Chapter 9: The People in Information Systems

Learning Objectives

Upon successful completion of this chapter, you will be able to:

• describe each of the different roles that people play in the design, development, and use of information systems;
• understand the different career paths available to those who work with information systems;
• explain the importance of where the information-systems function is placed in an organization; and
• describe the different types of users of information systems.

Introduction

In the opening chapters of this text, we focused on the technology behind information systems: hardware, software, data, and networking. In the last chapter, we discussed business processes and the key role they can play in the success of a business. In this chapter, we will be discussing the last component of an information system: people.

People are involved in information systems in just about every way you can think of: people imagine information systems, people develop information systems, people support information systems, and, perhaps most importantly, people use information systems.

The Creators of Information Systems

The first group of people we are going to look at play a role in designing, developing, and building information systems. These people are generally very technical and have a background in programming and mathematics. Just about everyone who works in the creation of information systems has a minimum of a bachelor’s degree in computer science or information systems, though that is not necessarily a requirement. We will be looking at the process of creating information systems in more detail in chapter 10.

Systems Analyst

The role of the systems analyst is to straddle the divide between identifying business needs and imagining a new or redesigned computer-based system to fulfill those needs. This individual will work with a person, team, or department with business requirements and identify the specific details of a system that needs to be built. Generally, this will require the analyst to have a good understanding of the business itself, the
business processes involved, and the ability to document them well. The analyst will identify the different stakeholders in the system and work to involve the appropriate individuals in the process.

Once the requirements are determined, the analyst will begin the process of translating these requirements into an information-systems design. A good analyst will understand what different technological solutions will work and provide several different alternatives to the requester, based on the company’s budgetary constraints, technology constraints, and culture. Once the solution is selected, the analyst will create a detailed document describing the new system. This new document will require that the analyst understand how to speak in the technical language of systems developers.

A systems analyst generally is not the one who does the actual development of the information system. The design document created by the systems analyst provides the detail needed to create the system and is handed off to a programmer (or team of programmers) to do the actual creation of the system. In some cases, however, a systems analyst may go ahead and create the system that he or she designed. This person is sometimes referred to as a programmer-analyst.

In other cases, the system may be assembled from off-the-shelf components by a person called a systems integrator. This is a specific type of systems analyst that understands how to get different software packages to work with each other.

To become a systems analyst, you should have a background both in the business and in systems design. Many analysts first worked as programmers and/or had experience in the business before becoming systems analysts.

Programmer

Programmers spend their time writing computer code in a programming language. In the case of systems development, programmers generally attempt to fulfill the design specifications given to them by a systems analyst. Many different styles of programming exist: a programmer may work alone for long stretches of time or may work in a team with other programmers. A programmer needs to be able to understand complex processes and also the intricacies of one or more programming languages. Generally, a programmer is very proficient in mathematics, as mathematical concepts underlie most programming code.

Computer Engineer

Computer engineers design the computing devices that we use every day. There are many types of computer engineers, who work on a variety of different types of devices and systems. Some of the more prominent engineering jobs are as follows:

- Hardware engineer. A hardware engineer designs hardware components, such as microprocessors. Many times, a hardware engineer is at the cutting edge of computing technology, creating something brand new. Other times, the hardware engineer’s job is to engineer an existing component to work faster or use less power. Many times, a hardware engineer’s job is to write code to create a program that will be implemented directly on a computer chip.

- Software engineer. Software engineers do not actually design devices; instead, they create new programming languages and operating systems, working at the lowest levels of the hardware to develop new kinds of software to run on the hardware.
• Systems engineer. A systems engineer takes the components designed by other engineers and makes them all work together. For example, to build a computer, the motherboard, processor, memory, and hard disk all have to work together. A systems engineer has experience with many different types of hardware and software and knows how to integrate them to create new functionality.

• Network engineer. A network engineer’s job is to understand the networking requirements of an organization and then design a communications system to meet those needs, using the networking hardware and software available.

There are many different types of computer engineers, and often the job descriptions overlap. While many may call themselves engineers based on a company job title, there is also a professional designation of “professional engineer,” which has specific requirements behind it. In the US, each state has its own set of requirements for the use of this title, as do different countries around the world. Most often, it involves a professional licensing exam.

Information-Systems Operations and Administration

Another group of information-systems professionals are involved in the day-to-day operations and administration of IT. These people must keep the systems running and up-to-date so that the rest of the organization can make the most effective use of these resources.

Computer Operator

A computer operator is the person who keeps the large computers running. This person’s job is to oversee the mainframe computers and data centers in organizations. Some of their duties include keeping the operating systems up to date, ensuring available memory and disk storage, and overseeing the physical environment of the computer. Since mainframe computers increasingly have been replaced with servers, storage management systems, and other platforms, computer operators’ jobs have grown broader and include working with these specialized systems.

Database Administrator

A database administrator (DBA) is the person who manages the databases for an organization. This person creates and maintains databases that are used as part of applications or the data warehouse. The DBA also consults with systems analysts and programmers on projects that require access to or the creation of databases.

Help-Desk/Support Analyst

Most mid-size to large organizations have their own information-technology help desk. The help desk is the first line of support for computer users in the company. Computer users who are having problems or need information can contact the help desk for assistance. Many times, a help-desk worker is a junior-level employee who does not necessarily know how to answer all of the questions that come his or her way. In these cases, help-desk analysts work with senior-level support analysts or have a computer knowledgebase.
at their disposal to help them investigate the problem at hand. The help desk is a great place to break into working in IT because it exposes you to all of the different technologies within the company. A successful help-desk analyst should have good people and communications skills, as well as at least junior-level IT skills.

**Trainer**

A computer trainer conducts classes to teach people specific computer skills. For example, if a new ERP system is being installed in an organization, one part of the implementation process is to teach all of the users how to use the new system. A trainer may work for a software company and be contracted to come in to conduct classes when needed; a trainer may work for a company that offers regular training sessions; or a trainer may be employed full time for an organization to handle all of their computer instruction needs. To be successful as a trainer, you need to be able to communicate technical concepts well and also have a lot of patience!

**Managing Information Systems**

The management of information-systems functions is critical to the success of information systems within the organization. Here are some of the jobs associated with the management of information systems.

**CIO**

The CIO, or chief information officer, is the head of the information-systems function. This person aligns the plans and operations of the information systems with the strategic goals of the organization. This includes tasks such as budgeting, strategic planning, and personnel decisions for the information-systems function. The CIO must also be the face of the IT department within the organization. This involves working with senior leaders in all parts of the organization to ensure good communication and planning.

Interestingly, the CIO position does not necessarily require a lot of technical expertise. While helpful, it is more important for this person to have good management skills and understand the business. Many organizations do not have someone with the title of CIO; instead, the head of the information-systems function is called vice president of information systems or director of information systems.

**Functional Manager**

As an information-systems organization becomes larger, many of the different functions are grouped together and led by a manager. These functional managers report to the CIO and manage the employees specific to their function. For example, in a large organization, there is a group of systems analysts who report to a manager of the systems-analysis function. For more insight into how this might look, see the discussion later in the chapter of how information systems are organized.

**ERP Management**

Organizations using an ERP require one or more individuals to manage these systems. These people make sure that the ERP system is completely up to date, work to implement any changes to the ERP that are needed, and consult with various user departments on needed reports or data extracts.
Project Managers

Information-systems projects are notorious for going over budget and being delivered late. In many cases, a failed IT project can spell doom for a company. A project manager is responsible for keeping projects on time and on budget. This person works with the stakeholders of the project to keep the team organized and communicates the status of the project to management. A project manager does not have authority over the project team; instead, the project manager coordinates schedules and resources in order to maximize the project outcomes. A project manager must be a good communicator and an extremely organized person. A project manager should also have good people skills. Many organizations require each of their project managers to become certified as a project management professional (PMP).

Information-Security Officer

An information-security officer is in charge of setting information-security policies for an organization, and then overseeing the implementation of those policies. This person may have one or more people reporting to them as part of the information-security team. As information has become a critical asset, this position has become highly valued. The information-security officer must ensure that the organization’s information remains secure from both internal and external threats.

Emerging Roles

As technology evolves, many new roles are becoming more common as other roles fade. For example, as we enter the age of “big data,” we are seeing the need for more data analysts and business-intelligence specialists. Many companies are now hiring social-media experts and mobile-technology specialists. The increased use of cloud computing and virtual-machine technologies also is breeding demand for expertise in those areas.
Career Paths in Information Systems

These job descriptions do not represent all possible jobs within an information-systems organization. Larger organizations will have more specialized roles; smaller organizations may combine some of these roles. Many of these roles may exist outside of a traditional information-systems organization, as we will discuss below.

Working with information systems can be a rewarding career choice. Whether you want to be involved in very technical jobs (programmer, database administrator), or you want to be involved in working with people (systems analyst, trainer), there are many different career paths available.

Many times, those in technical jobs who want career advancement find themselves in a dilemma: do they want to continue doing technical work, where sometimes their advancement options are limited, or do they want to become a manager of other employees and put themselves on a management career track? In many cases, those proficient in technical skills are not gifted with managerial skills. Some organizations, especially those that highly value their technically skilled employees, will create a technical track that exists in parallel to the management track so that they can retain employees who are contributing to the organization with their technical skills.

Sidebar: Are Certifications Worth Pursuing?

As technology is becoming more and more important to businesses, hiring employees with technical skills is becoming critical. But how can an organization ensure that the person they are hiring has the necessary skills? These days, many organizations are including technical certifications as a prerequisite for getting hired.

Certifications are designations given by a certifying body that someone has a specific level of knowledge in a specific technology. This certifying body is often the vendor of the product itself, though independent certifying organizations, such as CompTIA, also exist. Many of these organizations offer certification tracks, allowing a beginning certificate as a prerequisite to getting more advanced certificates. To get a certificate, you generally attend one or more training classes and then take one or more certification exams. Passing the exams with a certain score will qualify you for a certificate. In most cases, these classes and certificates are not free and, in fact, can run into the thousands of dollars. Some examples of the certifications in highest demand include Microsoft (software certifications), Cisco (networking), and SANS (security).

For many working in IT (or thinking about an IT career), determining whether to pursue one or more of these certifications is an important question. For many jobs, such as those involving networking or security, a certificate will be required by the employer as a way to determine which potential employees have a basic level of skill. For those who are already in an IT career, a more advanced certificate may lead to a promotion. There are other cases, however, when experience with a certain technology will negate the need for certification. For those wondering about the importance of certification, the best solution is to talk to potential employers and those already working in the field to determine the best choice.
Organizing the Information-Systems Function

In the early years of computing, the information-systems function (generally called data processing) was placed in the finance or accounting department of the organization. As computing became more important, a separate information-systems function was formed, but it still was generally placed under the CFO and considered to be an administrative function of the company. In the 1980s and 1990s, when companies began networking internally and then linking up to the Internet, the information-systems function was combined with the telecommunications functions and designated the information technology (IT) department. As the role of information technology continued to increase, its place in the organization also moved up the ladder. In many organizations today, the head of IT (the CIO) reports directly to the CEO.

Where in the Organization Should IS Be?

Before the advent of the personal computer, the information-systems function was centralized within organizations in order to maximize control over computing resources. When the PC began proliferating, many departments within organizations saw it as a chance to gain some computing resources for themselves. Some departments created an internal information-systems group, complete with systems analysts, programmers, and even database administrators. These departmental-IS groups were dedicated to the information needs of their own departments, providing quicker turnaround and higher levels of service than a centralized IT department. However, having several IS groups within an organization led to a lot of inefficiencies: there were now several people performing the same jobs in different departments. This decentralization also led to company data being stored in several places all over the company. In some organizations, a “matrix” reporting structure has developed, in which IT personnel are placed within a department and report to both the department management and the functional management within IS. The advantages of dedicated IS personnel for each department are weighed against the need for more control over the strategic information resources of the company.

For many companies, these questions are resolved by the implementation of the ERP system (see discussion of ERP in chapter 8). Because an ERP system consolidates most corporate data back into a single database, the implementation of an ERP system requires organizations to find “islands” of data so that they can integrate them back into the corporate system. The ERP allows organizations to regain control of their information and influences organizational decisions throughout the company.

Outsourcing

Many times, an organization needs a specific skill for a limited period of time. Instead of training an existing employee or hiring someone new, it may make more sense to outsource the job. Outsourcing can be used in many different situations within the information-systems function, such as the design and creation of a new website or the upgrade of an ERP system. Some organizations see outsourcing as a cost-cutting move, contracting out a whole group or department.

New Models of Organizations

The integration of information technology has influenced the structure of organizations. The increased ability to communicate and share information has led to a “flattening” of the organizational structure due to the removal of one or more layers of management.
Another organizational change enabled by information systems is the network-based organizational structure. In a networked-based organizational structure, groups of employees can work somewhat independently to accomplish a project. In a networked organization, people with the right skills are brought together for a project and then released to work on other projects when that project is over. These groups are somewhat informal and allow for all members of the group to maximize their effectiveness.

Information-Systems Users – Types of Users

Besides the people who work to create, administer, and manage information systems, there is one more extremely important group of people: the users of information systems. This group represents a very large percentage of the people involved. If the user is not able to successfully learn and use an information system, the system is doomed to failure.

One tool that can be used to understand how users will adopt a new technology comes from a 1962 study by Everett Rogers. In his book, *Diffusion of Innovation*, Rogers studied how farmers adopted new technologies, and he noticed that the adoption rate started slowly and then dramatically increased once adoption hit a certain point. He identified five specific types of technology adopters:

- **Innovators.** Innovators are the first individuals to adopt a new technology. Innovators are willing to take risks, are the youngest in age, have the highest social class, have great financial liquidity, are very social, and have the closest contact with scientific sources and interaction with other innovators. Risk tolerance has them adopting technologies that may ultimately fail. Financial resources help absorb these failures (Rogers 1962 5th ed, p. 282).

- **Early adopters.** The early adopters are those who adopt innovation after a technology has been introduced and proven. These individuals have the highest degree of opinion leadership among the other adopter categories, which means that they can influence the opinions of the largest majority. They are typically younger in age, have higher social status, more financial liquidity, more advanced education, and are more socially aware than later adopters. These people are more discrete in adoption choices than innovators, and realize judicious choice of adoption will help them maintain a central communication position (Rogers 1962 5th ed, p. 283).

- **Early majority.** Individuals in this category adopt an innovation after a varying degree of time. This time of adoption is significantly longer than the innovators and early adopters. This group tends to be slower in the adoption process, has above average social status, has contact with early...
adopters, and seldom holds positions of opinion leadership in a system (Rogers 1962 5th ed, p. 283).

- Late majority. The late majority will adopt an innovation after the average member of the society. These individuals approach an innovation with a high degree of skepticism, have below average social status, very little financial liquidity, are in contact with others in the late majority and the early majority, and show very little opinion leadership.

- Laggards. Individuals in this category are the last to adopt an innovation. Unlike those in the previous categories, individuals in this category show no opinion leadership. These individuals typically have an aversion to change-agents and tend to be advanced in age. Laggards typically tend to be focused on “traditions,” are likely to have the lowest social status and the lowest financial liquidity, be oldest of all other adopters, and be in contact with only family and close friends.

These five types of users can be translated into information-technology adopters as well, and provide additional insight into how to implement new information systems within an organization. For example, when rolling out a new system, IT may want to identify the innovators and early adopters within the organization and work with them first, then leverage their adoption to drive the rest of the implementation.

Summary

In this chapter, we have reviewed the many different categories of individuals who make up the people component of information systems. The world of information technology is changing so fast that new roles are being created all the time, and roles that existed for decades are being phased out. That said, this chapter should have given you a good idea of the importance of the people component of information systems.

Study Questions

1. Describe the role of a systems analyst.
2. What are some of the different roles for a computer engineer?
3. What are the duties of a computer operator?
4. What does the CIO do?
5. Describe the job of a project manager.
6. Explain the point of having two different career paths in information systems.
7. What are the advantages and disadvantages of centralizing the IT function?
8. What impact has information technology had on the way companies are organized?
9. What are the five types of information-systems users?
10. Why would an organization outsource?
Exercises

1. Which IT job would you like to have? Do some original research and write a two-page paper describing the duties of the job you are interested in.

2. Spend a few minutes on Dice or Monster to find IT jobs in your area. What IT jobs are currently available? Write up a two-page paper describing three jobs, their starting salary (if listed), and the skills and education needed for the job.

3. How is the IT function organized in your school or place of employment? Create an organization chart showing how the IT organization fits into your overall organization. Comment on how centralized or decentralized the IT function is.

4. What type of IT user are you? Take a look at the five types of technology adopters and then write a one-page summary of where you think you fit in this model.
Chapter 10: Information Systems Development

Learning Objectives

Upon successful completion of this chapter, you will be able to:

- explain the overall process of developing a new software application;
- explain the differences between software development methodologies;
- understand the different types of programming languages used to develop software;
- understand some of the issues surrounding the development of websites and mobile applications; and
- identify the four primary implementation policies.

Introduction

When someone has an idea for a new function to be performed by a computer, how does that idea become reality? If a company wants to implement a new business process and needs new hardware or software to support it, how do they go about making it happen? In this chapter, we will discuss the different methods of taking those ideas and bringing them to reality, a process known as information systems development.

Programming

As we learned in chapter 2, software is created via programming. Programming is the process of creating a set of logical instructions for a digital device to follow using a programming language. The process of programming is sometimes called “coding” because the syntax of a programming language is not in a form that everyone can understand – it is in “code.”

The process of developing good software is usually not as simple as sitting down and writing some code. True, sometimes a programmer can quickly write a short program to solve a need. But most of the time, the creation of software is a resource-intensive process that involves several different groups of people in an organization. In the following sections, we are going to review several different methodologies for software development.

Systems-Development Life Cycle

The first development methodology we are going to review is the systems-development life cycle (SDLC). This methodology was first developed in the 1960s to manage the large software projects associated with corporate systems running on mainframes. It is a very structured and risk-averse methodology designed to manage large projects that included multiple programmers and systems that would have a large impact on the organization.
Various definitions of the SDLC methodology exist, but most contain the following phases.

1. Preliminary Analysis. In this phase, a review is done of the request. Is creating a solution possible? What alternatives exist? What is currently being done about it? Is this project a good fit for our organization? A key part of this step is a feasibility analysis, which includes an analysis of the technical feasibility (is it possible to create this?), the economic feasibility (can we afford to do this?), and the legal feasibility (are we allowed to do this?). This step is important in determining if the project should even get started.

2. System Analysis. In this phase, one or more system analysts work with different stakeholder groups to determine the specific requirements for the new system. No programming is done in this step. Instead, procedures are documented, key players are interviewed, and data requirements are developed in order to get an overall picture of exactly what the system is supposed to do. The result of this phase is a system-requirements document.

3. System Design. In this phase, a designer takes the system-requirements document created in the previous phase and develops the specific technical details required for the system. It is in this phase that the business requirements are translated into specific technical requirements. The design for the user interface, database, data inputs and outputs, and reporting are developed here. The result of this phase is a system-design document. This document will have everything a programmer will need to actually create the system.

4. Programming. The code finally gets written in the programming phase. Using the system-design document as a guide, a programmer (or team of programmers) develop the program. The result of this phase is an initial working program that meets the requirements laid out in the system-analysis phase and the design developed in the system-design phase.

5. Testing. In the testing phase, the software program developed in the previous phase is put through a series of structured tests. The first is a unit test, which tests individual parts of the code for errors or bugs. Next is a system test, where the different components of the system are tested to ensure that they work together properly. Finally, the user-acceptance test allows those that will be using the software to test the system to ensure that it meets their standards. Any bugs, errors, or problems found during testing are addressed and then tested again.
6. Implementation. Once the new system is developed and tested, it has to be implemented in the organization. This phase includes training the users, providing documentation, and conversion from any previous system to the new system. Implementation can take many forms, depending on the type of system, the number and type of users, and how urgent it is that the system become operational. These different forms of implementation are covered later in the chapter.

7. Maintenance. This final phase takes place once the implementation phase is complete. In this phase, the system has a structured support process in place: reported bugs are fixed and requests for new features are evaluated and implemented; system updates and backups are performed on a regular basis.

The SDLC methodology is sometimes referred to as the waterfall methodology to represent how each step is a separate part of the process; only when one step is completed can another step begin. After each step, an organization must decide whether to move to the next step or not. This methodology has been criticized for being quite rigid. For example, changes to the requirements are not allowed once the process has begun. No software is available until after the programming phase.

Again, SDLC was developed for large, structured projects. Projects using SDLC can sometimes take months or years to complete. Because of its inflexibility and the availability of new programming techniques and tools, many other software-development methodologies have been developed. Many of these retain some of the underlying concepts of SDLC but are not as rigid.

**Rapid Application Development**

Rapid application development (RAD) is a software-development (or systems-development) methodology that focuses on quickly building a working model of the software, getting feedback from users, and then using that feedback to update the working model. After several iterations of development, a final version is developed and implemented.

The RAD methodology consists of four phases:

1. **Requirements Planning.** This phase is similar to the preliminary-analysis, system-analysis, and design phases of the SDLC. In this phase, the overall requirements for the system are defined, a team is identified, and feasibility is determined.

2. **User Design.** In this phase, representatives of the users work with the system analysts, designers, and programmers to interactively create the design of the system. One technique for working with all of these various stakeholders is the so-called JAD session. JAD is an acronym for joint application development. A JAD session gets all of the stakeholders together to have a
structured discussion about the design of the system. Application developers also sit in on this meeting and observe, trying to understand the essence of the requirements.

3. Construction. In the construction phase, the application developers, working with the users, build the next version of the system. This is an interactive process, and changes can be made as developers are working on the program. This step is executed in parallel with the User Design step in an iterative fashion, until an acceptable version of the product is developed.

4. Cutover. In this step, which is similar to the implementation step of the SDLC, the system goes live. All steps required to move from the previous state to the use of the new system are completed here.

As you can see, the RAD methodology is much more compressed than SDLC. Many of the SDLC steps are combined and the focus is on user participation and iteration. This methodology is much better suited for smaller projects than SDLC and has the added advantage of giving users the ability to provide feedback throughout the process. SDLC requires more documentation and attention to detail and is well suited to large, resource-intensive projects. RAD makes more sense for smaller projects that are less resource-intensive and need to be developed quickly.

**Agile Methodologies**

Agile methodologies are a group of methodologies that utilize incremental changes with a focus on quality and attention to detail. Each increment is released in a specified period of time (called a time box), creating a regular release schedule with very specific objectives. While considered a separate methodology from RAD, they share some of the same principles: iterative development, user interaction, ability to change. The agile methodologies are based on the “Agile Manifesto,” first released in 2001.

The characteristics of agile methods include:

- small cross-functional teams that include development-team members and users;
- daily status meetings to discuss the current state of the project;
- short time-frame increments (from days to one or two weeks) for each change to be completed; and
- at the end of each iteration, a working project is completed to demonstrate to the stakeholders.

The goal of the agile methodologies is to provide the flexibility of an iterative approach while ensuring a quality product.
One last methodology we will discuss is a relatively new concept taken from the business bestseller *The Lean Startup*, by Eric Reis. In this methodology, the focus is on taking an initial idea and developing a minimum viable product (MVP). The MVP is a working software application with just enough functionality to demonstrate the idea behind the project. Once the MVP is developed, it is given to potential users for review. Feedback on the MVP is generated in two forms: (1) direct observation and discussion with the users, and (2) usage statistics gathered from the software itself. Using these two forms of feedback, the team determines whether they should continue in the same direction or rethink the core idea behind the project, change the functions, and create a new MVP. This change in strategy is called a pivot. Several iterations of the MVP are developed, with new functions added each time based on the feedback, until a final product is completed.

The biggest difference between the lean methodology and the other methodologies is that the full set of requirements for the system are not known when the project is launched. As each iteration of the project is released, the statistics and feedback gathered are used to determine the requirements. The lean methodology works best in an entrepreneurial environment where a company is interested in determining if their idea for a software application is worth developing.

**Sidebar: The Quality Triangle**

When developing software, or any sort of product or service, there exists a tension between the developers and the different stakeholder groups, such as management, users, and investors. This tension relates to how quickly the software can be developed (time), how much money will be spent (cost), and how well it will be built (quality). The quality triangle is a simple concept. It states that for any product or service being developed, you can only address two of the following: time, cost, and quality.

So what does it mean that you can only address two of the three? It means that you cannot complete a low-cost, high-quality project in a small amount of time. However, if you are willing or able to spend a lot of money, then a project can be completed quickly with high-quality results (through hiring more good programmers). If a project’s completion date is not a priority, then it can be completed at a lower cost with higher-quality results. Of
course, these are just generalizations, and different projects may not fit this model perfectly. But overall, this model helps us understand the tradeoffs that we must make when we are developing new products and services.

Programming Languages

As I noted earlier, software developers create software using one of several programming languages. A programming language is an artificial language that provides a way for a programmer to create structured code to communicate logic in a format that can be executed by the computer hardware. Over the past few decades, many different types of programming languages have evolved to meet many different needs. One way to characterize programming languages is by their “generation.”

Generations of Programming Languages

Early languages were specific to the type of hardware that had to be programmed; each type of computer hardware had a different low-level programming language (in fact, even today there are differences at the lower level, though they are now obscured by higher-level programming languages). In these early languages, very specific instructions had to be entered line by line – a tedious process.

First-generation languages are called machine code. In machine code, programming is done by directly setting actual ones and zeroes (the bits) in the program using binary code. Here is an example program that adds 1234 and 4321 using machine language:

```
10111001 00000000
11010010 10100001
00000100 00000000
10001001 00000000
00001110 10001011
00000000 00000010
10111001 00000000
11100001 00000011
00010000 11000011
10001001 10100011
00001110 00000100
00000010 00000000
```

Assembly language is the second-generation language. Assembly language gives english-like phrases to the machine-code instructions, making it easier to program. An assembly-language program must be run through an assembler, which converts it into machine code. Here is an example program that adds 1234 and 4321 using assembly language:

```
Saylor URL: http://www.saylor.org/courses/bus206
Attributed to: David T. Bourgeois, Ph.D.
```
Third-generation languages are not specific to the type of hardware on which they run and are much more like spoken languages. Most third-generation languages must be compiled, a process that converts them into machine code. Well-known third-generation languages include BASIC, C, Pascal, and Java. Here is an example using BASIC:

```
A=1234
B=4321
C=A+B
END
```

Fourth-generation languages are a class of programming tools that enable fast application development using intuitive interfaces and environments. Many times, a fourth-generation language has a very specific purpose, such as database interaction or report-writing. These tools can be used by those with very little formal training in programming and allow for the quick development of applications and/or functionality. Examples of fourth-generation languages include: Clipper, FOCUS, FoxPro, SQL, and SPSS.

Why would anyone want to program in a lower-level language when they require so much more work? The answer is similar to why some prefer to drive stick-shift automobiles instead of automatic transmission: control and efficiency. Lower-level languages, such as assembly language, are much more efficient and execute much more quickly. You have finer control over the hardware as well. Sometimes, a combination of higher- and lower-level languages are mixed together to get the best of both worlds: the programmer will create the overall structure and interface using a higher-level language but will use lower-level languages for the parts of the program that are used many times or require more precision.
Compiled vs. Interpreted

Besides classifying a program language based on its generation, it can also be classified by whether it is compiled or interpreted. As we have learned, a computer language is written in a human-readable form. In a compiled language, the program code is translated into a machine-readable form called an executable that can be run on the hardware. Some well-known compiled languages include C, C++, and COBOL.

An interpreted language is one that requires a runtime program to be installed in order to execute. This runtime program then interprets the program code line by line and runs it. Interpreted languages are generally easier to work with but also are slower and require more system resources. Examples of popular interpreted languages include BASIC, PHP, PERL, and Python. The web languages of HTML and Javascript would also be considered interpreted because they require a browser in order to run.

The Java programming language is an interesting exception to this classification, as it is actually a hybrid of the two. A program written in Java is partially compiled to create a program that can be understood by the Java Virtual Machine (JVM). Each type of operating system has its own JVM which must be installed, which is what allows Java programs to run on many different types of operating systems.

Procedural vs. Object-Oriented

A procedural programming language is designed to allow a programmer to define a specific starting point for the program and then execute sequentially. All early programming languages worked this way. As user interfaces became more interactive and graphical, it made sense for programming languages to evolve to allow the user to define the flow of the program. The object-oriented programming language is set up so that the programmer defines “objects” that can take certain actions based on input from the user. In other words, a procedural program focuses on the sequence of activities to be performed; an object-oriented program focuses on the different items being manipulated.

For example, in a human-resources system, an “EMPLOYEE” object would be needed. If the program needed to retrieve or set data regarding an employee, it would first create an employee object in the program and then set or retrieve the values needed. Every object has properties, which are descriptive...
fields associated with the object. In the example below, an employee object has the properties “Name”, “Employee number”, “Birthdate” and “Date of hire”. An object also has “methods”, which can take actions related to the object. In the example, there are two methods. The first is “ComputePay()”, which will return the current amount owed the employee. The second is “ListEmployees()”, which will retrieve a list of employeeswhoreport to this employee.

<table>
<thead>
<tr>
<th>Object: EMPLOYEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Employee number</td>
</tr>
<tr>
<td>Birthdate</td>
</tr>
<tr>
<td>Date of hire</td>
</tr>
<tr>
<td>ComputePay()</td>
</tr>
<tr>
<td>ListEmployees()</td>
</tr>
</tbody>
</table>

Figure: An example of an object

Sidebar: What is COBOL?

If you have been around business programming very long, you may have heard about the COBOL programming language. COBOL is a procedural, compiled language that at one time was the primary programming language for business applications. Invented in 1959 for use on large mainframe computers, COBOL is an abbreviation of common business-oriented language. With the advent of more efficient programming languages, COBOL is now rarely seen outside of old, legacy applications.

Programming Tools

To write a program, a programmer needs little more than a text editor and a good idea. However, to be productive, he or she must be able to check the syntax of the code, and, in some cases, compile the code. To be more efficient at programming, additional tools, such as an integrated development environment (IDE) or computer-aided software-engineering (CASE) tools, can be used.

Integrated Development Environment

For most programming languages, an IDE can be used. An IDE provides a variety of tools for the programmer, and usually includes:

- an editor for writing the program that will color-code or highlight keywords from the programming language;
- a help system that gives detailed documentation regarding the programming language;
- a compiler/interpreter, which will allow the programmer to run the program;
- a debugging tool, which will provide the programmer details about the execution of the program in order to resolve problems in the code; and
• a check-in/check-out mechanism, which allows for a team of programmers to work together on a project and not write over each other’s code changes.

Probably the most popular IDE software package right now is Microsoft’s Visual Studio. Visual Studio is the IDE for all of Microsoft’s programming languages, including Visual Basic, Visual C++, and Visual C#.

CASE Tools

While an IDE provides several tools to assist the programmer in writing the program, the code still must be written. Computer-aided software-engineering (CASE) tools allow a designer to develop software with little or no programming. Instead, the CASE tool writes the code for the designer. CASE tools come in many varieties, but their goal is to generate quality code based on input created by the designer.

Sidebar: Building a Website

In the early days of the World Wide Web, the creation of a website required knowing how to use hypertext markup language (HTML). Today, most websites are built with a variety of tools, but the final product that is transmitted to a browser is still HTML. HTML, at its simplest, is a text language that allows you to define the different components of a web page. These definitions are handled through the use of HTML tags, which consist of text between brackets. For example, an HTML tag can tell the browser to show a word in italics, to link to another web page, or to insert an image. In the example below, some text is being defined as a heading while other text is being emphasized.

```
<h1>This is a first-level heading</h1>
Here is some text. <em>Here is some emphasized text.</em>
<h2>Here is a second-level heading</h2>
Here is some more text.
```

Simple HTML

This is a first-level heading

Here is some text. Here is some emphasized text.

Here is a second-level heading

Here is some more text.

Simple HTML output

While HTML is used to define the components of a web page, cascading style sheets (CSS) are used to define the styles of the components on a page. The use of CSS allows the style of a website to be set and stay consistent throughout. For example, if the designer wanted all first-level headings (h1) to be blue and centered, he or she could set the “h1” style to match. The following example shows how this might look.
HTML with CSS

This is a first-level heading

Here is some text. *Here is some emphasized text.*

This is a second-level heading

Here is some more text.

HTML with CSS output

The combination of HTML and CSS can be used to create a wide variety of formats and designs and has been widely adopted by the web-design community. The standards for HTML are set by a governing body called the World Wide Web Consortium. The current version of HTML is HTML 5, which includes new standards for video, audio, and drawing.

When developers create a website, they do not write it out manually in a text editor. Instead, they use web design tools that generate the HTML and CSS for them. Tools such as Adobe Dreamweaver allow the designer to create a web page that includes images and interactive elements without writing a single line of code. However, professional web designers still need to learn HTML and CSS in order to have full control over the web pages they are developing.

Build vs. Buy

When an organization decides that a new software program needs to be developed, they must determine if it makes more sense to build it themselves or to purchase it from an outside company. This is the “build vs. buy” decision.

There are many advantages to purchasing software from an outside company. First, it is generally less expensive to purchase a software package than to build it. Second, when a software package is purchased, it is available much more quickly than if the package is built in-house. Software applications can take months or years to build; a purchased package can be up and running within a month. A purchased package has already been tested and many of the bugs have already been worked out. It is the role of a systems integrator to make various purchased systems and the existing systems at the organization work together.

There are also disadvantages to purchasing software. First, the same software you are using can be used by your competitors. If a company is trying to differentiate itself based on a business process that is
that purchased software, it will have a hard time doing so if its competitors use the same software. Another
disadvantage to purchasing software is the process of customization. If you purchase a software package
from a vendor and then customize it, you will have to manage those customizations every time the vendor
provides an upgrade. This can become an administrative headache, to say the least!

Even if an organization determines to buy software, it still makes sense to go through many of the
same analyses that they would do if they were going to build it themselves. This is an important decision
that could have a long-term strategic impact on the organization.

Web Services

As we saw in chapter 3, the move to cloud computing has allowed software to be looked at as a service. One
option companies have these days is to license functions provided by other companies instead of writing the
code themselves. These are called web services, and they can greatly simplify the addition of functionality
to a website.

For example, suppose a company wishes to provide a map showing the location of someone who
has called their support line. By utilizing Google Maps API web services, they can build a Google Map
right into their application. Or a shoe company could make it easier for its retailers to sell shoes online by
providing a shoe-size web service that the retailers could embed right into their website.

Web services can blur the lines between “build vs. buy.” Companies can choose to build a software
application themselves but then purchase functionality from vendors to supplement their system.

End-User Computing

In many organizations, application development is not limited to the programmers and analysts in the
information-technology department. Especially in larger organizations, other departments develop their
own department-specific applications. The people who build these are not necessarily trained in
programming or application development, but they tend to be adept with computers. A person, for example,
who is skilled in a particular software package, such as a spreadsheet or database package, may be called
upon to build smaller applications for use by his or her own department. This phenomenon is referred to as
end-user development, or end-user computing.

End-user computing can have many advantages for an organization. First, it brings the development
of applications closer to those who will use them. Because IT departments are sometimes quite backlogged, it also provides a means
to have software created more quickly. Many organizations encourage end-user computing to reduce the strain on the IT department.

End-user computing does have its disadvantages as well. If departments within an organization are
developing their own applications, the organization may end up with several applications that perform
similar functions, which is inefficient, since it is a duplication of effort. Sometimes, these different versions
of the same application end up providing different results, bringing confusion when departments interact.
These applications are often developed by someone with little or no formal training in programming. In
these cases, the software developed can have problems that then have to be resolved by the IT department.

End-user computing can be beneficial to an organization, but it should be managed. The IT department
should set guidelines and provide tools for the departments who want to create their own solutions.
Communication between departments will go a long way towards successful use of end-user computing.
Sidebar: Building a Mobile App

In many ways, building an application for a mobile device is exactly the same as building an application for a traditional computer. Understanding the requirements for the application, designing the interface, working with users – all of these steps still need to be carried out.

So what’s different about building an application for a mobile device? In some ways, mobile applications are more limited. An application running on a mobile device must be designed to be functional on a smaller screen. Mobile applications should be designed to use fingers as the primary pointing device. Mobile devices generally have less available memory, storage space, and processing power.

Mobile applications also have many advantages over applications built for traditional computers. Mobile applications have access to the functionality of the mobile device, which usually includes features such as geolocation data, messaging, the camera, and even a gyroscope.

One of the most important questions regarding development for mobile devices is this: Do we want to develop an app at all? A mobile app is an expensive proposition, and it will only run on one type of mobile device at a time. For example, if you create an iPhone app, users with Android phones are out of luck. Each app takes several thousand dollars to create, so this may not be the best use of your funds.

Many organizations are moving away from developing a specific app for a mobile device and are instead making their websites more functional on mobile devices. Using a web-design framework called responsive design, a website can be made highly functional no matter what type of device is browsing it. With a responsive website, images resize themselves based on the size of the device’s screen, and text flows and sizes itself properly for optimal viewing. You can find out more about responsive design here.

Implementation Methodologies

Once a new system is developed (or purchased), the organization must determine the best method for implementing it. Convincing a group of people to learn and use a new system can be a very difficult process. Using new software, and the business processes it gives rise to, can have far-reaching effects within the organization.

There are several different methodologies an organization can adopt to implement a new system. Four of the most popular are listed below.

- Direct cutover. In the direct-cutover implementation methodology, the organization selects a particular date that the old system is not going to be used anymore. On that date, the users begin using the new system and the old system is unavailable. The advantages to using this methodology are that it is very fast and the least expensive. However, this method is the riskiest as well. If the new system has an operational problem or if the users are not properly prepared, it could prove disastrous for the organization.

- Pilot implementation. In this methodology, a subset of the organization (called a pilot group) starts using the new system before the rest of the organization. This has a smaller impact on the company and allows the support team to focus on a smaller group of individuals.

- Parallel operation. With parallel operation, the old and new systems are used simultaneously for a limited period of time. This method is the least risky because the old system is still being used
while the new system is essentially being tested. However, this is by far the most expensive methodology since work is duplicated and support is needed for both systems in full.

- Phased implementation. In phased implementation, different functions of the new application are used as functions from the old system are turned off. This approach allows an organization to slowly move from one system to another.

Which of these implementation methodologies to use depends on the complexity and importance of the old and new systems.

Change Management

As new systems are brought online and old systems are phased out, it becomes important to manage the way change is implemented in the organization. Change should never be introduced in a vacuum. The organization should be sure to communicate proposed changes before they happen and plan to minimize the impact of the change that will occur after implementation. Change management is a critical component of IT oversight.

Maintenance

Once a new system has been introduced, it enters the maintenance phase. In this phase, the system is in production and is being used by the organization. While the system is no longer actively being developed, changes need to be made when bugs are found or new features are requested. During the maintenance phase, IT management must ensure that the system continues to stay aligned with business priorities and continues to run well.

Summary

Software development is about so much more than programming. Developing new software applications requires several steps, from the formal SDLC process to more informal processes such as agile programming or lean methodologies. Programming languages have evolved from very low-level machine-specific languages to higher-level languages that allow a programmer to write software for a wide variety of machines. Most programmers work with software development tools that provide them with integrated components to make the software development process more efficient. For some organizations, building their own software applications does not make the most sense; instead, they choose to purchase software built by a third party to save development costs and speed implementation. In end-user computing, software development happens outside the information technology department. When implementing new software applications, there are several different types of implementation methodologies that must be considered.

Study Questions

1. What are the steps in the SDLC methodology?
2. What is RAD software development?
3. What makes the lean methodology unique?
4. What are three differences between second-generation and third-generation languages?
5. Why would an organization consider building its own software application if it is cheaper to buy one?
6. What is responsive design?
7. What is the relationship between HTML and CSS in website design?
8. What is the difference between the pilot implementation methodology and the parallel implementation methodology?
9. What is change management?
10. What are the four different implementation methodologies?

Exercises

1. Which software-development methodology would be best if an organization needed to develop a software tool for a small group of users in the marketing department? Why? Which implementation methodology should they use? Why?
2. Doing your own research, find three programming languages and categorize them in these areas: generation, compiled vs. interpreted, procedural vs. object-oriented.
3. Some argue that HTML is not a programming language. Doing your own research, find three arguments for why it is not a programming language and three arguments for why it is.
4. Read more about responsive design using the link given in the text. Provide the links to three websites that use responsive design and explain how they demonstrate responsive-design behavior.
Part 3: Information Systems Beyond the Organization
Chapter 11: Globalization and the Digital Divide

Learning Objectives

Upon successful completion of this chapter, you will be able to:

- explain the concept of globalization;
- describe the role of information technology in globalization;
- identify the issues experienced by firms as they face a global economy; and
- define the digital divide and explain Nielsen’s three stages of the digital divide.

Introduction

The Internet has wired the world. Today it is just as simple to communicate with someone on the other side of the world as it is to talk to someone next door. In this chapter, we will look at the implications of globalization and the impact it is having on the world.

What Is Globalization?

Globalization is the term used to refer to the integration of goods, services, and culture among the nations of the world. Globalization is not necessarily a new phenomenon; in many ways, we have been experiencing globalization since the days of European colonization. Further advances in telecommunication and transportation technologies accelerated globalization. The advent of the the worldwide Internet has made all nations next-door neighbors.

The Internet is truly a worldwide phenomenon. As of 2012, the Internet was being used in over 150 countries by a staggering 2.4 billion people worldwide, and growing.¹ From its initial beginnings in the United States in the 1970s to the development of the World Wide Web in the 1990s to the social networks and e-commerce of today, the Internet has continued to increase the integration between countries, making globalization a fact of life for citizens all over the world.

¹. http://internetworldstats.com/

Saylor URL: http://www.saylor.org/courses/bus206
Attributed to: David T. Bourgeois, Ph.D.
The Network Society

In 1996, social-sciences researcher Manuel Castells published *The Rise of the Network Society*, in which he identified new ways in which economic activity was being organized around the networks that the new telecommunication technologies have provided. This new, global economic activity was different from the past, because “it is an economy with the capacity to work as a unit in real time on a planetary scale.” We are now into this network society, where we are all connected on a global scale.

The World Is Flat

In 2005, Thomas Friedman’s seminal book, *The World Is Flat*, was published. In this book, Friedman unpacks the impacts that the personal computer, the Internet, and communication software have had on business, specifically the impact they have had on globalization. He begins the book by defining the three eras of globalization:

- “Globalization 1.0” occurred from 1492 until about 1800. In this era, globalization was centered around countries. It was about how much horsepower, wind power, and steam power a country had and how creatively it was deployed. The world shrank from size “large” to size “medium.”
- “Globalization 2.0” occurred from about 1800 until 2000, interrupted only by the two World Wars. In this era, the dynamic force driving change was multinational companies. The world shrank from size “medium” to size “small.”
- “Globalization 3.0” is our current era, beginning in the year 2000. The convergence of the personal computer, fiber-optic Internet connections, and software has created a “flat-world platform” that allows small groups and even individuals to go global. The world has shrunk from size “small” to size “tiny.”

According to Friedman, this third era of globalization was brought about, in many respects, by information technology. Some of the specific technologies he lists include:

- **The graphical user interface for the personal computer popularized in the late 1980s.** Before the graphical user interface, using a computer was relatively difficult. By making the personal computer something that anyone could use, it became commonplace very quickly. Friedman points out that this digital storage of content made people much more productive and, as the Internet evolved, made it simpler to communicate content worldwide.

- **The build-out of the Internet infrastructure during the dot-com boom during the late-1990s.** During the late 1990s, telecommunications companies laid thousands of miles of fiber-optic cable all over the world, turning network communications into a commodity. At the same time, the Internet protocols, such as SMTP (e-mail), HTML (web pages), and TCP/IP (network communications) became standards that were available for free and used by everyone.

- **The introduction of software to automate and integrate business processes.** As the Internet continued to grow and become the dominant form of communication, it became essential to build on the standards developed earlier so that the websites and applications running on the Internet would work well together. Friedman calls this “workflow software,” by which he means software that allows people to work together more easily, and allows different software packages and databases to integrate with each other more easily. Examples include payment-processing systems and shipping calculators.

These three technologies came together in the late 1990s to create a “platform for global collaboration.” Once these technologies were in place, they continued to evolve. Friedman also points out a couple more technologies that have contributed to the flat-world platform – the open-source movement (see chapter 10) and the advent of mobile technologies.

*The World Is Flat* was published in 2005. Since then, we have seen even more growth in information technologies that have contributed to global collaborations. We will discuss current and future trends in chapter 13.

### The Global Firm

The new era of globalization allows any business to become international. By accessing this new platform of technologies, Castells’s vision of working as a unit in real time on a planetary scale can be a reality. Some of the advantages of this include the following:

- The ability to locate expertise and labor around the world. Instead of drawing employees from their local area, organizations can now hire people from the global labor pool. This also allows organizations to pay a lower labor cost for the same work based on the prevailing wage in different countries.
• The ability to operate 24 hours a day. With employees in different time zones all around the world, an organization can literally operate around the clock, handing off work on projects from one part of the world to another. Businesses can also keep their digital storefront (their website) open all the time.

• A larger market for their products. Once a product is being sold online, it is available for purchase from a worldwide consumer base. Even if a company’s products do not appeal beyond its own country’s borders, being online has also made the product more visible to consumers within that country.

In order to fully take advantage of these new capabilities, companies need to understand that there are also challenges in dealing with employees and customers from different cultures. Some of these challenges include:

• Infrastructure differences. Each country has its own infrastructure, many of which are not of the same quality as the US infrastructure (average 4.60 MBps). For every South Korea (16 MBps average speed) there is an Egypt (0.83 MBps) or an India (0.82 MBps). A business cannot depend on every country it deals with having the same Internet speeds. See the sidebar called “How Does My Internet Speed Compare?”

• Labor laws and regulations. Different countries (even different states in the United States) have different laws and regulations. A company that wants to hire employees from other countries must understand the different regulations and concerns.

• Legal restrictions. Many countries have restrictions on what can be sold or how a product can be advertised. It is important for a business to understand what is allowed. For example, in Germany, it is illegal to sell anything Nazi related; in China, it is illegal to put anything sexually suggestive online.

• Language, customs, and preferences. Every country has its own (or several) unique culture(s), which a business must consider when trying to market a product there. Additionally, different countries have different preferences. For example, in some parts of the world, people prefer to eat their french fries with mayonnaise instead of ketchup; in other parts of the world, specific hand gestures (such as the thumbs-up) are offensive.

• International shipping. Shipping products between countries in a timely manner can be challenging. Inconsistent address formats, dishonest customs agents, and prohibitive shipping costs are all factors that must be considered when trying to deliver products internationally.

Because of these challenges, many businesses choose not to expand globally, either for labor or for customers. Whether a business has its own website or relies on a third-party, such as Amazon or eBay, the question of whether or not to globalize must be carefully considered.
Sidebar: How Does My Internet Speed Compare?

How does your Internet speed compare with others in your state, country, or around the world? The chart below shows how Internet speeds compare in different countries. You can find the full list of countries by going to this article (http://royal.pingdom.com/2010/11/12/real-connection-speeds-for-internet-users-across-the-world/). You can also compare the evolution of Internet speeds among countries by using this tool (http://www.akamai.com/stateoftheinternet/).

![Average Internet Speeds by Country (Top 20)](Image)

So how does your own Internet speed compare? There are many online tools you can use to determine the speed at which you are connected. One of the most trusted sites is speedtest.net, where you can test both your download speeds and upload speeds.

The Digital Divide

As the Internet continues to make inroads across the world, it is also creating a separation between those who have access to this global network and those who do not. This separation is called the “digital divide” and is of great concern. An article in Crossroads puts it this way:

Adopted by the ACM Council in 1992, the ACM Code of Ethics and Professional Conduct focuses on issues involving the Digital Divide that could prevent certain categories of people — those from low-income households, senior citizens, single-parent children, the undereducated, and

http://doi.acm.org/10.1145/1144375.1144377
minorities, and residents of rural areas — from receiving adequate access to the wide variety of resources offered by computer technology. This Code of Ethics positions the use of computers as a fundamental ethical consideration: “In a fair society, all individuals would have equal opportunity to participate in, or benefit from, the use of computer resources regardless of race, sex, religion, age, disability, national origin, or other similar factors.” This article summarizes the digital divide in its various forms, and analyzes reasons for the growing inequality in people’s access to Internet services. It also describes how society can bridge the digital divide: the serious social gap between information “haves” and “have-nots.”

The digital divide can occur between countries, regions, or even neighborhoods. In many US cities, there are pockets with little or no Internet access, while just a few miles away high-speed broadband is common. Solutions to the digital divide have had mixed success over the years. Many times, just providing Internet access and/or computing devices is not enough to bring true Internet access to a country, region, or neighborhood.

One Laptop per Child

One attempt to repair the digital divide was the One Laptop per Child effort. As stated on the organization’s website, “The mission of One Laptop per Child (OLPC) is to empower the children of developing countries to learn by providing one connected laptop to every school-age child. In order to accomplish our goal, we need people who believe in what we’re doing and want to help make education for the world’s children a priority, not a privilege.”

5 Announced to great fanfare in 2005 by Nicholas Negroponte, the OLPC project seemed destined for success.

The centerpiece of the project was the laptop itself: an inexpensive computer designed to withstand a lot of punishment. It utilized a revolutionary “mesh” network, allowing the laptops to act as repeaters, extending a Wi-Fi network far beyond their normal range. They also used minimal power, making them practical for remote areas with limited access to the electrical grid.

Unfortunately, the OLPC project failed to live up to expectations, running into many of the problems related to globalization discussed above: different cultures, corruption, and competition. In an article that examined the success and failures of OLPC, the authors state, “Expecting a laptop to cause such a revolutionary change showed a degree of naivete, even for an organization with the best of intentions and the smartest of people.”

Today, OLPC is evolving their methods and their technology, trying to deliver an OLPC tablet computer.

A New Understanding of the Digital Divide

In 2006, web-usability consultant Jakob Nielsen wrote an article that got to the heart of our understanding of this problem. In his article, he breaks the digital divide up into three stages: the economic divide, the usability divide, and the empowerment divide. What is usually called the digital divide is, in Nielsen’s terms, the economic divide: the idea that some people can afford to have a computer and Internet access while others cannot. Because of Moore’s Law (see chapter 2), the price of hardware has continued to drop and, at this point, we can now access digital technologies, such as smartphones, for very little. This fact, Nielsen asserts, means that for all intents and purposes, the economic divide is a moot point and we should not focus our resources on solving it.

The usability divide is concerned with the fact that “technology remains so complicated that many people couldn’t use a computer even if they got one for free.” And even for those who can use a computer, accessing all the benefits of having one is beyond their understanding. Included in this group are those with low literacy and seniors. According to Nielsen, we know how to help these users, but we are not doing it because there is little profit in doing so.

The empowerment divide is the most difficult to solve. It is concerned with how we use technology to empower ourselves. Very few users truly understand the power that digital technologies can give them. In his article, Nielsen explains that his (and others’) research has shown that very few users contribute content to the Internet, use advanced search, or can even distinguish paid search ads from organic search results. Many people will limit what they can do online by accepting the basic, default settings of their computer and not work to understand how they can truly be empowered.

Understanding the digital divide using these three stages provides a more nuanced view of how we can work to alleviate it. While efforts such as One Laptop per Child are an excellent start, more work needs to be done to address the second and third stages of the digital divide for a more holistic solution.

Sidebar: Using Gaming to Bridge the Digital Divide

Paul Kim, the Assistant Dean and Chief Technology Officer of the Stanford Graduate School of Education, designed a project to address the digital divide for children in developing countries. In their project, the researchers wanted to understand if children can adopt and teach themselves mobile learning technology, without help from teachers or other adults, and the processes and factors involved in this phenomenon. The researchers developed a mobile device called TeacherMate, which contained a game designed to help children learn math. The unique part of this research was that the researchers interacted directly with the children; they did not channel the mobile devices through the teachers or the schools. Another important factor to consider: in order to understand the context of the children’s educational environment, the researchers began the project by working with parents and local nonprofits six months before their visit. While the results of this research are too detailed to go into here, it can be said that the researchers found that children can, indeed, adopt and teach themselves mobile learning technologies.

What makes this research so interesting when thinking about the digital divide is that the researchers found that, in order to be effective, they had to customize their technology and tailor their implementation to the specific group they were trying to reach. One of their conclusions stated the following:

Considering the rapid advancement of technology today, mobile learning options for future projects will only increase. Consequently, researchers must continue to investigate their impact; we believe there is a specific need for more in-depth studies on ICT [information and communication technology] design variations to meet different challenges of different localities.

To read more about Dr. Kim’s project, locate the paper referenced in this sidebar.

Summary

Information technology has driven change on a global scale. As documented by Castells and Friedman, technology has given us the ability to integrate with people all over the world using digital tools. These tools have allowed businesses to broaden their labor pools, their markets, and even their operating hours. But they have also brought many new complications for businesses, which now must understand regulations, preferences, and cultures from many different nations. This new globalization has also exacerbated the digital divide. Nielsen has suggested that the digital divide consists of three stages (economic, usability, and empowerment), of which the economic stage is virtually solved.

Study Questions

1. What does the term globalization mean?
2. How does Friedman define the three eras of globalization?
3. Which technologies have had the biggest effect on globalization?
4. What are some of the advantages brought about by globalization?
5. What are the challenges of globalization?
6. What does the term digital divide mean?
7. What are Jakob Nielsen’s three stages of the digital divide?
8. What was one of the key points of The Rise of the Network Society?
9. Which country has the highest average Internet speed? How does your country compare?
10. What is the OLPC project? Has it been successful?

Exercises

1. Compare the concept of Friedman’s “Globalization 3.0” with Nielsen empowerment stage of the digital divide.
2. Do some original research to determine some of the regulations that a US company may have to consider before doing business in one of the following countries: China, Germany, Saudi Arabia, Turkey.
3. Go to speedtest.net to determine your Internet speed. Compare your speed at home to the Internet speed at two other locations, such as your school, place of employment, or local coffee shop. Write up a one-page summary that compares these locations.

4. Give one example of the digital divide and describe what you would do to address it.

5. How did the research conducted by Paul Kim address the three levels of the digital divide?
Chapter 12: The Ethical and Legal Implications of Information Systems

Learning Objectives

Upon successful completion of this chapter, you will be able to:

- describe what the term *information systems ethics* means;
- explain what a code of ethics is and describe the advantages and disadvantages;
- define the term *intellectual property* and explain the protections provided by copyright, patent, and trademark; and
- describe the challenges that information technology brings to individual privacy.

Introduction

Information systems have had an impact far beyond the world of business. New technologies create new situations that we have never dealt with before. How do we handle the new capabilities that these devices empower us with? What new laws are going to be needed to protect us from ourselves? This chapter will kick off with a discussion of the impact of information systems on how we behave (ethics). This will be followed with the new legal structures being put in place, with a focus on intellectual property and privacy.

Information Systems Ethics

The term *ethics* is defined as “a set of moral principles” or “the principles of conduct governing an individual or a group.”¹ Since the dawn of civilization, the study of ethics and their impact has fascinated mankind. But what do ethics have to do with information systems?

The introduction of new technology can have a profound effect on human behavior. New technologies give us capabilities that we did not have before, which in turn create environments and situations that have not been specifically addressed in ethical terms. Those who master new technologies gain new power; those who cannot or do not master them may lose power. In 1913, Henry Ford implemented the first moving assembly line to create his Model T cars. While this was a great step forward technologically (and economically), the assembly line reduced the value of human beings in the production process. The development of the atomic bomb concentrated unimaginable power in the hands of one government, who then had to wrestle with the decision to use it. Today’s digital technologies have created new categories of ethical dilemmas.

For example, the ability to anonymously make perfect copies of digital music has tempted many music fans to download copyrighted music for their own use without making payment to the music’s owner. Many of those who would never have walked into a music store and stolen a CD find themselves with dozens of illegally downloaded albums.

Digital technologies have given us the ability to aggregate information from multiple sources to create profiles of people. What would have taken weeks of work in the past can now be done in seconds, allowing private organizations and governments to know more about individuals than at any time in history. This information has value, but also chips away at the privacy of consumers and citizens.

Code of Ethics

One method for navigating new ethical waters is a code of ethics. A code of ethics is a document that outlines a set of acceptable behaviors for a professional or social group; generally, it is agreed to by all members of the group. The document details different actions that are considered appropriate and inappropriate.

A good example of a code of ethics is the *Code of Ethics and Professional Conduct* of the Association for Computing Machinery, an organization of computing professionals that includes academics, researchers, and practitioners. Here is a quote from the preamble:

Commitment to ethical professional conduct is expected of every member (voting members, associate members, and student members) of the Association for Computing Machinery (ACM).

This Code, consisting of 24 imperatives formulated as statements of personal responsibility, identifies the elements of such a commitment. It contains many, but not all, issues professionals are likely to face. Section 1 outlines fundamental ethical considerations, while Section 2 addresses additional, more specific considerations of professional conduct. Statements in Section 3 pertain more specifically to individuals who have a leadership role, whether in the workplace or in a volunteer capacity such as with organizations like ACM. Principles involving compliance with this Code are given in Section 4.

In the ACM’s code, you will find many straightforward ethical instructions, such as the admonition to be honest and trustworthy. But because this is also an organization of professionals that focuses on computing, there are more specific admonitions that relate directly to information technology:

- No one should enter or use another’s computer system, software, or data files without permission. One must always have appropriate approval before using system resources, including communication ports, file space, other system peripherals, and computer time.
- Designing or implementing systems that deliberately or inadvertently demean individuals or groups is ethically unacceptable.
- Organizational leaders are responsible for ensuring that computer systems enhance, not degrade, the quality of working life. When implementing a computer system, organizations must consider the personal and professional development, physical safety, and human dignity of all workers. Appropriate human-computer ergonomic standards should be considered in system design and in the workplace.

One of the major advantages of creating a code of ethics is that it clarifies the acceptable standards of behavior for a professional group. The varied backgrounds and experiences of the members of a group

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2. ACM Code of Ethics and Professional Conduct Adopted by ACM Council 10/16/92.
lead to a variety of ideas regarding what is acceptable behavior. While to many the guidelines may seem obvious, having these items detailed provides clarity and consistency. Explicitly stating standards communicates the common guidelines to everyone in a clear manner.

Having a code of ethics can also have some drawbacks. First of all, a code of ethics does not have legal authority; in other words, breaking a code of ethics is not a crime in itself. So what happens if someone violates one of the guidelines? Many codes of ethics include a section that describes how such situations will be handled. In many cases, repeated violations of the code result in expulsion from the group.

In the case of ACM: “Adherence of professionals to a code of ethics is largely a voluntary matter. However, if a member does not follow this code by engaging in gross misconduct, membership in ACM may be terminated.” Expulsion from ACM may not have much of an impact on many individuals, since membership in ACM is usually not a requirement for employment. However, expulsion from other organizations, such as a state bar organization or medical board, could carry a huge impact.

Another possible disadvantage of a code of ethics is that there is always a chance that important issues will arise that are not specifically addressed in the code. Technology is quickly changing, and a code of ethics might not be updated often enough to keep up with all of the changes. A good code of ethics, however, is written in a broad enough fashion that it can address the ethical issues of potential changes to technology while the organization behind the code makes revisions.

Finally, a code of ethics could have also be a disadvantage in that it may not entirely reflect the ethics or morals of every member of the group. Organizations with a diverse membership may have internal conflicts as to what is acceptable behavior. For example, there may be a difference of opinion on the consumption of alcoholic beverages at company events. In such cases, the organization must make a choice about the importance of addressing a specific behavior in the code.

Sidebar: Acceptable Use Policies

Many organizations that provide technology services to a group of constituents or the public require agreement to an acceptable use policy (AUP) before those services can be accessed. Similar to a code of ethics, this policy outlines what is allowed and what is not allowed while someone is using the organization’s services. An everyday example of this is the terms of service that must be agreed to before using the public Wi-Fi at Starbucks, McDonald’s, or even a university. Here is an example of an acceptable use policy from Virginia Tech.

Just as with a code of ethics, these acceptable use policies specify what is allowed and what is not allowed. Again, while some of the items listed are obvious to most, others are not so obvious:

- “Borrowing” someone else’s login ID and password is prohibited.
- Using the provided access for commercial purposes, such as hosting your own business website, is not allowed.
- Sending out unsolicited email to a large group of people is prohibited.

Also as with codes of ethics, violations of these policies have various consequences. In most cases, such as with Wi-Fi, violating the acceptable use policy will mean that you will lose your access to the resource. While losing access to Wi-Fi at Starbucks may not have a lasting impact, a university student getting banned from the university’s Wi-Fi (or possibly all network resources) could have a large impact.
Intellectual Property

One of the domains that have been deeply impacted by digital technologies is the domain of intellectual property. Digital technologies have driven a rise in new intellectual property claims and made it much more difficult to defend intellectual property.

Intellectual property is defined as “property (as an idea, invention, or process) that derives from the work of the mind or intellect.” This could include creations such as song lyrics, a computer program, a new type of toaster, or even a sculpture.

Practically speaking, it is very difficult to protect an idea. Instead, intellectual property laws are written to protect the tangible results of an idea. In other words, just coming up with a song in your head is not protected, but if you write it down it can be protected.

Protection of intellectual property is important because it gives people an incentive to be creative. Innovators with great ideas will be more likely to pursue those ideas if they have a clear understanding of how they will benefit. In the US Constitution, Article 8, Section 8, the authors saw fit to recognize the importance of protecting creative works:

Congress shall have the power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.

An important point to note here is the “limited time” qualification. While protecting intellectual property is important because of the incentives it provides, it is also necessary to limit the amount of benefit that can be received and allow the results of ideas to become part of the public domain.

Outside of the US, intellectual property protections vary. You can find out more about a specific country’s intellectual property laws by visiting the World Intellectual Property Organization.

In the following sections we will review three of the best-known intellectual property protections: copyright, patent, and trademark.

Copyright

Copyright is the protection given to songs, computer programs, books, and other creative works; any work that has an “author” can be copyrighted. Under the terms of copyright, the author of a work controls what can be done with the work, including:

- Who can make copies of the work.
- Who can make derivative works from the original work.
- Who can perform the work publicly.
- Who can display the work publicly.
- Who can distribute the work.

Many times, a work is not owned by an individual but is instead owned by a publisher with whom the original author has an agreement. In return for the rights to the work, the publisher will market and distribute the work and then pay the original author a portion of the proceeds.

Copyright protection lasts for the life of the original author plus seventy years. In the case of a copyrighted work owned by a publisher or another third party, the protection lasts for ninety-five years from the original creation date. For works created before 1978, the protections vary slightly. You can see the full details on copyright protections by reviewing the Copyright Basics document available at the US Copyright Office’s website.

Obtaining Copyright Protection

In the United States, a copyright is obtained by the simple act of creating the original work. In other words, when an author writes down that song, makes that film, or designs that program, he or she automatically has the copyright. However, for a work that will be used commercially, it is advisable to register for a copyright with the US Copyright Office. A registered copyright is needed in order to bring legal action against someone who has used a work without permission.

First Sale Doctrine

If an artist creates a painting and sells it to a collector who then, for whatever reason, proceeds to destroy it, does the original artist have any recourse? What if the collector, instead of destroying it, begins making copies of it and sells them? Is this allowed? The first sale doctrine is a part of copyright law that addresses this, as shown below:

The first sale doctrine, codified at 17 U.S.C. § 109, provides that an individual who knowingly purchases a copy of a copyrighted work from the copyright holder receives the right to sell, display or otherwise dispose of that particular copy, notwithstanding the interests of the copyright owner.

So, in our examples, the copyright owner has no recourse if the collector destroys her artwork. But the collector does not have the right to make copies of the artwork.

Fair Use

Another important provision within copyright law is that of fair use. Fair use is a limitation on copyright law that allows for the use of protected works without prior authorization in specific cases. For example, if a teacher wanted to discuss a current event in her class, she could pass out copies of a copyrighted news story to her students without first getting permission. Fair use is also what allows a student to quote a small portion of a copyrighted work in a research paper.

Unfortunately, the specific guidelines for what is considered fair use and what constitutes copyright violation are not well defined. Fair use is a well-known and respected concept and will only be challenged when copyright holders feel that the integrity or market value of their work is being threatened. The following four factors are considered when determining if something constitutes fair use:

1. The purpose and character of the use, including whether such use is of commercial nature or is for nonprofit educational purposes;

2. The nature of the copyrighted work;
3. The amount and substantiality of the portion used in relation to the copyrighted work as a whole;
4. The effect of the use upon the potential market for, or value of, the copyrighted work.

If you are ever considering using a copyrighted work as part of something you are creating, you may be able to do so under fair use. However, it is always best to check with the copyright owner to be sure you are staying within your rights and not infringing upon theirs.

Sidebar: The History of Copyright Law

As noted above, current copyright law grants copyright protection for seventy years after the author’s death, or ninety-five years from the date of creation for a work created for hire. But it was not always this way.

The first US copyright law, which only protected books, maps, and charts, provided protection for only 14 years with a renewable term of 14 years. Over time, copyright law was revised to grant protections to other forms of creative expression, such as photography and motion pictures. Congress also saw fit to extend the length of the protections, as shown in the chart below. Today, copyright has become big business, with many businesses relying on the income from copyright-protected works for their income.

Many now think that the protections last too long. The Sonny Bono Copyright Term Extension Act has been nicknamed the “Mickey Mouse Protection Act,” as it was enacted just in time to protect the copyright on the Walt Disney Company’s Mickey Mouse character. Because of this term extension, many works from the 1920s and 1930s that would have been available now in the public domain are not available.
The Digital Millennium Copyright Act

As digital technologies have changed what it means to create, copy, and distribute media, a policy vacuum has been created. In 1998, the US Congress passed the Digital Millennium Copyright Act (DMCA), which extended copyright law to take into consideration digital technologies. Two of the best-known provisions from the DMCA are the anti-circumvention provision and the “safe harbor” provision.

- The anti-circumvention provision makes it illegal to create technology to circumvent technology that has been put in place to protect a copyrighted work. This provision includes not just the creation of the technology but also the publishing of information that describes how to do it. While this provision does allow for some exceptions, it has become quite controversial and has led to a movement to have it modified.
- The “safe harbor” provision limits the liability of online service providers when someone using their services commits copyright infringement. This is the provision that allows YouTube, for example, not to be held liable when someone posts a clip from a copyrighted movie. The provision does require the online service provider to take action when they are notified of the violation (a “takedown” notice). For an example of how takedown works, here’s how YouTube handles these requests: YouTube Copyright Infringement Notification.

Many think that the DMCA goes too far and ends up limiting our freedom of speech. The Electronic Frontier Foundation (EFF) is at the forefront of this battle. For example, in discussing the anti-circumvention provision, the EFF states:

Yet the DMCA has become a serious threat that jeopardizes fair use, impedes competition and innovation, chills free expression and scientific research, and interferes with computer intrusion laws. If you circumvent DRM [digital rights management] locks for non-infringing fair uses or create the tools to do so you might be on the receiving end of a lawsuit.

Sidebar: Creative Commons

In chapter 2, we learned about open-source software. Open-source software has few or no copyright restrictions; the creators of the software publish their code and make their software available for others to use and distribute for free. This is great for software, but what about other forms of copyrighted works? If an artist or writer wants to make their works available, how can they go about doing so while still protecting the integrity of their work? Creative Commons is the solution to this problem.

Creative Commons is a nonprofit organization that provides legal tools for artists and authors. The tools offered make it simple to license artistic or literary work for others to use or distribute in a manner consistent with the author’s intentions. Creative Commons licenses are indicated with the symbol [©]. It is important to note that Creative Commons and public domain are not the same. When something is in the public domain, it has absolutely no restrictions on its use or distribution. Works whose copyrights have expired, for example, are in the public domain.

Saylor URL: http://www.saylor.org/courses/bus206
Attributed to: David T. Bourgeois, Ph.D.
By using a Creative Commons license, authors can control the use of their work while still making it widely accessible. By attaching a Creative Commons license to their work, a legally binding license is created. Here are some examples of these licenses:

- **CC-BY**: This is the least restrictive license. It lets others distribute and build upon the work, even commercially, as long as they give the author credit for the original work.
- **CC-BY-SA**: This license restricts the distribution of the work via the “share-alike” clause. This means that others can freely distribute and build upon the work, but they must give credit to the original author and they must share using the same Creative Commons license.
- **CC-BY-NC**: This license is the same as CC-BY but adds the restriction that no one can make money with this work. NC stands for “non-commercial.”
- **CC-BY-NC-ND**: This license is the same as CC-BY-NC but also adds the ND restriction, which means that no derivative works may be made from the original.

These are a few of the more common licenses that can be created using the tools that Creative Commons makes available. For a full listing of the licenses and to learn much more about Creative Commons, visit their web site.

**Patent**

Another important form of intellectual property protection is the patent. A patent creates protection for someone who invents a new product or process. The definition of invention is quite broad and covers many different fields. Here are some examples of items receiving patents:

- circuit designs in semiconductors;
- prescription drug formulas;
- firearms;
- locks;
- plumbing;
- engines;
- coating processes; and
- business processes.

Once a patent is granted, it provides the inventor with protection from others infringing on his or her patent. A patent holder has the right to “exclude others from making, using, offering for sale, or selling the invention throughout the United States or importing the invention into the United States for a limited time in exchange for public disclosure of the invention when the patent is granted.”

As with copyright, patent protection lasts for a limited period of time before the invention or process enters the public domain. In the US, a patent lasts twenty years. This is why generic drugs are available to replace brand-name drugs after twenty years.

Obtaining Patent Protection

Unlike copyright, a patent is not automatically granted when someone has an interesting idea and writes it down. In most countries, a patent application must be submitted to a government patent office. A patent will only be granted if the invention or process being submitted meets certain conditions:

- It must be original. The invention being submitted must not have been submitted before.
- It must be non-obvious. You cannot patent something that anyone could think of. For example, you could not put a pencil on a chair and try to get a patent for a pencil-holding chair.
- It must be useful. The invention being submitted must serve some purpose or have some use that would be desired.

The job of the patent office is to review patent applications to ensure that the item being submitted meets these requirements. This is not an easy job: in 2012, the US Patent Office received 576,763 patent applications and granted 276,788 patents. The current backlog for a patent approval is 18.1 months. Over the past fifty years, the number of patent applications has risen from just 100,000 a year to almost 600,000; digital technologies are driving much of this innovation.

Increase in patent applications, 1963–2012 (Source: US Patent and Trademark Office)
Sidebar: What Is a Patent Troll?

The advent of digital technologies has led to a large increase in patent filings and therefore a large number of patents being granted. Once a patent is granted, it is up to the owner of the patent to enforce it; if someone is found to be using the invention without permission, the patent holder has the right to sue to force that person to stop and to collect damages.

The rise in patents has led to a new form of profiteering called patent trolling. A patent troll is a person or organization who gains the rights to a patent but does not actually make the invention that the patent protects. Instead, the patent troll searches for those who are illegally using the invention in some way and sues them. In many cases, the infringement being alleged is questionable at best. For example, companies have been sued for using Wi-Fi or for scanning documents, technologies that have been on the market for many years.

Recently, the US government has begun taking action against patent trolls. Several pieces of legislation are working their way through Congress that will, if enacted, limit the ability of patent trolls to threaten innovation. You can learn a lot more about patent trolls by listening to a detailed investigation conducted by the radio program *This American Life*, by clicking this link.

Trademark

A trademark is a word, phrase, logo, shape or sound that identifies a source of goods or services. For example, the Nike “Swoosh,” the Facebook “f”, and Apple’s apple (with a bite taken out of it) are all trademarked. The concept behind trademarks is to protect the consumer. Imagine going to the local shopping center to purchase a specific item from a specific store and finding that there are several stores all with the same name!

Two types of trademarks exist – a common-law trademark and a registered trademark. As with copyright, an organization will automatically receive a trademark if a word, phrase, or logo is being used in the normal course of business (subject to some restrictions, discussed below). A common-law trademark is designated by placing “TM” next to the trademark. A registered trademark is one that has been examined, approved, and registered with the trademark office, such as the Patent and Trademark Office in the US. A registered trademark has the circle-R (®) placed next to the trademark.

While most any word, phrase, logo, shape, or sound can be trademarked, there are a few limitations. A trademark will not hold up legally if it meets one or more of the following conditions:

1. The trademark is likely to cause confusion with a mark in a registration or prior application.
2. The trademark is merely descriptive for the goods/services. For example, trying to register the trademark “blue” for a blue product you are selling will not pass muster.
3. The trademark is a geographic term.
4. The trademark is a surname. You will not be allowed to trademark “Smith’s Bookstore.”
5. The trademark is ornamental as applied to the goods. For example, a repeating flower pattern that is a design on a plate cannot be trademarked.

As long as an organization uses its trademark and defends it against infringement, the protection afforded by it does not expire. Because of this, many organizations defend their trademark against other companies whose branding even only slightly copies their trademark. For example, Chick-fil-A has trademarked the
phrase “Eat Mor Chikin” and has vigorously defended it against a small business using the slogan “Eat More Kale.” Coca-Cola has trademarked the contour shape of its bottle and will bring legal action against any company using a bottle design similar to theirs. As an example of trademarks that have been diluted and have now lost their protection in the US are “aspirin” (originally trademarked by Bayer), “escalator” (originally trademarked by Otis), and “yo-yo” (originally trademarked by Duncan).

Information Systems and Intellectual Property

The rise of information systems has forced us to rethink how we deal with intellectual property. From the increase in patent applications swamping the government’s patent office to the new laws that must be put in place to enforce copyright protection, digital technologies have impacted our behavior.

Privacy

The term privacy has many definitions, but for our purposes, privacy will mean the ability to control information about oneself. Our ability to maintain our privacy has eroded substantially in the past decades, due to information systems.

Personally Identifiable Information

Information about a person that can be used to uniquely establish that person’s identity is called personally identifiable information, or PII. This is a broad category that includes information such as:

- name;
- social security number;
- date of birth;
- place of birth;
- mother’s maiden name;
- biometric records (fingerprint, face, etc.);
- medical records;
- educational records;
- financial information; and
- employment information.

Organizations that collect PII are responsible to protect it. The Department of Commerce recommends that “organizations minimize the use, collection, and retention of PII to what is strictly necessary to accomplish their business purpose and mission.” They go on to state that “the likelihood of harm caused by a breach involving PII is greatly reduced if an organization minimizes the amount of PII it uses, collects, and stores.”


Attributed to: David T. Bourgeois, Ph.D.
most states now have laws in place requiring organizations that have had security breaches related to PII to notify potential victims, as does the European Union.

Just because companies are required to protect your information does not mean they are restricted from sharing it. In the US, companies can share your information without your explicit consent (see sidebar below), though not all do so. Companies that collect PII are urged by the FTC to create a privacy policy and post it on their website. The state of California requires a privacy policy for any website that does business with a resident of the state (see http://www.privacy.ca.gov/lawenforcement/laws.htm).

While the privacy laws in the US seek to balance consumer protection with promoting commerce, in the European Union privacy is considered a fundamental right that outweighs the interests of commerce. This has led to much stricter privacy protection in the EU, but also makes commerce more difficult between the US and the EU.

Non-Obvious Relationship Awareness

Digital technologies have given us many new capabilities that simplify and expedite the collection of personal information. Every time we come into contact with digital technologies, information about us is being made available. From our location to our web-surfing habits, our criminal record to our credit report, we are constantly being monitored. This information can then be aggregated to create profiles of each and every one of us. While much of the information collected was available in the past, collecting it and combining it took time and effort. Today, detailed information about us is available for purchase from different companies. Even information not categorized as PII can be aggregated in such a way that an individual can be identified.

This process of collecting large quantities of a variety of information and then combining it to create profiles of individuals is known as non-obvious relationship awareness, or NORA. First commercialized by big casinos looking to find cheaters, NORA is used by both government agencies and private organizations, and it is big business.
Non-obvious relationship awareness (NORA)

In some settings, NORA can bring many benefits, such as in law enforcement. By being able to identify potential criminals more quickly, crimes can be solved more quickly or even prevented before they happen. But these advantages come at a price: our privacy.

Restrictions on Record Collecting

In the US, the government has strict guidelines on how much information can be collected about its citizens. Certain classes of information have been restricted by laws over time, and the advent of digital tools has made these restrictions more important than ever.

Children’s Online Privacy Protection Act

Websites that are collecting information from children under the age of thirteen are required to comply with the Children’s Online Privacy Protection Act (COPPA), which is enforced by the Federal Trade Commission (FTC). To comply with COPPA, organizations must make a good-faith effort to determine the age of those accessing their websites and, if users are under thirteen years old, must obtain parental consent before collecting any information.
Family Educational Rights and Privacy Act

The Family Educational Rights and Privacy Act (FERPA) is a US law that protects the privacy of student education records. In brief, this law specifies that parents have a right to their child’s educational information until the child reaches either the age of eighteen or begins attending school beyond the high school level. At that point, control of the information is given to the child. While this law is not specifically about the digital collection of information on the Internet, the educational institutions that are collecting student information are at a higher risk for disclosing it improperly because of digital technologies.

Health Insurance Portability and Accountability Act

The Health Insurance Portability and Accountability Act of 1996 (HIPAA) is the law that specifically singles out records related to health care as a special class of personally identifiable information. This law gives patients specific rights to control their medical records, requires health care providers and others who maintain this information to get specific permission in order to share it, and imposes penalties on the institutions that breach this trust. Since much of this information is now shared via electronic medical records, the protection of those systems becomes paramount.

Sidebar: Do Not Track

When it comes to getting permission to share personal information, the US and the EU have different approaches. In the US, the “opt-out” model is prevalent; in this model, the default agreement is that you have agreed to share your information with the organization and must explicitly tell them that you do not want your information shared. There are no laws prohibiting the sharing of your data (beyond some specific categories of data, such as medical records). In the European Union, the “opt-in” model is required to be the default. In this case, you must give your explicit permission before an organization can share your information.

To combat this sharing of information, the Do Not Track initiative was created. As its creators explain:

Do Not Track is a technology and policy proposal that enables users to opt out of tracking by websites they do not visit, including analytics services, advertising networks, and social platforms. At present few of these third parties offer a reliable tracking opt out, and tools for blocking them are neither user-friendly nor comprehensive. Much like the popular Do Not Call registry, Do Not Track provides users with a single, simple, persistent choice to opt out of third-party web tracking.

Summary

The rapid changes in information technology in the past few decades have brought a broad array of new capabilities and powers to governments, organizations, and individuals alike. These new capabilities have required thoughtful analysis and the creation of new norms, regulations, and laws. In this chapter, we have seen how the areas of intellectual property and privacy have been affected by these new capabilities and how the regulatory environment has been changed to address them.

Study Questions

1. What does the term information systems ethics mean?
2. What is a code of ethics? What is one advantage and one disadvantage of a code of ethics?
3. What does the term intellectual property mean? Give an example.
4. What protections are provided by a copyright? How do you obtain one?
5. What is fair use?
6. What protections are provided by a patent? How do you obtain one?
7. What does a trademark protect? How do you obtain one?
8. What does the term personally identifiable information mean?
9. What protections are provided by HIPAA, COPPA, and FERPA?
10. How would you explain the concept of NORA?

Exercises

1. Provide one example of how information technology has created an ethical dilemma that would not have existed before the advent of information technology.
2. Find an example of a code of ethics or acceptable use policy related to information technology and highlight five points that you think are important.
3. Do some original research on the effort to combat patent trolls. Write a two-page paper that discusses this legislation.
4. Give an example of how NORA could be used to identify an individual.
5. How are intellectual property protections different across the world? Pick two countries and do some original research, then compare the patent and copyright protections offered in those countries to those in the US. Write a two- to three-page paper describing the differences.
Chapter 13: Future Trends in Information Systems

Learning Objectives

Upon successful completion of this chapter, you will be able to:

• describe future trends in information systems.

Introduction

Information systems have evolved at a rapid pace ever since their introduction in the 1950s. Today, devices that we can hold in one hand are more powerful than the computers used to land a man on the moon. The Internet has made the entire world accessible to us, allowing us to communicate and collaborate with each other like never before. In this chapter, we will examine current trends and look ahead to what is coming next.

Global

The first trend to note is the continuing expansion of globalization. The use of the Internet is growing all over the world, and with it the use of digital devices. The growth is coming from some unexpected places; countries such as Indonesia and Iran are leading the way in Internet growth.

<table>
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<tr>
<th>Country</th>
<th>New Internet Users (millions) 2008-2012</th>
<th>% Yearly Growth</th>
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<tr>
<td>China</td>
<td>264</td>
<td>10</td>
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<td>India</td>
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<td>Brazil</td>
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<td>6</td>
</tr>
<tr>
<td>Mexico</td>
<td>19</td>
<td>9</td>
</tr>
<tr>
<td>USA</td>
<td>18</td>
<td>3</td>
</tr>
</tbody>
</table>

Data source: internetworldstats.com

(Source: Internet World Stats)
Social

Social media growth is another trend that continues. Facebook now has over one billion users! In 2013, 80% of Facebook users were outside of the US and Canada.1 Countries where Facebook is growing rapidly include Indonesia, Mexico, and the Philippines.2

Besides Facebook, other social media sites are also seeing tremendous growth. Over 70% of YouTube’s users are outside the US, with the UK, India, Germany, Canada, France, South Korea, and Russia leading the way.3 Pinterest gets over 50% of its users from outside the US, with over 9% from India.4 Twitter now has over 230 million active users.5 Social media sites not based in the US are also growing. China’s QQ instant-messaging service is the eighth most-visited site in the world.6

Personal

Ever since the advent of Web 2.0 and e-commerce, users of information systems have expected to be able to modify their experiences to meet their personal tastes. From custom backgrounds on computer desktops to unique ringtones on mobile phones, makers of digital devices provide the ability to personalize how we use them. More recently, companies such as Netflix have begun assisting their users with personalizations by making suggestions. In the future, we will begin seeing devices perfectly matched to our personal preferences, based upon information collected about us in the past.

Mobile

Perhaps the most impactful trend in digital technologies in the last decade has been the advent of mobile technologies. Beginning with the simple cellphone in the 1990s and evolving into the smartphones and tablets of today, the growth of mobile has been overwhelming. Here are some key indicators of this trend:

- Mobile device sales. In 2011, smartphones began outselling personal computers.7
- The number of smartphone subscribers grew at 31% in 2013, with China leading the way at 354 million smartphone users.
- Internet access via mobile. In May of 2013, mobile accounted for 15% of all Internet traffic. In China, 75% of Internet users used their smartphone to access it. Facebook reported that 68% of its active users used their mobile platform to access the social network.
- The rise of tablets. While Apple defined the smartphone with the iPhone, the iPad sold more than three times as many units in its first twelve months as the iPhone did in its first twelve months. Tablet shipments now outpace notebook PCs and desktop PCs. The research firm IDC predicts that 87% of all connected devices will be either smartphones or tablets by 2017.8

5. https://about.twitter.com/company
7. http://mashable.com/2012/02/03/smartphone-sales-overtake-pcs/
Wearable

The average smartphone user looks at his or her smartphone 150 times a day for functions such as messaging (23 times), phone calls (22), listening to music (13), and social media (9). Many of these functions would be much better served if the technology was worn on, or even physically integrated into, our bodies. This technology is known as a “wearable.”

Wearables have been around for a long time, with technologies such as hearing aids and, later, Bluetooth earpieces. But now, we are seeing an explosion of new wearable technologies. Perhaps the best known of these is Google Glass, an augmented reality device that you wear over your eyes like a pair of eyeglasses. Visible only to you, Google Glass will project images into your field of vision based on your context and voice commands. You can find out much more about Google Glass at http://www.google.com/glass/start/.

Another class of wearables are those related to health care. The UP by Jawbone consists of a wristband and an app that tracks how you sleep, move, and eat, then helps you use that information to feel your best. It can be used to track your sleep patterns, moods, eating patterns, and other aspects of daily life, and then report back to you via an app on your smartphone or tablet. As our population ages and technology continues to evolve, there will be a large increase in wearables like this.

Collaborative

As more of us use smartphones and wearables, it will be simpler than ever to share data with each other for mutual benefit. Some of this sharing can be done passively, such as reporting our location in order to update traffic statistics. Other data can be reported actively, such as adding our rating of a restaurant to a review site.

The smartphone app Waze is a community-based tool that keeps track of the route you are traveling and how fast you are making your way to your destination. In return for providing your data, you can benefit from the data being sent from all of the other users of the app. Waze will route you around traffic and accidents based upon real-time reports from other users.

Yelp! allows consumers to post ratings and reviews of local businesses into a database, and then it provides that data back to consumers via its website or mobile phone app. By compiling ratings of restaurants, shopping centers, and services, and then allowing consumers to search through its directory, Yelp! has become a huge source of business for many companies. Unlike data collected passively however, Yelp! relies on its users to take the time to provide honest ratings and reviews.

10. https://jawbone.com/up
One of the most amazing innovations to be developed recently is the 3-D printer. A 3-D printer allows you to print virtually any 3-D object based on a model of that object designed on a computer. 3-D printers work by creating layer upon layer of the model using malleable materials, such as different types of glass, metals, or even wax.

3-D printing is quite useful for prototyping the designs of products to determine their feasibility and marketability. 3-D printing has also been used to create working prosthetic legs, handguns, and even an ear that can hear beyond the range of normal hearing. The US Air Force now uses 3-D printed parts on the F-18 fighter jet.11

3-D printing is one of many technologies embraced by the “maker” movement. Chris Anderson, editor of *Wired* magazine, puts it this way12:

In a nutshell, the term “Maker” refers to a new category of builders who are using open-source methods and the latest technology to bring manufacturing out of its traditional factory context, and into the realm of the personal desktop computer. Until recently, the ability to manufacture was reserved for those who owned factories. What’s happened over the last five years is that we’ve brought the Web’s democratizing power to manufacturing. Today, you can manufacture with the push of a button.

The “Internet of Things” refers to the idea of physical objects being connected to the Internet. Advances in wireless technologies and sensors will allow physical objects to send and receive data about themselves. Many of the technologies to enable this are already available – it is just a matter of integrating them together.

In a 2010 report by McKinsey & Company on the Internet of Things13, six broad applications are identified:

- **Tracking behavior.** When products are embedded with sensors, companies can track the movements of these products and even monitor interactions with them. Business models can be fine-tuned to take advantage of this behavioral data. Some insurance companies, for example, are offering to install location sensors in customers’ cars. That allows these companies to base the price of policies on how a car is driven as well as where it travels.
- **Enhanced situational awareness.** Data from large numbers of sensors deployed, for example, in infrastructure (such as roads and buildings), or to report on environmental conditions (including soil moisture, ocean currents, or weather), can give decision makers a heightened awareness of real-time events, particularly when the sensors are used with advanced display or visualization technologies. Security personnel, for instance, can use sensor networks that combine video, audio, and vibration detectors to spot unauthorized individuals who enter restricted areas.


Saylor URL: http://www.saylor.org/courses/bus206
Attributed to: David T. Bourgeois, Ph.D. saylor.org
• Sensor-driven decision analysis. The Internet of Things also can support longer-range, more complex human planning and decision making. The technology requirements—tremendous storage and computing resources linked with advanced software systems that generate a variety of graphical displays for analyzing data—rise accordingly.

• Process optimization. Some industries, such as chemical production, are installing legions of sensors to bring much greater granularity to monitoring. These sensors feed data to computers, which in turn analyze the data and then send signals to actuators that adjust processes—for example, by modifying ingredient mixtures, temperatures, or pressures.

• Optimized resource consumption. Networked sensors and automated feedback mechanisms can change usage patterns for scarce resources, such as energy and water. This can be accomplished by dynamically changing the price of these goods to increase or reduce demand.

• Complex autonomous systems. The most demanding use of the Internet of Things involves the rapid, real-time sensing of unpredictable conditions and instantaneous responses guided by automated systems. This kind of machine decision-making mimics human reactions, though at vastly enhanced performance levels. The automobile industry, for instance, is stepping up the development of systems that can detect imminent collisions and take evasive action.

### Autonomous

A final trend that is emerging is an extension of the Internet of Things: autonomous robots and vehicles. By combining software, sensors, and location technologies, devices that can operate themselves to perform specific functions are being developed. These take the form of creations such as medical nanotechnology robots (nanobots), self-driving cars, or unmanned aerial vehicles (UAVs).

A nanobot is a robot whose components are on the scale of about a nanometer, which is one-billionth of a meter. While still an emerging field, it is showing promise for applications in the medical field. For example, a set of nanobots could be introduced into the human body to combat cancer or a specific disease.

In March of 2012, Google introduced the world to their driverless car by releasing a video on YouTube showing a blind man driving the car around the San Francisco area. The car combines several technologies, including a laser radar system, worth about $150,000. While the car is not available commercially yet, three US states (Nevada, Florida, and California) have already passed legislation making driverless cars legal.

A UAV, often referred to as a “drone,” is a small airplane or helicopter that can fly without a pilot. Instead of a pilot, they are either run autonomously by computers in the vehicle or operated by a person using a remote control. While most drones today are used for military or civil applications, there is a growing market for personal drones. For around $300, a consumer can purchase a drone for personal use.

### Summary

As the world of information technology moves forward, we will be constantly challenged by new capabilities and innovations that will both amaze and disgust us. As we learned in chapter 12, many times the new capabilities and powers that come with these new technologies will test us and require a new way
of thinking about the world. Businesses and individuals alike need to be aware of these coming changes and prepare for them.

Study Questions

1. Which countries are the biggest users of the Internet? Social media? Mobile?
2. Which country had the largest Internet growth (in %) between 2008 and 2012?
3. How will most people connect to the Internet in the future?
4. What are two different applications of wearable technologies?
5. What are two different applications of collaborative technologies?
6. What capabilities do printable technologies have?
7. How will advances in wireless technologies and sensors make objects “findable”?
8. What is enhanced situational awareness?
9. What is a nanobot?
10. What is a UAV?

Exercises

1. If you were going to start a new technology business, which of the emerging trends do you think would be the biggest opportunity? Do some original research to estimate the market size.
2. What privacy concerns could be raised by collaborative technologies such as Waze?
3. Do some research about the first handgun printed using a 3-D printer and report on some of the concerns raised.
4. Write up an example of how the Internet of Things might provide a business with a competitive advantage.
5. How do you think wearable technologies could improve overall healthcare?
6. What potential problems do you see with a rise in the number of driverless cars? Do some independent research and write a two-page paper that describes where driverless cars are legal and what problems may occur.
7. Seek out the latest presentation by Mary Meeker on “Internet Trends” (if you cannot find it, the video from 2013 is available at http://allthingsd.com/20130529/mary-meekers-2013-internet-trends-deck-the-full-video/). Write a one-page paper describing what the top three trends are, in your opinion.
Answers to Study Questions

Chapter 1

1. What are the five components that make up an information system?
   a. hardware, software, data, people, process
2. What are three examples of information system hardware?
   a. There are a number of possible answers: a PC, a printer, a mouse, tablets, mobile phones, etc.
3. Microsoft Windows is an example of which component of information systems?
   a. It is an operating system, which is a part of the software component.
4. What is application software?
   a. Software that does something useful.
5. What roles do people play in information systems?
   a. The text includes examples such as helpdesk support, systems analyst, programmer, and CIO.
6. What is the definition of a process?
   a. A process is a series of steps undertaken to achieve a desired outcome or goal.
7. What was invented first, the personal computer or the Internet (ARPANET)?
   a. The Internet was activated in 1969; the personal computer was introduced in 1975.
8. In what year were restrictions on commercial use of the Internet first lifted? When were eBay and Amazon founded?
   a. Restrictions were lifted in 1991, Amazon was founded in 1994, and eBay was founded in 1995.
9. What does it mean to say we are in a “post-PC world”?
   a. The personal computer will no longer be the primary way that people interact and do business.
10. What is Carr’s main argument about information technology?
    a. That information technology is just a commodity and cannot be used to gain a competitive advantage.

Chapter 2

1. Write your own description of what the term information systems hardware means.
   a. Answers will vary, but should say something about information systems hardware consisting of the physical parts of computing devices that can actually be touched.
2. What is the impact of Moore’s Law on the various hardware components described in this chapter?
   a. The student should pick one of the components and discuss the impact of the fact that computing doubles in speed every two years. Most devices are getting smaller, faster, cheaper, and this should be indicated in the answer.
3. Write a summary of one of the items linked to in the “Integrated Computing” section.
   a. The student should write a summary of one of the linked articles.
4. Explain why the personal computer is now considered a commodity.
   a. The PC has become a commodity in the sense that there is very little differentiation between computers, and the primary factor that controls their sale is their price.
5. The CPU can also be thought of as the ____________ of the computer.
   a. brain
6. List the following in increasing order (slowest to fastest): megahertz, kilohertz, gigahertz.
   a. kilohertz, megahertz, gigahertz
7. What is the bus of a computer?
   a. The bus is the electrical connection between different computer components.
8. Name two differences between RAM and a hard disk.
   a. RAM is volatile; the hard disk is non-volatile. Data access in RAM is faster than on the hard disk.
9. What are the advantages of solid-state drives over hard disks?
   a. The main advantage is speed: an SSD has much faster data-access speeds than a traditional hard disk.
10. How heavy was the first commercially successful portable computer?
    a. The Compaq PC was 28 pounds.

Chapter 3

1. Come up with your own definition of software. Explain the key terms in your definition.
   a. A variety of answers are possible, but should be similar to the definition in the text: Software is the set of instructions that tell the hardware what to do. Software is created through the process of programming.
2. What are the functions of the operating system?
   a. The operating system manages the hardware resources of the computer, provides the user-interface components, and provides a platform for software developers to write applications.
3. Which of the following are operating systems and which are applications: Microsoft Excel, Google Chrome, iTunes, Windows, Android, Angry Birds.
   a. Microsoft Excel (application), Google Chrome (application), iTunes (application), Windows (operating system), Android (operating system), Angry Birds (application)
4. What is your favorite software application? What tasks does it help you accomplish?
   a. Students will have various answers to this question. They should pick an application, not an operating system. They should be able to list at least one thing that it helps them accomplish.
5. What is a “killer” app? What was the killer app for the PC?
   a. A killer app is application software that is so useful that people will purchase the hardware just so they can run it. The killer app for the PC was the spreadsheet (Visicalc).
6. How would you categorize the software that runs on mobile devices? Break down these apps into at least three basic categories and give an example of each.
   a. There are various ways to answer this question. Students should identify that there are mobile operating systems and mobile apps. Most likely, students will break down mobile apps into multiple categories: games, GPS, reading, communication, etc.
7. Explain what an ERP system does.
   a. An ERP (enterprise resource planning) system is a software application with a centralized database that is implemented across the entire organization.
8. What is open-source software? How does it differ from closed-source software? Give an example of each.
   a. Open-source software is software that makes the source code available for anyone to copy and use. It is free to download, copy, and distribute. Closed-source software does not make the source code available and generally is not free to download, copy, and distribute. There are many examples of both, such as: Firefox (open source), Linux (open source), iTunes (closed source), Microsoft Office (closed source).

9. What does a software license grant?
   a. Software licenses are not all the same, but generally they grant the user the right to use the software on a limited basis. The terms of the license dictate users’ rights in detail.

10. How did the Y2K (year 2000) problem affect the sales of ERP systems?
    a. Organizations purchased ERP software to replace their older systems in order to avoid any problems with the year 2000 in their software.

Chapter 4

1. What is the difference between data, information, and knowledge?
   a. Data are the raw bits and pieces of facts and statistics with no context. Data can be quantitative or qualitative. Information is data that has been given context. Knowledge is information that has been aggregated and analyzed and can be used for making decisions.

2. Explain in your own words how the data component relates to the hardware and software components of information systems.
   a. There are numerous answers to this question, but all should be variations on the following: Data is processed by the hardware via software. A database is software that runs on the hardware. Hardware stores the data, software processes the data.

3. What is the difference between quantitative data and qualitative data? In what situations could the number 42 be considered qualitative data?
   a. Quantitative data is numeric, the result of a measurement, count, or some other mathematical calculation. Qualitative data is descriptive. The number 42 could be qualitative if it is a designation instead of a measurement, count, or calculation. For example: that player’s jersey has number 42 on it.

4. What are the characteristics of a relational database?
   a. A relational database is one in which data is organized into one or more tables. Each table has a set of fields, which define the nature of the data stored in the table. A record is one instance of a set of fields in a table. All the tables are related by one or more fields in common.

5. When would using a personal DBMS make sense?
   a. When working on a smaller database for personal use, or when disconnected from the network.

6. What is the difference between a spreadsheet and a database? List three differences between them.
   a. A database is generally more powerful and complex than a spreadsheet, with the ability to handle multiple types of data and link them together. Some differences: A database has defined field types, a spreadsheet does not. A database uses a standardized query language (such as SQL), a spreadsheet does not. A database can hold much larger amounts of data than a spreadsheet.

7. Describe what the term normalization means.
a. To normalize a database means to design it in a way that: 1) reduces duplication of data between tables and 2) gives the table as much flexibility as possible.

8. Why is it important to define the data type of a field when designing a relational database?
   a. A data type tells the database what functions can be performed with the data. The second important reason to define the data type is so that the proper amount of storage space is allocated for the data.

9. Name a database you interact with frequently. What would some of the field names be?
   a. The student can choose any sort of system that they interact with, such as Amazon or their school’s online systems. The fields would be the names of data being collected, such as “first name”, or “address”.

10. What is metadata?
    a. Metadata is data about data. It refers to the data used to describe other data, such as the length of a song in iTunes, which describes the music file.

11. Name three advantages of using a data warehouse.
    a. The text lists the following (the student should pick at least three of these):
       i. The process of developing a data warehouse forces an organization to better understand the data that it is currently collecting and, equally important, what data is not being collected.
       ii. A data warehouse provides a centralized view of all data being collected across the enterprise and provides a means of determining data that is inconsistent.
       iii. Once all data is identified as consistent, an organization can generate one version of the truth. This is important when the company wants to report consistent statistics about itself, such as revenue or number of employees.
       iv. By having a data warehouse, snapshots of data can be taken over time. This creates a historical record of data, which allows for an analysis of trends.
       v. A data warehouse provides tools to combine data, which can provide new information and analysis.

12. What is data mining?
    a. Data mining is the process of analyzing data to find previously unknown trends, patterns, and associations in order to make decisions.

Chapter 5

1. What were the first four locations hooked up to the Internet (ARPANET)?
   a. UCLA, Stanford, MIT, and the University of Utah

2. What does the term packet mean?
   a. The fundamental unit of data transmitted over the Internet. Each packet has the sender’s address, the destination address, a sequence number, and a piece of the overall message to be sent.

3. Which came first, the Internet or the World Wide Web?
   a. the Internet

4. What was revolutionary about Web 2.0?
   a. Anyone could post content to the web, without the need for understanding HTML or web-server technology.

5. What was the so-called killer app for the Internet?
   a. electronic mail (e-mail)

6. What makes a connection a broadband connection?
a. A broadband connection is defined as one that has speeds of at least 256,000 bps.

7. What does the term VoIP mean?
   a. Voice over Internet protocol – a way to have voice conversations over the Internet.

8. What is an LAN?
   a. An LAN is a local network, usually operating in the same building or on the same campus.

9. What is the difference between an intranet and an extranet?
   a. An intranet consists of the set of web pages and resources available on a company’s internal network. These items are not available to those outside of the company. An extranet is a part of the company’s network that is made available securely to those outside of the company. Extranets can be used to allow customers to log in and check the status of their orders, or for suppliers to check their customers’ inventory levels.

10. What is Metcalfe’s Law?
    a. Metcalfe’s Law states that the value of a telecommunications network is proportional to the square of the number of connected users of the system.

Chapter 6

1. Briefly define each of the three members of the information security triad.
   a. The three members are as follows:
      i. Confidentiality: we want to be able to restrict access to those who are allowed to see given information.
      ii. Integrity: the assurance that the information being accessed has not been altered and truly represents what is intended.
      iii. Availability: information can be accessed and modified by anyone authorized to do so in an appropriate timeframe.

2. What does the term authentication mean?
   a. The process of ensuring that a person is who he or she claims to be.

3. What is multi-factor authentication?
   a. The use of more than one method of authentication. The methods are: something you know, something you have, and something you are.

4. What is role-based access control?
   a. With role-based access control (RBAC), instead of giving specific users access rights to an information resource, users are assigned to roles and then those roles are assigned the access.

5. What is the purpose of encryption?
   a. To keep transmitted data secret so that only those with the proper key can read it.

6. What are two good examples of a complex password?
   a. There are many examples of this. Students need to provide examples of passwords that are a minimum of eight characters, with at least one upper-case letter, one special character, and one number.

7. What is pretexting?
   a. Pretexting occurs when an attacker calls a helpdesk or security administrator and pretends to be a particular authorized user having trouble logging in. Then, by providing some personal information about the authorized user, the attacker convinces the security person to reset the password and tell him what it is.

8. What are the components of a good backup plan?
9. What is a firewall?
   a. A firewall can be either a hardware firewall or a software firewall. A hardware firewall is a device that is connected to the network and filters the packets based on a set of rules. A software firewall runs on the operating system and intercepts packets as they arrive to a computer.

10. What does the term physical security mean?
    a. Physical security is the protection of the actual hardware and networking components that store and transmit information resources.

Chapter 7

1. What is the productivity paradox?
   a. The productivity paradox is based on Erik Brynjolfsson’s finding, based on research he conducted in the early 1990s, that the addition of information technology to business had not improved productivity at all.

2. Summarize Carr’s argument in “Does IT Matter.”
   a. Information technology is now a commodity and cannot be used to provide an organization with competitive advantage.

3. How is the 2008 study by Brynjolfsson and McAfee different from previous studies? How is it the same?
   a. It is different because it shows that IT can bring a competitive advantage, given the right conditions. It is the same in the sense that it shows that IT, by itself, does not bring competitive advantage.

4. What does it mean for a business to have a competitive advantage?
   a. A company is said to have a competitive advantage over its rivals when it is able to sustain profits that exceed average for the industry.

5. What are the primary activities and support activities of the value chain?
   a. The primary activities are those that directly impact the creation of a product or service. The support activities are those that support the primary activities. Primary: inbound logistics, operations, outbound logistics, sales/marketing, and service. Support: firm infrastructure, human resources, technology development, and procurement.

6. What has been the overall impact of the Internet on industry profitability? Who has been the true winner?
   a. The overall impact has been a reduction in average industry profitability. The consumer has been the true winner.

7. How does EDI work?
   a. EDI is the computer-to-computer exchange of business documents in a standard electronic format between business partners.

8. Give an example of a semi-structured decision and explain what inputs would be necessary to provide assistance in making the decision.
   a. A semi-structured decision is one in which most of the factors needed for making the decision are known but human experience and other outside factors may still play a role. The student should provide an example of a decision that uses an information system to provide information but is not made by the system. Examples would include: budgeting decisions, diagnosing a medical condition, and investment decisions.

9. What does a collaborative information system do?
a. A collaborative system is software that allows multiple users to interact on a document or topic in order to complete a task or make a decision.

10. How can IT play a role in competitive advantage, according to the 2008 article by Brynjolfsson and McAfee?
   a. The article suggests that IT can influence competitive advantage when good management develops and delivers IT-supported process innovation.

Chapter 8

1. What does the term business process mean?
   a. A process is a series of tasks that are completed in order to accomplish a goal. A business process, therefore, is a process that is focused on achieving a goal for a business.

2. What are three examples of business process from a job you have had or an organization you have observed?
   a. Students can answer this in almost any way. The examples should consist of more than a single step.

3. What is the value in documenting a business process?
   a. There are many answers to this. From the text: it allows for better control of the process, and for standardization.

4. What is an ERP system? How does an ERP system enforce best practices for an organization?
   a. An ERP (enterprise resource planning) system is a software application with a centralized database that is implemented across the entire organization. It enforces best practices through the business processes embedded in the software.

5. What is one of the criticisms of ERP systems?
   a. ERP systems can lead to the commoditization of business processes, meaning that every company that uses an ERP system will perform business processes the same way.

6. What is business process reengineering? How is it different from incrementally improving a process?
   a. Business process reengineering (BPR) occurs when a business process is redesigned from the ground up. It is different from incrementally improving a process in that it does not simply take the existing process and modify it.

7. Why did BPR get a bad name?
   a. BPR became an excuse to lay off employees and try to complete the same amount of work using fewer employees.

8. List the guidelines for redesigning a business process.
   a. The guidelines are as follows:
      i. Organize around outcomes, not tasks.
      ii. Have those who use the outcomes of the process perform the process.
      iii. Subsume information-processing work into the real work that produces the information. Treat geographically dispersed resources as though they were centralized.
      iv. Link parallel activities instead of integrating their results.
      v. Put the decision points where the work is performed, and build controls into the process.
      vi. Capture information once, at the source.

9. What is business process management? What role does it play in allowing a company to differentiate itself?
a. Business process management (BPM) can be thought of as an intentional effort to plan, document, implement, and distribute an organization’s business processes with the support of information technology. It can play a role in differentiation through built-in reporting, and by empowering employees, enforcing best practices, and enforcing consistency.

10. What does ISO certification signify?
   a. ISO certification shows that you know what you do, do what you say, and have documented your processes.

Chapter 9

1. Describe the role of a systems analyst.
   a. To understand business requirements and translate them into the requirements of an information system.

2. What are some of the different roles for a computer engineer?
   a. hardware engineer, software engineer, network engineer, systems engineer

3. What are the duties of a computer operator?
   a. Duties include keeping the operating systems up to date, ensuring available memory and disk storage, and overseeing the physical environment of the computer.

4. What does the CIO do?
   a. The CIO aligns the plans and operations of the information systems with the strategic goals of the organization. This includes tasks such as budgeting, strategic planning, and personnel decisions relevant to the information-systems function.

5. Describe the job of a project manager.
   a. A project manager is responsible for keeping projects on time and on budget. This person works with the stakeholders of the project to keep the team organized and communicates the status of the project to management.

6. Explain the point of having two different career paths in information systems.
   a. To allow for career growth for those who do not want to manage other employees but instead want to focus on technical skills.

7. What are the advantages and disadvantages of centralizing the IT function?
   a. There are several possible answers here. Advantages of centralizing include more control over the company’s systems and data. Disadvantages include a more limited availability of IT resources.

8. What impact has information technology had on the way companies are organized?
   a. The organizational structure has been flattened, with fewer layers of management.

9. What are the five types of information-systems users?
   a. innovators, early adopters, early majority, late majority, laggards

10. Why would an organization outsource?
    a. Because it needs a specific skill for a limited amount of time, and/or because it can cut costs by outsourcing.

Chapter 10

1. What are the steps in the SDLC methodology?
   a. The steps are Preliminary Analysis, System Analysis, System Design, Programming, Testing, Implementation, and Maintenance.

2. What is RAD software development?
a. Rapid application development (RAD) is a software-development (or systems-development) methodology that focuses on quickly building a working model of the software, getting feedback from users, and then using that feedback to update the working model.

3. What makes the lean methodology unique?
   a. The biggest difference between the lean methodology and the other methodologies is that the full set of requirements for the system is not known when the project is launched.

4. What are three differences between second-generation and third-generation languages?
   a. Three key differences are as follows:
      i. The words used in the language: third generation languages use more English-like words than second-generation languages.
      ii. Hardware specificity: third generation languages are not specific to hardware, second-generation languages are.
      iii. Learning curve: third generation languages are easier to learn and use.

5. Why would an organization consider building its own software application if it is cheaper to buy one?
   a. They may wish to build their own in order to have something that is unique (different from their competitors), and/or something that more closely matches their business processes. They also may choose to do this if they have more time and/or more money available to do it.

6. What is responsive design?
   a. Responsive design is a method of developing websites that allows them to be viewed on many different types of devices without losing capability or effectiveness. With a responsive website, images resize themselves based on the size of the device’s screen, and text flows and sizes itself properly for optimal viewing.

7. What is the relationship between HTML and CSS in website design?
   a. While HTML is used to define the components of a web page, cascading style sheets (CSS) are used to define the styles of the components on a page.

8. What is the difference between the pilot implementation methodology and the parallel implementation methodology?
   a. The pilot methodology implements new software for just one group of people while the rest of the users use the previous version of the software. The parallel implementation methodology uses both the old and the new applications at the same time.

9. What is change management?
   a. The oversight of the changes brought about in an organization.

10. What are the four different implementation methodologies?
    a. direct cutover, pilot, parallel, phased

Chapter 11

1. What does the term globalization mean?
   a. Globalization refers to the integration of goods, services, and cultures among the nations of the world.

2. How does Friedman define the three eras of globalization?
   a. The three eras are as follows:
      i. “Globalization 1.0” occurred from 1492 until about 1800. In this era, globalization was centered around countries. It was about how much horsepower, wind power, and steam power a country had and how creatively it was deployed. The world shrank from size “large” to size “medium.”
ii. “Globalization 2.0” occurred from about 1800 until 2000, interrupted only by the two World Wars. In this era, the dynamic force driving change was comprised of multinational companies. The world shrank from size “medium” to size “small.”

iii. “Globalization 3.0” is our current era, beginning in the year 2000. The convergence of the personal computer, fiber-optic Internet connections, and software has created a “flat-world platform” that allows small groups and even individuals to go global. The world has shrunk from size “small” to size “tiny.”

3. Which technologies have had the biggest effect on globalization?
   a. There are several answers to this. Probably the most obvious are the Internet, the graphical interface of Windows and the World Wide Web, and workflow software.

4. What are some of the advantages brought about by globalization?
   a. Advantages include the ability to locate expertise and labor around the world, the ability to operate 24 hours a day, and a larger market for products.

5. What are the challenges of globalization?
   a. Challenges include infrastructure differences, labor laws and regulations, legal restrictions, and different languages, customs, and preferences.

6. What does the term digital divide mean?
   a. The separation between those who have access to the global network and those who do not. The digital divide can occur between countries, regions, or even neighborhoods.

7. What are Jakob Nielsen’s three stages of the digital divide?
   a. economic, usability, and empowerment

8. What was one of the key points of The Rise of the Network Society?
   a. There are two key points to choose from. One is that economic activity was, when the book was published in 1996, being organized around the networks that the new telecommunication technologies had provided. The other is that this new, global economic activity was different from the past, because “it is an economy with the capacity to work as a unit in real time on a planetary scale.”

9. Which country has the highest average Internet speed? How does your country compare?
   a. According to the chart in the chapter, South Korea has the highest Internet speeds. Students will need to look up their own to compare.

10. What is the OLPC project? Has it been successful?
    a. One Laptop Per Child. By most measures, it has not been a successful program.

Chapter 12

1. What does the term information systems ethics mean?
   a. There are various ways of answering this question, but the answer should include something about the application of ethics to the new capabilities and cultural norms brought about by information technology.

2. What is a code of ethics? What is one advantage and one disadvantage of a code of ethics?
   a. A code of ethics is a document that outlines a set of acceptable behaviors for a professional or social group. Answers may differ for the second part, but from the text: one advantage of a code of ethics is that it clarifies the acceptable standards of behavior for a professional group. One disadvantage is that it does not necessarily have legal authority.

3. What does the term intellectual property mean? Give an example.
   a. Intellectual property is defined as “property (as an idea, invention, or process) that derives from the work of the mind or intellect.”
4. What protections are provided by a copyright? How do you obtain one?
   a. Copyright protections address the following: who can make copies of the work, who can make derivative works from the original work, who can perform the work publicly, who can display the work publicly, and who can distribute the work. You obtain a copyright as soon as the work is put into tangible form.

5. What is fair use?
   a. Fair use is a limitation on copyright law that allows for the use of protected works without prior authorization in specific cases.

6. What protections are provided by a patent? How do you obtain one?
   a. Once a patent is granted, it provides the inventor with protection from others infringing on the patent. In the US, a patent holder has the right to “exclude others from making, using, offering for sale, or selling the invention throughout the United States or importing the invention into the United States for a limited time in exchange for public disclosure of the invention when the patent is granted.” You obtain a patent by filing an application with the patent office. A patent will be granted if the work is deemed to be original, useful, and non-obvious.

7. What does a trademark protect? How do you obtain one?
   a. A trademark protects a word, phrase, logo, shape, or sound that identifies a source of goods or services. You can obtain one by registering with the Patent and Trademark Office (US). There is also a common-law trademark.

8. What does the term personally identifiable information mean?
   a. Information about a person that can be used to uniquely establish that person’s identity is called personally identifiable information, or PII.

9. What protections are provided by HIPAA, COPPA, and FERPA?
   a. The answers are as follows:
      i. HIPAA: protects records related to health care as a special class of personally identifiable information.
      ii. COPPA: protects information collected from children under the age of thirteen.
      iii. FERPA: protects student educational records.

10. How would you explain the concept of NORA?
    a. There are various ways to answer this. The basic answer is that NORA (non-obvious relationship awareness) is the process of collecting large quantities of a variety of information and then combining it to create profiles of individuals.

Chapter 13

1. Which countries are the biggest users of the Internet? Social media? Mobile?
   a. Students will need to look outside the text for this, as it changes all the time. There are also different ways of measurement: number of users, % of population, most active users, etc. Some good sites to use are Internet World Stats, Kissmetrics, and the World Bank.

2. Which country had the largest Internet growth (in %) between 2008 and 2012?
   a. Iran, at 205%

3. How will most people connect to the Internet in the future?
   a. via mobile devices

4. What are two different applications of wearable technologies?
   a. There are many answers to this question; two examples are Google Glass and Jawbone UP.

5. What are two different applications of collaborative technologies?
a. There are many answers to this; two examples are software that routes us to our
destination in the shortest amount of time, and websites that review different companies.

6. What capabilities do printable technologies have?
   a. Using 3-D printers, designers can quickly test prototypes or build something as a proof
      of concept. Printable technologies also make it possible to bring manufacturing to the desktop
      computer.

7. How will advances in wireless technologies and sensors make objects “findable”?
   a. Advances in wireless technologies and sensors will allow physical objects to send and
      receive data about themselves.

8. What is enhanced situational awareness?
   a. Data from large numbers of sensors can give decision makers a heightened awareness of
      real-time events, particularly when the sensors are used with advanced display or visualization
      technologies.

9. What is a nanobot?
   a. A nanobot is a robot whose components are on the scale of about a nanometer.

10. What is a UAV?
    a. An unmanned aerial vehicle – a small airplane or helicopter that can fly without a pilot.
    UAVs are run by computer or remote control.


