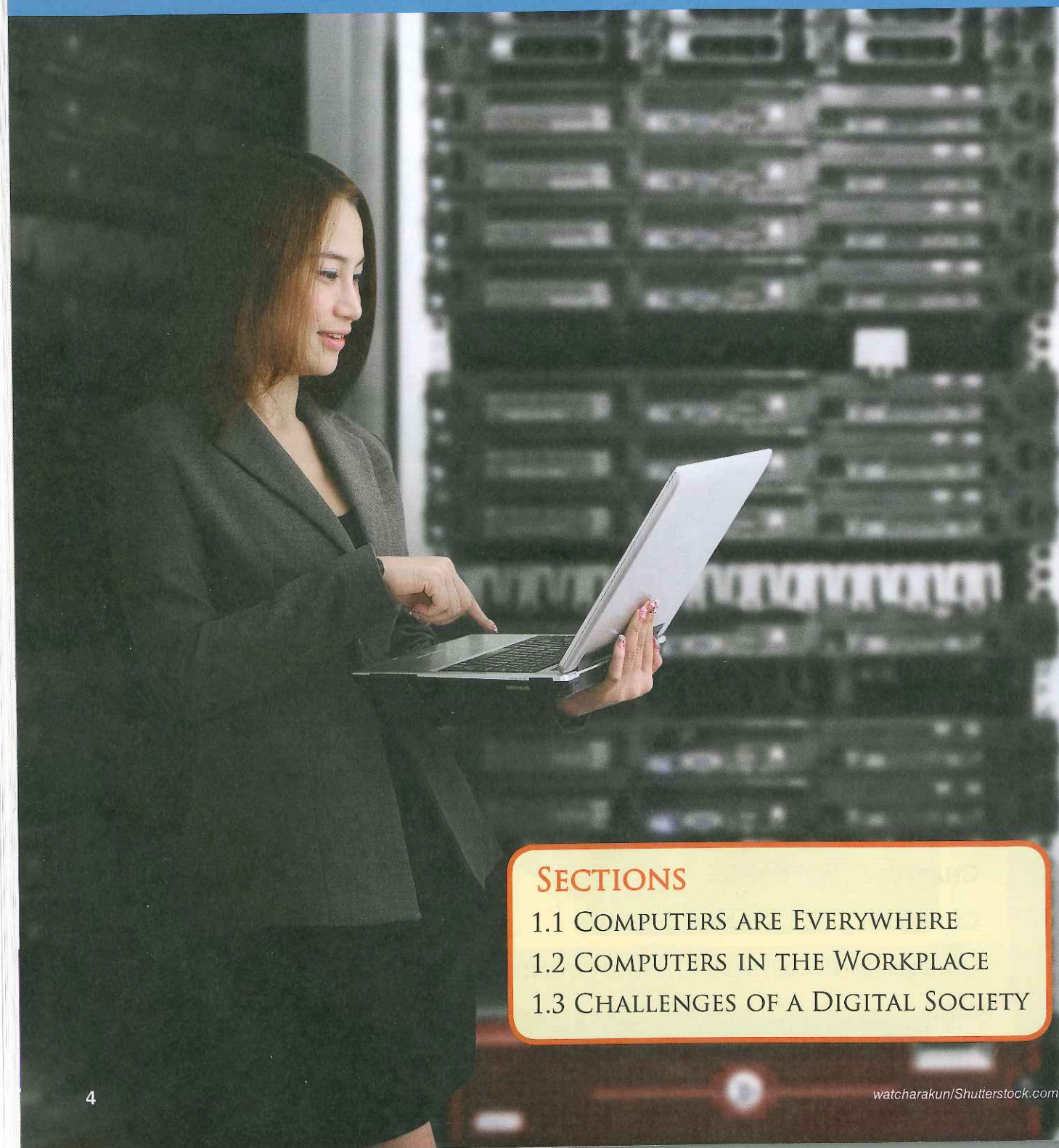




INTRODUCTION TO INFORMATION TECHNOLOGY

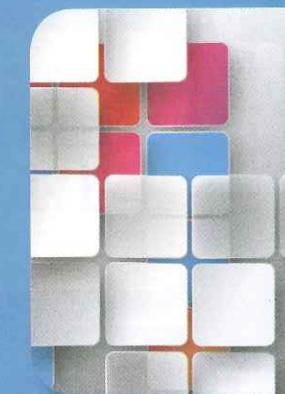


SECTIONS

- 1.1 COMPUTERS ARE EVERYWHERE
- 1.2 COMPUTERS IN THE WORKPLACE
- 1.3 CHALLENGES OF A DIGITAL SOCIETY

—CHECK YOUR IT IQ—

Before you begin this chapter, see what you already know about information technology by scanning the QR code to take the chapter pretest. If you do not have a smartphone, visit www.g-wlearning.com.



IC3 CERTIFICATION OBJECTIVES

Computing Fundamentals

Domain 2.0

Computer hardware and concepts

Objective 2.2

Types of devices

Domain 4.0

Troubleshooting

Objective 4.4

Backup/restore

Most young adults have been using computers since they could read and write or, in many cases, even before then. Computers are used to complete school assignments, conduct business, and—most of all—communicate. Most people are computer *users*; they know how to *operate* these devices. After completing this course, you will become computer *literate*. That is, you will understand more than just how to operate computers. You will understand the details of how computers work and the impact computers have on your life and career.

This chapter provides an overview of the field of information technology (IT). You may already know some of the facts, but some facts will likely be new to you. You will learn about emerging technologies as well as the arithmetic that computers use. Additionally, information is included about future career opportunities. Other topics are discussed to start you thinking about issues faced by information technology professionals and society as a whole. Perhaps you will be able to solve some of these problems yourself.



College
and Career
Readiness

Reading Prep. As you read this chapter, determine the point of view or purpose of the author. What aspects of the text help to establish this purpose or point of view?

SECTION 1.1

COMPUTERS ARE EVERYWHERE



How has the digital revolution changed communication?

Look around. There are computers everywhere! They can be found on desks, in people's pockets, under people's arms, in offices, in stores, in banks, and in movie theaters. Some computers are located where you cannot look: inside other devices. The average person operates more than 20 computerized devices every day. Most people take computers for granted because this technology has become an integral part of

our lives. The integration of computer technology into daily life is why our society is referred to as a *digital society*.

Understanding where computers are and how they function is a necessity for social and professional success. Computers are used for communication, social connections, business, industry, research, recreation, and navigation, among other applications. The demand for better and new digital devices continues to grow.

This section explores the widespread use of computers and other digital devices in today's world.



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TERMS

augmented printing	information technology (IT)
augmented reality (AR)	quick response (QR) codes
bandwidth	interactive books
cloud computing	smartphone
computer	software as a service (SaaS)
digital revolution	software-defined storage
e-mail	
embedded computers	
emerging technologies	

LEARNING GOALS

After completing this section, you will be able to:

- List the phases of the digital revolution.
- Describe embedded computers.
- Identify communication technologies.
- Discuss emerging technologies.

Digital Revolution

The field of **information technology (IT)** includes all work done with computers, from the design and installation of hardware and software to the maintenance of these systems. Many changes have occurred over time in the IT field. The state of the art of computing today is ever-changing with new and innovative additions, such as shown in Figure 1-1. These changes are part of the digital revolution. The **digital revolution** is the ever-expanding progression of technical, economic, and cultural changes brought about by computers. It has gone through four phases:

- giant computers
- personal computers
- networked computers
- cloud computing

A **computer** is a device that handles input, processes data, stores data, and produces usable output according to sets of stored instructions. Computer categories are covered in detail in Chapter 2.

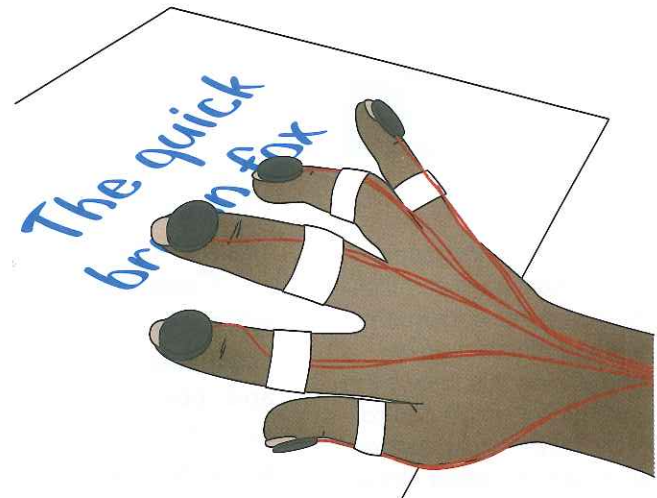
Giant Computers

The first phase of the digital revolution occurred from the 1940s through the 1960s and is characterized by the use of giant computing machines. These machines were physically so large that they had to be located in special facilities, as shown in Figure 1-2. These computers required highly-skilled technicians to run even simple reports. Programs had to be small and extremely efficient.

At first, only one program could be run at a time. Computer time had to be scheduled because there were so few computers. Later, workstations were connected to the main computer. These workstations, or terminals, allowed many people to connect to the computer and share computing time. However, these workstations were called "dumb" terminals because they were not able to do anything on their own. They just connected to the giant machines.

Personal Computers

The second phase of the digital revolution began with the advent of personal computers (PCs) in the 1970s and lasted through the early 1990s. PCs were small and inexpensive enough to be used in households and businesses. They were not dumb

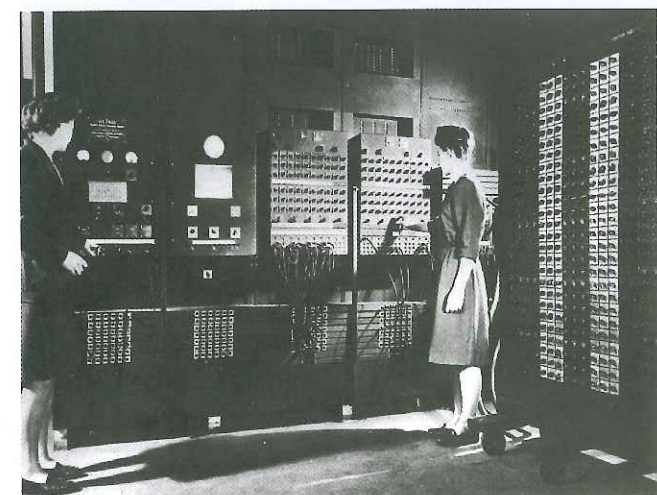


Goodheart-Willcox Publisher

Figure 1-1. An innovative method for data input to a computer uses sensors on the fingers to determine input.

FYI

Data processing was the term used from the 1940s to the 1970s to describe the computer operations. Today, this is known as *information management*.



US Army Photo

Figure 1-2. Programmers Elizabeth (Betty) Jean Jennings and Frances (Fran) Bilas preparing for the public unveiling of ENIAC. ENIAC was the first electronic digital computer.



Green Tech

Power Strips

Computer workstations should be set up so all of the computer equipment is plugged into a power strip. Doing this allows the employee to have control of the power to an entire workstation. Power strips are now available with several different features. "Smart" power strips make it easy and convenient to save power each day.

terminals connected to a main computer. They were complete computers that could run programs all by themselves. The first PCs were only capable of displaying one color on the monitor screen against a black background.

The software had a text-based interface, and many people found it difficult to use. Word processing and business spreadsheet programs were the most popular business applications. Games were the most used computer programs at home.

Communication from computer to computer was performed over telephone lines. Computer hobbyists set up programs that allowed other people to connect to a software program called a bulletin board to leave and retrieve messages. What became known as the Internet was not available to the general public until late in the second phase of the digital revolution, and the World Wide Web did not exist.

Networked Computers

The popularity of personal computers only gradually increased until the mid-1990s. It was at this time when software became what most of the population could consider user-friendly. Also at this time, computer networks became interconnected, as shown in Figure 1-3. Both businesses and the general public alike could access these networks. This marks the beginning of the third phase of the digital revolution, which would last through the early 2000s.

Networks were invented around 1970, but they became easier to use with the evolution of personal computers. The computers were connected in a limited area, such as within a business, school, or house. These were called local area networks (LANs).

Networks allowed for great expansion in the use of electronic mail (e-mail). **E-mail** is communication sent to a computer address where the message is stored to be read at a later time by the recipient. E-mail became popular in the general public through companies such as AOL (formerly called America On-Line) and CompuServe. These were two early commercial Internet service providers (ISPs). Many people today use web-based e-mail, such as Google or Yahoo! mail, and a wide variety of ISPs.

Internet

The Internet began as a project in the 1960s called ARPANET. This project was funded by the US Department of Defense and produced a network of computers for efficient transmission of data between different geographic locations. The network was known as the wide area network (WAN). It was connected to the National Science Foundation network (NSFNET) in 1990, and in 1995 the last restrictions on its commercial use were eliminated.



Arjuna Kodisinghe/Shutterstock.com

Figure 1-3. Computer networks can be very large and may contain many servers to manage data.

World Wide Web

The World Wide Web (WWW), or the web, is a part of the Internet. The web *uses* the Internet, but the Internet and the web are not the same thing. There are other parts of the Internet, such as e-mail, file transfers, and news feeds, that are not part of the web. The World Wide Web was launched in 1991.

The World Wide Web was conceived and developed by Sir Tim Berners-Lee. He found that locating the proper document on the Internet, transmitting it to his computer, and trying to figure out how to open the document was inefficient and time-consuming. He created the World Wide Web as an easy way to find and read documents.

At the beginning, the web was one web page on one website. The web grew slowly at first, staying very small and containing few pages and documents. Today, the web extends all over the world and contains trillions of pages and documents.

Mobile Computers

Mobile devices are commonplace today. These are small, typically handheld digital devices that rely on satellite, microwave, and cellular transmissions for data transfer. Examples of mobile devices are cellular telephones and smartphones, tablet computers, e-book readers, and global positioning system (GPS) devices. The distinctions between types of computers begin to blur now that a smartphone can perform the same actions as desktop computers plus telephone communication.

Mobile devices are often capable of using Wi-Fi to minimize other forms of more costly transmissions. Wi-Fi is a local area network in which the network connection is provided wirelessly. Wi-Fi is available in many public places, sometimes provided as part of a purchased data plan or provided for free by a business, school, or municipality as a public service. Many people have a Wi-Fi network within their homes as well. The name *Wi-Fi* is a play on the phrase used to describe high-quality sound reproduction. High fidelity was called *hi-fi* for short.

Cloud Computing

The fourth and current phase of the digital revolution began in the early 2000s when cloud computing became popular. **Cloud computing** involves storing and retrieving data from Internet-based spaces. Collectively, these spaces are called *the cloud*. The cloud is useful for backing up and sharing data, but it also makes it possible to run a program not installed on the local computer. The cloud involves sharing resources among computers.

In a sense, it can be said that information technology is back at the giant computers phase. The cloud is like the giant computer, and personal computing devices are like the terminals. However, the cloud is more powerful because the terminals are "smart" and portable.

Computing Fundamentals

2.2.4, 2.2.5, 2.2.6

FYI

The concept of cloud computing dates to the 1950s. Functional precursors to the cloud began appearing in the 1990s.

Computing Fundamentals

4.4.3

Embedded Computers

Embedded computers are small digital computers found inside other devices. They are not readily visible, nor do they look like familiar desktop, laptop, or tablet computers. Embedded systems are found in digital cameras, mobile phones, home appliances, music players, special IT hardware, and even automobiles. Embedded systems must be reliable because they are programmed to perform the same tasks over and over.

Location

A remarkable characteristic of embedded computers is that they can be easily incorporated into many devices that did not previously contain them. For example, automobiles have become increasingly computerized over the last few decades. Embedded computers can be found in

very visible devices, such as navigation and entertainment systems. But they are also being used to affect the fundamental functioning of the vehicle: metering fuel flow, monitoring emissions levels, controlling braking systems, and even diagnosing functional problems.

Embedded computers can be found in a wide variety of devices. In an average living room, embedded computers are found in televisions, DVD players, game consoles, and all of the remotes that control them. Programmable home thermostats contain them, as shown in Figure 1-4. Medical devices, business and industrial equipment, and even many washers, dryers, ovens, and stoves may contain embedded computers. Any device that is programmable likely contains an embedded computer.



Steve Cukrov/Shutterstock.com

Figure 1-4. Most programmable home thermostats contain embedded computers.

Continuous Operation

Embedded computers often reside in machines that are expected to run continuously for years without errors. Sometimes these embedded computers must recover by themselves if a system error occurs. As a result, the software and hardware are thoroughly tested and run flawlessly.

Imagine a situation where the system cannot be shut down for repair or is too inaccessible to reach. The systems on NASA space probes and the Mars rover Curiosity are impossible to access except through data communication. Other examples of remote applications include undersea cables, navigational beacons, and control systems for boreholes that carry fluids hundreds of feet underground.

Sometimes systems that include embedded computers must be kept running for safety reasons. Such devices handle aircraft navigation, nuclear reactor control systems, chemical factory controls, and train signals.

Other systems containing embedded computers demand high reliability because of the potential for significant disruptions to business or loss of large amounts of money when shut down. Examples are telephone switches, factory controls, bridge and elevator controls, and automated trains and trams.

Communication Technologies

Computer technology has made it possible for those with access to digital communication devices to stay in touch with others 24 hours a day. As a result, communication methods are changing at a rapid pace. A notable innovation in communication technology is the smartphone. The **smartphone** is a handheld computer that contains a telephone, software applications commonly called apps, and the ability to quickly connect to the Internet. The impact of having a smartphone is the increased speed of communication and the breadth of geographic reach. There are advantages and disadvantages to the advances in communication technology.

Speed

In the past, a person had to wait days for the post office to carry written communication in the form of a letter. Even in the last decade of the 20th century, fast written communication meant waiting minutes to send a fax. The Internet has reduced waiting time for written communication to milliseconds. Even spoken communication is carried over the Internet in nearly real time.

Bandwidth is a measure of the amount of data that can travel on a communication system. Just as a large artery can carry more blood cells than a small capillary, a high-bandwidth Internet connection can carry more data at one time than a low-bandwidth connection. The demand for greater bandwidth is growing. Multiuser networks, music streaming, movie downloads, and the ever-growing number of Internet users all increase the need for greater bandwidth. Use of high bandwidth is also referred to as *broadband communication*.

Reach

Communication programs that share video, voice, and data are accessible to anyone with a computer or smartphone and an Internet connection. In developing countries, people who may have never owned a radio or television now often have smartphones. These devices allow global communication, which opens a wide view of world culture.

Advantages

The amount, intimacy, and power of computer-based communication have been enormously affected by social media through innovations such as Facebook, Twitter, Tumblr, and LinkedIn, as shown in Figure 1-5. Participation in Facebook has been described as an ongoing virtual reality show where the users are the entertainers as well as the audience.



Ethics

Sourcing

Ethical businesses purchase raw materials from reputable suppliers where products are created in safe conditions. Factories in which products are created should be clean and safe for its workers. Manufacturers in other countries may have different work safety standards than the United States. It is important to remember that purchasing products at the expense of others to save money is unethical, even if the working conditions are deemed legal.



Pieter Beens/Shutterstock.com

Figure 1-5. Smartphones have been a key part of the growth of social media, which itself greatly affected computer-based communication.

The speed and reach of social media have had enormous consequences in giving the users significant power to access information and participate in global discussions. News and opinions spread quickly. For example, when Britain's Prince George was born in July of 2013, the initial announcement received over 13,000 retweets and nearly 4,000 favorites in the first few minutes after its posting. Additionally, the Royal Family made the official birth announcement through its account on Instagram. When Princess Charlotte was born in 2015, the Royal Family's first announcement was on Twitter, not the traditional posting of a physical note on the palace gates.

When the first cases of swine flu (H1N1) were detected in the spring of 2009, postings on Twitter were numerous. Researchers from leading search engine providers like Google and Yahoo found that certain search terms were good indicators of flu activity. As a result, Google launched Google Flu Trends to estimate flu activity. Researchers at the University of Iowa found Twitter could not only track the reaction to H1N1, but also track the disease itself by using the comments in tweets not available in search terms. Twitter could become an innovative scientific tool for epidemiologists. Epidemiologists are scientists who study the cause and spread of disease.

Global communication has allowed small businesses in developing countries to have a worldwide marketplace. In many developing countries, a majority of workers have low incomes, limited job security, and no social protection. Technology allows these workers to participate in the global market. In turn, there is the potential they can raise their welfare and improve economic outcomes.

FYI

Google Flu Trends is www.google.org/flu-trends/. Click a country on the map to see its statistics.

Starting up businesses requires money. Many businesses borrow money from banks to get going. Smartphones have made it possible for very small businesses in developing countries to have access to banks and money. Microfinancing is providing small loans to businesses in developing countries. Providing microfinance services is made possible by direct interaction between lenders and borrowers via the Internet rather than physical offices.

There are many other advantages of communication technologies. There is a greater use of online health care services. Medical diagnosis one day may be done by an online artificial intelligence. There is more transparency in pricing online education. This has led to more competition, resulting in lower costs for many students.

Disadvantages

Internet-based communication is so fast that the expectation is a message must be sent or replied to as quickly as possible. As a result, often people do not take time for reflection before sending the message. This can end in embarrassing situations when an inappropriate message is sent. If the communication is part of work functions, the inappropriate message may even result in the worker being fired.

Internet-based communication has also led to an epidemic of crime, including fraud, and unethical behavior, such as cyberbullying. In many cases, cyberbullying can be a crime, but it is always unethical behavior. E-mail scams such as phishing seek to steal a person's identity and use it to commit fraud, which is a form of theft. Computer viruses and other malware can also be transmitted by Internet-based communication.

The privacy and security of personal and business information as well as the ownership of that information are at risk. The ease of obtaining digital information through communication technologies leads many to believe the information is not owned by anybody. This is incorrect. Almost everything on the Internet, from text to streamed videos and music downloads, is copyrighted and owned by somebody. This means it is intellectual property protected by law. It is illegal to copy and use the information without permission.

Emerging Technologies

Emerging technologies are innovations that represent significantly new fields or technologies. Companies are finding new ways to use technology to make money. However, emerging technologies can also be found in education and other industries that are not driven by profit.

One emerging technology that is a new field is electronic textiles, or e-textiles. E-textiles are fabrics with embedded computers that react to sensors in the fabric. Currently available is a belt with an embedded performance monitor that is worn around the torso. The company that manufactures this product predicts additional products in the future, such as a touch screen fitness tracker embedded in the fabric of an exercise shirt.

Visual Displays

Another example of an emerging technology is augmented reality. **Augmented reality (AR)** is a view of the live world that has been enhanced with computerized graphics, sound, or other outputs. A form of AR is **augmented printing**. The user holds a mobile device over a printed page, and instantly associated videos or other content appears on the screen. In this way, the printed page is connected to the virtual world.

Currently available AR systems include Google Glass and smartphone apps that overlay data on the phone's video display, as shown in Figure 1-6. Other possible applications include computer-linked glasses or bionic contact lenses that can be used for facial recognition. For example, while attending a meeting or convention, the wearer could enter a voice or eye-movement command to activate facial-recognition software, and then the computer would display profile information about the speaker the user is engaging.

Medical Technology

Emerging technologies have led to amazing advances in medical diagnosis and treatment. Diagnosis can be done remotely, including collecting and analyzing blood samples. Ultra-high-resolution graphics allow physicians to visualize the detail and activity of functioning hearts and brains. With feedback systems under development, they can even feel the organs without actually touching the patient.

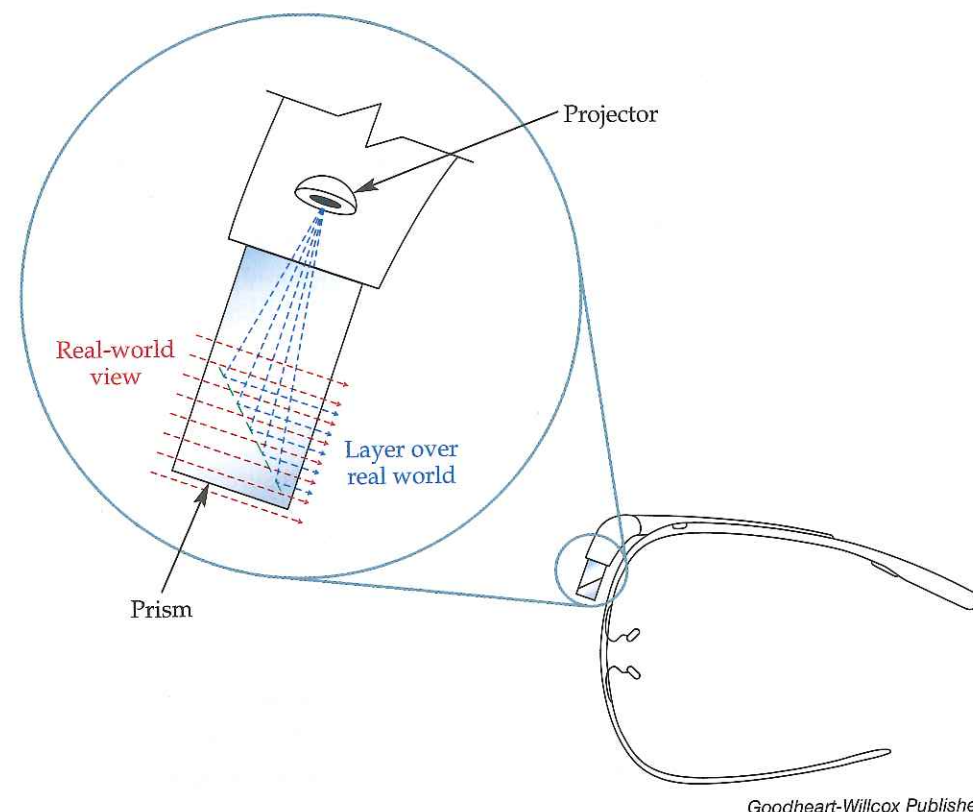


Figure 1-6. An augmented-reality device provides a view of the real world enhanced with computerized elements.

Three-dimensional (3D) printing, which is itself an emerging technology, has led to emerging technology in the area of organ-transplant surgery. Researchers are working on eliminating the need for an organ donor by using the patient's own living cells to create a 3D-printed kidney. About 98% of patients on the organ waiting lists need kidneys.

Interactive Books

Most electronic books (e-books) offer limited interaction with the material. The reader can turn the pages, search for content, or highlight words to view a dictionary definition. Additionally, visually impaired readers benefit from the ability to increase the size of the text. An emerging technology is interactive books that offer many improvements over standard e-books.

Interactive books are enhanced e-books that contain integrated multimedia features such as audio, video, pop-up graphics, 3D images, and animations. This technology offers consumers upgraded works of fiction and nonfiction that incorporate movies, videos, photographs, illustrations, and maps. It also leads to enhanced educational opportunities when publishers offer interactive digital textbooks.

New and Emerging Classes of Software

The basic fact of emerging technologies is that they will continue to multiply at a very quick pace. Keeping current is the way of life for an IT professional. Some of the technologies that did not exist just a few years ago are software as a service, software-defined storage, QR codes, and software-defined networking.

Software as a Service

Software as a service (SaaS) is software that resides in the cloud and is accessed by users without downloading or installing it on their local computers. Another name for this software is *on-demand software*. Some of the software is free to use, while other software is for-purchase that the user typically pays a monthly subscription fee to access. The advantage is that users do not need to purchase expensive licenses to own the software and the software is always up to date. Google Apps, which includes Calendar, Gmail, and Docs, is an example of free SaaS. An example of a subscription SaaS is Adobe Creative Cloud, which includes Adobe Photoshop, Adobe Illustrator, and Adobe InDesign.

Software-Defined Storage

Software-defined storage is cloud-based file storage. Sharing of files can be permitted, or the files may be stored privately. Examples of free software-defined storage are Dropbox, Apple iCloud, Google Drive, and Amazon Cloud. For-purchase software-defined storage is also available, which typically offers benefits not found in the free options.

FYI

The distinction between apps and e-books can be confusing. Both are digital files, but apps are computer applications and e-books are documents. Generally, an app is needed to read an e-book.

TITANS OF TECHNOLOGY

While computing has been a human need for thousands of years, electronic digital computers have existed for less than a century. Starting in 1945 with the development of the Electronic Numerical Integrator and Computer (ENIAC), the digital age was born. The leaders of the design team for this first programmable digital computer were J. Presper Eckert and John Mauchly at the University of Pennsylvania. They conceived the

idea for using vacuum tubes to represent the on-off digital values. The calculations required 36 vacuum tubes to represent a single digit. Once the ENIAC was completed and tested, it was used at Aberdeen Proving Ground in Maryland to perform ballistics calculations. The first programmers were Kay McNulty, Betty Jennings, Betty Snyder, Marlyn Wescoff, Fran Bilas, and Ruth Lichterman.

There are several advantages to storing files in the cloud. Where a local disk drive may fail, resulting in loss of files, cloud storage has redundancies to prevent data loss. Restoring files from the cloud is easier and faster than restoring files from an inventory of physical media.

QR Codes

Quick response (QR) codes are two-dimensional bar codes.

The traditional one-dimensional bar code, or zebra stripe, contains information that can be read only in one direction. The universal product code (UPC) symbols found on all product packaging and scanned at the cash register are examples of one-dimensional bar codes. QR codes contain information that can be read in two directions. A comparison of a QR code and a traditional zebra stripe is shown in Figure 1-7.

QR codes are used to facilitate the exchange of information. They typically contain an encoded web or e-mail address, but may contain information in one of four data types: numeric, alphanumeric, binary, and kanji. QR codes can be scanned using a smartphone and the proper app. Many QR code reader apps are free.

Software-Defined Networking

Some areas of networks used to be controlled by hardware, but are now under software control. Until recently, all modifications to the network architecture had to be made at the network source. New

technology allows programming of the network by external applications. This technology slightly modifies the Open System Interconnection (OSI) model. This is the long-standing model for network architecture. The shift to software control also allows network administrators to centrally control and view the network. This provides better flexibility for network administrators and more secure networks.



Goodheart-Willcox Publisher

Figure 1-7. A QR code (left) is a two-dimensional bar code, while a UPC zebra stripe (right) is a one-dimensional bar code.

FYI

Kanji are characters in the Japanese written alphabet. QR codes were invented in 1994 for use in the Japanese automotive manufacturing industry.

1.1

SECTION REVIEW

CHECK YOUR UNDERSTANDING

- 1. List the four phases of the digital revolution.
- 2. Name three items that currently are enhanced due to embedded computer technology.
- 3. Use of high bandwidth is also referred to as _____.
- 4. How does augmented printing connect the printed page to the virtual world?
- 5. List four new and emerging classes of software.

IC3 CERTIFICATION PRACTICE

The following question is a sample of the types of questions presented on the IC3 exam.

- 1. Perform this simulation.
Demonstrate how to safely back up and restore data and software to the cloud.

BUILD YOUR VOCABULARY

As you progress through this course, develop a personal IT glossary. This will help you build your vocabulary and prepare you for a career. Write a definition for each of the following terms and add it to your IT glossary.

augmented printing	information technology
augmented reality (AR)	(IT)
bandwidth	interactive books
cloud computing	quick response (QR)
computer	codes
digital revolution	smartphone
e-mail	software as a service
embedded computers	(SaaS)
emerging technologies	software-defined storage

SECTION
1.2

COMPUTERS IN THE WORKPLACE



Essential
Question

How does changing technology affect current and future employment?

Computers have greatly changed work. In the beginning days of electronic computers, computers were single-purpose machines. For example, the ENIAC was used at Aberdeen Proving Ground in 1946 to calculate ballistics information.

With the advent of operating systems in the 1960s, computers could be used for many different purposes. New ideas were quickly

implemented. The uses spanned data processing, spreadsheet generation, word processing, and desktop publishing. Soon almost every office worker had a desktop computer. Productivity soared. Output improved. Some jobs began to be replaced by computers, but new jobs were created for people who could work with computers. This section discusses how computers have affected worker productivity as well as what jobs are available.



wavebreakmedia/Shutterstock

LEARNING GOALS

After completing this section, you will be able to:

- Explain how advances in information technology have affected productivity.
- Describe the use of information technology in current employment.
- Discuss the future outlook for employment in information technology.

TERMS



telecommuting
worker productivity

Worker Productivity

Worker productivity is a measure of how efficiently and quickly a person completes tasks. Using computers in the workplace has increased the efficiency, speed, level of detail, and overall progress of many types of jobs. The workplace is responding to the exponential growth in technology. Use of computers and the Internet have revolutionized how and where people work. See Figure 1-8. The new world of work has changed peoples' values and created a global economy.

Changing Tools

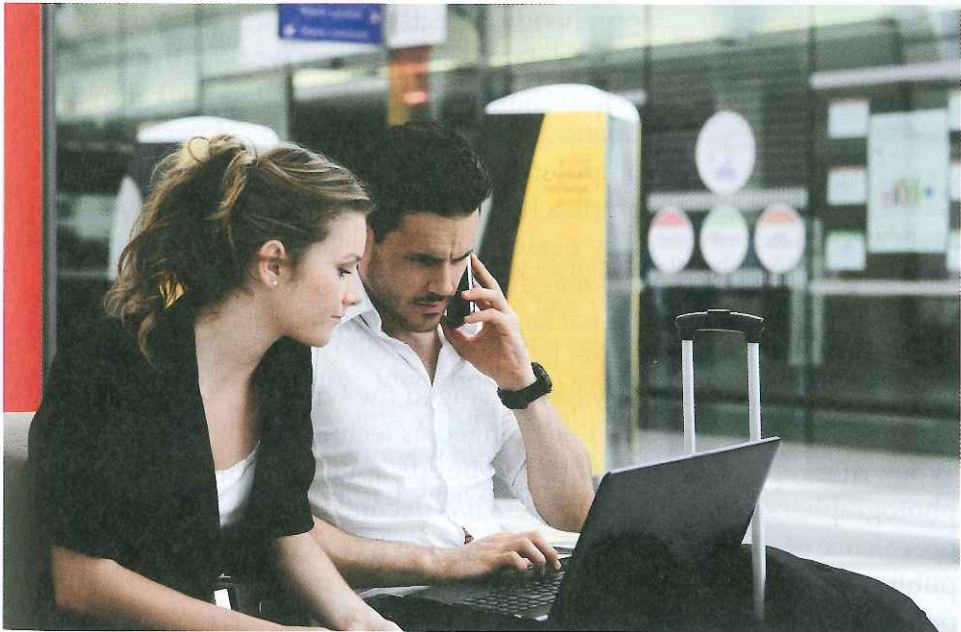
Workers are becoming loyal to their skills, not to their employers. Work used to be somewhere people went. Now it has become something people do. People used to read books and manuals to learn things. Now they use the Internet and search engines such as Google. There are over six million searches conducted on Google each day.

Eliminating Distance

People can work from anywhere. Distance does not matter. Thomas Friedman, well-known journalist and author, has said:

"It has become possible for more people to collaborate and compete in real time, with more other people on more different kinds of work from more different corners of the planet, on a more equal footing than any previous time in the history of the world."

For example, the authors of this textbook live and work in different states and the publisher is located in a third state. Working together is



LDprod/Shutterstock.com

Figure 1-8. Computer-based communication technologies have changed how and where work can be done.

FYI

The US Department of Labor predicts that today's high school students will have held between 10 and 14 jobs by the time they are 38 years old.

not bound by nearness anymore. Employees can communicate with colleagues around the world.

Many workers have offices in their homes. This can result in significant savings of time and money since they do not have to travel to an office. **Telecommuting** is working for a company from home using information technologies. Telecommuters can spend more time working instead of driving. They can save money on transportation costs.

Technical Knowledge

The number of Internet devices in use around the world in 1984 was only one thousand. That number grew to one million by 1994. In 2008, it exceeded one billion. Employers expect workers to have an increasing grasp of software, such as project management, spreadsheet, and database software, and the Internet. Employers also expect a solid foundation in use of hardware, including networked computers and cloud computing.

The amount of available information is overwhelming. This exponential rate of exploding information will have significant effects on the lives of students starting a four-year technical degree. It is possible that what they learn in their first year will be outdated by their third year. Educators have the daunting task of preparing students for jobs that do not currently exist.



Corepics VOF/Shutterstock.com

Figure 1-9. Package delivery workers use personal digital assistants to track deliveries.

Current Employment

Most jobs today require that employees have at least a basic understanding of how to use computers. Law enforcement officials use the Internet to find lost children, track and apprehend suspects, and connect to national and global databases. Educators work with computer programmers to develop software that allows autistic children to speak. Medical personnel use computers to research diseases and maintain complex health records. Package delivery workers carry personal data assistants (PDAs), also called personal digital assistants, to track the progress of a package from its origin to its destination, as shown in Figure 1-9.

Advances in technology have changed the types of jobs people do. Many jobs have disappeared or changed as technology has advanced. Typewriter repair is a job that has all but disappeared. The number of photographers at major newspapers has declined in part due to the prevalence of digital cameras on mobile devices in the hands of the public. The publishing industry is undergoing a revolution from creating printed products to digital products, so the jobs involved in creating the final product are changing.

On the other hand, many new types of careers have been created. Somebody has to program the software and hardware to make augmented reality and other emerging technologies work. Continued growth in the use of the Internet and communication technologies means technicians must design, install, and maintain new systems. Additionally, customer support is needed for new technology, and there is an increased demand for sales associates.

Future Employment

The field of research in digital applications is rapidly growing. Emerging technologies grow from this research. What inventions do you think have yet to be created? Perhaps you will have a career that uses some new form of information technology to improve the lives of people around the nation or across the globe.

In addition to careers in the digital arena, other fields are emerging as a good source of rewarding employment. The use of computers and the Internet will be essential to success in these fields.

It is safe to anticipate that many new jobs will emerge as time goes on. Keeping current is the top educational goal for an IT professional. IT careers are discussed in detail in Chapter 17.

Advanced Medical Research

A current trend in the medical field is to move from treating and curing diseases to preventing diseases. Using the results of research projects such as decoding the human genome can be coupled with the ability to track detailed personal health. IT is vital here because of the enormous amount of data that need to be processed. More personalized health care will create more jobs. Patients will have their own private web pages established by their physicians. Their medical histories will be instantly available. This will lead to more personalized health care, thus creating more jobs. More laboratory analysis jobs will appear. Examples could be a gene splicer or DNA information specialist.

Automotive Industry

Vehicles are becoming more energy efficient. Hybrid and electric cars are more common than they were just a few years ago. More complex embedded computer systems are being developed. This has prompted changes in urban planning, including new infrastructure to accommodate new vehicle models. New jobs would include designing these new streets and electrical-charging stations. These jobs will require knowledge of 3D mapping and computer-aided design software.

Finance

The world of money will include a look at gathering more real-time data in an effort to model future growth. This will help corporations to better invest their assets. Individuals will need more help from personal financial advisors or rely on computer programs to perform that function.



Career Skills

Architect

An architect uses information technology in every phase of design and presentation. The use of 3D modeling software to design and develop structures, as well as the use of databases to identify the proper materials for strength and stability, is an ongoing process for architects. Architects often use word processing software to create documents that will serve as communication with the clients and the building contractors. They may also communicate using e-mail, the Internet, and by smartphones.

Home Health Care

The health care industry has found it is more affordable and beneficial for patients to recuperate at home than in a hospital. As a result, hospitals discharge patients as soon as it is medically appropriate to do so. But the patients must have specialized, individual, and intermittent care. The home health care field increased in size by around 50 percent over the past few years. Employees in this field can have direct contact with the patients or act in an advisory capacity at a remote location. Networks and the Internet make this possible. Knowledge on how to set up and maintain these systems will require proficiency with hardware and software.

Green Collar Jobs

Green collar jobs are those involved in designing, manufacturing, selling, installing, and maintaining environmentally friendly technologies. As interest in this area continues to grow, there will be a need for more investigation and implementation of renewable energy sources such as wind and solar. Initiatives in urban planning will lead to changes in the management of the electrical grid. Examples of new jobs might be supervising energy-management systems, tracking and managing a community green space or garden project, or engineering soil replenishment. All of these systems will require knowledge of hardware to track the statistics and skills in software usage to interpret the data.

1.2

SECTION REVIEW

CHECK YOUR UNDERSTANDING

1. What are four ways in which the use of computers has impacted the workplace?
2. How does telecommuting improve productivity?
3. How have advances in technology changed the types of jobs people do?
4. How will continued growth in the use of the Internet and communication technologies create new careers?
5. What are green collar jobs, and how is IT needed in them?

IC3 CERTIFICATION PRACTICE

The following question is a sample of the type of questions presented on the IC3 exam.

1. People who certify in IC3 include:
 - A. beginning professional
 - B. student
 - C. average user
 - D. All of the above.

BUILD YOUR VOCABULARY

As you progress through this course, develop a personal IT glossary. This will help you build your vocabulary and prepare you for a career. Write a definition for each of the following terms and add it to your IT glossary.

telecommuting
worker productivity

CHALLENGES OF A DIGITAL SOCIETY



All of the major technical advances over the past 150 years were impressive when they first appeared. But soon society absorbed them, and the innovations became commonplace and moved into the background of people's lives. Examples include automobiles, washing machines, radios, landline and cellular telephones, televisions, microwaves, personal computers, and home computer printers.

Digital devices were once remarkable innovations, too, but now are commonplace. The number of homes with digital devices has grown, but the situation is not uniformly good. Some people have no or limited access to computers. People without access to digital devices are placed at a disadvantage. This section discusses the challenges faced by society as digital devices become more and more integrated.

SECTION 1.3



Why is it important to close the digital divide?

TERMS

cybersecurity
data mining
digital divide
digital middle class



LEARNING GOALS

After completing this section, you will be able to:

- Identify cultural and social issues related to information technology.
- Discuss ways to close the digital divide.

Cultural and Societal Issues

The first computers were used mostly as electronic typewriters or calculators with memory. For most people, computers were not easy to use. Before the Internet, computing was primarily a local and individual endeavor. At about the same time that personal and commercial connections to the Internet began in the 1990s, consumers began demanding that computers be easier to use and more powerful. As a result, computers became more popular. This had a profound effect on society and culture.

Digital Middle Class

The **digital middle class** is the group of people who extensively use digital devices and embrace the newest digital technologies. These users expect more capability to be available to maximize access to the Internet and all it offers, including social media and the cloud. Small businesses will drive the movement because they will need to create distinct markets all over the world. People without computers are at a disadvantage and denied entry into the digital middle class.

Data Mining

Data mining is the method of searching through huge amounts of data to find patterns. See Figure 1-10. Data mining is an enormous asset to a business. Owners can know how much and when to stock inventory

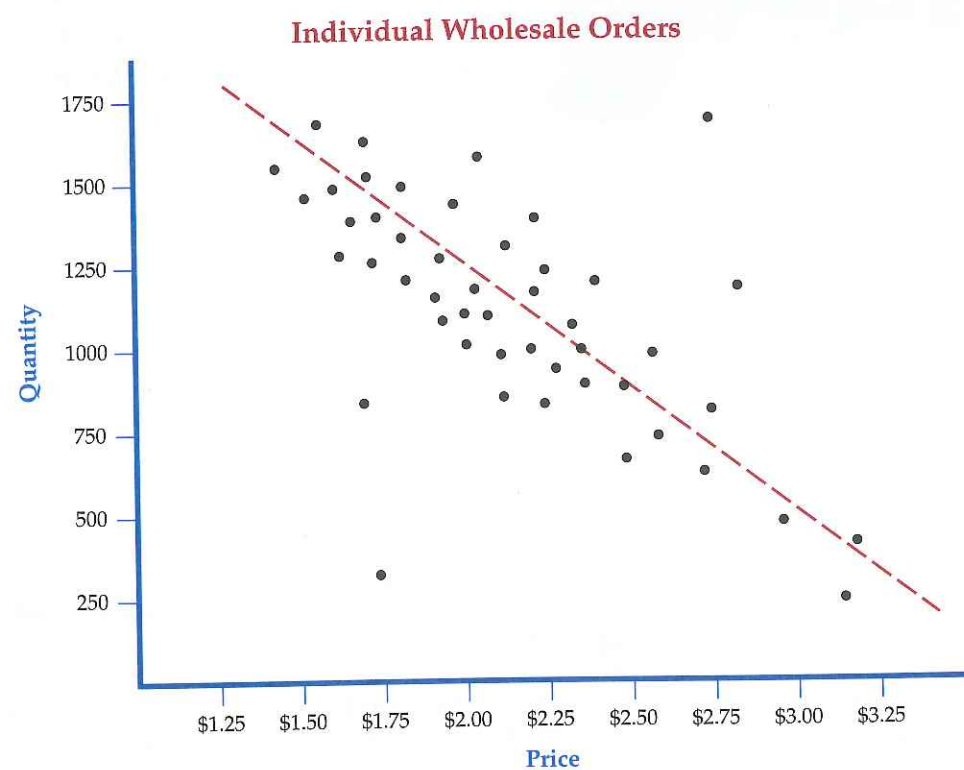


Figure 1-10. Data mining allows businesses to find patterns that can be used to improve sales, services, or products.

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and what items to put on sale. Because of the use of data mining, the buying behavior of customers is analyzed and trends are made visible. These results translate into valuable marketing data.

When an online movie source recommends what movies a client would probably enjoy, it is not just guessing. Similarly, online retailers can suggest new purchases that will probably appeal to a customer. These predictions are based on hard facts obtained through data mining. Online search engines also engage in data mining, and then place advertisements on the screen in response to a user's search. Supermarkets actually reward their customers for donating information. Many stores give out discounts to cardholders so that the store is able to track customers' purchases.

Data mining presents concerns about what data are being collected. Many people express concern over the amount of data about themselves that companies mine. Many others may not even be aware of how much data about them are being collected.

Cybersecurity

Individuals, companies, and governments have enormous quantities of information on the Internet, much of it confidential. With so much data available and easily transmittable, security of this information is a great concern to society. There are many software programs, safety procedures, and protective methods to aid users in maintaining their privacy. See Figure 1-11.



Rocketclips, Inc./Shutterstock.com

Figure 1-11. Cybersecurity protects computer systems. It is important to many aspects of life, such as online shopping.

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A career in cybersecurity is a path an IT professional may choose to pursue. **Cybersecurity** is the branch of IT that protects computer systems. The prefix *cyber* means relating to computers or computer networks. Cybersecurity is more fully discussed in Chapter 16.

Closing the Digital Divide

The **digital divide** is most commonly defined as the gap between those individuals, communities, and countries having access to the information technologies that transform life and those who do not have this access. A more technical definition is an educational, social, and economic disparity across socioeconomic status, race, and gender caused by unequal contact with computing resources. The digital divide was created when people became classified as *computer users* or *not computer users*.

Educational

Many initiatives are directed at closing the digital divide in education. Access to technology and learning how to use it are important for preparing students for future careers and civic duties. Many schools provide tablet computers for students. This ensures equal access to the technology. The students access digital textbooks or use productivity tools such as word processing. A critical step is providing computer literacy for all students. In addition, many schools offer access to computers before and after school.

Social

Access to information is necessary for promoting good citizenship. There are many sources for free access to computing. Most public libraries provide access to computers. Free Wi-Fi is offered in many public locations. This helps people who may have access to a mobile device, but do not have Internet service in their homes.

More and more governmental agencies have websites to assist the citizens in getting problems resolved. Libraries and community colleges often have free training sessions on how to use these sites.

Economic

The economic impact of the digital divide is most obvious in developing countries. Many developing regions do not have a dependable source of electricity. Among other things, that means access to radios, televisions, or computers is limited or missing. Those who do not have access to this technology are not as able to improve their economic situations as those who have access. Therefore, in these countries, technologies are being invented to operate without an electrical power grid. Use of solar power or windup generators provides the ability to power computers or mobile devices.

An important step to a good economy is access to money. The growth of smartphone use is narrowing the digital divide. With smartphones,

remote areas can have a way to obtain financial services. MasterCard developed a smartphone-based service to allow users to make payments, deposits, and transfers as well as purchase prepaid credit cards. As a result, funds can be exchanged over smartphones even though the financial institution is in another country. Visa allows smartphone companies and banks to create their own customized mobile financial services. This service has been set up in both a very large developing country (India) and a very small developing country (Rwanda).

In Nigeria, farmers use their smartphones to receive vouchers for seed and fertilizer. The Nigerian government uses the phones and biometrics to match the exact locations of registered farmers. This method eliminated a centuries-old tradition of corruption, thus ensuring materials actually reach the farmers who need them. In turn, the farmers are able to improve their economic situations.

1.3

SECTION REVIEW

CHECK YOUR UNDERSTANDING

1. What is the meaning of a digital society?
2. Searching through huge amounts of data to find patterns describes what aspect of information technology?
3. Which field of IT is involved in keeping computer systems protected?
4. What is the digital divide?
5. What are the three areas of the digital divide that define the gap?

IC3 CERTIFICATION PRACTICE

The following question is a sample of the type of questions presented on the IC3 exam.

1. A search engine is used to:
 - A. store data in a database.
 - B. generate reports from a database.
 - C. mine data in a database.
 - D. None of the above.

BUILD YOUR VOCABULARY

As you progress through this course, develop a personal IT glossary. This will help you build your vocabulary and prepare you for a career. Write a definition for each of the following terms and add it to your IT glossary.

cybersecurity
data mining
digital divide
digital middle class



STEM

Technology

In June 2009, the United States transitioned its television broadcasts from analog to digital. The benefits of digital are better quality pictures, higher resolution pictures, high-definition broadcasts, less bandwidth usage, and multicasting. The downside is that digital channels either work or they do not; there is no gray area.

Chapter Summary

Section 1.1

Computers Are Everywhere

- The digital revolution is the ever-expanding progression of technical, economic, and cultural changes brought about by computers. It has gone through four phases: giant computers, personal computers, networked computers, and cloud computing.
- Embedded computers are small digital computers found inside of other devices, such as digital cameras, mobile phones, home appliances, music players, special IT hardware, and even automobiles.
- Computer technology has made it possible for those with access to digital communication devices to stay in touch with others 24 hours a day. Advances in this technology have increased the speed of communication and the breadth of geographic reach, but there are advantages and disadvantages to the technology.
- Emerging technologies are innovations that represent significantly new fields or technologies. Visual displays, medical technology, interactive books, and new and emerging classes of software are all areas in which emerging technologies play an important role.

Section 1.2

Computers in the Workplace

- Using computers in the workplace has increased the efficiency, speed, level of detail, and overall progress of many types of jobs. The tools used in the workplace have changed due to computers,

computer technology has eliminated distance as a restriction, and technical knowledge of workers has increased.

- Most jobs today require that employees have at least a basic understanding of how to use computers. Advances in technology have changed the types of jobs people do, and many new types of careers have been created.
- There are many careers in the digital arena and in other fields as well that are related to information technology. Due to rapid growth in the IT field, many new jobs will emerge as time goes on.

Section 1.3

Challenges of a Digital Society

- Computers have had a profound effect on society and culture. The digital middle class has been created, data mining has evolved as an important tool for business, and cybersecurity has become a critical issue.
- The digital divide is the gap between those who do and do not have access to the information technologies that transform life. The digital divide can be closed by addressing the educational, social, and economic aspects that cause the divide.

Now that you have finished this chapter, see what you know about information technology by scanning the QR code to take the chapter posttest. If you do not have a smartphone, visit www.g-wlearning.com.



Chapter 1 Test

Multiple Choice

Select the best response.

- Which event is not a major phase of the digital revolution?
 - Giant computers.
 - The Industrial Revolution.
 - Cloud computing.
 - Personal computers.
- The Internet began as:
 - the World Wide Web
 - NSFNET
 - ARPANET
 - WWW
- Using computers in the workplace has increased which of the following for many types of jobs?
 - Job security.
 - Free time.
 - Satisfaction.
 - Level of detail.
- Which of the following is an example of how computers are currently used in the workplace?
 - Track and apprehend criminal suspects.
 - Research diseases and maintain complex health records.
 - Track the progress of a package.
 - All of the above.
- What defines the digital middle class?
 - Casual use of the Internet.
 - Extensive use of digital devices and adoption of the newest digital technologies.
 - Ownership of a smartphone.
 - Online gaming.

Completion

Complete the following sentences with the correct word(s).

- New technologies that develop out of existing technologies are called ____.
- ____ measures how efficiently and quickly a person completes tasks.
- ____ is working for a company from home using information technologies.
- Data mining is the method of searching through huge amounts of data to find ____.
- The gap between those countries that have access to computer technology and those without is the ____.

Matching

Match the correct term with its definition.


- | | |
|-----------------------|--|
| A. telecommuting | 11. Ever-expanding progression of technical, economic, and cultural change brought about by computers and the Internet. |
| B. data mining | 12. Device that handles input, processes data, stores data, and produces usable output according to sets of stored instructions. |
| C. computer | 13. Allows workers to spend more time working instead of driving. |
| D. digital revolution | 14. Process of extracting useful information in the form of relationships and patterns from stored information from purchases |
| E. digital divide | 15. An educational, social, and economic disparity across socioeconomic status, race, and gender caused by unequal contact with computing resources. |


Application and Extension of Knowledge

1. Research common locations of embedded computers. Make a list of devices you use each day that contain embedded computers. Bring your list to class for discussion.
2. Identify three emerging technologies. List one positive and negative effect of each. Be prepared to defend your position in a class discussion.
3. Identify five new information technology careers that were created as a result of the advent of social media.
4. Research the practice of data mining, and develop an opinion on the practice. Write a one-page paper stating your view of the advantages and disadvantages of data mining with regard to personal privacy.
5. Write a one-page paper describing why you feel an information technology worker must keep his or her skills up to date.

Online Activities

Complete the following activities, which will help you learn, practice, and expand your knowledge and skills.

 **Certification Practice.** Complete the certification practice test for this chapter.

 **Vocabulary.** Practice vocabulary for this chapter using the e-flash cards, matching activity, and vocabulary game until you are able to recognize their meanings.

Communication Skills



College and Career Readiness

Reading. Read a magazine, newspaper, or online article about the importance of effective communication for teens, especially when using social media. Determine the central ideas of the article and review the conclusions made by the author. Take notes to identify its purpose and intended audience.

Demonstrate your understanding of the information by summarizing what you read.

Writing. Rhetoric is the study of writing or speaking as a way of communicating information or persuading someone. Describe a rhetorical technique that a writer can use to provide information or persuade someone. Write an example of the technique you chose.

Speaking. Create a one-act play for two persons that depicts both a positive and a negative interaction between two coworkers. Include notes to the actors about body language and facial expressions. What is the essential difference between the two interactions? How does body language influence whether the message will be received negatively or positively? Write several paragraphs describing your opinion about the impact of body language in the workplace.

Internet Research

Digital Citizenship. Research digital citizenship using various Internet resources. List and analyze specific elements of digital citizenship that users of technology should understand when using the Internet. What are the day-to-day effects of digital citizenship on society? Summarize your findings.

Teamwork

With your team, create a list of long or complex words or phrases that might be used in technical writing related to information technology. List each of the words and phrases on a dry-erase board or flip chart. As a team, work together to think of simpler words or phrases to replace each list item. Use a thesaurus if one is available.

Portfolio Development



College and Career Readiness

Portfolio Overview. When you apply for a job, community service, or college, you will need to tell others why you are qualified for the position. To support your qualifications, you will need to create a portfolio. A *portfolio* is a selection of related materials that you collect and organize to show your qualifications, skills, and talents to support a career or personal goal. For example, a certificate that shows you have completed lifeguard and first-aid training could help you get a job at a local pool as a lifeguard. An essay you wrote about protecting native plants could show that you are serious about eco-friendly efforts and help you get a volunteer position at a park. A transcript of your school grades could help show that you are qualified for college. A portfolio is a *living document*, which means it should be reviewed and updated on a regular basis.

Artists and other communication professionals have historically presented portfolios of their creative work when seeking jobs or admission to educational institutions. However, portfolios are now used in many professions. Two types of portfolios commonly used are print portfolios and digital portfolios. A digital portfolio may also be called an *e-portfolio*.

1. Use the Internet to search for *print portfolio* and *digital portfolio*. Read articles about each type.
2. In your own words, compare and contrast a print portfolio with a digital one.

CTSOs



Student Organizations.

Career and technical student organizations (CTSOs) are a valuable

asset to any educational program. These organizations support student learning and the application of the skills learned in real-world situations. Competitive events may be written, oral, or a combination of both. There is a variety of organizations from which to select, depending on the goals of your educational program. To prepare for any competitive event, complete the following activities.

1. Go to the website of your organization to find specific information for the events. Visit the site often because information changes quickly. If the organization has an app, download it to your digital device.
2. Read all the organization's guidelines closely. These rules and regulations must be strictly followed, or disqualification can occur.
3. Communication plays a role in all the competitive events, so read which communication skills are covered in the event you select. Research and preparation are important keys to a successful competition.
4. Select one or two events that are of interest to you. Print the information for the events and discuss your interest with your instructor.