Big Data Equals Big Profits with the Right Focus

Every time you use a computer or mobile device to send an e-mail, upload a picture, or check a bank balance, you are generating information that is encoded and transmitted to a network of computer servers. While the size of these transactions may generate anywhere from a kilobyte to a few megabytes of data, when these actions are summed together among the billions of computer users worldwide, the amount of information collected is mind boggling. In fact, worldwide data transmitted or stored on computer servers is now estimated to be in the multiple zettabyte range—with a zettabyte equaling one number followed by *21* zeros.

While technical issues like data storage and data search are being addressed by the likes of Amazon, Cisco, EMC, Google, and Facebook, there are a number of new companies being formed specifically to look through all of this information, which is now called big data. Much of the work done by these firms relies on advanced statistical methods, sifting through huge volumes of data looking for trends, patterns, and new insights. The companies sell this data to other firms, which use it as part of their overall business strategy.

Given the exceedingly large amounts of data available, it is hard to know how to analyze all of this information. Big data startup companies face the same challenge. Kaggle is a business that started several years ago as a platform for hosting public data science challenges, in which companies paid a fee, posted their problems to the Kaggle website, and data scientists from all over the world competed to create the best solution. Recently, however, the San Francisco–based company has shifted its big data business model to focus on creating models and software for the energy industry.

For Kaggle, this meant zeroing in on the oil and gas drilling sector. While the data used in traditional oil drilling is understood, fracking—discussed in Chapter 1's opening story—is a somewhat different process. Variables like how long have deep rock formations existed in the Earth and which operator to partner with may matter when it comes to conducting successful fracking operations. And these types of new and seemingly unrelated variables make big data an important tool for many businesses.

And if Kaggle needs an incentive to stay focused, it might want to consider the case of Climate Corporation. This firm tried to sell predictive data about weather to farmers, house painters, and even golf courses. After it decided to concentrate on data analytics in the agriculture industry, Climate Corporation was bought by chemical giant Monsanto for $930 million. Perhaps the most important trend for big data firms to focus on is how to provide a continuing stream of value to their clients.[1]

Overview

This chapter explores how businesses manage information as a resource, particularly how they use technology to do so. Today, virtually all business functions—from human resources to production to supply chain management—rely on information systems. The chapter begins by differentiating between information and data and then defines an information system. The components of information systems are presented, and two major types of information systems are described. Because of their importance to organizations, the chapter discusses databases, the heart of all information systems. Then the chapter looks at the computer hardware and software that drive information systems. Today, specialized networks make information access and transmission function smoothly, so the chapter examines different types of telecommunications and computer networks to see how companies are applying them for competitive advantage. The chapter then turns to a discussion of the ethical and security issues affecting information systems, followed by a description of how organizations plan for, and recover from, information system disasters. A review of the current trends in information systems concludes the chapter.

1 Data, Information, and Information Systems

Every day, businesspeople ask themselves questions such as the following:

- How well is our product selling in Boston compared to Phoenix? Have sales among consumers aged 25 to 45 increased or decreased within the past year?
- How will fluctuating energy prices affect production and distribution costs?
- If employees can access the benefits system through our network, will this increase or decrease benefit costs?
- How can we communicate more efficiently and effectively with our increasingly diverse and global workforce?

An effective information system can help answer these and many other questions. **Data** consist of raw facts and figures that may or may not be relevant to a business decision. **Information** is knowledge gained from processing those facts and figures. So although businesspeople need to gather data about the demographics of a target market or the specifications of a certain product, the data are useless unless they are transformed into relevant information that can be used to make a competitive decision. For instance, data might be the sizes of various demographic groups. Information drawn from those data could be how many of those individuals are potential customers for a firm's products. Technology has advanced so quickly that all businesses, regardless of size or location, now have access to data and information that can make them competitive in a global arena.

data raw facts and figures that may or may not be relevant to a business decision.

information knowledge gained from processing data.

An **information system** is an organized method for collecting, storing, and communicating past, present, and projected information on internal operations and external intelligence. Most information systems today use computer and telecommunications technology. A large organization typically assigns responsibility for directing its information systems and related operations to an executive called the **chief information officer (CIO)**. Often, the CIO reports directly to the firm's chief executive officer (CEO). An effective CIO will understand and harness technology so that the company can communicate internally and externally in one seamless operation. But small companies rely just as much on information systems as large ones do, even if they do not employ a manager assigned to this area on a full-time basis.

information system organized method for collecting, storing, and communicating past, present, and projected information on internal operations and external intelligence.

chief information officer (CIO) executive responsible for managing a firm's information system and related computer technologies.

Today's CIO, closely connected to the company's overall business strategies and marketing efforts, is concerned with how cloud-delivered business services of software and data are transmitted to enterprises, with a focus on sales, customer interfaces, and "consumerization," the reorientation of goods and service designs around the individual end user. Yesterday's CIO, focused on installation and design of software, has become increasingly aware of the need for data security, systems availability, and responsiveness. Their expertise makes CIOs and former CIOs good candidates for corporate boards.[2]

Information systems can be tailored to assist many business functions and departments—from marketing and manufacturing to finance and accounting. They can manage the overwhelming information overload by organizing data in a logical and accessible manner. Through the system, a company can not only plan better but also manage all components of its operations and business strategy, identifying challenges and opportunities. Information systems gather data from inside and outside the organization; they then process the data to produce information that is relevant to all aspects of the organization. Processing steps could involve storing data for later use, classifying and analyzing it, and retrieving it easily when needed.

Many companies and nations combine various solutions to manage the flow of information. E-mail, online meetings, intranets, and wireless communications have not totally replaced face-to-face meetings, written correspondence, and phone conversations, but they

have become increasingly common. Information can make the difference between a company being profitable or filing for bankruptcy. Keeping on top of changing consumer demands, competitors' actions, and the latest government regulations will help a firm fine-tune existing products, develop new ones, and maintain effective marketing. Today's companies face technological megatrends that include cloud computing, mobile computing, social media, video platforms, and big data.[3]

Assessment Check

1. Distinguish between data and information.
2. What is an information system?

Components and Types of Information Systems

The definition of *information system* in the previous section does not specifically mention the use of computers or technology. In fact, information systems have been around since the beginning of civilization but were, by today's standards, very low tech. Think about your college or university's library. At one time the library probably had card catalog files to help users find information. Those files were information systems because they stored data about books and periodicals on 3-by-5-inch index cards.

Today, however, when businesspeople think about information systems, they are most likely thinking about **computer-based information systems**. These systems rely on computer and related technologies to store information electronically in an organized, accessible manner. So, instead of card catalogs, your college library probably uses a computerized information system that allows users to search through periodicals, journals, and books and even digital collections of historic photographs, manuscripts, and maps.

computer-based information systems information systems that rely on computer and related technologies to store information electronically in an organized, accessible manner.

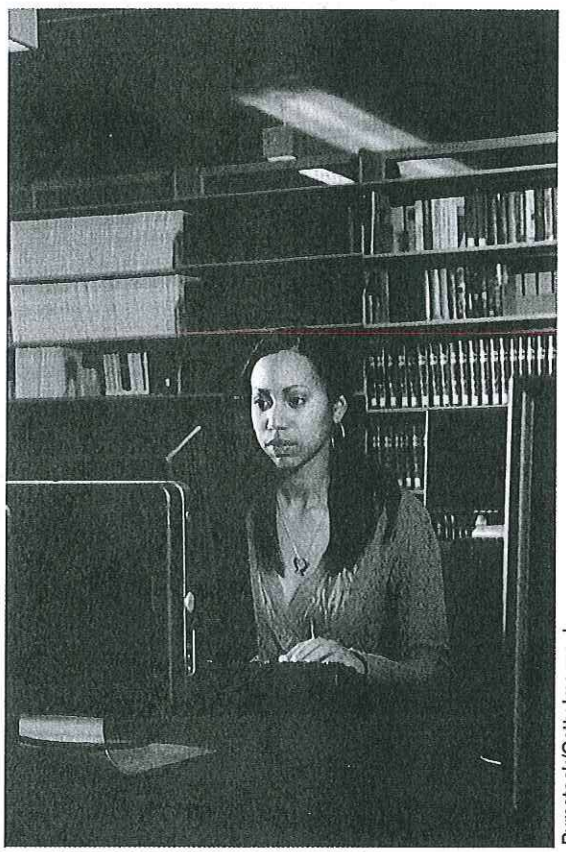
Computer-based information systems consist of four components and technologies:

- computer hardware
- computer software
- telecommunications and computer networks
- data resource management

Computer hardware consists of machines that range from supercomputers to smart phones. It also includes the input, output, and storage devices needed to support computing machines. Software includes operating systems, such as Microsoft's Windows 8 or Linux, and applications programs, such as Adobe Acrobat and Customer Relationship Management, or CRM. Consumer software includes Dropbox and Evernote, while enterprise software includes Salesforce.com and Workday. In addition, mobile software consists primarily of iOS and Android operating systems.

Telecommunications and computer networks encompass the hardware and software needed to provide wired or wireless voice and data communications. This includes support for external networks such as the Internet and private internal networks. Data resource management involves developing and maintaining an organization's databases so that decision makers are able to access the information they need in a timely manner.

In the case of your institution's library, the computer-based information system is generally made up of computer hardware, such as monitors and keyboards, which are linked to the library's network and a database containing information on the library's holdings. Specialized software allows users to access the database. In addition, the library's network is likely also



Purestock/Getty Images, Inc.

Libraries typically use a computer-based information system, made up of computer hardware linked to the library's network and a database containing information on the books in the library. Specialized software allows users to access the database.

Hit&Miss

Target's Customer Data Gets Hacked

At the height of a recent holiday season, a retailer's worst nightmare became a reality for Minneapolis-based Target. In less than three weeks, cyber thieves hacked more than 110 million customer debit and credit card account names and numbers, stealing encrypted PIN data and security codes on the back of the cards used at the 1,797 U.S. Target stores. The hack occurred through Target's point-of-sale-system, where every number was copied as shoppers swiped or entered data at store checkouts.

Target set up a telephone hotline to answer all questions and offered one year of free credit monitoring to all customers, regardless of whether or not they were impacted by the breach. In addition, storewide discounts of 10 percent were offered the weekend after the breach was discovered.

While customers are not responsible for any fraudulent charges on their cards, many are angry, and a number of shoppers have pursued class action lawsuits against the retailer, claiming it was negligent at protecting their data. Then CEO Gregg Steinhafel apologized to customers about the breach and announced that Target would work with banks and other retailers to adopt a more secure technology that uses credit and debit cards with embedded chips, which are more difficult to counterfeit. Both Steinhafel and the company's chief technology officer have since resigned from the company over the data breach.

Questions for Critical Thinking

1. Critics say that what happened to Target is not the retailer's fault, but is more the blame of U.S. data security and how much we lag behind the rest of the world in securing personal financial information. Do you agree or disagree?
2. How much do you think a breach of this nature actually hurts Target in the long run?

Sources: Russell Brandom, "Target CEO Resigns in the Wake of Data Breach," *The Verge,* accessed May 18, 2014, www.theverge.com; Tiffany Hsu, "Target Technology Chief Beth Jacob Resigns after Breach," *Los Angeles Times,* accessed May 18, 2014, http://articles.latimes.com; Michael Riley, Ben Elgin, Dune Lawrence, and Carol Matlack, "Missed Alarms and 40 Million Stolen Credit Card Numbers: How Target Blew It," *Bloomberg Businessweek,* accessed March 20, 2014, www.businessweek.com; Kevin Johnson, "Feds Investigating Target Data Breach," *USA Today,* accessed March 20, 2014, www.usatoday.com; Gregory Wallace, "Target Credit Card Hack: What You Need to Know," *CNN,* accessed March 20, 2014, http://money.cnn.com; Joshua Brustein "Is Target to Blame for Its Data Breach? Let the Lawsuits Begin," *Bloomberg Businessweek,* accessed March 20, 2014, www.businessweek.com.

connected to a larger private network and the Internet. This connection gives users remote access to the library's database, as well as access to other computerized databases such as LexisNexis.

Databases

database centralized integrated collection of data resources.

The heart of any information system is its **database**, a centralized integrated collection of data resources. A company designs its databases to meet particular information processing and retrieval needs of its workforce. Businesses obtain databases in many ways. They can hire a staff person to build them on site, hire an outside source to do so, or buy cloud-based services from specialized vendors, such as Oracle, SAP, or Salesforce.com. A database serves as an electronic filing cabinet, capable of storing massive amounts of data and retrieving it within seconds. A database should be continually updated; otherwise, a firm may find itself with information that is obsolete, outdated, and possibly useless. One problem with databases is that they can contribute to information overload—too much data for people to absorb or data that are not relevant to decision making. Because both computer processing speed and storage capacity have increased so dramatically, and because data have become more abundant, businesspeople need to be careful that their databases contain only the facts they need. If they don't, they can waste time wading through unnecessary data. Another challenge with databases is security, as the "Hit & Miss" feature describes.

operational support systems information systems designed to produce a variety of information on an organization's activities for both internal and external users.

transaction processing systems operational support system to record and process data from business transactions.

Decision makers can also look up online data. Online systems give access to enormous amounts of government data, such as economic data from the Bureau of Labor Statistics and the Department of Commerce. One of the largest online databases is that of the U.S. Census Bureau. The census of population, conducted every ten years, collects data on more than 120 million households across the United States. After attempting to count everyone in the country, the Census Bureau has selected participants fill out forms containing questions

about marital status, place of birth, ethnic background, citizenship, workplaces, commuting time, income, occupation, type of housing, number of telephones and vehicles, even grandparents as caregivers.[4] Households receiving the most recent questionnaire can respond in English as well as a variety of other languages including Spanish, Chinese, Vietnamese, and Korean. Not surprisingly, sifting through all the collected data takes time. Although certain restrictions limit how businesspeople can access and use specific census data, the general public may access the data via the American FactFinder on the Census Bureau's website (http://factfinder2.census.gov), as well as at state data centers and public libraries.

Another source of free information is company websites. Interested parties can visit a company's site to research customers, suppliers, and competitors. Trade associations and academic institutions also maintain websites with relevant information.

Types of Information Systems

Many different types of information systems exist. In general, however, information systems fall into two broad categories: operational support systems or management support systems.

Operational Support Systems **Operational support systems** are designed to produce a variety of information on an organization's activities for both internal and external users. Examples of operational support systems include transaction processing systems, process control systems, and enterprise collaboration systems, which facilitate efficient sharing of documents and knowledge between teams and individuals within an organization. **Transaction processing systems** record and process data from business transactions. For example, major retailers use point-of-sale systems, which link electronic cash registers to the retailer's computer centers. Sales data are transmitted from cash registers to the computer center either immediately or at regular intervals. **Process control systems** monitor and control physical processes. A steel mill, for instance, may have electronic sensors linked to a computer system monitoring the entire production process. The system makes necessary changes and alerts operators to potential problems.

Management Support Systems Information systems that are designed to provide support for effective decision making are classified as **management support systems**. Several different types of management support systems are available. A **management information system (MIS)** is designed to produce reports for managers and other personnel.

A **decision support system (DSS)** gives direct support to businesspeople during the decision-making process. For instance, a marketing manager might use a decision support system to analyze the impact on sales and profits of a product price change.

An **executive support system (ESS)** lets senior executives access the firm's primary databases, often by touching the computer screen, pointing and clicking a mouse, or using voice recognition. The typical ESS allows users to choose from many types of data, such as the firm's financial statements and sales figures, as well as stock market trends for the company and for the industry as a whole. Managers can start by looking at summaries and then access more detailed information as needed.

Finally, an **expert system** is a computer program that imitates human thinking through complicated sets of if-then rules. The system applies human knowledge in a specific subject area to solve a problem. Expert systems

process control systems operational support system to monitor and control physical processes.

management support systems information systems that are designed to provide support for effective decision making.

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The complex process of airline maintenance is critical to passenger safety. To track parts, schedule inspections, and manage inventory levels, many airlines, including American, use an operational support system.

sessment eck

st the four components a computer-based formation system.

/hat is a database?

/hat are the two eneral types of infor- ıation systems? Give xamples of each.

are used for a variety of business purposes: determining credit limits for credit card applicants, monitoring machinery in a plant to predict potential problems or breakdowns, making mortgage loans, and determining optimal plant layouts. They are typically developed by capturing the knowledge of recognized experts in a field whether within a business itself or outside it.

3 Computer Hardware and Software

The first commercial computer, UNIVAC I, was sold to the U.S. Census Bureau in the early 1950s. It cost $1 million, took up most of a room, and could perform about 2,000 calculations per second.[5] The invention of transistors and then integrated circuits (microchips) quickly led to smaller and more powerful devices. By the 1980s, computers could routinely perform several million calculations per second. Now, computers perform billions of calculations per second, and many fit in the palm of your hand.

When the first personal computers were introduced in the late 1970s and early 1980s, the idea of a computer on every desk, or in every home, seemed far-fetched. Today they have become indispensable to both businesses and households. Not only have computers become much more powerful and faster over the past 25 years, but they are less expensive as well. IBM's first personal computer (PC), introduced in 1981, cost well over $5,000 fully configured. Today, due to decreased demand and lower production costs, a typical PC sells for between $400 and $700; products in Apple's Mac lineup average $1,300. Average performance laptops sell for between $275 and $500.[6]

Types of Computer Hardware

ardware all tangible ements of a computer ystem.

Hardware consists of all tangible elements of a computer system—the input devices, the components that store and process data and perform required calculations, and the output devices that present the results to information users. Input devices allow users to enter data and commands for processing, storage, and output. The most common input devices are the keyboard and mouse. Storage and processing components consist of the hard drive found on older computers. Although more expensive, solid-state drives are faster and more power efficient today, and some computers use a disk array controller for greater performance. Backing up important documents with external hardware is less prevalent today, as the Internet has provided storage solutions like Box, a service that allows you to save local files to the cloud. Flash memory devices, also called thumb drives, are small and can hold large amounts of data and are easily accessed by plugging the drive into a USB (universal serial bus) port. Output devices, such as monitors and printers, are the hardware elements that transmit or display documents and other results of a computer system's work.

Because of their ever-increasing capabilities, smart phones have rapidly replaced cell phones on a worldwide basis.

Different types of computers incorporate widely varying memory capacities and processing speeds. These differences define four broad classifications: mainframe computers, midrange systems, personal computers, and hand-held devices. A mainframe computer is the largest type of computer system with the most extensive storage capacity and the fastest processing speeds. Especially powerful mainframes called *supercomputers* can handle extremely rapid, complex calculations involving thousands of variables, such as weather modeling and forecasting. One of the fastest supercomputers today is the Tianhe-2 in China, with 33,860 trillion calculations per second.[7]

Midrange systems consist of high-end network servers and other types of computers that can handle large-scale processing

needs. They are less powerful than mainframe computers but more powerful than most personal computers. A **server** is the heart of a midrange computer network, supporting applications and allowing the sharing of output devices, software, and databases among networked users. Many Internet-related functions at organizations are handled by midrange systems. Midrange systems are also commonly employed in process control systems, computer-aided manufacturing (CAM), and computer-aided design (CAD).

Once the center of the digital universe, a full-scale Windows or Mac OS personal desktop computer was the way most people accessed the Internet, wrote papers, played games, organized music and photos, and more. While some believe the PC is on its way to extinction and ownership rates have declined, PCs are still popular in homes, businesses, schools, and government agencies. Tablet sales recently surpassed PC sales.[8]

Desktop computers used to be the standard PC seen in offices and homes. While millions of desktop computers remain on the job, laptops—including notebooks and netbooks—have surpassed desktop units in sales. The increasing popularity of these computers can be explained by smaller, lighter, more powerful computing, and by their improved displays, faster processing speeds, ability to handle more intense graphics, larger storage capacities, and more durable designs. Business owners, managers, salespeople, and students all benefit from their portability and instantaneous access to information. In the next few years, analysts predict that more than half of the smart connected devices sold will be tablets, followed by laptops and desktops. In a recent quarter, tablet sales surpassed desktop and laptop sales combined.[9]

Prices for full-size laptops, notebooks, and netbooks vary greatly—but you can purchase a netbook for an average of $250 to $350 or a MacBook Pro laptop for between $1,200 and $2,600. A netbook does not have the computing capacity of a larger, more expensive notebook, but it can perform basic tasks such as search, e-mail, word processing, and spreadsheet calculations.

Hand-held devices such as smart phones are even smaller. The most popular smart phones today are powered by Google's Android and Apple's iOS mobile operating systems. Smart phones like the iPhone and Samsung's Galaxy essentially combine a mobile phone with more advanced computing capabilities than their predecessor, the basic cell phone.

Two other devices—tablets and e-readers—are taking major market share from laptops. According to Pew Research Center's Internet and American Life Project, more than a third of U.S. adults now own a tablet.[10] In addition to the Apple iPad, the top selling tablet, there are a proliferation of tablet models on the market, including those from Google, Samsung, Amazon, and Sony. E-readers such as Amazon's Kindle continue to expand their market share. Currently, about 32 percent of U.S. adults own an e-reader. A hybrid device, called a phablet, is a cross between a smart phone and a tablet, with a screen larger than a smart phone but smaller than a tablet.

While smart phones can be terrific tools that boost productivity, some people overuse or even misuse them. The "Career Kickstart" feature describes some of the do's and don'ts of smart phone use in the business environment.

server the heart of a midrange computer network.

CareerKickstart

Courteous Communications via Mobile Devices

The number of smart phone users worldwide is expected to reach 4.5 billion over the next few years. It is estimated that at least 25 percent of the world's population use a smart phone at least monthly. With so much mobile phone use, it's more important than ever to communicate courteously. Consider these tips:

1. *Be aware of your surroundings and your neighbors.* If you're someplace where a phone conversation would be disruptive, turn off your ringtone. If the call or e-mail simply can't wait, excuse yourself and leave the room to respond.
2. *Lower your voice.* If you're in a room that's quieter than your speaking voice, go somewhere else.
3. *When e-mailing or texting, don't overabbreviate.* Business messages can be concise without being cute or unintelligible. For example, say "See you at 3," not "cu@3."
4. *Before sending a text message or e-mail, reread it carefully.* Typos and grammatical errors have no place in a business message.
5. *Be careful with Facebook photos.* Now that smart phones let users link all their contact information, your photo will appear on the other person's phone when you call. And people beyond those on your Facebook friends list will see it. Be sure your photo is appropriate for both friends and business callers.

Sources: "Smartphone Users Worldwide Will Total 1.75 Billion in 2014," *eMarketer,* accessed February 27, 2014, www.emarketer.com; Christopher Elliott, "E-Mail Etiquette for Wireless Devices," *Microsoft Small Business Center,* accessed February 25, 2014, www.microsoft.com; Taya Flores, "Cell Phone Etiquette Is Important," *JC Online,* accessed February 25, 2014, www.jconline.com; Mike Elgan, "Here Comes the New Cell Phone Etiquette," *IT World,* accessed February 25, 2014, www.itworld.com.

In addition to smart phones, specialized hand-held devices are used in a variety of businesses for different applications. Some restaurants, for example, have small wireless devices that allow servers to swipe a credit card and print out a receipt right at the customer's table. Drivers for UPS and FedEx use special hand-held scanning devices to track package deliveries and accept delivery signatures. The driver scans each package as it is delivered, and the information is transmitted to the delivery firm's network. Within a few seconds, the sender, using an Internet connection, can obtain the delivery information and even see a facsimile of the recipient's signature.

Computer Software

Software includes all of the programs, routines, and computer languages that control a computer and tell it how to operate. The software that controls the basic workings of a computer system is its *operating system*. More than 80 percent of personal computers use a version of Microsoft's popular Windows operating system. Personal computers made by Apple use the Mac operating system. The Android and iPhone models have their own operating systems. Other operating systems include Unix, which runs on many midrange computer systems, and Linux, which runs on both PCs and midrange systems.

software all the programs, routines, and computer languages that control a computer and tell it how to operate.

A program that performs the specific tasks that the user wants to carry out—such as writing a letter or looking up data—is called *application software*. Examples of application software include Adobe Acrobat, Microsoft PowerPoint, and Quicken. Table 14.1 lists the major categories of application software. Most application programs are currently stored on individual computers. However, most application software has become web based, with the programs themselves stored on Internet-connected, cloud-based servers.

TABLE 14.1 Common Types of Application Software

TYPE	DESCRIPTION	EXAMPLES
Word processing	Programs that input, store, retrieve, edit, and print various types of documents.	Microsoft Word, Google Docs
Spreadsheets	Programs that prepare and analyze financial statements, sales forecasts, budgets, and similar numerical and statistical data.	Microsoft Excel, Google Docs
Presentation software	Programs that create presentations. Users can create bulleted lists, charts, graphs, pictures, audio, and even short video clips.	Microsoft PowerPoint, Google Docs, Prezi
Desktop publishing	Software that combines high-quality type, graphics, and layout tools to create output that can look as attractive as documents produced by professional publishers and printers.	Adobe InDesign, Microsoft Publisher
Financial software	Programs that compile accounting and financial data to create financial statements, reports, and budgets; they perform basic financial management tasks such as balancing a checkbook.	Quicken, Intuit QuickBooks
Database programs	Software that searches and retrieves data from a database; it can sort data based on various criteria.	Microsoft Access, Intuit QuickBase
Personal information managers	Specialized database programs that allow people to track communications with personal and business contacts; some combine e-mail capability.	Microsoft Outlook
Enterprise resource planning	Integrated cross-functional software that controls many business activities, including distribution, finance, and human resources.	SAP Enterprise Resource Planning, Salesforce.com

Assessment Check

1. List two input and output devices.
2. What accounts for the increased popularity of laptop and notebook computers?
3. What is software? List the two categories of software.

An app is a software program, and most are designed to run on a smart phone or a tablet. Originally intended for e-mail, calendar, and contact databases, apps continue to be in high demand for other areas like games, GPS, factory automation, banking, order tracking, ticket purchases, and travel. In a recent year, more than 102 billion apps were downloaded, most of them free, but they still generated $26 billion in revenue.[11]

4 Computer Networks

As mentioned earlier, virtually all computers today are linked to networks. In fact, if your PC has Internet access, you're linked to a network. Local area networks and wide area networks allow businesses to communicate, transmit and print documents, and share data. These networks, however, require businesses to install special equipment and connections between office sites. But Internet technology has also been applied to internal company communications and business tasks, tapping a ready-made network. Among these Internet-based applications are intranets, virtual private networks (VPNs), and voice over Internet protocol (VoIP). Each has contributed to the effectiveness and speed of business processes, so we discuss them next.

Local Area Networks and Wide Area Networks

Most organizations connect their offices and buildings by creating **local area networks (LANs)**, computer networks that connect machines within limited areas, such as a building or several nearby buildings. LANs are useful because they link computers and allow them to share printers, documents, and information, as well as provide access to the Internet. Figure 14.1 shows what a small business computer network might look like.

Wide area networks (WANs) tie larger geographical regions together by using telephone lines and microwave and satellite transmission. One familiar WAN is long-distance telephone service. Companies such as AT&T and Verizon provide WAN services to businesses and consumers. Firms also use WANs to conduct their own operations. Typically, companies link their own network systems to outside communications equipment and services for transmission across long distances.

Wireless Local Networks

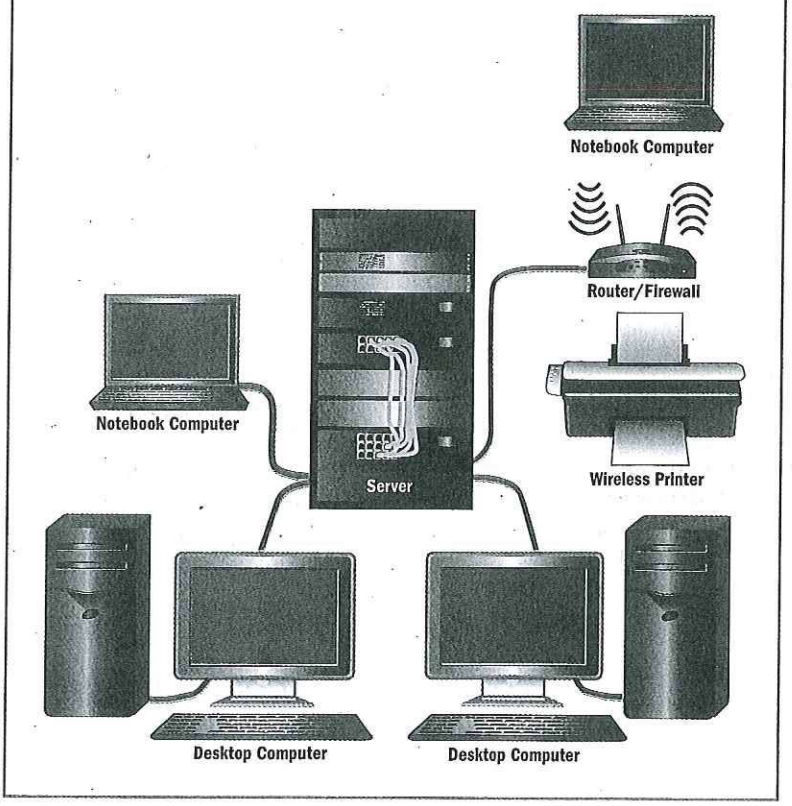
A wireless network allows computers, printers, and other devices to be connected without the hassle of stringing cables in traditional office settings. The current standard for wireless networks is called Wi-Fi. **Wi-Fi**—short for *wireless fidelity*—is a wireless network that connects various devices and allows them to communicate with one another through radio waves. Any device with a Wi-Fi receptor can connect with the Internet at so-called hot spots—locations with a wireless router and a high-speed Internet modem. There are hundreds of thousands of hot spots worldwide today. Wi-Fi can be found in a variety of places, including restaurants, hotels, airports, libraries, and cafés. Some locations, like

local area networks (LANs) computer networks that connect machines within limited areas, such as a building or several nearby buildings.

wide area networks (WANs) tie larger geographical regions together by using telephone lines and microwave and satellite transmission.

Wi-Fi wireless network that connects various devices and allows them to communicate with one another through radio waves.

FIGURE 14.1 A Local Area Network



Wi-Fi connections are often called hot spots—locations with a wireless router and a high-speed Internet modem. There are hundreds of thousands of hot spots worldwide today found in a variety of places, including airports, libraries, and coffee shops.

McDonald's, Starbucks, Panera, Whole Foods, Staples, and Apple Stores, offer free access, while others charge a fee.[12]

Many believe that the successor to Wi-Fi will be *Wi-Max*. Unlike Wi-Fi's relatively limited geographic coverage area—generally around 300 feet—a single Wi-Max access point can provide coverage over many miles. Due to its higher cost, however, the adoption of Wi-Max has been limited.[13] In addition, cell phone service providers, such as Sprint Nextel and AT&T, offer broadband network cards for notebook PCs. These devices allow users to access the provider's mobile broadband network from virtually any location where cell phone reception is available.

Intranets

A broad approach to sharing information in an organization is to establish a company network patterned after the Internet. Such a network is called an **intranet**. Intranets are similar to the Internet, but they limit access to employees or other authorized users. An intranet blocks outsiders without valid passwords from entering its network by incorporating both software and hardware known as a **firewall**. Firewalls limit data transfers to certain locations and log system use so that managers can identify attempts to log on with invalid passwords and other threats to a system's security. Highly sophisticated real-time threat defense alert systems let administrators know about suspicious activities and permit authorized personnel to use smart cards to connect from remote terminals.

tranet computer network that is similar to the ternet but limits access to ıthorized users.

rewall limits data ansfers to certain cations and log system se so that managers can lentify attempts to log on ith invalid passwords and ther threats to a system's ecurity.

Intranets solve the problem of linking different types of computers. Like the Internet, intranets can integrate computers running all kinds of operating systems. In addition, intranets are relatively easy and inexpensive to set up because most businesses already have some of the required hardware and software. All the business's computers will be linked with each other and with the Internet. Microsoft's SharePoint is the dominant software used for creating intranets.

Intranets enable collaboration among employees who are traveling or telecommuting. They can nurture innovation and the development of creative ideas. They can be used to share marketing and brand information worldwide. Mobile intranets—with access from smart phones—are becoming increasingly popular for companies with employees who are often on the go.

Virtual Private Networks

To gain increased security for Internet communications, companies often turn to **virtual private networks (VPNs)**, secure connections between two points on the Internet. These VPNs use firewalls and programs that encapsulate data to make them more secure during transit. Loosely defined, a VPN can include a range of networking technologies, from secure Internet connections to private networks from service providers such as IBM. A VPN is less expensive for a company to use than leasing several of its own lines. It can also take months to install a leased line in some parts of the world, but a new user can be added to a VPN in a day. Because a VPN uses the Internet, it can be wired, wireless, or a combination of the two.

virtual private networks (VPNs) secure connections between two points on the Internet.

Colorado-based Advanced Systems Group (ASG) provides data storage and management services to other companies. As the company expanded and opened branch offices, its own security became a concern. ASG turned to Check Point, which created a secure VPN

connecting ASG's home office and its branch offices. The VPN allows ASG to add new sites and new remote users automatically.[14]

VoIP

VoIP—which stands for *voice over Internet Protocol*—is an alternative to traditional telecommunication services provided by companies such as Verizon and Sprint. The VoIP telephone is connected to a personal computer with any type of broadband connection instead of a traditional phone jack. Special software transmits phone conversations over the Internet, rather than through telephone lines. A VoIP user dials the phone as usual. The person can make and receive calls to and from those with traditional telephone connections (landline or wireless).

A growing number of consumers and businesses have embraced VoIP, mainly due to its cost savings and extra features. As technology continues to advance, demand for the service has increased. Several wireless companies, including AT&T and Verizon, permit VoIP on smart phones. Google integrates its Google Voice over VoIP. The various VoIP providers are working together with the goal of creating a single VoIP standard that would permit seamless roaming worldwide.[15]

In spite of VoIP's apparent advantages, there are several potential drawbacks to replacing traditional telephony with Internet telephony. For one thing, your Internet phone service will be only as reliable as your broadband connection. If your broadband connection goes out, so will your phone service. Also, without extensive safeguards, VoIP can expose a phone system to the havoc that can affect the rest of the Internet, such as worms and viruses.

VoIP alternative to traditional telecommunication services provided by companies such as Verizon and Sprint.

Assessment Check

1. What is a LAN?
2. What are the differences between an intranet and a VPN?
3. Briefly explain how VoIP works.

5 Security and Ethical Issues Affecting Information Systems

Numerous security and ethical issues affect information systems. As information systems become increasingly important business assets, they also become progressively harder and more expensive to replace. Damage to information systems or theft of data can have disastrous consequences. When computers are connected to a network, a problem at any individual computer can affect the entire network. Two of the major security threats are cybercrime and so-called malware.

Cybercrime

Computers provide efficient ways for employees to share information. But they may also allow people with more malicious intentions to access information. Or they may allow pranksters—who have no motive other than to see whether they can hack into a system—to gain access to private information. Common cybercrimes involve stealing or altering data in several ways:

- Employees or outsiders may change or invent data to produce inaccurate or misleading information.
- Employees or outsiders may modify computer programs to create false information or illegal transactions or to insert viruses.
- Unauthorized people can access computer systems for their own benefit or knowledge or just to see if they can get in.

Individuals, businesses, and government agencies are all vulnerable to computer crime. Computer hackers—unauthorized users—sometimes work alone and sometimes work in groups. Hackers can break into computer systems just to show that they can do it; other times they have more sinister motives. A recent survey reported that although computer

crime decreased slightly recently, the majority of such attacks may go undetected because many firms have concentrated on foiling hackers and blocking pornography while leaving themselves open to cybercriminals who are developing increasingly sophisticated weapons. Even Apple computers, usually immune to cybercrime, are becoming vulnerable as more and more Mac users store data in the cloud—that is, on the Internet itself—rather than on hard drives. Until now there has been no single uniform system for reporting cybercrime, but the Internet Engineering Task Force (IETF) is proposing a common format able to analyze massive amounts of data much faster than human analysts can.[16]

Information system administrators implement two basic protections against computer crime: They try to prevent access to their systems by unauthorized users and the viewing of data by unauthorized system users. The simplest method of preventing access requires authorized users to enter passwords. The company may also install firewalls, described earlier. To prevent system users from reading sensitive information, the company may use encryption software, which encodes, or scrambles, messages. To read encrypted messages, users must use an electronic key to convert them to regular text. But as fast as software developers invent new and more elaborate protective measures, hackers seem to break through their defenses. Thus, security is an ongoing battle.

Consumers with credit cards are particularly at risk from hackers. Recently, luxury retailer Neiman Marcus discovered that hackers had breached its cyber-security system, which compromised customer credit card data. It is important for payment-processing companies used by major credit card companies to put protections in place so that consumer credit and debit card information remain safe.[17]

As the size of computer hardware diminishes, it becomes increasingly vulnerable to theft. Hand-held devices, for instance, are particularly susceptible to theft. At an estimated cost of $30 billion annually, one in three robberies now involves smart phones.[18] Many notebook computers and hand-held devices contain special security software or passwords that make it difficult for a thief or any unauthorized person to access the data stored in the computer's memory. Find My iPhone was introduced for iOS users to locate their device and remotely delete data in the event it was lost or stolen. Apple recently updated its operating system to include software with an activation lock to prevent access to confidential information in the event of theft, similar to a kill switch feature.[19] Lawmakers in several states have proposed legislation requiring manufacturers to install a kill switch or mechanism to disable stolen phones in an effort to protect data and diminish resale value of the stolen device.[20]

Computer Viruses, Worms, Trojan Horses, and Spyware

malware any malicious software program designed to infect computer systems.

Viruses, worms, Trojan horses, and spyware, collectively referred to as **malware**, are malicious software programs designed to infect computer systems. These programs can destroy data, steal sensitive information, and even render information systems inoperable. Recently, malware has been discovered in advertisements on major sites such as Yahoo, Fox, and Google as well as *The New York Times* and WhitePages.com. Malware attacks cost consumers and businesses billions of dollars annually. And malware is proliferating: according to a recent estimate, companies are spending more than $100 billion annually to deal with malware-related cyber attacks.[21]

viruses programs that secretly attach themselves to other programs (called hosts) and change them or destroy data.

Computer **viruses** are programs that secretly attach themselves to other programs (called *hosts*) and change them or destroy data. Viruses can be programmed to become active immediately or to remain dormant for a period of time, after which the infections suddenly activate themselves and cause problems. A virus can reproduce by copying itself onto other programs stored in the same drive. It spreads as users install infected software on their systems or exchange files with others, usually by exchanging e-mail, accessing electronic bulletin boards, trading disks, or downloading programs or data from unknown sources on the Internet.

worm small piece of software that exploits a security hole in a network to replicate itself.

A **worm** is a small piece of software that exploits a security hole in a network to replicate itself. A copy of the worm scans the network for another machine that has a specific security hole. It copies itself to the new machine using the security hole and then starts replicating from there as well. Unlike viruses, worms don't need host programs to damage computer systems.

A **botnet** is a network of PCs that have been infected with one or more data-stealing viruses. Computer criminals tie the infected computers into a network, often without the owners being aware of it, and sell the botnet on the black market. They or others use the botnet to commit identity theft, sell fake pharmaceuticals, buy blocks of concert tickets for scalping, and attack the Internet itself. U.S. security company Symantec recently seized part of the 1.9 million computer-strong ZeroAccess, one of the largest botnets worldwide. ZeroAccess worked by targeting and infecting search results from Google, Bing, and Yahoo and generating revenue from artificial clicks associated with display ads from infected computers.[22]

botnet a network of PCs that have been infected with one or more data-stealing viruses.

A **Trojan horse** is a program that claims to do one thing but in reality does something else, usually something malicious. For example, a Trojan horse might claim, and even appear, to be a game. When an unsuspecting user clicks on the Trojan horse to launch it, the program might erase the hard drive or steal any personal data stored on the computer.

Trojan horse program that claims to do one thing but in reality does something else, usually something malicious.

Spyware is software that secretly gathers user information through the user's Internet connection without his or her knowledge, usually for advertising purposes. Spyware applications are typically bundled with other programs downloaded from the Internet. Once installed, the spyware monitors user activity on the Internet and transmits that information in the background to someone else.

spyware software that secretly gathers user information through the user's Internet connection without his or her knowledge, usually for advertising purposes.

Attacks by malware are not limited to computers and computer networks. Users of smart phones have reported a sharp increase in viruses, worms, and other forms of malware. A recent malware scare known as Backdoor AndroidOS.Obad.a is a Trojan horse that infects the handsets of unsuspecting users. It duplicates itself, installs additional malware, distributes malicious software to other phones via Bluetooth, and performs remote commands in the Android handset, while racking up enormous charges to premium-rate phone numbers.[23]

As viruses, worms, botnets, and Trojan horses become more complex, the technology to fight them must become more sophisticated as well. The simplest way to protect against computer viruses is to install one of the many available antivirus software programs, such as Norton AntiVirus and McAfee VirusScan. These programs, which also protect against worms and some Trojan horses, continuously monitor systems for viruses and automatically eliminate any they spot. Users should regularly update them by downloading the latest virus definitions. In addition, computer users should also install and regularly update antispyware programs because many Trojan horses are forms of spyware.

But management must begin to emphasize security at a deeper level: during software design, in corporate servers, at web gateways, and through Internet service providers. Because the vast majority of the world's computers run on Microsoft operating systems, a single virus, worm, or Trojan horse can spread among them quickly. Individual computer users should carefully choose the files they load onto their systems, scan their systems regularly, make sure their antivirus software is up to date, and install software only from known sources. They should also be very careful when opening attachments to e-mails because many viruses, worms, and Trojan horses are spread that way.

Information Systems and Ethics

The scope and power of today's information systems not surprisingly raise a number of ethical issues and concerns. These affect both employees and organizations. For instance, it is not uncommon for organizations to have specific ethical standards and policies regarding the use of information systems by employees and vendors. These standards include obligations to protect system security and the privacy and confidentiality of data. Policies also may cover the personal use of computers and related technologies, both hardware and software, by employees.

Ethical issues also involve organizational use of information systems. Organizations have an obligation to protect the privacy and confidentiality of data about employees and customers. Employment records contain sensitive personal information, such as bank account numbers, which, if not protected, could lead to identity theft. Another ethical issue is the use of computer technology to monitor employees while they are working. The "Solving an Ethical Controversy" feature debates the issue of employee monitoring in further detail.

Assessment Check

1. Explain computer hacking.
2. What is malware?
3. How does a computer virus work?

Solving an Ethical Controversy

Should Employers Monitor Employees' Internet Use?

Nearly three-quarters of employers monitor their employees' Internet use. Internet and desktop surveillance technology allow companies to check the sites employees visit, the amount of time spent online—and even keystrokes on individual computers. Most employees are unable to resist the temptation of searching the Internet at work, and most admit to using the Internet for nonwork purposes. Personal Internet usage includes social media sites, shopping, banking, playing games, and instant messaging. While a company's Facebook can be a powerful marketing tool, it can also be grounds for termination if employees use the social media site to express concerns about the company.

Should employers monitor employees' web use?

PRO

1. Employees spend an estimated one to two hours daily online for personal use. Regardless of the purpose, this is lost time for employers.
2. Employees' inappropriate use of office technology could leave a company vulnerable to security breaches.

CON

1. Some employers say monitoring erodes employees' trust and commitment.
2. Without notification of monitoring, employees have a legitimate privacy concern.

Summary

Federal law permits employers' monitoring of computer activity. However, to avoid privacy issues, employers should establish clear policies on personal use of the organization's technology.

Sources: Pamela S. Stevens, "Employee Monitoring Software Review 2014," *Top Ten Reviews,* accessed March 20, 2014, http://employee-monitoring-software-review.toptenreviews.com; "How Do Employers Monitor Internet Usage at Work," *wiseGeek,* accessed March 20, 2014, www.wisegeek.com; Susan M. Heathfield, "Electronic Surveillance of Employees," *About.com,* accessed March 20, 2014, http://humanresources.about.com; Karen Codere, "Managing Social Media in the Workplace," *The Business Ledger,* accessed March 20, 2014, www.businessledger.com; Laura Petrecca, "More Employers Use Tech to Track Workers," *USA Today,* accessed March 20, 2014, www.usatoday.com.

6 Disaster Recovery and Backup

Natural disasters, power failures, equipment malfunctions, software glitches, human error, and terrorist attacks can disrupt even the most sophisticated computer information systems. These problems can cost businesses and other organizations billions of dollars. Even more serious consequences can occur. One study found that 60 percent of companies that lose their data will shut down within six months of the disaster.[24]

FalconStor, a global firm headquartered in Melville, New York, provides data back-up applications and sophisticated disaster recovery solutions for businesses. The firm's services go way beyond simply replicating data because organizations that have suffered a major loss have needs well beyond replicating their data. FalconStor's software solutions permit them to access their applications, restart operations, and return to serving customers.[25]

Disaster recovery planning—deciding how to prevent system failures and continue operations if computer systems fail—is a critical function of all organizations. Disaster prevention programs can avoid some of these costly problems. The most basic precaution is routinely backing up software and data—at the organizational and individual levels. However, the organization's data center cannot be the sole repository of critical data because a single location is vulnerable to threats from both natural and human-caused disasters. Consequently, off-site data backup is a necessity, whether in a separate physical location or online. Companies that perform online backups store the encrypted data in secure facilities that in turn have their own backups. The initial backup may take a day or more, but subsequent ones take far less

GoingGreen

Box Inc. Serving in the Cloud

Procter & Gamble, Pandora, and Six Flags are among the more than 25 million customers of Box Inc., a cloud storage company whose 20-something founder, Aaron Levie, started developing the service while still in college. Now the company has 750 employees in its Los Altos, California, offices and is worth about $2 billion.

Box Inc. serves three customer segments: enterprise, business, and personal. The business version of its cloud-based storage system, used by close to 225,000 firms (including 97 percent of the Fortune 500), offers applications for PCs, Macs, and mobile platforms and can provide highly secure shared access for groups of multiple users. Security for the personal version is a bit more limited and works for only one user at a time. But both versions receive high marks for ease of use and simplicity, even for users who are not tech savvy.

Competing services include Dropbox and Microsoft's OneDrive. Box recently doubled its free storage space, announced plans to expand to Europe, and recently announced plans to go public.

Questions for Critical Thinking

1. Do you think business users of cloud services such as Box will ever set up cloud storage as part of their IT departments? Explain.
2. Should Box provide the same degree of security for individual users as for business customers? Why or why not?

Sources: Company website, http://box.com, accessed June 20, 2014; Eric Markowitz, "Don't Bet Against Aaron Levie," *Entrepreneur,* accessed June 20, 2014, www.entrepreneur.com; Donna Tam, "Box Doubles Free Storage to 10GB, Hits 20 Million Users," *CNET,* accessed February 27, 2014, http://news.cnet.com; Douglas MacMillan and Telis Demos, "Web Storage Firm Box Files for IPO," *The Wall Street Journal,* accessed February 27, 2014, http://online.wsj.com.

time because they involve only new or modified files. Cloud computing services can greatly simplify off-site backup; see the accompanying "Going Green" feature for a profile of Box, a market leader.

According to security experts, there are five important considerations for off-site data storage. First is planning. The organization needs to decide what data need to be protected. Priority should be given to data having severe legal or business consequences should they be lost. Second, a backup schedule must be established and closely adhered to. Third, when data are transmitted off site, they must be protected by the highest level of security possible. Fourth, care should be taken in selecting the right security vendor. There are dozens of vendors offering different services and having different areas of expertise. Finally, the backup system should be continually tested and evaluated.

Assessment Check

1. What are the types of disasters to which information systems are vulnerable?
2. List the five considerations for off-site data storage.

7 Information Technology Trends

Computer information systems are constantly—and rapidly—evolving. To keep their information systems up-to-date, firms must continually keep abreast of changes in technology. A recent report by Accenture of the trends driving the future of technology includes data mining and analytics; data security; social platforms as a new source of business intelligence; cloud computing as a driver of business growth; data privacy, and mobile device diversity and management.[26]

Another topic that has received considerable press is the Internet of Everything or the Internet of Things for short. This refers to a move beyond standalone devices and greater connectivity between items. It consists of an entire Internet-connected eco-system, including TVs, cars, and wearable tech devices. Cisco's CEO says "The Internet of Everything will have five to ten times the impact on society as the Internet itself."[27]

The Distributed Workforce

As discussed in earlier chapters, many companies rely more and more on a *distributed workforce*—employees who no longer work in traditional offices but rather in what are called *virtual*

Continued technological advances in data storage and cloud computing allow businesspeople to work on their laptops, tablets, or smart phones from anywhere in the world.

offices, including at home. Information technology makes a distributed workforce possible. Computers, networks, and other components of information systems allow workers to do their jobs effectively almost anywhere. For instance, none of JetBlue's reservations agents work in offices; they all work at home, connected to the airline's information system. JetBlue is hardly alone in its use of home-based workers. Boeing, Starbucks, Agilent Technologies, Sun Microsystems, and most other companies have policies and options that permit at least some employees to work outside the organization's offices exclusively in a virtual setting. Virtual offices can range from a mailing address, mail forwarding, and voice mail to a physical office, usually leased by the month. The increasing demands of the distributed workforce will likely lead to more innovative and increasingly powerful information systems. Today, co-shared offices are increasingly popular.

Application Service Providers

application service provider (ASP) outside supplier that provides both the computers and the application support for managing an information system.

As with other business functions, many firms find that outsourcing at least some of their information technology function makes sense. Because of the increasing cost and complexity of obtaining and maintaining information systems, many firms hire an **application service provider (ASP)**, an outside supplier that provides both the computers and the application support for managing an information system. An ASP can simplify complex software for its customers so that it is easier for them to manage and use. When an ASP relationship is successful, the buyer can then devote more time and resources to its core businesses instead of struggling to manage its information systems. Other benefits include stretching the firm's technology dollar farther and giving smaller companies more competitive information power. Even large companies turn to ASPs to manage some or all of their information systems. Microsoft outsourced much of its internal information technology services to Infosys Technology to save money and streamline, simplify, and support its services.[28]

Companies that decide to use ASPs should check the backgrounds and references of these firms before hiring them to manage critical systems. In addition, customers should try to ensure that the service provider has strong security measures to block computer hackers or other unauthorized access to the data, that its data centers are running reliably, and that adequate data and applications backups are maintained.

On-Demand, Cloud, and Grid Computing

on-demand computing firms essentially rent the software time from application providers and pay only for their usage of the software.

Another trend that continues with great momentum is **on-demand computing**, also called *utility computing*. Instead of purchasing and maintaining expensive software, firms essentially rent the software time from application providers and pay only for their usage of the software, similar to purchasing electricity from a utility. On-demand computing is particularly useful for firms that experience annual peaks in demand or seasonal spikes in customer usage of their applications. By renting the service they need only when they need it, they can avoid buying the software that is not routinely required. On-demand computing can also help companies remain current with the most efficient software on the market without purchasing huge upgrades.

Hit&Miss

WhatsApp's Potential to Reach 1 Billion Users

Facebook's recent acquisition of WhatsApp for $19 billion represents an all-time record for the largest purchase of a venture-backed company. With 480 million active users, WhatsApp is an ad-free mobile messaging service that collects no user information other than a person's cell phone number. So, why would Facebook make such an expensive purchase?

While addressing the Mobile World Congress Trade Show in Barcelona, Spain, Facebook CEO Mark Zuckerberg recently spoke about his company's overall vision and WhatsApp's potential to increase Facebook's user base. Internet.org, Facebook's latest initiative, includes the philanthropic goal of bringing Internet connectivity to developing economies through a bundle of basic services that would be free of charge to use.

With the purchase of WhatsApp, Zuckerberg is determined to provide what he refers to as "a 911 for the Internet," to users who don't see the point of paying for basic data services through a telecommunications carrier. In addition, WhatsApp has the potential to reach a billion users—and some of them might just want to give Facebook a try.

Questions for Critical Thinking

1. Discuss your thoughts about the purchase of WhatsApp as part of Zuckerberg's goal to bring Internet connectivity to developing economies free of charge. Do you agree or disagree with his strategy?
2. While WhatsApp's founders disavow revenue-based business models and want to know as little as possible about their users, Facebook relies on placing ads in front of users based on their interests. Even if WhatsApp operates as a separate company, how might this conflict of ideas work out?

Sources: Parmy Olson, "WhatsApp Founder Defends His Commitment to Privacy After $19B Facebook Deal," *Forbes*, accessed March 20, 2014, www.forbes.com; Dennis Berman, "I Thought Facebook's WhatsApp Deal Was Crazy. Then I Did Some Math," *The Wall Street Journal*, accessed March 20, 2014, http://online.wsj.com; Jonathan Cheng, Sam Schechner, and Reed Albergotti, "WhatsApp to Offer Calling Feature," *The Wall Street Journal*, accessed February 26, 2014, http://online.wsj.com; Ingrid Lunden, "WhatsApp Is Actually Worth More Than $19B, Says Facebook's Zuckerberg, and It Was Internet.org That Sealed The Deal," *TechCrunch*, accessed February 26, 2014, http://techcrunch.com.

Cloud computing uses powerful servers to store applications software and databases. Users access the software and databases via the web using anything from a PC to a smart phone. The software as a service (SaaS) movement is an example of cloud computing. The "Hit & Miss" feature describes how Facebook's latest acquisition provides the company with the potential to reach a billion more users worldwide.

Small and medium-sized companies occasionally find themselves with jobs that require more computing power than their current systems offer. A cost-effective solution for these firms may be something called **grid computing**, which consists of a network of smaller computers running special software. The software breaks down a large, complex job into smaller tasks and then distributes them to the networked computers. The software then reassembles the individual task results into the finished job. By combining multiple small computers, grid computing creates a virtual mainframe or even a supercomputer.

cloud computing powerful servers store applications software and databases for users to access the software and databases via the web using anything from a PC to a smart phone.

grid computing consists of a network of smaller computers running special software.

What's Ahead

This is the first of two chapters devoted to managing technology and information. The next chapter, "Understanding Accounting and Financial Statements," focuses on accounting, financial information, and financing reporting. Accounting is the process of measuring, interpreting, and communicating financial information to enable people inside and outside the firm to make informed decisions. The chapter describes the functions of accounting and role of accountants; the steps in the accounting cycle; the types, functions, and components of financial statements; and the role of budgets in an organization.

Assessment Check

1. What is an application service provider?
2. Explain on-demand computing.