager** is a program that sets up, or structures, a database. It also provides tools to enter, edit, and retrieve data from the database. All kinds of individuals use databases, from hospital administrators recording patient information to police officers checking criminal histories. Colleges and universities use databases to keep records on their students, instructors, and courses. Organizations of all types maintain employee databases.

Four widely used database management systems designed for personal computers are Microsoft Access, Apple FileMaker, Google Obvibase, and OpenOffice Base.

Assume that you have accepted a job as an employment administrator for the Lifestyle Fitness Club. To see how you could use Microsoft Access, see Figure 3-8.

> ☑ **concept check**
>
> ● What are word processors? What are they used for?
>
> ● What are spreadsheets? What are they used for?
>
> ● What are presentation graphics programs? What are they used for?
>
> ● What are database management systems? What are they used for?

Specialized Applications

While general-purpose applications are widely used in nearly every profession, specialized applications are widely used within specific professions. These programs include graphics programs and web authoring programs.

Graphics

Graphics are widely used by professionals in the graphic arts profession. They use desktop publishing programs, image editing programs, illustration programs, and video editors.

- **Desktop publishing programs,** or **page layout programs,** allow you to mix text and graphics to create publications of professional quality. While word processors focus on creating text and have the ability to combine text and graphics, desktop publishers focus on page design and layout and provide greater flexibility. Professional graphic artists use desktop publishing programs to create documents such as brochures, newsletters, newspapers, and textbooks.
  Popular desktop publishing programs include Adobe InDesign, Microsoft Publisher, and QuarkXPress. While these programs provide the capability to create text and graphics, typically graphic artists import these elements from other sources, including word processors, digital cameras, scanners, image editors, illustration programs, and image galleries.

Creating a Database

You have been asked to create an employee database to replace the club's manual system for recording employee data. The first step in creating the database management system is to plan. You study the existing manual system focusing on how and what data is collected and how it is used. Next, using Microsoft Access, one of the most widely used DBMS programs, you design the basic structure or organization of the new database system to include a table that will make entering data and using the database more efficient. You create the table structure by specifying the fields and primary key field. To make the process faster and more accurate, you create a form and enter the data for each employee as a record in the table. ●

Primary Key
The **primary key** is the unique employee identification number. You considered using the last name field as the primary key but realized that more than one employee could have the same last name. Primary keys are often used to link tables.

Fields
Fields are given field names that are displayed at the top of each table. You select the field names to describe their contents.

Table
Tables make up the basic structure of a relational database with columns containing field data and rows containing record information. This table records basic information about each employee, including name, address, and telephone number.

Record
Each **record** contains information about one employee. A record often includes a combination of numeric, text, and object data types.

Form
Like printed paper forms, electronic **forms** should be designed to be easy to read and use. This form makes it easy to enter and view all employees' data, including their photographs.

Figure 3-8 Database

Letter A

Expanded view
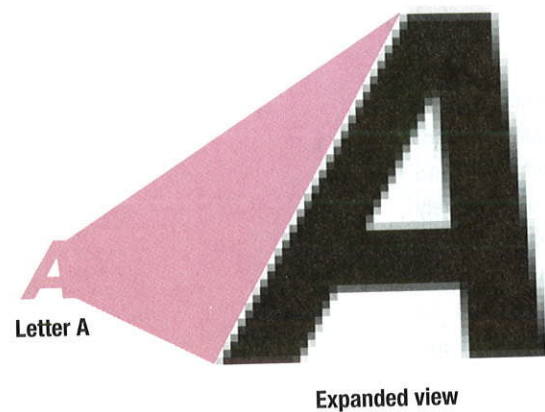
Figure 3-9 **Bitmap image**

Figure 3-10 **Vector image**

- **Image editors,** also known as **photo editors,** are specialized graphics programs for editing or modifying digital photographs. They are often used to touch up photographs to remove scratches and other imperfections. The photographs consist of thousands of dots or **pixels** that form images often referred to as **bitmap** or **raster** images. One limitation of bitmap images, however, is that when they are expanded, the images can become pixelated, or jagged on the edges. For example, when the letter *A* in Figure 3-9 is expanded, the borders of the letter appear jagged, as indicated by the expanded view.

  Popular image editors include Adobe Photoshop, Corel PaintShop Pro, GIMP (GNU Image Manipulation Program), and Windows Photo Gallery.

- **Illustration programs,** also known as **drawing programs,** are used to create and edit vector images. While bitmap images use pixels to represent images, **vector images,** also known as **vector illustrations,** use geometric shapes or objects. These objects are created by connecting lines and curves avoiding the pixeleted or ragged edges created by bitmap images. (See Figure 3-10.) Because these objects can be defined by mathematical equations, they can be rapidly and easily resized, colored, textured, and manipulated. An image is a combination of several objects.

  Illustration programs are often used for graphic design, page layout, and creating sharp artistic images. Popular illustration programs include Adobe Illustrator, CorelDRAW, and Inkscape.

- **Video editors** are used to edit videos to enhance quality and appearance. Once used only by Hollywood professionals, video editors are now widely used to edit high-quality video captured using smartphones and other devices. You can readily add special effects, music tracks, titles, and on-screen graphics.

  Just a few years ago, video editors were used only by professionals with expensive specialized hardware and software. Now, there are several free or inexpensive editors designed to assist the amateur videographer. Three well-known video editors are Windows Live Movie Maker, Apple iMovie, and YouTube Video Editor. (See Figure 3-11.)

Figure 3-11 **Video editor**

Figure 3-12 **Video game design software**

Video Game Design Software

Have you ever thought about designing a video game? While it may initially be unrealistic to create an immersive 3D world like Skyrim or BioShock, you can experiment and create some impressive games on your own with the right software. The first step is to visualize the game by thinking about the game's length and plot. The second step is to choose the right video game design software.

Video game design software will help you organize your thoughts and guide you through the game design process including character development and environmental design. There are many choices from free software to very expensive software designed for professional game designers. Some of the better-known free or inexpensive video game design software are YoYo GameMaker, Stencyl, Flixel, and Unity. (See Figure 3-12.)

Web Authoring Programs

There are over a billion websites on the Internet, and more are being added every day. Corporations use the web to reach new customers and to promote their products. Individuals create online diaries or commentaries, called **blogs.** Creating a site is called **web authoring.**

Almost all websites consist of interrelated web pages. As we mentioned in Chapter 2, web pages are typically HTML (Hypertext Markup Language) and CSS (cascading style sheets) documents. With knowledge of HTML and a simple text editor, you can create web pages. Even without knowledge of HTML, you can create simple web pages using a word processing package like Microsoft Word.

More specialized and powerful programs, called **web authoring programs,** are typically used to create sophisticated commercial sites. Also known as **web page editors** and **HTML editors,** these programs provide support for website design and HTML coding. Some web authoring programs are **WYSIWYG (what you see is what you get) editors,** which means you can build a page without interacting directly with HTML code. WYSIWYG editors preview the page described by HTML code. Widely used web authoring programs include Adobe Dreamweaver and Microsoft Expression Web.

Other Specialized Applications

There are numerous other specialized applications including accounting, personal finance, and project management applications. Accounting applications such as Intuit QuickBooks help companies record and report their financial operations. Personal financial applications such as Quicken Starter Edition help individuals track their personal finances and investments. Project management software like Microsoft Project is widely used in business to help coordinate and plan complicated projects.

☑ **concept check**

What are desktop publishing programs? Image editors? Illustration programs? Video editors?

What is video game design software?

What are blogs? Web authoring? Web authoring programs? WYSIWYG?

Mobile Apps

Mobile apps or **mobile applications** are add-on programs for a variety of mobile devices including smartphones and tablets. Sometimes referred to simply as **apps,** mobile apps have been widely used for years. The traditional applications include address books, to-do lists, alarms, and message lists. With the introduction of smartphones, tablets, and wireless connections to the Internet, mobile capabilities have exploded. Now, any number of applications are available.

Apps

The breadth and scope of available mobile applications for smartphones and other mobile devices are ever expanding. There are over 500,000 apps just for Apple's iPhone alone. Some of the most widely used are for listening to music, viewing video, social networking, shopping, and game playing.

- Music. For many, their smartphone and/or tablet is their primary source for music. The mobile app Pandora offers free streaming music with ads and playlists that you can customize in a limited way. Spotify is another streaming music service that requires a monthly fee but offers direct control of what music you listen to and no ads.
- Video. With faster data speeds and higher resolution screens, smartphones and tablets are becoming a favorite way to watch TV shows, movies, or video clips. The YouTube app offers access to free online videos such as movie trailers and video blogs. The Netflix app provides access to more professional videos for a fee.
- Social networking. Mobile apps are ideal for sharing a picture while on vacation, checking in at your favorite coffee shop, or sending out invites to a last-minute party. The Facebook mobile app offers many of the features of the Facebook website, with additional features that take advantage of a mobile device's camera and GPS capability. The Instagram app provides a more specialized and artistic flair by focusing on sharing photos.

- Shopping. A recent poll concluded that well over half of all smartphone users in the United States regularly use their phones for shopping. By scanning a product's barcode, shopping apps search for the product and provide price comparisons as well as product reviews. Using Amazon's Price Check app, all you need to do is take a picture of the product.
- Games. One of the most popular activities on smartphones and tablets is game playing. Some of these games are quite basic, are free, and include in-app optional purchases. For example, Crossy Road challenges game players to assist a character across obstacles (roads, rivers, grass, and train tracks) without succumbing to obstacles such as rivers, trees, trains and cars. Players have the option to buy additional characters. Some other games are quite complex and are not free. For example, Dragon Quest V is a popular **role playing game (RPG)** where gamers create their own villages, fight off intruders, and form alliances with millions of other players online. (See Figure 3-13.)
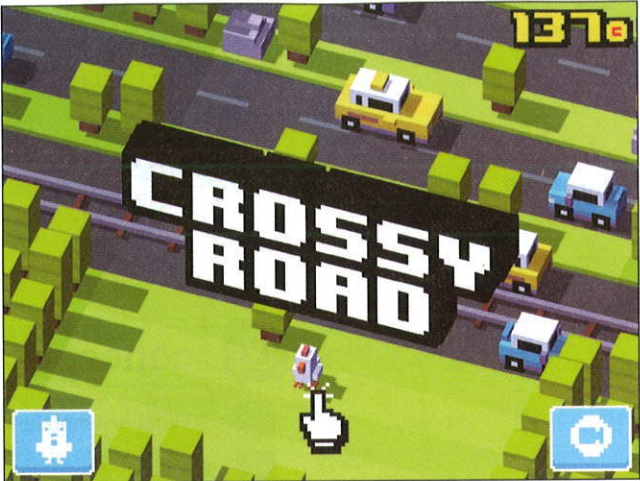
Figure 3-13 **Crossy Road game**

Many apps are written for a particular type of mobile device and will not run on other types. For example, an app designed for Apple's iPhone may not work with Google's Android.

App Stores

An **app store** is typically a website that provides access to specific mobile apps that can be downloaded either for a nominal fee or free of charge. Two of the best-known stores are Apple's App Store and Google Play. (See Figure 3-14.) Although most of the best-known app stores specialize in applications for a particular line of mobile device, other less well-known stores provide apps for a wide variety of mobile devices. For a list of some more widely used app stores, see Figure 3-15.

Figure 3-14 **Apple's App Store**

Figure 3-15 **App stores**

App Store	Focus	Site
Apple App Store	Apple devices	www.apple.com/itunes/charts
Google Play	Android devices	play.google.com/store/apps
Appszoom	Android and Apple devices	www.appszoom.com

☑ **concept check**

What are mobile apps? What are they used for?

Describe two types of game apps. What is RPG?

What are app stores? What are they used for?

Software Suites

A **software suite** is a collection of separate application programs bundled together and made available as a group. Four types of suites are office suites, cloud suites, specialized suites, and utility suites.

Office Suites

Office suites, also known as **office software suites** and **productivity suites,** contain general-purpose application programs that are typically used in a business situation. Productivity suites commonly include a word processor, spreadsheet, database manager, and a presentation application. The best known is Microsoft Office. Other well-known productivity suites are Apple iWork and OpenOffice.

Cloud Computing

Cloud suites or **online office suites** are stored at a server on the Internet and are available anywhere you can access the Internet. Documents created using online applications can also be stored online, making it easy to share and collaborate on documents with others. One downside to cloud applications is that you are dependent on the server providing the application to be available whenever you need 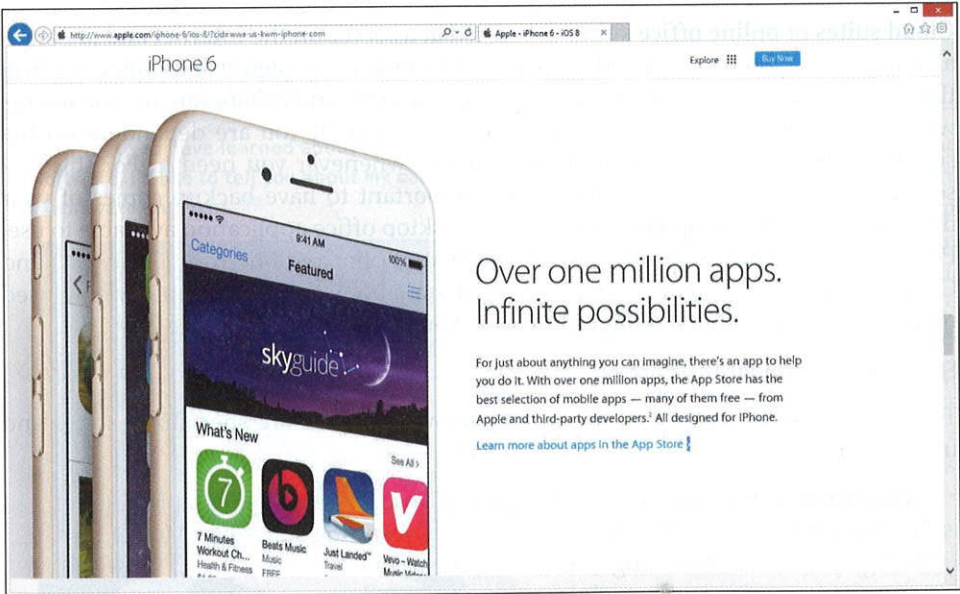it. For this reason, when using online applications, it is important to have backup copies of your documents on your computer and to have a desktop office application available to use. Popular online office suites include Google Docs, Zoho, and Microsoft Office 365 and Office for iPad. (See Figure 3-16.) To learn more about one of the most widely used online office suites, see Making IT Work for You: Google Docs on page 78.

Specialized and Utility Suites

Two other types of suites that are more narrowly focused are specialized suites and utility suites.

- **Specialized suites** focus on specific applications. These include graphics suites like CorelDRAW Graphics Suite X6, financial planning suites like Moneytree Software's TOTAL Planning Suite, and many others.
- **Utility suites** include a variety of programs designed to make computing easier and safer. Two of the best known are Norton SystemWorks and Norton Internet Security Suite. (Utility suites will be discussed in detail in Chapter 4.)
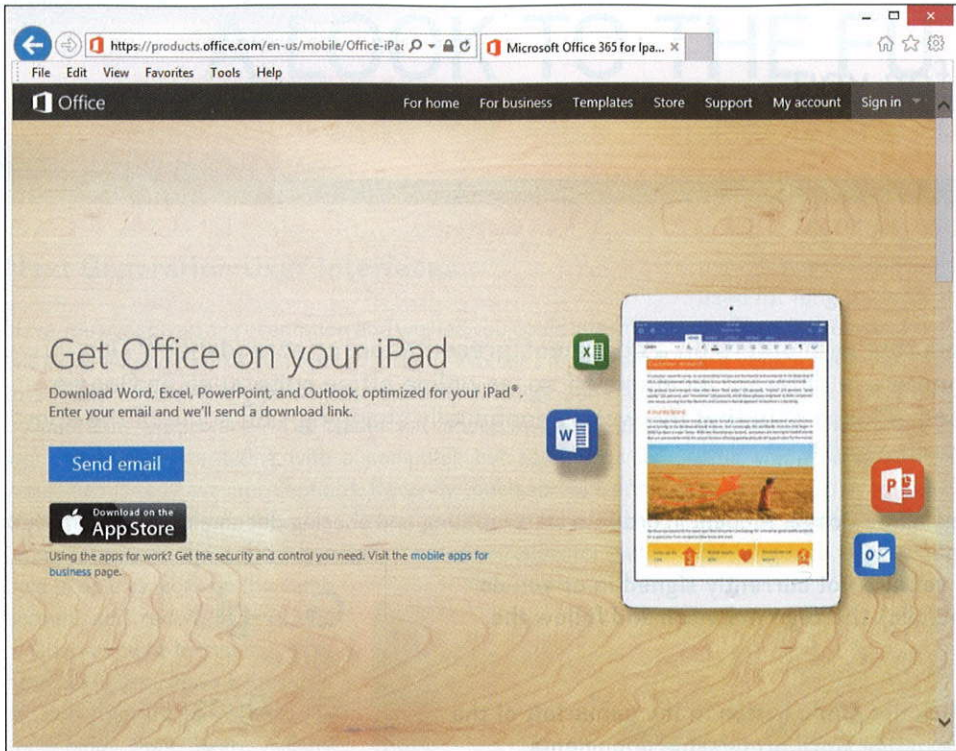
Figure 3-16 **Office for iPad**

☑ **concept check**

What is a software suite? What are the advantages of purchasing a suite?

What is the difference between a traditional office suite and a cloud or online suite?

What is a specialized suite? What is a utility suite?

Careers in IT

❝Now that you have learned about application software, I'd like to tell you about my career as a software engineer.❞

Software engineers analyze users' needs and create application software. Software engineers typically have experience in programming but focus on the design and development of programs using the principles of mathematics and engineering.

A bachelor's or an advanced specialized associate's degree in computer science or information systems and an extensive knowledge of computers and technology are required by most employers. Internships may provide students with the kinds of experience employers look for in a software engineer. Those with specific experience with web applications may have an advantage over other applicants. Employers typically look for software engineers with good communication and analytical skills.

Software engineers can expect to earn an annual salary in the range of $55,000 to $71,000. Starting salary is dependent on both experience and the type of software being developed. Experienced software engineers are candidates for many other advanced careers in IT.

GOOGLE DOCS

Do you need to create and collaborate with others on a document, presentation, or spreadsheet? Do you need access from different computers in different locations? If so, an online office suite, such as Google Docs, might be just what you need. (Please note that the web is continually changing, and some of the specifics presented below may have changed.)

Creating a Document   You must have a free Google account in order to start creating and sharing documents. To get started:

1 ● Go to docs.google.com. If you are not currently signed in or you do not have a Google account, click the *Sign in* button and follow the appropriate instructions.

2 ● Once you are signed in, click the *Menu* button in the upper left of the page. Select *Docs* to see existing word processing documents.

3 ● Click the *Create New Documents* button in the lower right of the page (a red circle with a white + in the center).

4 ● Start typing in the blank document. You will notice many familiar buttons in the toolbar above the document area.

5 ● Click the *Untitled document* area at the top left, and you will be prompted to enter a name for the document.

6 ● Close the *browser* tab (or window) in order to close the document.

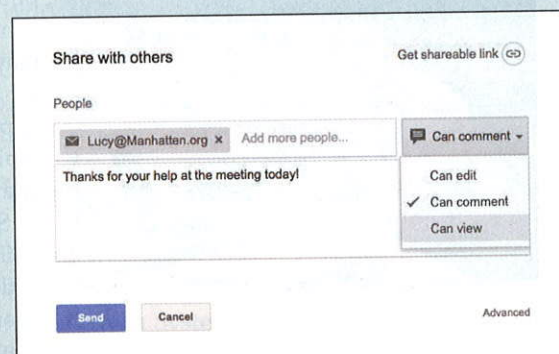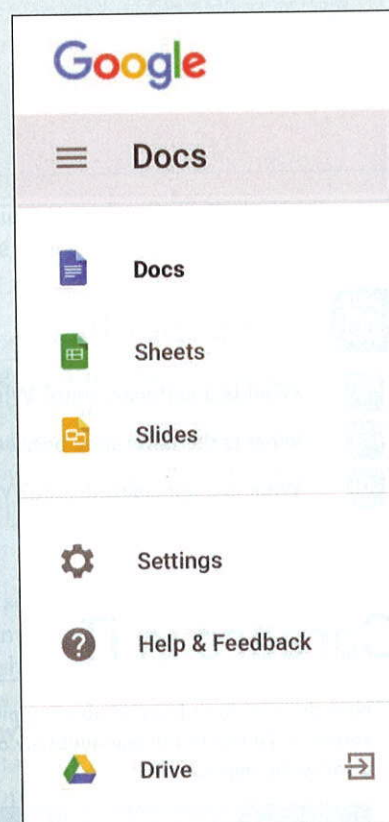You may have noticed that there is no save option. This is because your document is automatically being saved as you work on it.

Sharing a Document   Any document that you create can be shared with one or more individuals. Those individuals can be granted read-only access, or they could be allowed to edit the document, even at the same time that you are working on it. To share a document:

1 ● With the document open, click the *Share* button at the top right.

2 ● Type in the e-mail addresses of those with whom you wish to share the document.

3 ● To the right of this text box, select the permission these individuals will have for the document.

4 ● Click the *Done* button to finish.

Google

≡ Docs

■ Docs
■ Sheets
■ Slides
⚙ Settings
? Help & Feedback
▲ Drive

Share with others   Get shareable link ⊖

People

✉ Lucy@Manhatten.org ✕   Add more people...   💬 Can comment ▾

Thanks for your help at the meeting today!   ✓ Can edit
                                                    Can comment
                                                    Can view

Send   Cancel   Advanced

A LOOK TO THE FUTURE

Next-Generation User Interfaces

Have you ever given a presentation and wished you could interact with the whiteboard like a computer screen? Wouldn't it be great to be able to have a digital whiteboard with different pens for collaborating on projects? The traditional mouse and keyboard work great for interacting with a computer, but sometimes it would be nice to have more options. Recently, touch screens and voice recognition offer new ways to interface. In the future, larger touch screens that can identify different users will allow for multiple people to work on the same screen, and recent innovations in video capture technology may have computers leaving the desktop and entering the yoga studio. Technology has been making better interfaces, and will continue to evolve to improve our lives as we look to the future.

There are several challenges with designing interfaces. First is the simple fact that individuals have varying preferences. Some might prefer to interact with a friend through text messages, while others prefer voice communication. Therefore, it is doubtful that a single interface will become dominant. The second challenge is ergonomic in nature; that is, it must be comfortable to use.

Since tablets and smartphones have touch-screen interfaces, many people believe that all home and business computers will eventually have them too. In futuristic movies individuals use both hands to interact with a large screen. Such a setup allows a person to interact with multiple objects at the same time. The only problem with a multi-touch, multi-gesture screen is that it is not comfortable to extend our arms for prolonged periods. Knowing this, many companies are looking toward large, interactive surfaces that perform the same function while lying flat on a desk. Microsoft has already developed a product called "PixelSense" that acts like a large, interactive table. It responds to both human interactions and objects that are placed on top of it. Although costs prevent it from replacing the desktop of today, the strain on a person's neck from looking down could prevent it from being used for long periods of time.

The ideal use of PixelSense appears to be activities involving collaboration and teamwork. Voice recognition is another form of input that is already available, but much improvement is needed. Computers are becoming better at following specific voice commands, but they cannot engage in everyday conversation or follow complex requests. Researchers in the field of artificial intelligence are working to improve natural language processing to help computers understand our writing and speech. When that is fully developed, you will be able to speak to your computer in the same way you would speak to another person.

Both cameras and software are becoming sophisticated enough to observe and interpret our movements and gestures. The "Kinect" system for the Xbox One has the ability to use body movements to interact with various games and fitness programs, including ones that analyze and correct form during yoga routines. Researchers at MIT are also working with cameras that can observe our gestures and the physical objects we interact with in order to communicate with a computer. In the future, computers could become so attuned to our emotions and expressions that they will be able to see our frustration with the current operation and take various corrective actions to relieve that frustration.

The next step in computer interaction may be something called "Augmented Reality." Microsoft HoloLens offers glasses that you can see through but can also act as a monitor that can overlay text and images onto the real world. Through the HoloLens, and sophisticated body tracking cameras, your real world may become populated with virtual assistants, digital notes, and interactive how-to manuals.

Which type of interface do you currently enjoy using the most? Do you think that touch-screen interfaces will replace keyboards? Do you believe augmented reality will become the keyboard and mouse of the future?

VISUAL SUMMARY   Application Software
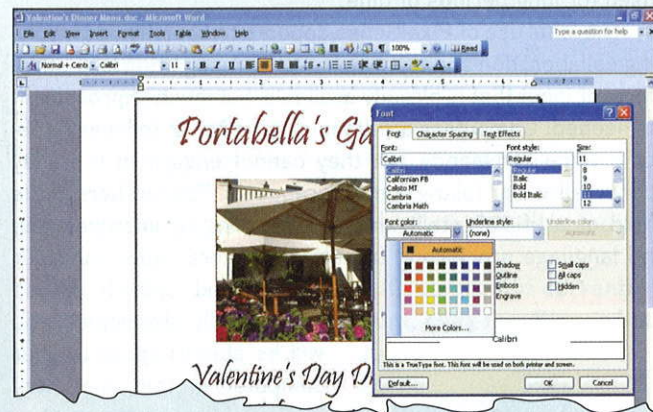
APPLICATION SOFTWARE

The three categories of application software are **general purpose**, **specialized**, and **mobile**.

User Interface

You control and interact with a program using a **user interface**. A **graphical user interface (GUI)** uses **icons** selected by a mouse-controlled **pointer**. A **window** contains a document, program, or message. Software programs with a traditional GUI have

- **Menus**—present commands listed on the **menu bar**.
- **Toolbars**—contain **buttons** for quick access to commonly used commands.
- **Dialog box**—provides additional information or requests user input.

Software programs with a **Ribbon GUI** have

- **Ribbons**—replace menus and toolbars.
- **Tabs**—divide ribbons into **groups. Contextual tabs** automatically appear when needed.
- **Galleries**—graphically display alternatives before they are selected.

Common Features

Common features include spell checkers, alignment, fonts and font sizes, character effects, and edit options.

GENERAL-PURPOSE APPLICATIONS

General-purpose applications include word processors, spreadsheets, presentation graphics, and database management systems.

Word Processors

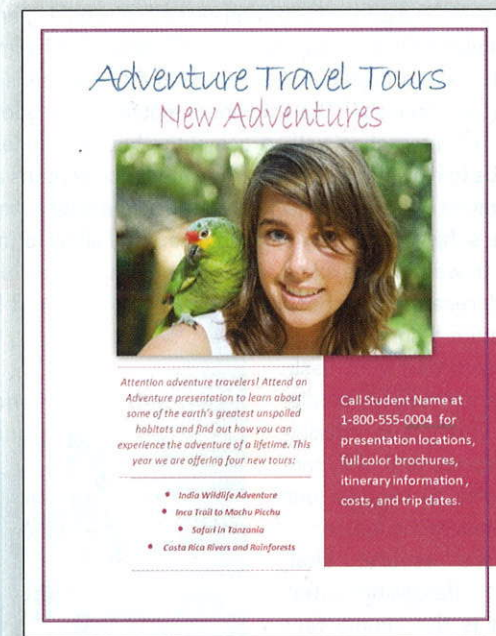**Word processors** create text-based documents. Individuals and organizations use word processors to create memos, letters, and faxes. Organizations also create newsletters, manuals, and brochures to provide information to their customers. Microsoft Word is the most widely used word processor. Others include Apple Pages, Google Docs, Corel WordPerfect, and OpenOffice Writer.

Spreadsheets

Spreadsheets organize, analyze, and graph numeric data such as budgets and financial reports. They are widely used by nearly every profession. Microsoft Excel is the most widely used spreadsheet program. Others include Apple Numbers, Corel Quattro Pro, Google Sheets, and OpenOffice Calc.

To efficiently and effectively use computers, you need to understand the capabilities of general-purpose and specialized application software. Additionally, you need to know about mobile applications and software suites.

GENERAL-PURPOSE APPLICATIONS
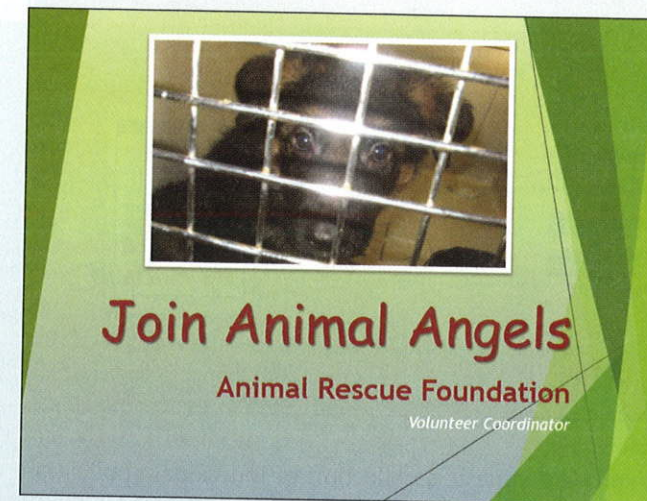
Presentation Graphics

Presentation graphics are programs that combine a variety of visual objects to create attractive, visually interesting presentations. They are excellent tools to communicate a message and to persuade people. People in a variety of settings and situations use presentation graphics programs to make their presentations more interesting and professional. Six of the most widely used presentation graphics programs are Microsoft PowerPoint, Apple Keynote, Google Slides, Corel Presentations, OpenOffice Impress, and Prezi.

Database Management Systems

A **database** is a collection of related data. A **database management system (DBMS)** or **database manager** is a program that structures a database. It provides tools to enter, edit, and retrieve data from the database. Organizations use databases for many purposes including maintaining employee records. Four widely used database management systems designed for personal computers are Microsoft Access, Apple FileMaker, Google Obvibase, and OpenOffice Base.

SPECIALIZED APPLICATIONS

Specialized applications are widely used within specific professions. They include graphics programs, video game design software, and web authoring programs.

Graphics Programs

Graphics programs are used by graphic arts professionals.

- **Desktop publishing programs (page layout programs)** mix text and graphics to create professional-quality publications.
- **Image editors (photo editors)** edit digital photographs consisting of thousands of dots or **pixels** that form **bitmap** or **raster** images.
- **Illustration programs (drawing programs)** create and edit vector images. **Vector images (vector illustrations)** use geometric shapes.
- **Video editors** edit video to enhance quality and appearance.

Video Game Design Software

Video game design software helps to organize thoughts and guide users through the game design process including character development and environmental design.

Web Authoring Programs

Web authoring is the process of creating a website. Individuals create online diaries called **blogs**. **Web authoring programs (web page editors, HTML editors)** create sophisticated commercial websites. Some are **WYSIWYG (what you see is what you get)** editors.

MOBILE APPS
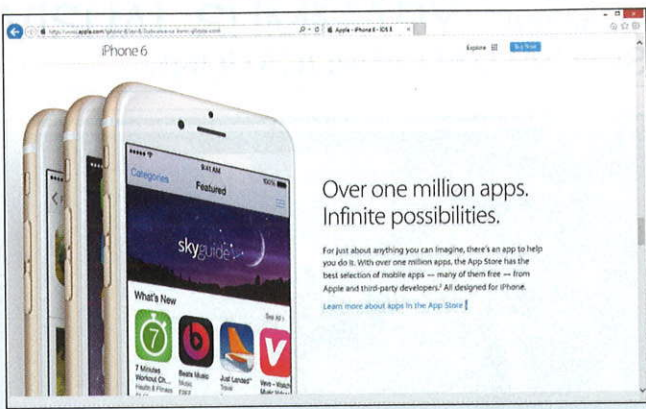
Mobile apps (mobile applications, apps) are add-on programs for a variety of mobile devices. Traditional applications include address books, to-do lists, alarms, and message lists. Recently, mobile capabilities have exploded.

Apps

Popular apps include those for music, videos, social networking, shopping, and game playing.

- Pandora and Spotify provide popular music apps.
- YouTube and Netflix provide streaming videos apps.
- Facebook and Instagram provide social networking apps.
- Crossy Road and Dragon Quest V are popular game playing apps. Crossy Road includes in-app optional purchases including the ability to purchase additional characters. Dragon Quest V is a **role playing game (RPG)** where gamers create their own villages, fight off intruders, and form alliances with millions of other players online.

App Stores

An **app store** is typically a website that provides access to specific mobile apps that can be downloaded either for a nominal fee or free of charge. Two of the best-known stores are Apple's App Store and Google Play. Most of the best-known app stores specialize in applications for a particular line of mobile device, other less well-known stores provide apps for a wide variety of mobile devices.

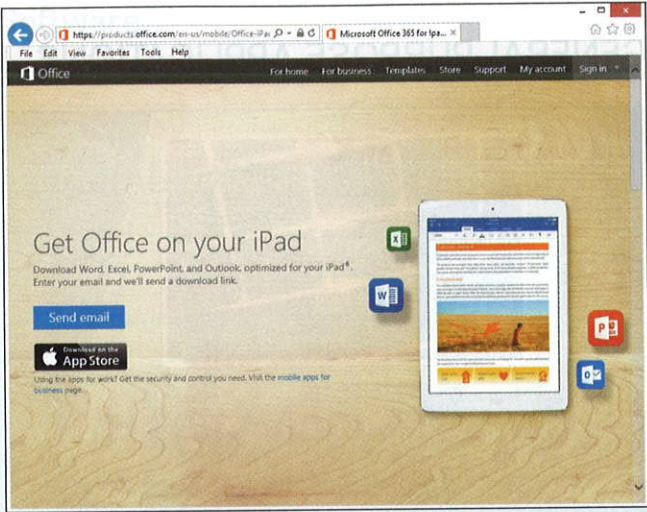| App Store	Focus	Site
Apple App Store	Apple devices	www.apple.com/itunes/charts
Google Play	Android devices	play.google.com/store/apps
Appszoom	Android and Apple devices	www.appszoom.com

SOFTWARE SUITES

A **software suite** is a collection of individual application packages sold together.

- **Office suites (office software suites** or **productivity suites)** contain professional-grade application programs.
- **Cloud suites (online office suites)** are stored on servers and available through the Internet.
- **Specialized suites** focus on specific applications such as graphics.
- **Utility suites** include a variety of programs designed to make computing easier and safer.

CAREERS IN IT

Software engineers analyze users' needs and create application software. A bachelor's or advanced specialized associate's degree in computer science or information systems and extensive knowledge of computers and technology are required. Salary range is $55,000 to $71,000.

KEY TERMS

app (74)
application software (62)
app store (75)
bitmap (72)
blog (73)
button (62)
cloud suite (76)
contextual tab (63)
database (70)
database management system (DBMS) (70)
database manager (70)
desktop publishing program (70)
dialog box (62)
document (64)
drawing program (72)
gallery (64)
general-purpose application (62)
graphical user interface (GUI) (62)
group (63)
HTML editor (73)
icon (62)
illustration program (72)
image editor (72)
menu (62)
menu bar (62)
mobile app (62, 74)
mobile application (74)
office software suite (76)
office suite (76)
online office suite (76)
page layout program (70)

photo editor (72)
pixel (72)
pointer (62)
presentation graphics (69)
productivity suite (76)
raster (72)
ribbon (63)
Ribbon GUI (63)
role playing game (RPG) (75)
software engineer (77)
software suite (76)
specialized application (62)
specialized suite (76)
spreadsheet (67)
system software (62)
tab (63)
toolbar (62)
user interface (62)
utility suite (76)
video editor (72)
video game design software (73)
vector illustration (72)
vector image (72)
web authoring (73)
web authoring program (73)
web page editor (73)
window (62)
word processor (64)
WYSIWYG (what you see is what you get) editor (73)

MULTIPLE CHOICE

Circle the correct answer.

1. This type of software works with end users, application software, and computer hardware to handle the majority of technical details.
   a. application
   b. specialized
   c. system
   d. utility

2. A rectangular area that can contain a document, program, or message.
   a. dialog box
   b. form
   c. frame
   d. window

3. Programs that create text-based documents.
   a. DBMS
   b. suites
   c. spreadsheets
   d. word processors

4. Programs that organize, analyze, and graph numerical data such as budgets and financial reports.
   a. DBMS
   b. suites
   c. spreadsheets
   d. word processors

5. Program that allows you to mix text and graphics to create publications of professional quality.
   a. database
   b. desktop publishing
   c. presentation
   d. productivity

6. The type of image that consists of geometric shapes.
   a. bitmap
   b. raster
   c. ribbon
   d. vector

7. An online diary or commentary.
   a. bitmap
   b. blog
   c. HTML
   d. vector

8. Programs that combine a variety of visual objects to create attractive, visually interesting presentations.
   a. DBMS
   b. presentation graphics
   c. spreadsheet
   d. word processor

9. Programs typically used to create sophisticated commercial websites.
   a. game design programs
   b. illustration programs
   c. video editors
   d. web authoring programs

10. Also known as an online suite.
    a. cloud
    b. integrated
    c. office
    d. utility

MATCHING

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

a. buttons
b. cloud
c. database
d. galleries
e. image editor
f. pixels
g. spreadsheet
h. store
i. utility
j. word processor

____ 1. Toolbars typically appear below the menu bar and include small graphic elements called _____.

____ 2. Simplifies the process of making a selection from a list of alternatives by graphically displaying the effect of alternatives before being selected.

____ 3. A general-purpose program that creates text-based documents.

____ 4. Program that organizes, analyzes, and graphs numerical data.

____ 5. A collection of related data.

____ 6. Also known as a photo editor, this specialized graphics program edits or modifies digital photographs.

____ 7. Image editors create images made up of thousands of dots known as _____.

____ 8. A website that provides access to specific mobile apps is known as an app _____.

____ 9. A type of suite that is stored at a server on the Internet and is available anywhere you can access the Internet.

____ 10. A type of specialized suite that includes a variety of programs designed to make computing easier and safer.

OPEN-ENDED

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

1. Explain the difference between general-purpose and specialized applications. Also discuss the common features of application programs, including those with traditional and ribbon graphical user interfaces.

2. Discuss general-purpose applications, including word processors, spreadsheets, database management systems, and presentation graphics.

3. Discuss specialized applications, including graphics programs, video game design software, web authoring programs, and other professional specialized applications.

4. Describe mobile apps, including popular apps and app stores.

5. Describe software suites, including office suites, cloud suites, specialized suites, and utility suites.

DISCUSSION

Respond to each of the following questions.

① Making IT Work for You: GOOGLE DOCS

Would you like to try free alternatives to traditional office software suites? Review the Making IT Work for You: Google Docs on page 78, and then respond to the following: (a) Do you currently use Google Docs? If so, what types of documents do you typically create? If not, then list some possible benefits Google Docs could provide. (b) Do you share documents and/or collaborate with others? How do you do it? If you have used Google Docs, describe how you would share documents. (c) Using a search engine or your own research, list a few differences between Google Docs and Microsoft Office Web Apps. Which one do you prefer? Why?

② Privacy: SMARTPHONE TRACKING

If you have a smartphone, then it is likely that your movements are recorded and stored. Review the Privacy box on page 75, and respond to the following: (a) Do you think that smartphone tracking is a violation of your privacy? If yes, what can be done? If no, explain your position. (b) Does a company that tracks your movements have the right to sell this information to other companies? Would your opinion change if the company sells your location information but does not reveal your identity? State and defend your position. (c) Does the government have the right to subpoena GPS information from an app maker? Why or why not? (d) Are there any circumstances in which it would be acceptable/justifiable for a company to reveal location data to the government or another company? If so, give some examples.

③ Ethics: IMAGE EDITING

Various image and video editing applications have made it easy for both professionals and amateurs to alter photographs and videos. Some of these edits raise ethical concerns when they are used inappropriately. Review the Ethics box on page 72. Research examples of digital photo or video editing that have resulted in controversy, and then respond to the following: (a) Do you see any ethical issues related to altering photographs or videos? (b) What do you consider the boundary to be between acceptable editing and deceptive or misleading practices? (c) How does such editing affect courtrooms where visual evidence is often presented? (d) Do you feel the old saying "seeing is believing" needs to be reconsidered for the digital age? Defend your answers.

④ Environment: APPS

Did you know that using mobile devices and apps can benefit the environment? Review the Environment box on page 74, and then respond to the following: (a) In what ways are mobile devices helping the environment? (b) Do you currently read any books on mobile devices? If so, list a few of your most recent ones. If you do not, name three of your traditional textbooks that are available as e-books. (c) List and briefly describe three apps that allow you to take notes on your mobile device. If you do not own a mobile device, research these apps for any mobile operating system. (d) Is it possible that mobile devices could actually be worse for the environment? Discuss your response.

PHOTO CREDITS

System Software

```
eTransaction = new Struct
function deleteRegisterAssistance($nIdBenefit,$oTransaction,$s
$oRegisterAssistanceBD = $this->startRegisterAssistanceBD($sBan
$bResult = $oRegisterAssistanceBD->delete($nIdBenefit);
if($bResult) {

$oStructureTransaction = new StructureTransactionBD();

function
startDataAssistance($nIdBenefit,$nSubsidized,$nSystemUserPercent
UserPercentage,$sObs){
$oDataAssistance=new
DataAssistance($nIdBenefit,$nSubsidized,$nSystemUserPercentage,$n
Percentage,$sObs);
return $oDataAssistance;
}
stance = new
$oDataAssistanceBD = $this->startDataAssistanceBD($sBank);
($nIdBenefit,$nSubsidiz
stance($nIdBenefit,$sBank);
ger,$sObs)
function RecoverDataAssistance($nIdBenefit,$sBank) {
$oDataAssistanceBD = $this->startDataAssistanceBD($sBank);
$oDataAssistance,
$voObject = array();
$voObject = $oDataAssistanceBD->RecoverAll();
return $voObject;
}
function RecoverAllDataAssistance($sBank) {
oDataAssistance,
function actualDataAssistance($nIdBenefit,$sBank){
$oDataAssistanceBD = $this->startDataAssistanceBD($sBank);
$bResult = $oDataAssistanceBD->actual($nIdBenefit);
return $bResult;
}
function insertDataAssistance($oDataAssistance,$sBank){
n RecoverDataAssistance($oDataAssistance,$sBank) {
return $nId;
function insertDataAssistance($nIdBen
AssistanceBD = $this->startDataA
stance = $oDataAssistance($oTransaction,$sBank) {
Assistance = $oDataAssistance($oDataAssistance,$sTransaction,$sBank){
$oDataAss               stance,$oTransaction,$sBank);
function changeDataAssistance()->getIdBenefit(),$sBank){
$s-Resul                          $oDataAssistance->getSubsidized
if($oAssistenciaTemp->getSystemUserPercentage() !=
$oDataAssistance
if($oAssistenciaTemp->getSystemUserPer
$oDataAssistance
AllDataAssistance($sBank)
eBD $oDataAssistanceBD    $this->startDataAss
($bchange){
tructure transaction = new StructureTransaction($oTransaction,$sBank))
$bResult)
ataAssistanceBD->RecoverA
ray()
Object = $oDa
bchange)
rue;
function startSafeLifeBD($sBank){
SafeLifeBD = new SafeLifeBD;
stance($nIdBenefit
stance $oSafeLifeBD;              startDataAss
```
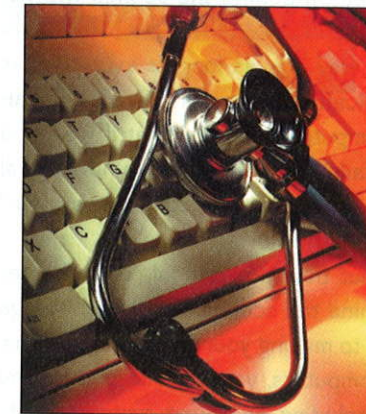
Why should I read this chapter?

Someday soon, your computer will be able to automatically diagnose and repair problems, much like your body's immune system. For now, however, your electronics are at risk from dangerous viruses and software failures.

This chapter covers the things you need to know to protect your computer and data today and to prepare you for tomorrow, including:

- Desktop operating systems—discover how operating systems control and protect desktop and laptop computers.
- Mobile operating systems—learn the key features of the operating systems that control tablets and cell phones.
- Utilities—protect your computer from viruses and perform important maintenance tasks.

Learning Objectives

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

1 Describe the differences between system software and application software.

2 Identify the four types of system software programs.

3 Explain the basic functions, features, and categories of operating systems.

4 Compare mobile operating systems, including iOS, Android, and Windows Phone.

5 Compare desktop operating systems, including Windows, Mac OS, UNIX, Linux, and virtualization.

6 Explain the purpose of utilities and utility suites.

7 Identify the four most essential utilities.

8 Describe Windows utility programs.

Introduction

When most people think about computers, they think about surfing the web, writing papers, e-mailing friends, chatting online, making presentations, and any number of other valuable applications. We typically think about applications and application software. Computers and computer applications have become a part of the fabric of our everyday lives. Most of us agree that they are great . . . as long as they are working.

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

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

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

System Software

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

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

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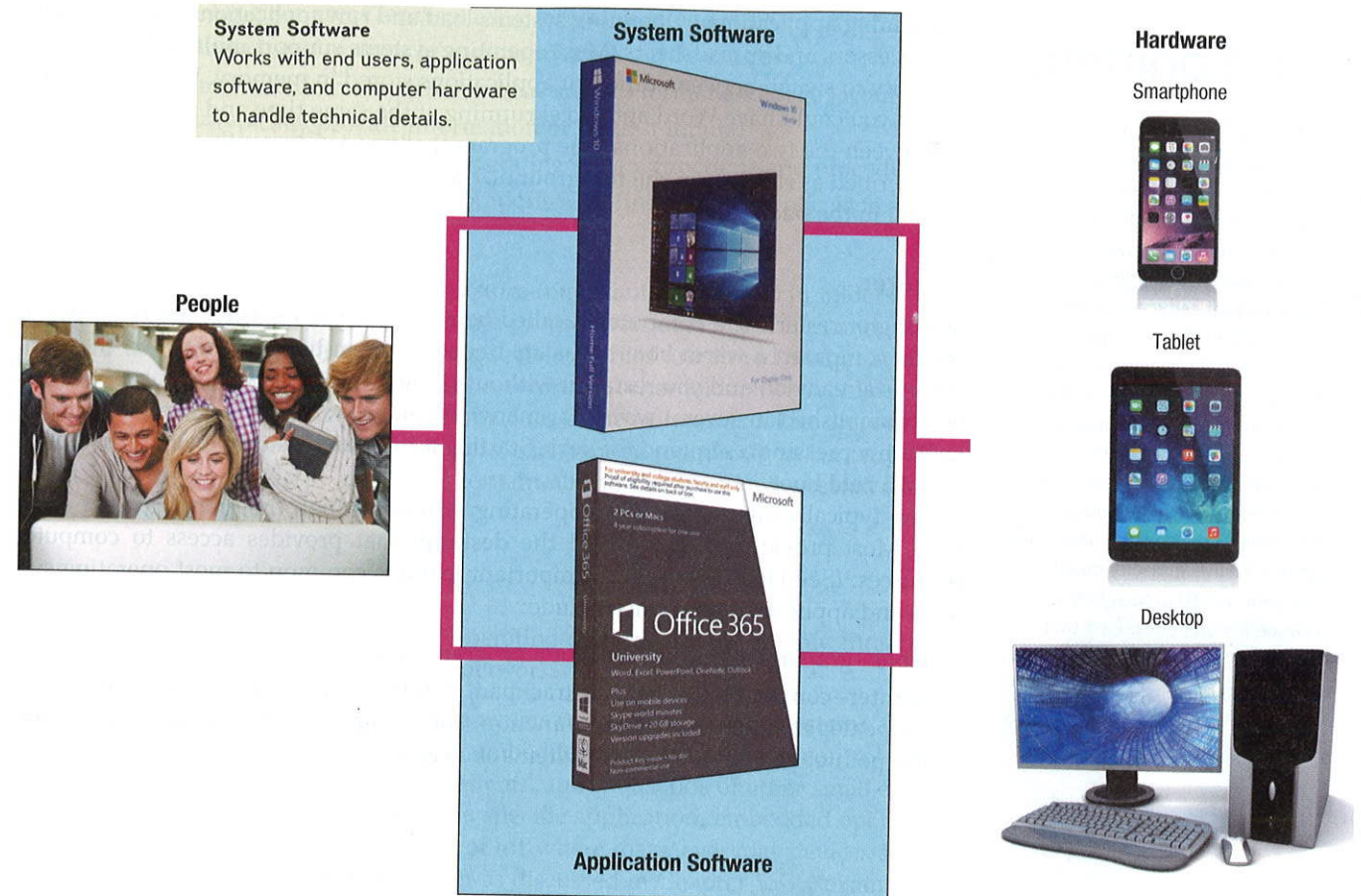

System Software
Works with end users, application software, and computer hardware to handle technical details.

Figure 4-1 **System software handles technical details**

Operating Systems

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

Functions

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

- **Managing resources:** Operating systems coordinate all the computer's resources including memory, processing, storage, and devices such as printers and monitors. They also monitor system performance, schedule tasks, provide security, and start up the computer.
- **Providing user interface:** Operating systems allow users to interact with application programs and computer hardware through a **user interface.** Originally, operating systems used a character-based interface in which users communicated with the operating system through written commands such as "Copy A: report.txt C:". Today, most operating systems use a **graphical user interface (GUI).** As we discussed in Chapter 3, a graphical user interface uses graphical elements such as icons and windows. A new feature available with many operating systems is voice recognition. This allows users to interact with voice commands.

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

Features

Starting or restarting a computer is called **booting** the system. There are two ways to boot a computer: a warm boot and a cold boot. A **warm boot** occurs when the computer is already on and you restart it without turning off the power. A warm boot can be accomplished in several ways. For many computer systems, they can be restarted by simply pressing a sequence of keys. Starting a computer that has been turned off is called a **cold boot.**

You typically interact with the operating system through the graphical user interface. Most provide a place, called the **desktop,** that provides access to computer resources. (See Figure 4-2.) Some important features common to most operating systems and application programs include:

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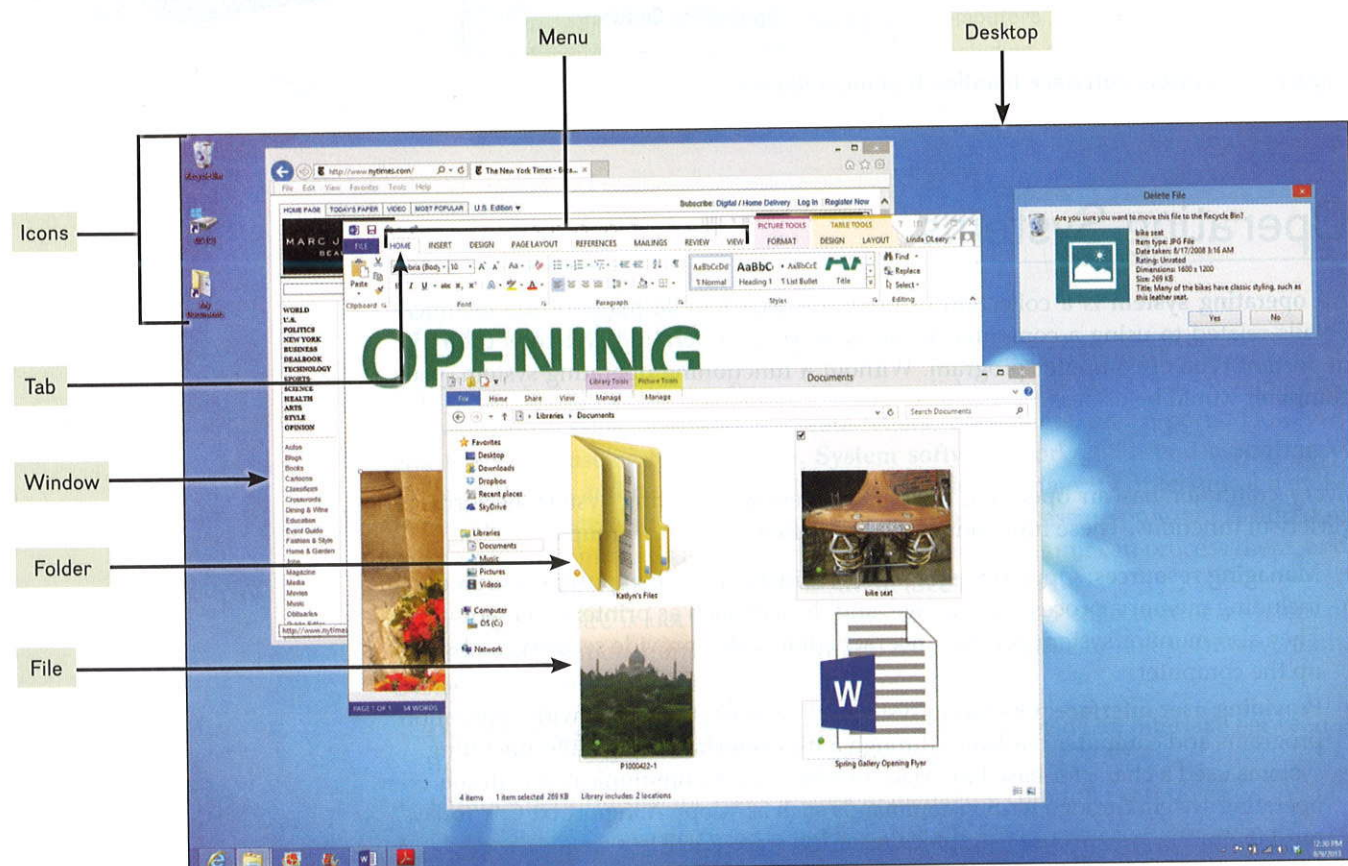

Figure 4-2 **Desktop**

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

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

Categories

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

- **Embedded operating systems,** also known as **real-time operating systems** and **RTOS,** are entirely stored within (i.e., embedded in) a device. They control smartwatches, smartphones, video game systems, and thousands of other small electronic devices. Typically designed for a specific application, embedded operating systems are essential in the evolution of IoT where many everyday devices are able to communicate with one another as discussed in Chapter 1. For example, Watch OS was developed by Apple exclusively for the Apple Watch and Pebble OS was developed by Pebble Technology specifically for the Pebble Smartwatch. (See Figure 4-3.)

- **Stand-alone operating systems,** also called **desktop operating systems,** control a single desktop or laptop computer. (See Figure 4-4.) These operating systems are located on the computer's hard disk. Often desktop computers and laptops are part of a network. In these cases, the desktop operating system works with the network to share and coordinate resources.

- **Network operating systems (NOS)** are used to control and coordinate computers that are networked or linked together. Many networks are small and connect only a limited number of personal computers. Other networks, like those at colleges and universities, are very large and complex. These networks may include other smaller networks and typically connect a variety of different types of computers.

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

Figure 4-3 **Embedded operating systems control smartwatches**

Figure 4-4 **Laptops use stand-alone operating systems**

The operating system is often referred to as the **software environment** or **software platform.** Almost all application programs are designed to run with a specific platform. For example, Apple's iMovie software is designed to run with the Mac OS environment. Many applications, however, have

different versions, each designed to operate with a particular platform. For example, one version of Microsoft Office is designed to operate with Windows. Another version is designed to operate with Mac OS.

concept check

What is system software? What are the four kinds of system software programs?

What is an operating system? Discuss operating system functions and features.

Describe each of the three categories of operating systems.

Mobile Operating Systems

Figure 4-5 Apple's iPad and iPhone use iOS mobile operating system

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

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

- **Android** was introduced in 2007. It was originally developed by Android Inc. and later purchased by Google. Android is widely used in many of today's smartphones.
- **iOS,** formerly known as **iPhone OS,** was originally developed in 2007 by Apple. It is based on Mac OS and is used as the platform for Apple's iPad and iPhone. (See Figure 4-5.)
- **Windows Phone 8** was introduced in 2012 by Microsoft to support a variety of mobile devices, including smartphones. In 2015 Microsoft introduced a new mobile operating system, sometimes referred to as **Windows 10 Mobile** as a replacement for Windows Phone. It has the ability to run many powerful programs designed for desktop and laptop computers.

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

concept check

What is a mobile operating system?

List the most widely used mobile operating systems.

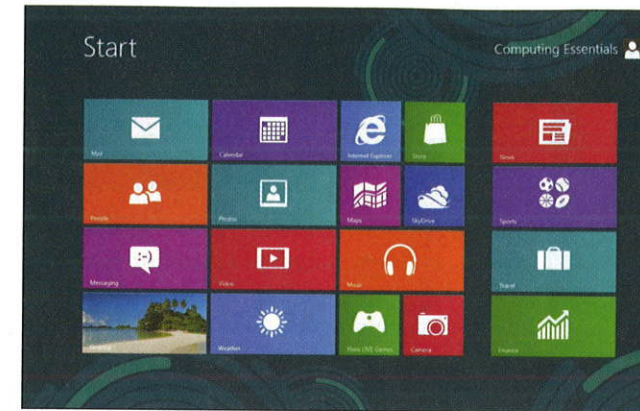Which mobile operating system works with the iPhone? Which mobile operating systems were developed by Microsoft?
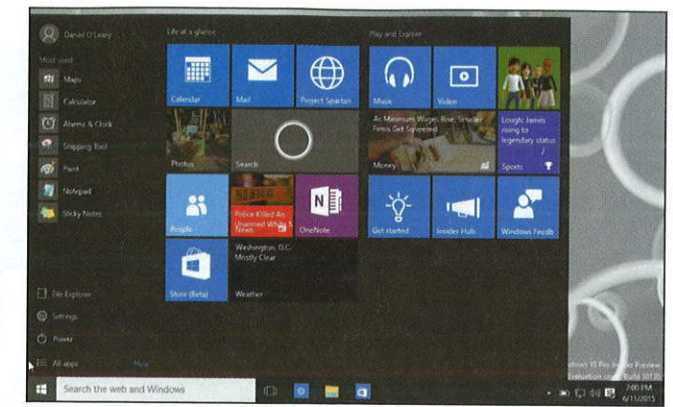

Figure 4-6 Windows 8

Figure 4-7 Windows 10

Desktop Operating Systems

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

Windows

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

The two recent versions are Windows 8 and Windows 10.

- **Windows 8** was released in 2012 and was created to better integrate Microsoft's desktop operating systems with its mobile operating systems. (See Figure 4-6.) It provided support for gestures, cloud integration, and apps. Windows 8 also introduced a new interface. This interface is very similar to the interface for Microsoft's mobile operating system, Windows Phone, and is a dramatic shift from the traditional Windows interface. Windows 8 offers a **start screen** consisting of tiles. Each **tile** displays active content linked to an application. A desktop similar to the traditional Windows desktop can be accessed various ways. **Windows RT** is a version of Windows 8 designed to run with tablets using a particular microprocessor from ARM.
- **Windows 10** was announced in 2015. (See Figure 4-7.) It merges Windows' desktop and mobile operating systems. Unlike previous Windows versions, Windows 10 runs on all Windows devices, including desktops, tablets, and smartphones. This unification has brought several mobile OS innovations to the desktop OS, including **Cortana,** a digital assistant that can accept commands through text or speech, and Windows apps, such as Office, that can run on desktops, tablets, and smartphones. Other innovations include improved gaming with the Xbox gaming environment, a new web browser, and support for Microsoft HoloLens, an augmented reality tool.

Mac OS

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

privacy

What information would you lose if a thief stole your computer or smartphone? If you use your computer or to shop on the Internet, check your bank balance, or read e-mail, then the thief would have access to your credit cards, bank accounts, and personal correspondence. The operating system on your computer or phone can be set up to require a password or secret code whenever the OS starts up. This could prevent a lost or stolen device from providing access to your private information.
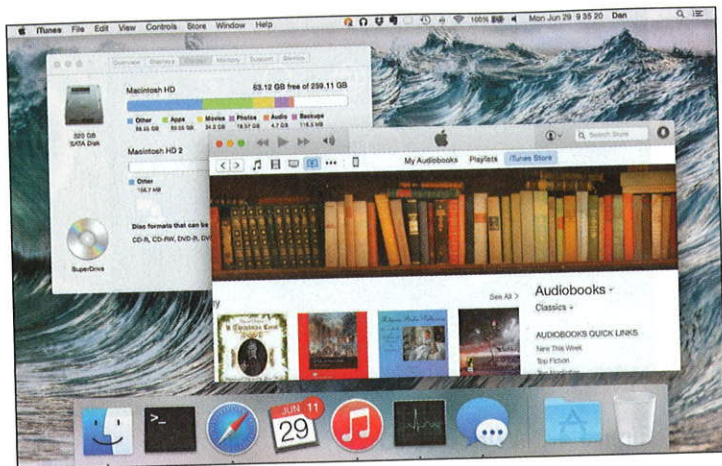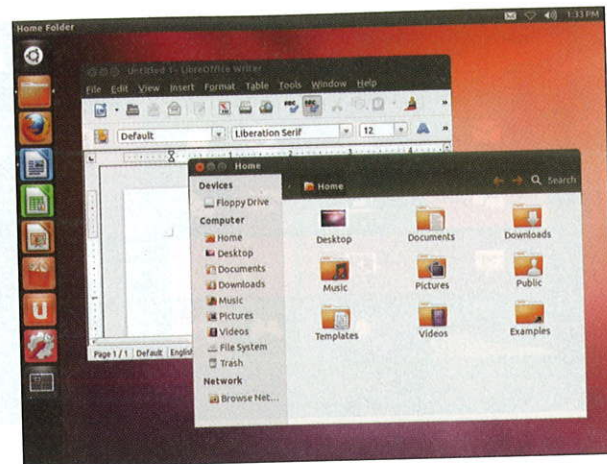
Figure 4-8 Mac OS X Yosemite

Figure 4-9 Linux

Mac OS X is the most widely used Mac desktop operating system. Its two most recent versions are

- **OS X Mavericks,** which was announced in 2013 and introduced several improvements, including better power management for longer laptop battery life, enhanced workflow options for multiple monitor setups, and better integration with cloud computing.
- **OS X Yosemite,** which was released in 2014. (See Figure 4-8.) It provided a new user interface similar to the iOS interface. Other innovations include greater use of Apple's cloud storage service, iCloud, and greater compatibility with Apple mobile devices. This compatibility includes the ability to send and receive text messages and phone calls from Apple's desktop computers and the ability to start e-mails and spreadsheets on one device and finish them on another.

UNIX and Linux

The **UNIX** operating system was originally designed in the late 1960s to run on minicomputers in network environments. Over the years, UNIX has evolved with numerous different versions. Now, it is widely used by servers on the web, mainframe computers, and very powerful personal computers. There are a large number of different versions of UNIX.

Linux is an operating system that extended one of the UNIX versions. It was originally developed by a graduate student at the University of Helsinki, Linus Torvalds, in 1991. He allowed free distribution of the operating system code and encouraged others to modify and further develop the code. Programs released in this way are called **open source.** Linux is a popular and powerful alternative to the Windows operating system. (See Figure 4-9.) Linux has been the basis of several other operating systems. For example, Google's **Chrome OS** is based on Linux.

Chrome OS integrates with web servers to run applications and to perform other traditional operating system functions. This capability has made Chrome OS a popular choice for inexpensive notebook computers that use cloud computing and cloud storage to do things that would normally require much more expensive hardware. One limitation of these computers is that their efficiency is dependent upon the speed of their Internet connection.

Virtualization

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

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

Figure 4-10 OS X Yosemite running Windows 10 in a virtual machine.

☑ **concept check**

What is Windows? What are the two most recent versions?

What is Mac OS? What are Mavericks and Yosemite?

What is UNIX? What is Linux? What is Chrome OS?

Utilities

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

- **Troubleshooting** or **diagnostic programs** that recognize and correct problems, ideally before they become serious. To learn more about using a troubleshooting program, see Making IT Work for You: Mac OS X Activity Monitor on pages 98–99.
- **Antivirus programs** that guard your computer system against viruses or other damaging programs that can invade your computer system. Popular antivirus programs include Norton AntiVirus and Webroot SecureAnywhere AntiVirus.
- **Backup programs** that make copies of files to be used in case the originals are lost or damaged. Windows 10 comes with a free backup program, the File History tool, and Mac OS X has a backup feature named Time Machine.
- **File compression programs** that reduce the size of files so they require less storage space and can be sent more efficiently over the Internet. Most operating systems handle unzipping files automatically when you open a .zip file.

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

MAC OS X ACTIVITY MONITOR

Have you ever been working with a program when it simply stopped working and would not respond to you? Does your computer seem to be getting slower and slower? OS X Activity Monitor, which gives you a live view of every program that is currently in RAM, is designed to help with these and many other operational problems.
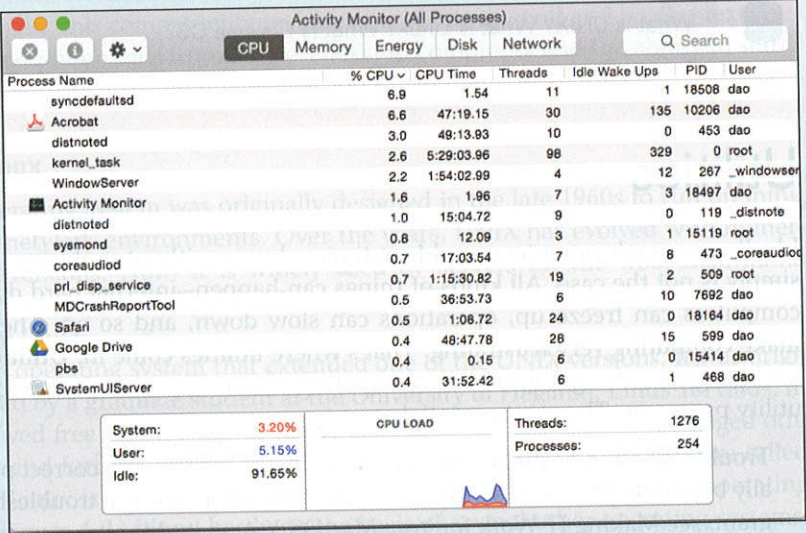
Starting Activity Monitor   You can open Activity Monitor from anywhere by following these steps:

1 • Press and momentarily hold the command key (⌘) + space bar.

2 • Type *Activity Monitor* and press return.

As you can see, the Activity Monitor window provides a list of active programs; more information can be seen about an active program by clicking on the active program in the list and then clicking on the information button (the button with a lowercase "i" in a circle in the upper right of the window). This will open with more information about the process, including the CPU and Memory resources it uses. Click the red x button in the upper right to close this window.

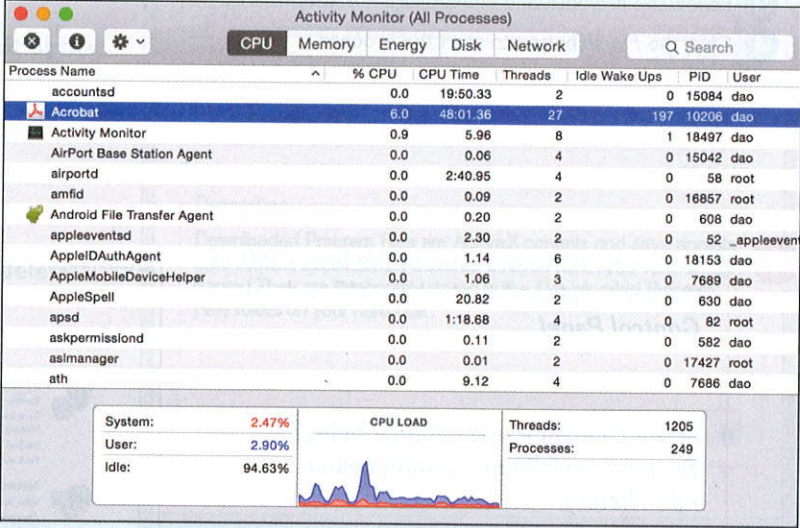**Closing an Application**   Use Activity Monitor when a program you are using becomes stuck and stops responding.

1 • In the menu bar, click *view →* *Windowed Processes*. The Activity Monitor should show only the programs open on the desktop.

2 • In the Activity Monitor window, find the program that is stuck. Next to the program name there should read, "(not responding)" in red.

3 • Select the program and press the button in the upper left of the window with a gray octagon with a white "x" in it. This will force the process to quit.

Process Name	% CPU	CPU Time	Threads	Idle Wake Ups	PID	User
syncdefaultsd	6.9	1.54	11	1	18508	dao
Acrobat	6.6	47:19.15	30	135	10206	dao
distnoted	3.0	49:13.93	10	0	453	dao
kernel_task	2.6	5:29:03.96	98	329	0	root
WindowServer	2.2	1:54:02.99	4	12	267	_windowser
Activity Monitor	1.6	1.96	7	3	18497	dao
distnoted	1.0	15:04.72	9	0	119	_distnote
sysmond	0.8	12.09	3	2	15119	root
coreaudiod	0.7	17:03.54	7	8	473	_coreaudioc
prl_disp_service	0.5	1:15:30.82	19	2	509	root
MDCrashReportTool	0.5	36:53.73	6	10	7692	dao
Safari	0.5	1:08.72	24	0	18164	dao
Google Drive	0.4	48:47.78	28	15	599	dao
pbs	0.4	0.15	6	0	15414	dao
SystemUIServer	0.4	31:52.42	6	1	468	dao

System:	3.20%	CPU LOAD	Threads:	1276
User:	5.15%		Processes:	254
Idle:	91.65%			

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

Viewing Processes   This is the most powerful area of Activity Monitor. Here you will see a list of every process that is currently residing in your computer's RAM.

1 • In the menu bar, click *view → All Processes*. The Activity Monitor should show all processes currently running on your computer.

2 • In the Activity Monitor window, click the button labeled *Memory*. All the processes will be sorted from highest (occupying the most RAM) to the lowest.

3 • Click the *CPU* button. This will show any process that the CPU is currently working on.

Process Name	% CPU	CPU Time	Threads	Idle Wake Ups	PID	User
accountsd	0.0	19:50.33	2	0	15084	dao
Acrobat	6.0	48:01.36	27	197	10206	dao
Activity Monitor	0.9	5.96	8	1	18497	dao
AirPort Base Station Agent	0.0	0.06	4	0	15042	dao
airportd	0.0	2:40.95	4	0	58	root
amfid	0.0	0.09	2	0	16857	root
Android File Transfer Agent	0.0	0.20	2	0	608	dao
appleeventsd	0.0	2.30	2	0	52	_appleeven
AppleIDAuthAgent	0.0	1.14	6	0	18153	dao
AppleMobileDeviceHelper	0.0	1.06	3	0	7689	dao
AppleSpell	0.0	20.82	2	0	630	dao
apsd	0.0	1:18.68	4	0	82	root
askpermissiond	0.0	0.11	2	0	582	dao
aslmanager	0.0	0.01	2	0	17427	root
ath	0.0	9.12	4	0	7686	dao

System:	2.47%	CPU LOAD	Threads:	1205
User:	2.90%		Processes:	249
Idle:	94.63%			

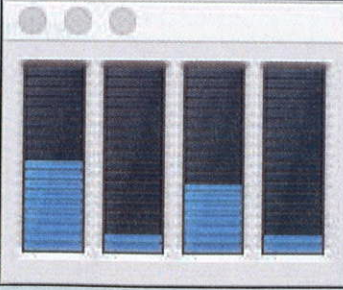It is normal for the numbers to fluctuate, especially those for the CPU.

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

1 • In the Activity Monitor window, click the *Process Name* heading (to avoid the fluctuating positions of each process).

2 • Click the process you want to end.

3 • Select the program and press the button in the upper left of the window with a gray octagon with a white "x" in it. This will force the process to quit.

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

Monitoring CPU History   If you are wondering what you may be doing that is taxing your computer, monitoring your CPU history can give you an idea. The Activity Monitor can open a small window where you can see the CPU load on your computer.

1 • In the menu bar, click *Window* then select *CPU Usage*. A small window will open showing the load on each core in your CPU as a bar chart.

2 • Keeping the CPU window visible, perform an action on your computer to see it impact the CPU load. For example, open a web page or a document.

3 • When you are done viewing the CPU Usage, close the window.

Windows Utilities

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

File History is a utility program included with Windows 10 that makes a copy of all files that are in the libraries, contacts, and favorites and on the desktop. It helps protect you from the effects of a disk failure. For example, you can select *File History* from the Windows 10 System and Security window to create a backup for your hard disk as shown in Figure 4-11.

1 Click the Windows icon in the lower left of the screen, type "control panel," and select *Control Panel.*

In the Control Panel window, select *Systems and Security* and click on *File History.*

Choose the destination for the backup.

Click the *Turn on* button.
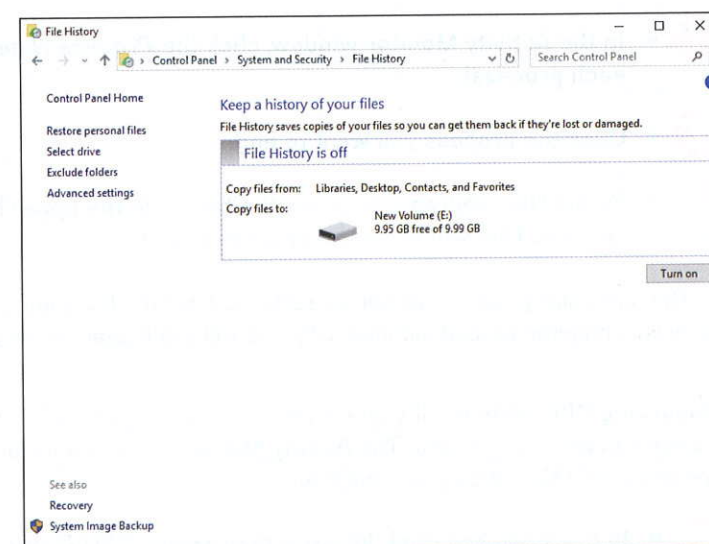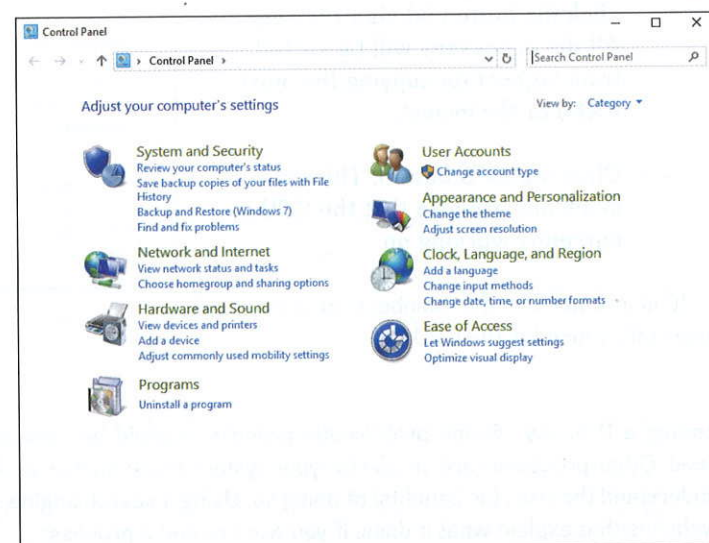
Figure 4-11 File History utility

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

For example, by opening Disk Cleanup from the Windows 10 search results, you can eliminate unneeded files on your hard disk as shown in Figure 4-12.

1 Click the Windows icon in the lower left of the screen, type "disk cleanup," and select *Disk Cleanup.*

Review the files suggested for cleanup, and then click *OK.*

Confirm that you want to permanently delete these files by clicking *Delete Files.*
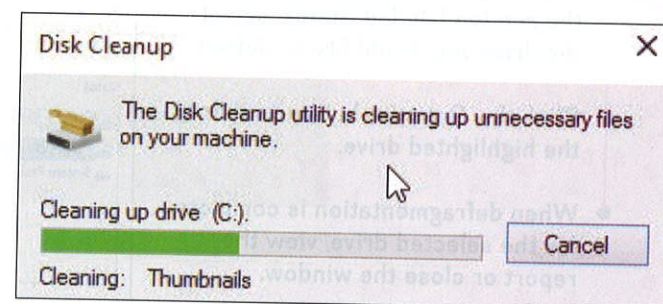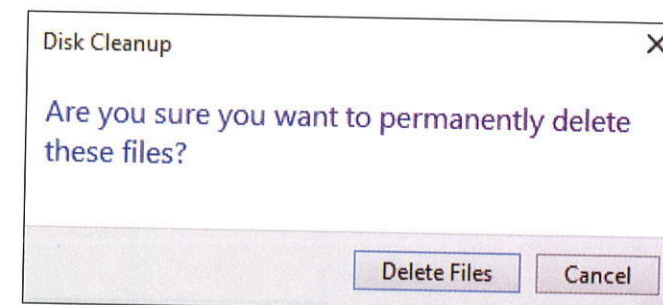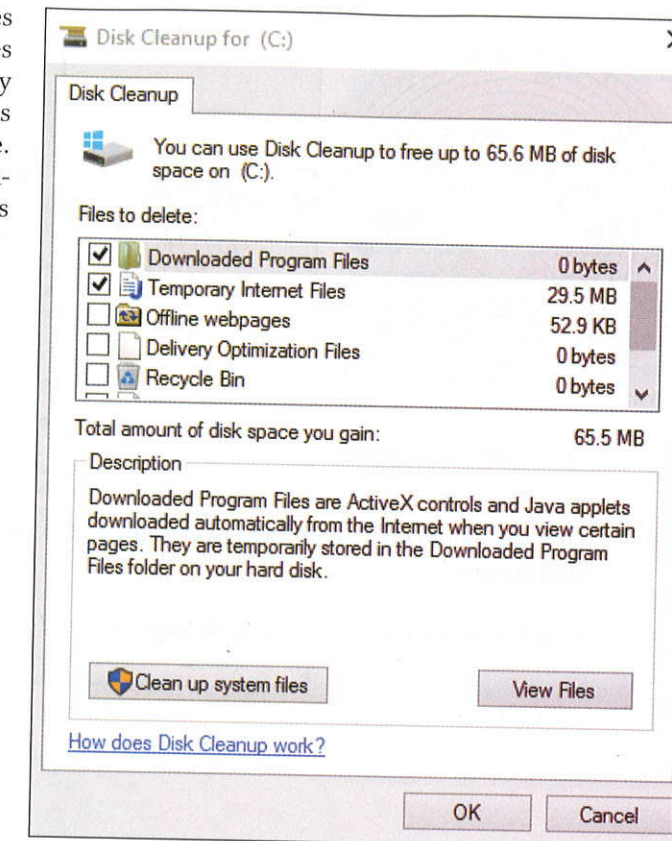
2 The utility cleans the selected files.
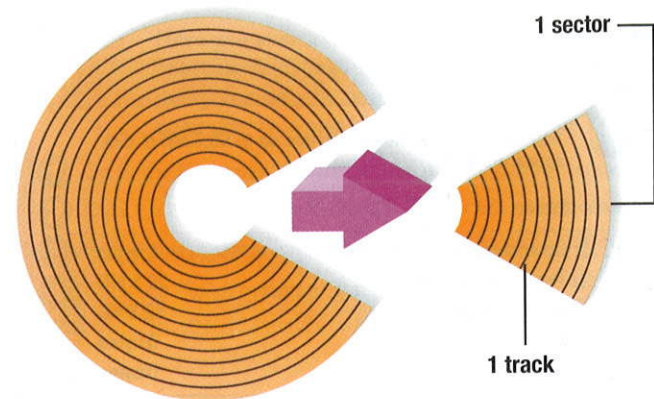
Figure 4-12 Disk Cleanup utility

Figure 4-13 Tracks and sectors

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

Optimize Drives is a utility program that locates and eliminates unnecessary fragments and rearranges files and unused disk space to optimize operations. For example, by selecting Optimize Drives from the Windows 10 search results, you can defrag your hard disk as shown in Figure 4-14.

1 ● Click the Windows icon in the lower right of the screen, type "Defragment".

● From the search results, select *Defragment and optimize your drives.*
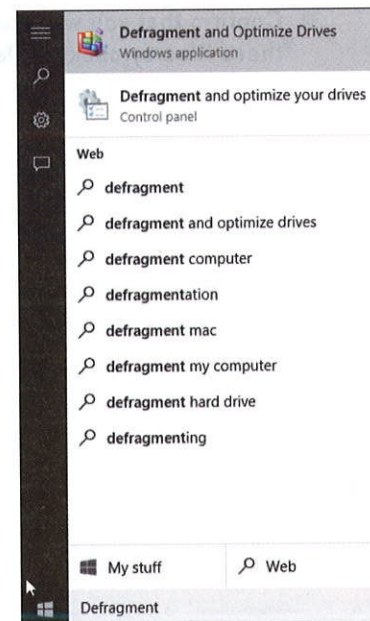
2 ● In the Optimize Drives window, in the section labeled Status, select the drive you would like to defrag.

● Click the *Optimize* button to defrag the highlighted drive.

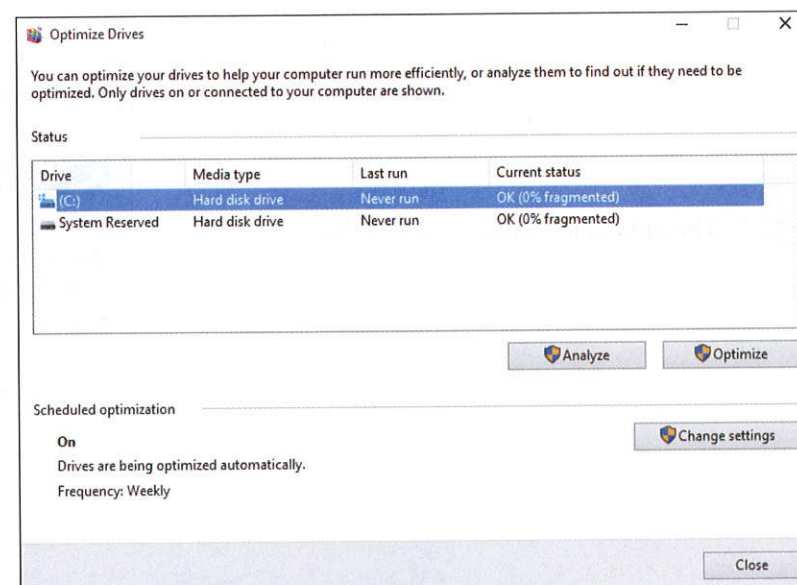● When defragmentation is complete for the selected drive, view the report or close the window.

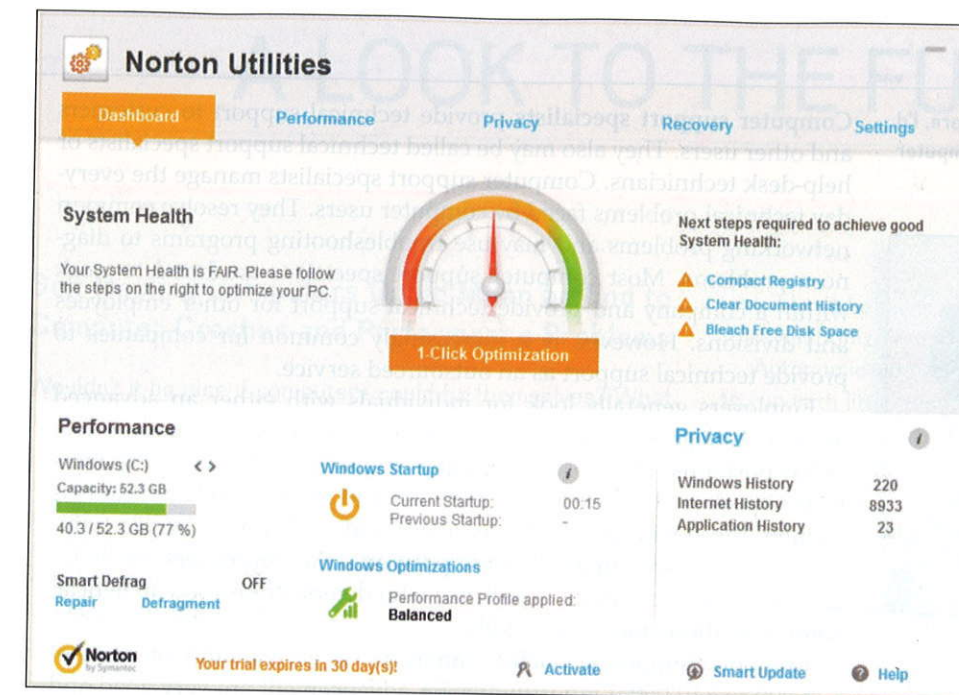**Figure 4-14** Optimize Drives utility

Figure 4-15 Utility suite

Utility Suites

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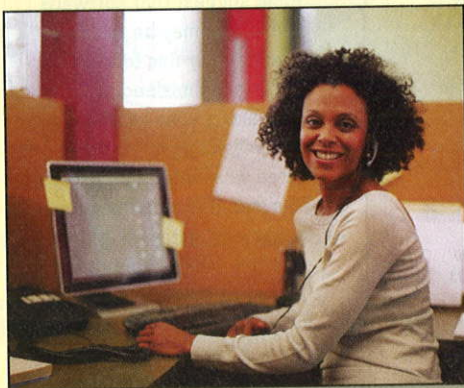
concept check

● Discuss four essential utilities.

● Describe Windows File History, Disk Cleanup, and Optimize Drives.

● What is the difference between a utility and a utility suite?

Careers in IT

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

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

Computer support specialists can expect to earn an annual salary of $29,000 to $40,000. Opportunities for advancement are very good and may involve design and implementation of new systems.

A LOOK TO THE FUTURE

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

Wouldn't it be nice if computers could fix themselves? What if your computer could continually fine-tune its operations to maintain peak performance? Computers often perform performance improvements on a regular schedule, such as disk defragmentation. More recently, improvements in virus protection and eradication can identify and remove viruses before they impact performance. In the future, computers may not only fix software issues, but actually identify hardware problems and route functions around broken hardware. For many people, this sounds too good to be true. Maintenance and troubleshooting tasks like these can be time-consuming and frustrating. Technology has been making better self-fixing computers, and will continue to evolve to improve our lives as we look to the future.

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

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

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

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

It is important to note that autonomic computing is not artificial intelligence because autonomic machines do not have human cognitive abilities or intelligence. Instead, these machines have knowledge of their own systems and the capability to learn from experience to correct errors.

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

System Software

SYSTEM SOFTWARE

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

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

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

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

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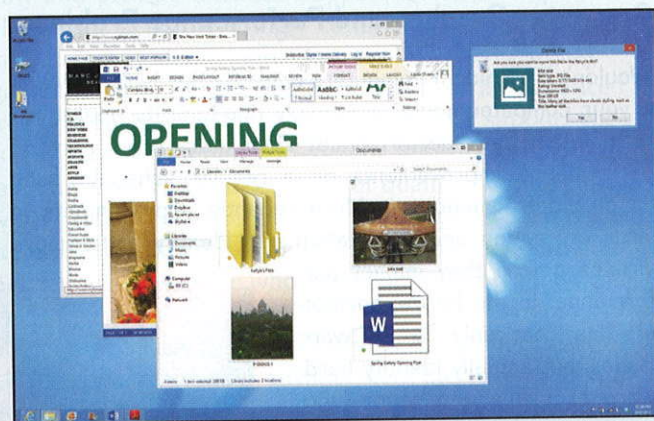
Operating systems (software environments, software platforms) handle technical details.

Functions

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

Features

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

Categories

Three categories of operating systems are

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

Operating systems are often called **software environments** or **software platforms.**

To efficiently and effectively use computers, you need to understand the functionality of system software, including operating systems and utility programs.
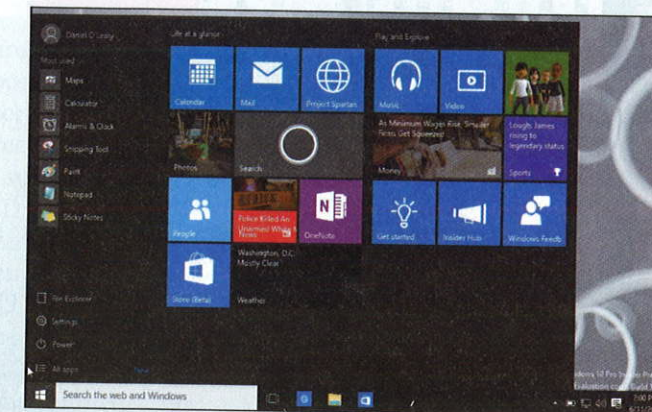
MOBILE OPERATING SYSTEMS

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

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

- **Android** was originally developed by Android Inc. and later purchased by Google. It is a widely used mobile OS.
- **iOS (iPhone OS)** was developed by Apple to support iPhone and iPad.
- **Windows Phone 8** was introduced in 2012 by Microsoft to support a variety of mobile devices, including smartphones. **Windows 10 Mobile** was introduced in 2015 to replace Windows 8. It can run many powerful programs designed for laptop and desktop computers.

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

DESKTOP OPERATING SYSTEMS

Windows

Windows is designed to run with many different microprocessors. The two recent versions are **Windows 8** and **Windows 10.** Windows 10 was introduced in 2015. It merged Windows' desktop and mobile operating systems. Innovations include **Cortana** (accepts commands through text or speech), support for Windows apps on desktops and mobile devices, improved gaming with the Xbox gaming environment, a new web browser, and support for Microsoft HoloLens, an augmented reality tool.

Mac OS

Mac OS, an innovative, powerful, easy-to-use operating system, runs on Macintosh computers. The two most recent versions are **Mavericks** and **Yosemite.** Yosemite was released in 2014. It provided a new user interface similar to the iOS interface. Innovations include greater use of Apple's cloud storage service (iCloud) and greater compatibility with Apple mobile devices. Compatibility includes the ability to send/receive text/phone messages from Apple's desktop computers and the ability to start e-mails/spreadsheets on one device and finish on another.
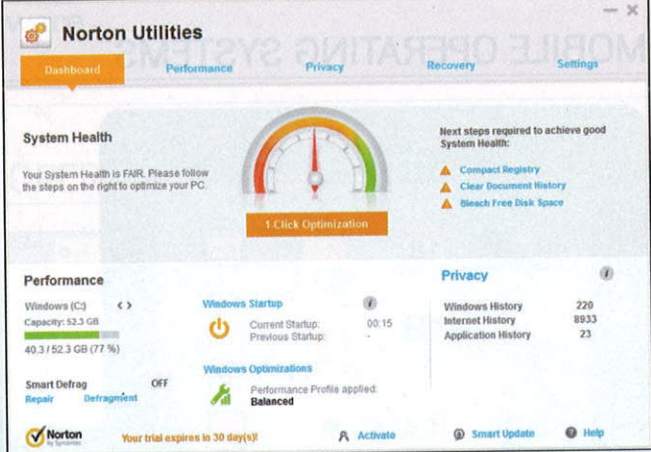
DESKTOP OPERATING SYSTEMS
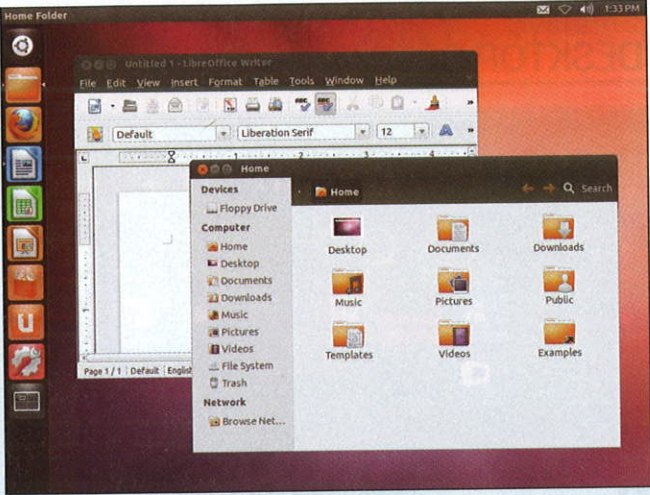
UNIX and Linux

UNIX was originally designed to run on minicomputers in network environments. Now, it is widely used by servers on the web, mainframe computers, and very powerful personal computers. There are many different versions of UNIX. One version, **Linux**, a popular and powerful alternative to the Windows operating system, is **open source** software. Google's **Chrome OS** is based on Linux. It integrates with web servers to run applications and to perform other traditional operating system functions. Chrome OS is a popular choice for inexpensive notebook computers using cloud computing and cloud storage. One limitation of these computers is that their efficiency is dependent upon the speed of their Internet connection.

Virtualization

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


UTILITIES

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

Windows Utilities

Windows operating systems are accompanied by several utility programs, including **File History, Disk Cleanup,** and **Optimize Drives** (eliminates unnecessary **fragments; tracks** are concentric rings; **sectors** are wedge-shaped).

Utility Suites

Utility suites combine several programs into one package. Computer **viruses** are dangerous programs.
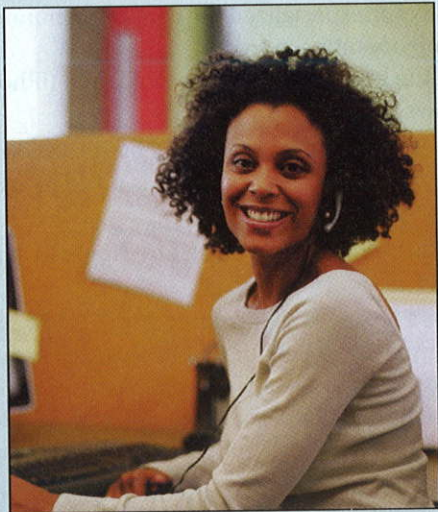
CAREERS in IT

Computer support specialists provide technical support to customers and other users. Degrees in computer science or information systems are preferred plus good analytical and communication skills. Salary range is $29,000 to $40,000.

KEY TERMS

Android   (94)
antivirus program   (97)
background   (92)
backup program   (97)
booting   (92)
Chrome OS   (96)
cold boot   (92)
computer support specialist   (104)
Cortana   (95)
desktop   (92)
desktop operating system   (93)
device driver   (90)
diagnostic program   (97)
dialog box   (93)
Disk Cleanup   (101)
embedded operating system   (93)
file   (93)
file compression program   (97)
File History   (100)
folder   (93)
foreground   (92)
fragmented   (102)
gesture control   (93)
graphical user interface (GUI)   (91)
guest operating system   (97)
Help   (93)
host operating system   (97)
icon   (92)
iOS   (94)
iPhone OS   (94)
language translator   (90)
Linux   (96)
Mac OS   (95)
Mac OS X   (96)
menu   (93)
mobile operating system   (94)
mobile OS   (94)

multitasking   (92)
network operating system (NOS)   (93)
network server   (93)
open source   (96)
operating system   (90, 91)
Optimize Drives   (102)
OS X Mavericks   (96)
OS X Yosemite   (96)
pointer   (92)
real-time operating system (RTOS)   (93)
sector   (102)
software environment   (93)
software platform   (93)
stand-alone operating system   (93)
start screen   (95)
system software   (90)
tab   (93)
tile   (95)
track   (102)
troubleshooting program   (97)
UNIX   (96)
user interface   (91)
utilities   (90, 97)
utility suite   (103)
virtual machine   (97)
virtualization   (97)
virtualization software   (97)
virus   (103)
warm boot   (92)
window   (93, 99)
Windows   (95)
Windows 8   (95)
Windows 10   (95)
Windows 10 Mobile   (94)
Windows Phone 8   (94)
Windows RT   (95)

MULTIPLE CHOICE

Circle the correct answer.

1. What type of software works with users, application software, and computer hardware to handle the majority of technical details?
   - **a.** application
   - **b.** desktop
   - **c.** Linux
   - **d.** system

2. The programs that convert programming instructions written by programmers into a language that computers understand and process are language:
   - **a.** converters
   - **b.** linguists
   - **c.** managers
   - **d.** translators

3. The ability to switch between different applications stored in memory is called:
   - **a.** diversion
   - **b.** multitasking
   - **c.** operational interference
   - **d.** programming

4. Graphic representation for a program, type of file, or function:
   - **a.** app
   - **b.** icon
   - **c.** image
   - **d.** software

5. This operating system feature is controlled by a mouse and changes shape depending on its current function.
   - **a.** dialog box
   - **b.** menu
   - **c.** mouse
   - **d.** pointer

6. The operating system based on Linux, designed for notebook computers that use cloud computing and cloud storage:
   - **a.** Chrome
   - **b.** Mac
   - **c.** UNIX
   - **d.** Windows

7. The mobile operating system developed by Apple and originally called iPhone OS:
   - **a.** Android
   - **b.** iOS
   - **c.** Mac OS
   - **d.** Phone OS

8. A utility program that copies all files in the libraries, contacts, favorites, and on the desktop:
   - **a.** File History
   - **b.** Disk Cleanup
   - **c.** Optimize Drives
   - **d.** Compactor

9. A troubleshooting utility that identifies and eliminates nonessential files, frees up valuable disk space, and improves system performance:
   - **a.** File History
   - **b.** Disk Cleanup
   - **c.** Optimize Drives
   - **d.** Compactor

10. BitDefender, Kaspersky, and Norton are examples of:
   - **a.** application packages
   - **b.** apps
   - **c.** operating systems
   - **d.** utility suites

MATCHING

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

- **a.** Android
- **b.** antivirus
- **c.** driver
- **d.** fragmented
- **e.** multitasking
- **f.** NOS
- **g.** platform
- **h.** utilities
- **i.** virtualization
- **j.** warm boot

___ **1.** Programs that perform specific tasks related to managing computer resources.

___ **2.** Restarting a running computer without turning off the power.

___ **3.** Type of operating system that controls and coordinates networked computers.

___ **4.** An operating system is often referred to as the software environment or software _____.

___ **5.** Switching between different applications.

___ **6.** A type of software that allows a single physical computer to operate as though it were two or more separate and independent computers.

___ **7.** Mobile operating system that is owned by Google and is widely used in many smartphones.

___ **8.** Type of program that guards computer systems from viruses and other damaging programs.

___ **9.** If a file cannot be saved on a single track, it has to be _____.

___ **10.** Program that works with the operating system to allow communication between a device and the rest of a computer system is called a device _____.

OPEN-ENDED

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

1. Describe system software. Discuss each of the four types of system programs.

2. Define operating systems. Describe the basic features and the three categories of operating systems.

3. What are mobile operating systems? Describe the leading mobile operating systems.

4. What are desktop operating systems? Compare Windows, Mac OS, Linux, and Chrome OS. Discuss virtualization.

5. Discuss utilities. What are the most essential utilities? What is a utility suite?

DISCUSSION

Respond to each of the following questions.

1 Making IT Work for You: MAC OS X ACTIVITY MONITOR

Have you ever been working with a program when it simply stopped working and would not respond to you? Review the Making IT Work for You: Mac OS X Activity Monitor on pages 98–99, and open Activity Monitor using a Mac computer. Then respond to the following: (a) List the top three processes in terms of memory usage. (b) List three processes that are using your CPU, even if it is only for a second or two as you look at that dialog box. (c) Find one process that you do not recognize. Using your favorite search engine, determine what the process does. Write down the name of the process, its description or purpose, and the URL of the website you used to research it.

2 Privacy: OPERATING SYSTEM SECURITY

Did you know that your computer or mobile device can provide others access to your personal information? Review the Privacy box on page 95, and respond to the following: (a) Have you ever lost a personal computer or mobile device? If so, what personal information was stored on it? If not, what personal information is stored on your current computer and/or mobile device? (b) Are you doing anything now that would make it difficult for someone to access personal information from your computing devices? If you are, discuss what you are doing. If not, what could/should you be doing? Be specific. (c) Investigate the privacy setting on your devices and describe them. (d) Do you think computer manufacturers have a responsibility to provide better security and privacy features? Why or why not?

3 Ethics: VIRUS PROTECTION SCAMS

Everyone should be concerned about viruses infecting computer systems. Some report that this fear is being used to manipulate users into purchasing new or upgraded antivirus programs. Some even report specific antivirus scams. Review the Ethics box on page 103, and then respond to the following: (a) Have you ever been offered a free virus alert program? If so, describe the offer and whether you accepted the offer. (b) Almost all legitimate antivirus software manufacturers issue new virus alerts. Do you think these alerts are motivated by greed or by good consumer service? Why or why not? (c) Is this an ethical issue for antivirus software manufacturers? If so, create some ethical guidelines for antivirus software manufacturers to follow when issuing virus alerts. (d) What can users do to protect themselves against antivirus scams and against unethical manufacturers of antivirus programs? Be specific and defend your suggestions.

4 Environment: OS POWER MANAGEMENT

Did you know that some operating systems help protect the environment? Review the Environment box on page 92, and then respond to the following: (a) In what ways do operating systems help the environment? (b) Do you leave your desktop or laptop computer on all day? Do you use sleep or hibernate modes? Explain the reasons behind your decision. (c) Find the power management options for your operating system. List a few options that you would consider adjusting in order to reduce your computer's energy consumption.

PHOTO CREDITS